DETERMINANTS OF NUTRITIONAL STATUS AND LIFESTYLE DISEASES AMONG MIDDLE AGED WORKING WOMEN

By

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DECLARATION

I, hereby declare that the thesis entitled **"DETERMINANTS OF NUTRITIONAL STATUS AND LIFESTYLE DISEASES AMONG MIDDLE AGED WORKING WOMEN"** is a bonafide record of research work done by me during the course of research and the thesis has not previously formed during the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

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Certified that the thesis entitled **"DETERMINANTS OF NUTRITIONAL STATUS AND LIFESTYLE DISEASES AMONG MIDDLE AGED WORKING WOMEN"** is a record of research work done independently by **Mrs. Siji, M. S. (2015-24-002)** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, fellowship or associateship to her.

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DEDICATED TO MY FAMILY

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF APPENDICES

ABBREVIATIONS	
BMD	Bone Mineral Density
BMI	Body Mass Index
BPL	Below Poverty Line
CVD	Cardio Vascular Diseases
DBP	Diastolic blood pressure
DES	Directorate of Economics and Statistics
DGI	Dietary Guidline Index
DQI	Diet Quality Index
FA	Functional Ability
FAO	Food and Agricultural Organisation
FBS	Fasting Blood Sugar
FVC	Forced Vital Capacity
GCS	Green Climateric Scale
GHQ	General Health Questionnaire
GOI	Government Of India
GPAQ	Global Physical Activity Questionnaire
Hb	Haemoglobin
HDL	High Density Lipoprotein
HDLC	High Density Lipoprotein Cholesterol
IC	Intrinsic Capacity
ICMR	Indian Council for Medical Research
IFAD	
IGT	Impaired Glucose Tolerence
KSRTC	Kerala State Road Transport Corporation
LDL	Low Density Lipoprotien
LD	Life Style Diseases
MET	Metabolic Equivalents
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MSLI	Modified Standard of Living Index
NCD	Non Communicative Disease
NCO	National Classification of Occupation
NFHS	National Family Health Survey
NIN	National Institute of Nutrition

NNMB	National Nutrition Monitoring Bureau
NSS	National Sample Survey
NSSO	National Sample Survey Organisation
PA	Physical activity
PAL	Physical Activity Level
PCA	Principle Component Analysis
PD	Psychological distress
PEFR	Peak Expiratory Flow Rate
PUFA	Poly Unsaturated Fatty Acid
RDA	Recommented Dietary Allowance
RDI	Recommented Dietary Intake
RFI	Risk Factor Index
SBP	Systolic blood pressure
SES	Socio Economic Status
SI	Stress Index
SLI	Standard of Living Index
SPSS	Statistical Package for Social Sciences
T.chol	Total cholesterol
TEE	Total Energy Expenditure
UN	United Nations

INTRODUCTION

1. INTRODUCTION

"Yatra naryastu pujyante ramante tatra Devata,
yatraitaastu na pujyante sarvaastatrafalaah kriyaah"

(*Manu Smrithi*)

The greatness of India's ancient culture, lies in the noble position ascribed to women in India. The above ancient *sloka* from "*Manusmrithi*" means where ever women are given respect, divinity flourishes, and where ever women are dishonoured, all action no matter how noble it may be, remains worthless. The worth of a civilization can be evaluated from the position that it gives to women. It is true since women forms an integral part of the society.

Tremendous change in women's role has put forth great impact in moulding today's society. In India, women are recognized not only as equal citizens but also as means of sustained socioeconomic development and change. The health of families and communities are tied to the health of women. Women have particular health needs at the time of midlife. In this context, the study on middle aged women gains significance.

The nutritional and health status of women is of great concern because they constitute half of the world's population and among them 38 per cent are middle aged (Census of India, 2011). Middle age is a phase of transition from young age to old age and represents the end of women's reproductive life (Pal *et al.*, 2013).Women in middle age, experience higher complications and age related health issues on comparison with their male counterparts, experience more age related health changes and complications (Sharifi *et al.*, 2014). The risk for encountering at least one chronic lifestyle disease is predicted as 83.2 per cent among women during middle age (Ayranci *et al.*, 2010).

According to World Health Organization (2009), women in their middle life are confronted with double burden of health threats associated with infectious diseases along with emerging challenges related to chronic non-communicable diseases.

Balancing family and work life is a major challenge for women. Further, dealing with issues related to family and work has also contributed in developing stress among women (Harilal and Santhosh, 2017). The hectic schedule of balancing between family and work along with their social and personal life lead middle aged women to ignore their health issues until the health problems become chronic or fatal. Along with psychological and physiological transitions of middle life, many chronic diseases emerge and become evident only when women enter their middle age (Mellner and Christin, 2003).

Women are pre disposed to several diseases depending on their lifestyle and nature of occupation. Most of which can be prevented and are modifiable by adopting suitable changes in their environment as well as dietary and lifestyle practices. Furthermore, the onset of lifestyle diseases is insidious and once developed is not easy to recover (Lichtenstein *et al.*, 2000). These diseases usually become evident in mid-life due to habituation of unhealthy lifestyle for an extended period (Krisela and Albertino, 2006).

According to World Health organization (2010), lifestyle diseases are a set of diseases with similar risk factors such as unhealthy diets, unhealthy habits like smoking and alcoholism, physical inactivity and stress, culminating in higher mortality. They include cardiovascular diseases, respiratory disorders like asthma and chronic obstructive pulmonary disease, cancer, liver disease, diabetes, metabolic syndrome, obesity, Crohn's disease, renal disorders, musculo-skeletal problems including osteoporosis, depression and stroke (Pollen and Michael, 2001).

Among the Indian states, Kerala is evolving as the 'capital' of lifestyle diseases with the prevalence rate of chronic diseases and related risk factors increasing tremendously that can be compared with those of western regions

(Thankappan *et al.*, 2010). Rapid urbanization and subsequent nutrition transition has led to a rise in the unhealthy lifestyle behaviours among both men and women including high intake of energy dense foods and physical inactivity. These are documented as the major risk factors for the high prevalence of lifestyle diseases and nutritional disorders in the State (Sathish *et al.*, 2017).

The prevalence of various lifestyle and nutrition related problems such as musculoskeletal pain, pain in the neck, headache, low back pain, frequency in urination along with gastrointestinal problems, diabetes mellitus, hypertension, hyperlipidemia, heart diseases and thyroid problems adversely affect the quality of life of middle aged women (Karmakar *et al.*, 2017).

But the health concerns of middle aged women are seldom given any importance. In India, middle aged women, constitute the neglected section of the community and the health studies mostly focus only on younger or older age groups (Pandey *et al.*, 2013). They represents the unnoticed group as they are totally ignored from all nutritional intervention programmes even though they are more prone to various health and nutrition related problems (Chandran, 2005).

Highlighting the fact that working women play vital and multiple roles, measures to ease the double burden of work on the health and nutritional status of middle aged women necessarily requires policy attention and age specific intervention programmes. In this back drop, the present investigation entitled "Determinants of nutritional status and lifestyle diseases among middle aged working women" was conducted with the following objectives.

- To assess the nutritional status, work stress, standard of living and prevalence of life style diseases among middle-aged working women.
- Deriving risk factor index, correlates and prediction formulae for the determinants of nutritional disorders and lifestyle diseases of middle-aged working women.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

The review of literature pertaining to the research study entitled "Determinants of nutritional status and lifestyle diseases among middle aged working women" is presented in this chapter under the following headings

2.1. Concept and significance of middle age in women

2.2. Working women: problems and prospects

2.3. Prevalence of lifestyle diseases and nutritional disorders among middle aged women

2.4. Determinants of nutritional status and lifestyle diseases

2.5. Health and nutrition related indices and scales: Significance and application

2.1. Concept and significance of middle age in women

"Middle age is when your children are no longer
Friends but critics, stern of face and severe with their tongue."

(Kamala Das)

The biggest achievement of last century was greater longevity of women than men worldwide (World Population Prospects, 2007), but the extra years of life for women are not always lived in good health (Stewart, 1997). World population prospects, (2007) reported that major proportion of the world's middle aged women belong to middle income or low income countries and almost half of them belong to Western Pacific and South-East Asia regions including India. Census of India (2011) revealed that women accounts to around half of the total population and among them 38 per cent are middle aged. While in Kerala, 20 per cent of the women population belonged to middle aged group (Census of India, 2011).

Middle age is a phase of transition from young age to old age (Tsao *et al.*, 2004 and Kase, 2009).Women worldwide face various health challenges at every stage of their lives as well as at home, at workplace or in wider society. Women have particular health needs at the time of midlife.

Middle age can be categorized into the early middle- aged group, (between the ages of 40 years and 50 years) and the late middle- aged group (between the ages of 50 years and 60 years) (Staudinger and Bluck, 2001). It is considered as the period between early adulthood and old age, usually considered as 45 years and above.

Middle age is the prime of life, rich with possibilities for renewal and psychological growth. Jung (1954) explains midlife as a time of astonishing change and personal transformation for many individual. He also pointed out the possibilities for individuals at this time to achieve greater integration, balance of personality and fulfillment of complete potentiality.

Erikson (1982), recognized and named the different developmental tasks that adults face defines middle adulthood as between 40 and 65 years of age and the person is still productive at this stage will likely feel well-being.

Stevenson (1977) subdivided middle adulthood into younger mid-adulthood, aged 25 to 44 years and older middle adulthood of 45 to 64 years. According to the World Health Organization (1996) women in the middle aged group are free from burden of child birth and they are entering into the higher social status of ageing women. Women in midlife are facing challenges with changes in their personal lives and in their families (Avis *et al.,* 2004).

McMunn *et al*. (2006) indicated that women in the age group of 45–55 years would pass through two stage transition. One of the stage is the transition to mid-life, and the second stage is the menopausal transition. The first stage is characterized by the psychosocial development of mid-life. While the second stage represents the biological maturation of mid-life.

Lachman (2004) provides a comprehensive overview of the challenges faced by midlife adults. These include losing parents and associated grief, launching children into their own lives, adjusting to home life without children, becoming grandparents, preparing for late adulthood, and acting as caregivers for aged parents or spouses or grandchildren. Kulmala *et al.* (2014) observed that work-related stress in midlife is associated with higher number of mobility limitation in older age women.

Park *et al.* (2010) documented that women's life in middle age, is a process of change in life, may bring phenomenal crisis along with many life affairs, stress and start of aging process, and may show diversified forms of physical and emotional reaction depending on experience, belief, attitude and habit toward menopause.

Middle aged women need to pass through significant life situations such as retirement and related financial problems, performing multiple roles and responsibilities, weight gain, age related changes in appearance and empty nest syndrome, (Shojaeyan *et al.*, 2005; Kase, 2009; and Ayranci *et al.*, 2010).

Mari *et al.* (2016) described the middle-aged women's perception of ageing process, which includes signs such as slowness to perform daily tasks, fatigue, muscle pain, rheumatic pain, a slowing of weight loss, gray hair, impaired vision and hearing, difficulty performing some movements, marks on skin and forgetfulness.

Despite the potential onset of negative events at middle age, the period is also associated to autonomy conquest and decision power, to professional fulfillment, to personal development, maturation and broadening of perspectives for the future (Mori and Coelho, 2004).

The middle age is a vulnerable period for many women followed by a decrease in quality of life in the physical and psychological domains compared to young adult women (Fuh *et al.*, 2003) or to men at the same age (Avis *et al.*,

2004) and by a decrease in quality of life in the psychological and social domains compared to elderly women (Waidyasekera *et al.,* 2009).

Medical opinion has always projected this period as a malady because of its association with a variety of acute and chronic conditions, both physical and psychological, ranging from mild to more severe (Porter *et al*., 1996 and Stadberg *et al*., 1997). Kumbhar *et al*. (2014) identified that overall work strain, lower socioeconomic class and social factors like marital status and type of family of middle aged women are equally important for their health status.

Pandey *et al.* (2013), stated that Indian middle aged women, is a segment of the society that has been neglected in community health studies, which are mostly limited to younger or older age-groups. Studies indicated that compared to men, women experience more age related health issues and complications during middle age (Sharifi *et al*., 2014).

The health concerns of middle aged women are seldom given any importance. Gregory (2000) noticed that even though middle aged women are more prone to various micronutrient deficiencies like anaemia, Vitamin-A, and Iodine deficiencies, Walker (2001) observed that, there were no nutritional intervention programs for this group. Chandran (2005) also reported that middle aged women are the unnoticed group since they are totally ignored from all nutritional intervention programmes.

World Health Organization (2009), estimated that middle aged women are confronted by a dual burden of traditional health threats related to infectious diseases alongside emerging challenges associated with non-communicable chronic diseases such as cardiovascular disease, stroke and cancers.

Ayranci *et al*. (2010) estimated the risk for encountering at least one chronic lifestyle disease is more than eighty per cent for middle aged women. Zheng *et al*. (2017) documented in a study among health professionals that weight gain during middle adulthood was associated with significantly increased risk of major chronic diseases such as diabetes, hypertension, cardio vascular diseases and obesity related cancers along with a decreased odds of healthy aging.

Mellner and Christin (2003) observed that the hectic schedule of balancing family and work life along with their social and personal life, lead middle aged women to neglect their health issues until the health problems become chronic or fatal. Also most of the lifestyle diseases become evident only when women reach their middle age.

Bertrais (2005) found that the likelihood to have metabolic syndrome in middle aged women increased with time spent in sedentary activities and decreased with increasing physical activity levels. Lawton *et al*. (2006) reported that multiple duties left women with less time for physical activity. Agrawal *et al.* (2015) observed that almost half of the middle aged women were physically inactive.

Pandey *et al.* (2013) concluded that greater prevalence of CVD risk factors in urban middle-aged Indian women is explained by greater income and literacy, dietary fat, low physical activity, obesity and truncal obesity.

Goyal *et al*. (2013) opined that middle age is a period of life when aging process starts along with various physiological and psychological changes especially in women which in turn affect their nutritional status. Pal *et al.* (2013) indicated that menopause is perhaps the most significant event occurring during the middle age in women and represents the end of women's reproductive life. Menopause is defined as the permanent cessation of menstruation due to loss of ovarian follicular activity. The average age of natural menopause is considered as 51 worldwide and 47.5 in India.

Aaron *et al.* (2002) observed that most of the middle aged women are in the pre or postmenopausal period. Borker *et al.* (2013) found that the mean age attaining menopause in Kerala is 48.26.

Doubova *et al.* (2011) stated that in human life span development, menopausal phase signifies the normal aging process that transforms women from the reproductive to the non-reproductive state, further, subjecting women into a complex bio-physiological and psychosocial change.

With an increase in life expectancy, the proportion of menopausal women has also significantly increased. The Population Projections Survey for India from the year 2001 to 2026, reveals that the number of women in the age group of 45 years and above is expected to reach 401 million in 2026 from 96 million at present. These huge population of women are expected to spend around 30 years in a post-reproductive period of life (Census of India, 2001).

Aaron *et al.* (2002) documented that a poor compliance to recommended lifestyle modifications and limited knowledge could impede a better overall health-related quality of life in middle age. Pallikadavath *et al.* (2016) observed that menopausal status and non-communicable diseases such as diabetes, hypertension, osteoporosis, cervical cancer, and breast cancer were positively correlated. Furthermore, the menopausal women experience complex psychosocial problems such as mood swings, sleep disorders, loss of social and professional roles, poor ego integrity and depression.

Singh (2012) reported that menopausal transitions result in a wide range of physical, psychological and metabolic symptoms among women in middle age. Other somatic and emotional disturbances occur frequently during women's mid-lives, such as irritation, depressive mood, sleeping problems, fatigue, headache, musculoskeletal pains and joint problems and also indicated that early menopause may be related to the poor health status of women.

Studies have shown that the presence of menopausal symptoms significantly reduces the quality of life in middle age (Peeyananjarassri *et al.*, 2006 and Waidysakera *et al.*, 2009). Nisar and Sohoo (2010) opined that women are expected to live a quarter to a third of their lives in menopause, which makes their quality of life during this period a great concern for women.

Rohr *et al.* (2005) revealed that the prevalence of menopausal systems like hot flushes, aches, joint pain, and stiffness and depressed mood increased in the menopausal transition. Ram *et al.* (2010) indicated that insomnia and sleep disorder are more prevalent in middle aged women and these are mainly attributed to the mood changes and depression and are associated with the hormonal changes. Kalahroudi *et al.* (2012) observed that hot flashes and night sweats were the most common and severe symptom in midlife period.

Particular attention should be laid during middle age in women for enhancing their quality of life because intrinsic capacity peaks in early adulthood and tends to decline from midlife onwards. Intrinsic Capacity (IC) is defined as the combination of the individual's physical and mental, including psychological capacities and functional ability (FA) (WHO Clinical Consortium on Healthy Ageing, 2016).

2.2. Working women: Problems and prospects

The economic prosperity of a nation depends on the quality of its workforce (Bhende, 1985). The vision of human development cannot be achieved without the empowerment and development of women as per the Human Development Reports. (UNDP, 1990). Factors which contribute to gender inequality in India include high levels of illiteracy, the lack of decision making power over child bearing and early marriage of women, which in turn limit the chances of women entering the labor force or starting a career and becoming entrepreneurs. According to the 2013 Human Development Report (UNDP, 2013) India ranks 132th out of 186 countries in its gender inequality index. This makes it South Asia's worst performing country after Afghanistan. Pakistan, Nepal and Bangladesh, which have lower HDIs, all do comparatively better than India when it comes to gender equality.

Jaumotte (2004) indicated that women's participation in economic activities enhance their personal and household development along with the economy development of the society. The participation of women in the labour market is strongly influenced by decisions taken at the household level. According to ILO (2005), the labour force participation rate of women is lower in India when compared to other East Asian, South-East Asian and developed economies.

Varma (1992) opined that women are the integral part of family and they play a crucial role in the socio-economic welfare of the family and thus the entire nation. The prosperity and growth of a nation depend on the status and development of its women who constitute nearly half of its population and influence the growth of the remaining half of the population

Work and family are two important parts of a person's life and both are closely related (Ford *et al.*, 2007). Since an increasing number of women are entering the work force and pursuing careers (Sevim, 2006), they have to balance the competing demands of both workplace and family life (Bickazsiz, 2009).

Sen (1990) observed that inspite of better female education and employment, women are compelled to do their traditional duties of cooking and shouldering the responsibility of childcare and other household chores. Neither women's education nor does her employment ensures women's control over her earnings or decision making ability (Heward and Bunwaree, 1999; Basu and Jeffrey, 2012).

Harilal and Santhosh (2017) observed that working within and outside the home are the two phases of a woman's life. Balancing work and family life has become a major challenge for women and dealing with family issues as well as work issues has resulted in increasing amount of stress. The heavy stress and strain they face while combining the professional work and domestic work, child care, care for elderly make women more tiresome and gain less leisure.

Kumari (2014) reported that different age group of working women have different kinds of problems and challenges and different categories as married, single, divorcee, single parent, separated, have different issues at stake in the workplace. Some problems are definitely common, like mental and physical stress, lack of proper balance between employment and family care, unfair treatment in the workplace, stressful life and work place discrimination. But some challenges are age or category specific, like prejudiced and stereotyped thinking, safety and security issues, ego hassles with colleagues, and problem of glass ceiling.

A healthy woman builds a healthy community. Ramya (2013) detailed that multiple roles of woman not only affect her personal health and well-being but also affect the overall well-being and health of her family. The study revealed nearly one fourth of working women belonging to elementary occupations face permanent health problems like back pain and related problems, followed by service workers and sales and shop workers which mainly formed due to the nature of work they performed. Moreover, nearly one third of working women consider lack of family support as one of the important problems they face.

As per the recent Economic Review (2017), Kerala, combining the tasks of production and reproduction it affects the well-being of women through strenuous long hours of work, with very short breaks and irregular meals, and are more prone to occupational hazards. Moreover, for the poor working women involved in works such as transplanting paddy, cashew shelling/peeling, coir spinning, cotton spinning, handloom weaving, fish processing, the wages received have to withstand high work intensity.

Shah (2013), studied the challenges and obstacles women entrepreneurs face. Availing finance and juggling many responsibilities are the major hurdles faced by women in initiating, requiring and managing an enterprise. Lack of awareness about opportunities, gender discrimination, inaccessibility to information, lack of training opportunities and infrastructure facilities, lack of family support along with some internal factors such as risk aversion by women, lack of self-esteem and self-confidence, lack of vision also hinder women's entrepreneurship. Devi (2015) observed that factors like political instability, poor infrastructure, high production costs and non-conductive business environment affect women entrepreneurs more than men.

Asha (2014), elucidated the role conflict among working women, and observed that in the beginning of occupational career, women face difficulties in balancing the family obligations and her work schedules. Over a period of time her experience may enable her to acquire certain skills required for efficient balancing between family and organizational expectations. Further, she pointed out that a woman performing multiple roles finds it difficult to do justice to the two roles at the same time and hence facing the problem of psychological pressure, stress and associated health problems resulting in declining work efficiency.

Prasad and Raveendran (2019), studied the work-life balance among female nursing employees of North Kerala and observed that family related issues, personal issues, the disturbed behavior of society and patients makes frustration to a certain level and less quality time that they can make use for their family as unscientific scheduling of shifts arranged by authorities were the major factors contributing to the work-life imbalance among these health professionals.

Baruah (2008) reported the following as the major constraints faced by unskilled and semiskilled construction women laborers: lack of specialized construction skills, lack of opportunities for skill acquisition and up gradation, low average earnings, lack of employment security and benefits, absence of both child care provisions and toilet facilities and high incidence of accidents and occupational health hazards.

Tiwari and Gangopadhyay (2011) pointed out the major occupational diseases in construction industrial workers requiring attention are lung disorders like silicosis, other muscular skeletal disorders, lead poisoning, diseases of joints and bones, headaches and various types of skin diseases. Nelson *et al.* (2016) found a high prevalence of health related issues pertaining to musculoskeletal system, respiratory system, and skin conditions among women engaged in cashew processing industries of Kerala.

Employment alone may not be a sufficient condition for empowerment, partly because of wage inequalities stemming from gender-based discrimination in labour markets (Appleton 1996, Rocha, 2000).

Arun (1999) and Eapen (2004) indicated the shifts in cropping patterns, demand for male labour, unequal wages for women, and decline in employment in cottage industries reflect the gender related nature of the labour market.

Arun (2012), explored the gender dimensions of the changing nature of agricultural households in northern Kerala, where he observed that women from marginal land holdings have to contribute their physical labour to the cultivation of land that is leased, compensate for farm-specific constraints, as well as juggled paid farm work, family farm work, and child rearing tasks leads to time poverty among these women. Kannan (2018) reported that irrespective of region, labour status, occupation or sector, the Indian labour markets are marked with wage based gender disparities.

Chakravarty *et al.* (2013) pointed out that women are still at the lower end of the labour market in pay and authority. Poverty stricken women typically occupy lower-paid and are engaged in low skill and lower status jobs. Majority of them are found in vast rural and urban unorganized sector as landless workers and petty share croppers in the agriculture sector and as contractual wage labourers in mining and construction sector and also as domestic help. They together form an exploited segment of population and belong to below poverty line.

Abraham (2013) pointed out that female labour force participation seems to be negatively related to income levels. Further, In India, many of the home-based economic activities of women are being accounted as un paid domestic activity in the employment surveys.

Studies on the IT industry by Baskar *et al.* (2001) have brought out a rather striking result that in the gender-wise distribution of jobs in the Indian software industry, majority (60 per cent) of women are engaged in 'call services' whereas only a minor proportion (6 per cent) are 'project managers' and a quarter of the women are employed as 'consultants' which clearly indicates that these new categories of 'women's work' are once again placing women to the lower rungs of the work hierarchy.

Srivastava and Srivastava (2010) documented the conditions of work, especially for women wage worker, are quite dismal. Women workers are also subjected to various forms of discrimination including job typing, which gives them a lower wage compared to men. Among the women wage workers, a proportion of those who report regular employment also work in poor conditions, receiving low wages with long hours of work, no social security and very few holidays. The position of self employed women in non-agriculture is also poor. Their capital base is low and consequently their value addition is also low.

Mathew and Panchanatham (2011), revealed that role overload, dependent care issues, quality of health, problems in time management and lack of proper social support are the major factors influencing the work life balance of women entrepreneurs in India.

A comparison of health status of middle aged working and non-working women by Manjrekar *et al.* (2014) revealed that generalized weakness, overweight and obesity, physical inactivity and stress was higher among working women than their counter parts. Moreover, majority of middle aged women do not prefer to undergo periodic medical examination.

A study conducted by Sanlier and Arpaci (2007) on the effects of stress on women's health reported a high level of stress and related physical and mental disease among working women than non-working women. Akhil (2012) reported that most of the working women suffered ailments such as obesity, depression, spondylosis, high or low blood pressure, diabetes, heart diseases, asthma, urinary infection and arthritis. The study also reported that over 77 per cent of working women avoided routine health check-ups.

Raman and Sharma (2003) indicated that anaemia results in poor work output among adult women of industrial and agricultural sectors.

Shihabudheen (2013) pointed out that employment scheme particularly MGNREGA implementation has given rise to very high level of economic empowerment, high level of social empowerment with respect to deciding on purchase of household goods and freedom to decide on children's education along with moderate level of political empowerment of rural women.

Deshpande and Sethi (2009), concluded that the emergence as well as development of women entrepreneurs is quite visible in India and their overall contribution to Indian economy is also very significant.

Ganesan *et al.* (2002) opined that self-identity, independence, family necessity, earning money for meeting the requirements, and earning a social status were the major motivational factors of middle aged women entrepreneurs.

It is documented that education and labour force participation are potential sources of 'autonomy' for women. Together they provide better opportunity and choices in the lives of women, along with an independent source of income, raising their contribution to the household, strengthening fallback position and enhanced individual interest (Dyson and Moore, 1983; Mason, 1986; Mason, 1993).

Many studies revealed positive impact of women's work on household food security, treatment of children, especially girl children in terms of schooling and nutritional levels, as well as the enhancement of capability and wellbeing of women themselves (Sen, 1990; Kennedy and Peters, 1992; Agarwal, 1994 and Appleton, 1996).

Mathew and Goyari (2011) recommended a set of policy measures including provision of affordable and quality child care facilities near the workplace and formation of agencies providing child and elderly care under state monitoring and licensing along with improved maternal and paternal benefits, such as extension of the duration of existing paid and unpaid forms of leave, may also ease double burden of work of employed women to some extent.

Upamanyu (1997) found that supportive work and family policy, effective management, communication, health insurance coverage for mental illness and medical dependence, and fixed scheduling of work hours were effective in reducing job burnout of working women. Explored stress management techniques used by working women are sleep and relaxation, exercise, time management, diet and yoga.

The work opportunities outside home reduce the economic dependence of women on men and in turn, increase her economic command within the family. With economic empowerment of women, her decision making control over personal life situations like marriage, divorce, overall household authority, self-confidence and self-esteem would also improve. (Dreze and Sen, 1995, Martha, 1988, Philip and Pepper, 1983). Further, it enhances women's household status, family as well as children's well-being.

Joan (1988) in her research on female to male contributions in 20 villages of South India identified that even with equal wages, compared to men, women's earnings was essential for the family's survival. World Bank (1989) also reported that improvement in the income status of women in turn improves the health and nutrition status of their children.

Devi (2002) identifies relevant policies for enhancing women empowerment and work participation in Kerala. The findings recommend that dissemination of technological know-how and skills up-gradation are essential for generating better productivity, competency and income of women workers. Again, focus on technical and job-oriented education can facilitate in women's struggle for economic power and empowerment. Further, the study recommends to ascertain availability of universal child care facilities and women oriented developmental policies.

Rajesh and Manoj (2015) indicated that working women face a range of physical and psychological imbalances. Problems like sedentary lifestyle, unhealthy diets, insufficient sleep, awkward job timings and work pressure would desist a woman from clinging on the job.

2.3. Prevalence of lifestyle diseases and nutritional disorders among middle aged women

The countries of Asia are undergoing unprecedented economic growth, rapid technical changes, urbanization and major changes in diet and lifestyle (Hughes *et al.*, 1990 and Janus *et al.,* 1996). Tremendous economic and global development, modernization and rural to urban migration that has led to a dramatic transition in the dietary and lifestyle patterns are the underlying causes of lifestyle diseases (Hawkes, 2005 and Reddy *et al.,* 2006).

The health and quality of life of millions of people worldwide are affected by these chronic lifestyle diseases (IOA, 2008). According to World Health organization, lifestyle diseases are a set of diseases with similar risk factors such as unhealthy diets, unhealthy habits like smoking and alcoholism, physical inactivity and stress, culminating in higher mortality. (WHO, 2010).

The prevalence and occurrence of lifestyle diseases increases with increase in industrialisation and life expectancy of people (Pollen and Michael, 2001). They include diseases like cardiovascular diseases, respiratory disorders like asthma and chronic obstructive pulmonary disease, cancer, liver diseases, diabetes, metabolic syndrome, obesity, Crohn's disease, renal disorders, musculo-skeletal problems including osteoporosis, depression and stroke.

As per the reports of World Health Organization (2014), three out of every four global deaths are caused by these non-communicable diseases commonly known as lifestyle diseases takes place in low and middle income countries including India.

Women are pre disposed to several diseases depending on their lifestyle and nature of occupation. Most of which can be prevented and are modifiable by adopting suitable changes in their environment as well as dietary and lifestyle practices. Furthermore, the onset of lifestyle diseases is insidious and once developed is not easy to recover (Lichtenstein *et al.*, 2000).

Sandvik *et al.* (2000) observed that lifestyle diseases become evident only in a later stage of a person's life and could become the cause of death with a prolonged life span. Krisela and Albertino (2006) also opined that these diseases usually emerge in mid-life due to habituation of a unhealthy lifestyle for an extended period (Krisela and Albertino, 2006).

Among the Indian states, Kerala is evolving as the 'capital' of lifestyle diseases with the prevalence rate of chronic diseases and related risk factors increasing tremendously that can be compared with those of western regions even among women (Thankappan *et al.*, 2010). Similar findings have been reported by Misra *et al.* (2011).

Various evidence based studies done among Kerala population documents the reason for high prevalence of lifestyle diseases and nutritional disorders in the state. The study findings of Sathish *et al.* (2017) reflect the increase in unhealthy lifestyle behaviours among men and women from rural Kerala including consumption of energy dense foods and low physical activity due to rapid urbanization and nutrition transition.

Over the last three decades, the rate of physical inactivity combined with a high daily consumption of calorie dense foods among Keralites have increased by almost two-third. Also, the consumption of processed foods rich in sugar and salt is double the amount consumed by the rest of India (Sivasankaran and Thankappan, 2013). Low intake of adequate amount of vegetables and fruits and high intake of foods rich in saturated fats are typical about Kerala's population (Daivadanam *et al.* 2015).

Chronic conditions that require ongoing medical care such as asthma, heart disease, arthritis, depression and diabetes are common in women as they age, particularly in poorer women and those living in rural areas (Jamison, 2006).

Davis *et al.* (2015) viewed that the prevalence of obesity is higher in postmenopausal women than in premenopausal women. Menopause leads to an increase of total body fat and a redistribution of body fat from the periphery to the trunk, which results in visceral adiposity.

The presence of high abdominal fat even at a lower body mass index is a typical feature observed among Asian population when compared to their counterparts. Hence, a lower cut off values of BMI have been set for determining overweight (> 23 kg/m^2) and obesity (> 25 kg/m^2) for Asians by the World Health Organisation's International task force (WHO, 2005).

Tapadar *et al.* (2004) reported that energy expenditure decreases with age due to decrease in basal metabolic rate. One of the reasons for weight gain may be water retention due to hormonal imbalance and high fat intake. The study also found that, 50 per cent of the middle age women belonged to obese category, 13 per cent were overweight and 20 per cent fall under normal category.

Visceral adiposity and decline in oestrogen levels contribute to adverse metabolic and nutritional disorders mainly insulin resistance, type 2 diabetes mellitus and hyperlipidemia among middle aged women. In middle age, actual pattern of body fat distribution changes. The accumulation of central abdominal fat in women is associated with decline in the production of protein adiponectin. Low serum adiponectin levels are associated with the condition called insulin resistance. This results in increased intra- abdominal fat and cause high diabetes prevalence in middle aged women (Lee *et al.*, 2004). Studies point out that high blood pressure is also common among middle aged women (Gupta *et al.*, 2014).

Chronic backache, obesity, hypertension and diabetes were the common lifestyle diseases reported by major proportion of working women (Assocham, 2009). Two out of every three women suffer from work related lifestyle diseases (Sharma, 2010).

Unhealthy dietary practices, sedentary lifestyle, unhealthy personal habits, improper body posture and altered biological clock are the major contributory factors of the lifestyle diseases (WHO, 2005).

Modern work life has dramatically shifted the eating habits of the population to an instant and tasty diets but poor in diet quality or other essential nutrients. These changes have led to an increased incidence of diet related lifestyle diseases (Bagchi *et al.,* 2004).

Sengupta *et al*. (2015) highlights substantial increase in the proportion of overweight and the risk of overweight/obesity among rural and poorer women from states where overweight is the major nutritional problem. At the same time in those states where people experience high chronic energy deficiency, problem of overweight/obesity is concentrated within urban and wealthier women.

Earlier studies have reported that the prevalence of osteoarthritis not only increases with age, but also is higher in women especially after menopause (Tsai and Liu, 1992; Verbrugge, 1995; Li *et al*., 2002). Musculoskeletal disorders is identified as the major cause of disability and long term pain worldwide (Miranda *et al.*, 2012 and Smith *et al.*, 2014). Krishnan (2016) found the prevalence of musculoskeletal problems among middle aged women from Thiruvanathapuram district was 63.3 per cent.

Karmakar *et al.* (2017) studied the quality of life of menopausal women in West Bengal and found the prevalence of various lifestyle and nutrition related problems such as musculoskeletal pain (84%), pain in the neck and headache (76%), low back pain (69%) and frequency in urination (63%). Apart from this varying proportion of middle aged women in the study also reported gastrointestinal problems, diabetes mellitus, hypertension, hyperlipidemia, heart diseases and thyroid problems.

It was reported that cardiovascular disease is the most important cause of death in middle aged women in India (Registrar General of India, 2009). The reasons for high cardiovascular disease (CVD) in women are attributed to the high prevalence of multiple cardiovascular risk factors- hypertension, diabetes, dyslipidemia (Connor, 1997) and metabolic syndrome (Misra and Khurana, 2009).

Gupta *et al.* (2012) observed a high prevalence and very low awareness, treatment and control of hypertension among Asian Indian women. A nationwide study conducted by Pandey *et al.* (2013) determined the prevalence of CVD risk factors in middle-aged Indian women and found the prevalence of hypertension (38.9%), hypercholesterolemia (20%), impaired fasting glucose (13.6%) as well as diabetes (9.3%) are significantly greater in urban middle aged women.

Chandran (2005) indicated that as age increased, weight also increased among middle aged women. Isaac (2013) observed a decreasing trend in height and an increasing trend in weight with the advancement of age among women.

Jareena (2009) estimated that overweight (20.9%) exceeded underweight (18.9%) among women in Kerala. Bikai *et al.* (2015) showed a significant association of height and bone density decline with age among middle aged population. Priya (2016) observed the trend of having a higher weight for height value among the women population of Trivandrum.

Savinainen *et al.* (2004) ascertained that the perceived physical work capacity decreased from good to moderate among middle aged working women (>45 years) over a 10-year follow up study. Tripathi *et al.* (2017) indicated that age had a significant association with health problems such as back pain, joint pain, shoulder pain and pain in legs or feet in the age group of 40–60 years women being two times more likely to have health problems due to their occupation.

Chandran (2005) observed that 66 per cent of middle aged women were having a haemoglobin level below 12g/dL and further indicated that the insufficiency of iron rich foods quantitatively and qualitatively, vitamin-C rich foods coupled with parasitic infections has superimposed into the development of anemia among middle aged women. Ismail *et al.* (2016) indicated that among females increasing age more than 40 years, low socio-economic class and menorrhagia to be significantly associated with anaemia prevalence.

Sundaravalli (2012), observed a highly significant association on the prevalence of osteoporosis with increasing age among women and further indicated that the relative risk of developing osteoporosis was 1 to 2.4 times more as age increased from 46-60 years compared to 41-45 years in women.

2.4. Determinants of nutritional status and lifestyle diseases

An analysis study done among women in Kerala shows that lifestyle diseases such as overweight and obesity prevails mostly among the non-consumers of fruits, egg, milk or curd, pulses or beans, dark green vegetables and daily users of fish and chicken or meat (Moli and Mini, 2012).

Various studies have identified stress, physical inactivity and poor diet quality as significant contributory factors of lifestyle diseases (Sugathan *et al.*, 2008; Sivasankaran and Thankappan, 2013; Oommen *et al.*, 2016; and Gupta *et al.*, 2016).

Oommen *et al.* (2016) observed that increasing age, BMI ≥25 kg/m2 and central obesity were significant risk factors for both hypertension and diabetes. The finding also showed that waist circumference had significant positive association with BMI, body fat, waist-hip ratio and stress, while a negative association with standard of living index. Sugathan *et al.* (2008) showed that higher position in the social hierarchy was associated with higher BMI.

Moore and Cunningham (2012) reviewed that higher stress was associated with less healthy dietary behaviors and with higher body weight among women.

Oommen *et al.* (2016) indicated that physical inactivity is associated with hypertension, body mass index (BMI) ≥25 kg/m2, central obesity and dyslipidaemia. Sathish *et al.* (2012) indicated that high to normal blood pressure, central obesity and current smoking were significantly associated with incident hypertension.

Daivadanam *et al.* (2013) and Arya *et al.* (2015) identified unhealthy diet, stress, lack of physical activity, overweight and obesity as the important risk factors for developing a spectrum of cardiovascular disorders among the Government officials.

Sivasankaran and Thankappan (2013), recommends the adoption of healthy diet and physical activity in a life-course approach, especially by women for the prevention of non-communicable diseases in Kerala.

Vijayakumar *et al.* (2009) found that raised fasting blood glucose was positively associated with both hypercholesterolemia and raised blood pressure. A significant positive association between systolic and diastolic blood pressure was observed in the previous research findings among Indians (Gupta *et al.* 2012; Anchala *et al.,* 2014; and Nethan *et al.* 2017).

Aggarwal *et al.* (2011) and Agrawal and Verma (2013) determined lack of exercise to be significantly associated with lower BMD in Indian women.

Sugathan *et al.* (2008) revealed a substantially high rate of prevalence of behavioural risk factors of lifestyle diseases such as stress, overweight, unhealthy dietary intake, smoking and alcohol consumption among the respondents with lower socio-economic background except in the case of physical inactivity and obesity.

Biochemical risk factors such as raised fasting blood glucose, raised total cholesterol (Vijayakumar *et al.*, 2009 and Gupta *et al.*, 2012) and raised blood pressure were also identified as significant risk factors in developing various non-communicable diseases (Sathish *et al.*, 2012; Nethan *et al.*, 2017).

Gulati and Misra (2017), indicated the important dietary imbalances as a significant risk factor leading to higher prevalence of metabolic disorders among South Asians including Indians are high consumption of saturated and trans fat, sugar and refined carbohydrates, processed foods, deep frying of foods, reheating of oils besides a poor consumption of protein and fiber- rich foods.

Andersen (2008) pointed out that the nutrition transition from traditional diets based on minimally processed foods to highly processed, energy-dense, micronutrient-poor foods and drinks, which lead to obesity and diet related chronic diseases.

It is documented that a high intake of carbohydrate (more than 55 per cent of energy), even with a low fat intake is an important risk factor to low levels of high density lipoprotein-cholesterol (HDL-C) (Misra *et al.*, 2005), high serum triglyceride levels and hyperinsulinemia (Misra *et al.*, 2009).

Studies have documented that Asian Indian phenotypes have high body fat with relatively less BMI, less lean body mass and marked abdominal obesity (Kasliwal *et al.*, 2004). According to recent National Nutrition Monitoring Bureau report (2018), 39.1 per cent and 29.8 per cent urban women with hypertension and diabetes respectively had elevated abdominal adiposity. Further, 34.1 per cent and 26 per cent urban women with hypertension and diabetes respectively had high body fat percentage.

According to Isaac (2013), 34.3 per cent women with normal BMI and 88.6 per cent of overweight women were in increased risk category based on waist circumference cut-off recommended by WHO (2011).

Sathish *et al.* (2017) analyzed the longitudinal change in risk factors for non-communicable diseases in rural areas of Thiruvananthapuram district for a period of seven years and the findings reflected a significant increases in all the anthropometric variables including weight, BMI, waist circumference, waist-to-hip ratio, obesity, central/abdominal obesity along with physical inactivity, unhealthy personal habits and unhealthy food habits are the probable reason for the high prevalence of diabetes (Thankappan *et al.*, 2010) and high mortality due to cardiovascular disease in Kerala (Registrar General of India, 2009), particularly rural Kerala.

METHODOLOGY

3. MATERIALS AND METHODS

The methods and procedures employed in the various phases of the research are detailed in this chapter under the following sections.

3.1. Location of the study

3.2. Selection of the respondents

3.3. Plan of the study

3.4. Methods adopted for the study

3.5. Development of tools and conduct of the study

3.6. Derivation of correlates and prediction formulae

3.7. Development of Risk Factor Index (RFI) for lifestyle diseases and nutritional disorders

3.8. Analysis of the data

3.1. Location of the study

Thiruvananthapuram district in Kerala State was selected for the present study. The district has heterogeneous, multi-ethnic occupational population with 21.37 female work participation rate. The district is privileged with large, medium and small scale industries along with numerous government, non-government and private organizations. Of these, 6985 small scale industrial units are promoted by women (Census of India, 2011). Hence, the district is quite representative of the working women population of the State.

3.2. Selection of the respondents

Women accounts to around half of the total population and among them 38 per cent belong to middle aged group. As per Census of India (2011), 20 per cent of the women population in Kerala, belong to middle aged group. The present study was conducted among middle aged (45-55 years) working women of Thiruvananthapuram district using stratified multi-stage random sampling design. The nine divisions of occupation as envisaged in the National Classification of Occupation (NCO, 2004) formed the strata for sample selection. The nine occupational division includes senior officials-(D1), professionals-(D2), technicians-(D3), clerks-(D4), service workers-(D5), agriculture & fishery workers-(D6), craft workers-(D7), machine operators-(D8) and construction workers-(D9). A district level baseline survey was done to elicit information regarding offices, institutions, associations, agencies, societies, enterprises, self-help groups and similar groups of social relevance to identify the members working in different divisions. Formal administrative permission were obtained from the heads of the occupational institutes in order to contact and collect data from women working in various organisations. Oral and written consent was obtained from all participants.

The corresponding principal institutes, associations and head offices formed the first stage units. Sub offices and cluster offices formed the second and third stage units for all the divisions. The sampling technique gives each element in the different strata an equal and independent chance of being selected. A list of middle aged working women in the ultimate units selected were prepared. A sample of forty respondents were drawn from the selected units. Thus a total of 360 middle aged (45-55 years) working women with a minimum of 10 years of service in the specified field formed the study population. Working middle aged women is operationalized as women in the age group of 45- 55 years who work outside the home for income in addition to the work they perform at home.

An in-depth investigation was conducted among 30 per cent of the respondents (n=108) identified to be the most vulnerable to lifestyle diseases. The following criteria were set for the selection of most vulnerable population using Syntax programming in SPSS version 16 software.

- Stress category: moderate and high stress level
- Body mass index: Pre obese and obese
- Waist circumference : $\geq$ 80cms
- Body fat percentage : $\geq$ 30 %
- Physical activity : < 600 MET/minutes
- Presence of at least one lifestyle diseases
- Daily consumption of fruits and vegetables <400g/d
- Diet Quality Index : Average and below

3.3. Plan of the study

The plan of the study was formulated on the basis of specific objectives which comprised of:

3.3.1. A baseline survey to collect relevant data on the socio-economic status of the respondents and derivation of modified Standard of Living Index (MSLI).

3.3.2. Assessment of work pattern and stress prevalence among the respondents and derivation of stress index (SI).

3.3.3. A dietary survey to assess food consumption pattern and food adequacy of the respondents and derivation of diet quality index for Indian middle aged women (DQI-W).

3.3.4. Assessment of prevalence and occurrence of lifestyle diseases

3.3.5. Physical activity pattern assessment and derivation of physical activity scores.

3.3.6. Assessment of nutritional status of the respondents through

3.3.6.1. Anthropometric measurements

3.3.6.2. Clinical examination (subsample).

3.3.6.3. Biochemical analysis of blood for fasting blood sugar, blood haemoglobin, serum calcium and total cholesterol (subsample).

3.3.6.4. Bio-physical measurements of blood pressure, bone mineral density (BMD), physical work capacity and vital capacity (subsample).

3.3.6.5. Actual food and nutrient intake (subsample).

3.3.7. Computation of energy expenditure pattern and energy balance (subsample).

3.3.8. Derivation of correlates among variables *viz.* socio-economic status, standard of living index (SLI), stress index (SI), nutritional status, physical activity, diet quality index (DQI-W) and prevalence of lifestyle diseases.

3.3.9. Derivation of prediction formulae for determinants of nutritional disorders and lifestyle diseases.

3.3.10. Development of Risk Factor Index for middle aged working women.

3.3.11. Statistical analysis and interpretation of data using suitable statistical tools.

3.4. Methods adopted for the study

Success of every research depends upon the adoption of appropriate methods and procedures to elicit information from the respondents. The interview method is the most reliable method for data collection as it proceeds systematically and quickly.

Interview method was adopted in the present study for collecting baseline data on the socioeconomic profile, work profile and stress prevalence and food consumption pattern of the respondents.

Development of indices *viz.* standard of living index (SLI), stress index (SI) and diet quality index for Indian middle aged women (DQI-W) were computed from the collected baseline data using standard procedures and statistical techniques.

Medical camps were organized under a registered medical practitioner for eliciting information regarding the occurrence and prevalence of lifestyle diseases through medical checkups, recording medical history and personal interview with the respondent on health and morbidity.

Physical activity patterns of the entire study population were assessed as it is an established risk factor for lifestyle disease using the standardised Global Physical Activity Questionnaire (GPAQ version 2), suggested by WHO (2013). Metabolic equivalents (MET) score were used for the analysis of the GPAQ data and derivation of physical activity scores.

Nutritional status assessment was done to determine the indicators of lifestyle diseases by employing the following methods:

1. Measurement of anthropometric variables.

2. Clinical assessment by a registered medical practitioner.

3. Biochemical analysis of blood for fasting blood sugar, blood haemoglobin, serum calcium and total cholesterol.

4. Bio-physical measurement of blood pressure, bone mineral density (BMD), physical work capacity and vital capacity.

5. Actual food and nutrient intake (24-hour dietary recall)

Anthropometry is the single most portable, universally applicable, inexpensive and non-evasive techniques for nutritional status assessment. Anthropometry is widely used as a screening tool for disease assessment in adults (Cole, 1993). Height, weight, waist and hip circumference of all the respondents were taken using standard procedures described by Jelliffe (1966). From the data collected BMI and WHR were computed. Body fat percentage is the amount of body fat mass (kg) with regard to the total body weight (kg) which is expressed as a percentage, were also assessed for the entire population using body fat monitor device (Model Omron HBF- 212, Accuracy of ± 1%).

Clinical examination is the simplest method used to get the direct information on the signs and symptoms of malnutrition as well as other chronic diseases. Clinical examination of subsamples were done to assess the signs and symptoms of nutritional disorders and lifestyle diseases with the help of a medical practitioner. The menopausal symptoms were assessed by direct interview method.

Biochemical estimation of fasting blood sugar, blood haemoglobin, serum calcium and total cholesterol were done among the subsamples by trained technicians of Govt. approved laboratories using standard procedure and methodology.

All bio-physical examinations were conducted among the respondents selected as subsamples. Blood pressure was measured using a digital blood pressure device (Model Omron HEM- 7121, Japan, and Accuracy: ±3 mm Hg). Bone mineral density (BMD) of the calcus (angle) bone was performed by a trained technician using bone densitometer. Physical work capacity was determined using Harvard step test method (Brouha, 1943). Vital capacity screening was done using peak flow expiratory meter based on standard procedure.

To assess the actual food and nutrient intake, 24-hour dietary recall was conducted among the subsamples using the procedure given by Thimmayyama and Rao (2003).

Energy expenditure pattern was estimated using Satyanarayana method (IGNOU, 2006) and energy balance were determined using ICMR prediction equations for Indians.

Derivation of prediction formulae and correlates for the determinants of nutritional disorders and lifestyle diseases of middle-aged working women were done using suitable statistical techniques.

The risk factor index for lifestyle diseases of the entire study population was assessed using the newly derived risk factor scale.

3.5. Development of tools and conduct of the study

3.5.1. Socioeconomic profile of the respondents

A tool is defined as an instrument in the hand of researcher for measuring the variables pertaining to the study. The details pertaining to the socioeconomic status, work pattern and food consumption pattern of the families were collected with the help of three separate specially structured and pre-tested interview schedule. All instruments and protocols were piloted before the start of the study. The information on the following socio economic variables of the respondents *viz.* age, marital status, religion, average monthly income, family size and type, educational status, occupational status, personal habits of family, household conditions, possession details of consumer durables, details of social participation, lifestyle and activity patterns, monthly expenditure pattern, indebtedness and savings were elicited by framing a structured and pretested questionnaire. The socioeconomic status of the family were further categorized using Kuppuswamy's updated SES scale. The interview schedule is appended in Appendix IA.

Plate 1. Direct interview of middle aged working women

3.5.1.1. Development of Modified Standard of Living Index (MSLI)

Based on the baseline data obtained from socio economic and personal profile, a modified Standard of Living Index (MSLI) (modified from National Family Health Survey -2) was derived.

A standard of living index was developed by the National Family Health Survey (NFHS, 1998-99) as a summary household measure. It is composed of 27 items, including consumer durables, agricultural machinery, housing conditions and access to basic services (water, light, fuel, etc). In the present study, the Standard of Living Index (MSLI; modified from NFHS-2) was developed taking into consideration certain variables that are most relevant to the Kerala living conditions. The modified SLI (MSLI) is composed of 4 dimensions *viz.* Individual characteristics (2 items), housing conditions (8 items), consumer durables (7 items) and social variables (2 items) totaling to 19 items. The MSLI have been constructed by assigning scores for each variable in ascending order. The total score for each respondent has been obtained by simple aggregation of the scores for individual variables. From the total scores the quartiles were calculated and the respondents were categorized into upper, middle and lower SLI.

The modified index score ranged from 0 to 30. The score '0' represents the lowest standard of living and '30' represents the highest standard of living. The score cut-off have been worked out as lowest one third population with scores 0 to 10 categorized into lower SLI, next one third with scores 11 to 20 categorized into middle SLI and last one third of the population with scores 21 to 30 as upper SLI.

Validity of the scale

The validity of a scale is defined as the accuracy with which it measures the intended variable (Kerlinger, 1978). Validity of MSLI was ascertained by assessing content validity. The content validity of the scale was ensured by an extensive review of literature and obtaining the opinion of experts to cover the subject matter which is important for the variable under study.

The final modified standard of living index (MSLI) and the corresponding scores are detailed in Table 1.

Table 1. Modified Standard of Living Index (MSLI) and the corresponding scores

Sl No	Variables/ Dimensions	Corresponding scores		
I.	**Individual characteristics**	**Maximum scores (3)**		
1	Educational status	above primary level- 1	primary or below-0	
2	Occupational status	Permanent-2	Temporary/ contract-1	Daily wages-0
II.	**Household conditions**	**Maximum scores (12)**		
3	Ownership of house	yes-1	no-0	
4	Separate room for cooking	yes-1	no-0	
5	House type	pucca -2	semi pucca-1	kachha-0
6	Electricity in house	yes-1	no-0	
7	Type of Toilet facility	Improved toilet (own/public/shared)-2	pit toilet (public/ shared /own)-1	no facility-0
8	Main fuel for cooking	electricity, liquid petroleum gas or biogas-2	coal, charcoal or kerosene-1	wood/ other fuel-0
9	Source of drinking water	water source into the residence (pipe/hand pump/ well-1	public (tap/ hand pump/ well/tanker/truck/other open source-0	
10	Garbage / Waste water disposal	separate disposal for degradable and non-bio degradable waste (Compost pit/ garbage collectors-2	disposal away from house/ open spaces -1	burning of plastics- 0
III	**Consumer durables**	**Maximum scores (12)**		
11	Car	yes-1	no-0	
12	Two wheeler	yes-1	no-0	

13	Possession of the following: Air conditioner/ Refrigerator/ Computer or laptop/ Colour TV/ Labour saving devices/ Mobile phone (each variable gets 1 score)	yes-1	no-0	
14	Bank/post office account	yes-1	no-0	
15	Credit card	yes-1	no-0	
16	Possession of agricultural/ non-agricultural land/ parental property	yes-1	no-0	
17	Ownership of livestock	yes-1	no-0	
IV	**Social variables**	**Maximum scores (3)**		
18	Access to mass media (scoring for any one variable)	Television/ social media- 2	radio/transistor -1	Irregular/ no newspaper reading- 0
19	Active participation in any social organisation/ NGO/social issues	yes-1	no-0	
Maximum score: 30 Minimum score: 0** * (Lower SLI: score 0-10, Middle SLI: score 11-20, Upper SLI: 21-30)**				

3.5.2. Work profile and stress prevalence of the respondents

The details of work pattern of the respondents like nature of work, tenure of service, travel distance and mode of conveyance to work place, interest and motivations in the work, discrimination faced by women in the work place and occupational hazards were collected using the interview schedule given in Appendix I B. Besides, the details of work stress, household stress and psychological distress were assessed separately after modifying the Stress rating Scale of Menon (2003).

Plate 2. Work pattern of middle aged women

3.5.2.1. Development of Stress Index (SI)

The stress index was developed (modified from stress inventory of Menon, 2003) to assess the details of work place as well as household stress. The original scale was not suitable to measure work related stress of middle aged women. Hence, the scale was modified to specifically measure the stress issues of middle age working women. The following methodology have been selected for the development of stress scale:

Identification of dimensions

Three dimensions/components which are the most relevant to measure the stress of middle aged working women were enlisted. The dimensions enlisted were in the areas of household stress, work life stress and psychological distress faced by the middle aged working women.

Items/ Statements selection and scrutiny of items

The items/statements needed for measuring stress levels of working women were listed carefully and prepared under the above mentioned three broad areas. These were scrutinized using the criteria suggested by Likert (1932) to make them free from double negative, ambiguity and complexity. Sixteen negative statements to measure work life as well as household stress were retained. The psychological distress of working middle aged women were measured using a standardized scale, the General Health Questionnaire (GHQ-12) of 12-item version (Goldberg, 1972; Goldberg and Williams, 1988). The GHQ is a screening instrument to identify psychological distress and potential cases of common psychiatric disorder (especially depression) (McDowell, 2006). The GHQ is the most frequently used scale worldwide to assess psychological well-being (Boyd *et al.*, 2011).

Pre- testing and Item analysis by calculating t statistic

The edited statements were administered to 40 working middle aged women who had been outside the net respondents of the study and their agreement or disagreement to each statement related to work place and household stress were sought on a 5 point Likert scale (Likert,1932) with scores ranging from 0 (totally disagree) to 4 (totally agree). All responses related to psychological distress was given on 4-point Likert-type scales (less than usual, no more than usual, rather more than usual, much more than usual). The study adopt the GHQ scoring method, which uses a bimodal 0-0-1-1 scheme to score subsequent response categories. The collected responses were coded and subjected to item analysis. The aim of item analysis is to measure how efficiently each statement could differentiate between respondents with varying stress levels.

The procedure suggested by Edwards (1969) was used in item analysis. The total scores for each respondent was calculated by adding the scores obtained for all statements of the scale and were arranged in descending order. Twenty five per cent of respondents with highest score and twenty five per cent of respondents with lowest score were considered for item analysis. The value of 't' was used as a measure of the extent to which a given statement differentiates the high stress groups and the low stress groups. Any value of 't' $\geq$ 1.75 only was considered. This formed the criteria for the inclusion of items/statements in the proposed final scale.

Validity of the scale

A good scale needs to be standardized in terms of its reliability and validity. The content validity is the representativeness or sampling adequacy of the contents, the substance, the matter and topics of a measuring instrument (Kerlinger, 1978). Validity of the scale was ascertained by assessing content validity and construct validity. The content validity of the scale was ensured by an extensive literature search and seeking the opinion of experts to cover the subject matter which is important for the variable under study. The construct validity of the scale was established by computing the correlation of component scores with total scores of the test. The items showing significant correlation co-efficient with the total scores were identified as valid for selection (Guilford, 1965). The scale developed for the study was administered to 40 working middle aged women other than the respondents selected for the study to measure their stress levels.

Reliability analysis of scale

Reliability of a scale ensured the stability, dependability, consistency and accuracy of measurement by the instrument (Kerlinger, 1978). The reliability of the index was established through coefficient alpha (Cronbach, 1951). It gave the mean of all possible split-half reliabilities. The scale was administered to 40 respondents other than the respondents selected for the study. The sub-components were divided into two equal halves with even number items in one half and the odd numbers in the other half. The co-efficient of correlation between two sets of scores of the scale was computed. Inter- reliability test was also done by correlating the total stress score of the respondents with the odd serial numbered items. The inter- item correlation co-efficient of high stress group and low stress group was also worked out for the scale.

The final stress scale had 3 dimensions with 24 items/statements *viz.*, work place stress (6 items), household stress (6 items), and psychological distress (12 items). The total scores ranges from 0 to 60. Stress levels were classified into very high, high, moderate, low and very low based on percentiles.

The modified stress index and the corresponding scores are detailed in Table 2.

Table 2. Work life stress, Household stress and Psychological distress scale with corresponding score

Sl. No	Items of Work stress	Totally disagree (0)	Disagree (1)	Can't say (2)	Agree (3)	Totally agree (4)
1	I am worried about job security					
2	Work life gives mental and physical fatigue					
3	I have no time for relaxation and leisure					
4	The demands of work life interferes with my family life (Eg: time spent with children, attending family functions)					
5	My health problems interferes with work efficiency and family life					
6	I feel upset to take up responsibilities					
Sl. No	**Items of Household stress**	Totally disagree (0)	Disagree (1)	Can't say (2)	Agree (3)	Totally agree (4)
1	I do not receive families help in household activities					
2	I am not satisfied with my family relationship (husband, children, in-laws, others)					
3	I am always worried about family issues (Eg: financial problems, children's future, ill health of family members)					
4	I feel negligence/ lack of understanding from family members					
5	The demands of family interferes with work life (reaching duty on time, overtime duties)					
6	Household stress interferes with my efficiency to perform job/work related duties					

General Health Questionnaire

Sl.No	Items of Psychological distress	Less than usual (0)	No more than usual (0)	More than usual (1)	Much more than usual (1)
1.	Felt under constant strain				
2.	Feeling unhappy and depressed				
3.	Lost sleep over worry				
4.	Could not overcome difficulties				
5.	Not enjoying day-to-day activities				
6.	Lost confidence in self				
7.	Not playing a useful role				
8.	Could not concentrate				
9.	Not feeling happy				
10.	Felt worthless				
11.	Could not make decisions				
12.	Could not face problems				

3.5.3. Food consumption pattern of the respondents

A diet survey was conducted to assess the food habits, food consumption pattern, food expenditure pattern, food use frequency, food adequacy, frequency of use of instant, preserved, reheated and processed foods, healthy dietary practices adopted and dietary diversity of the diet using a specially designed interview schedule pre-tested and modified suitably. The pre-tested schedule is presented in Appendix IC.

The frequency of use of different food items by the respondents was assessed by recording the use of different foods, using a frequency scale *viz.*, daily, thrice a week, twice a week, once a week, monthly twice, monthly once, occasionally/never. The percentage of food use frequency scores was computed using the formula suggested by Reaburn *et al.* (1979). The formula is given below.

Percentage of total score = $(R1S1 + R2S2 + \cdots + RnSn)/n$

Sn = Scale of rating given for frequency of a food item

Rn = Percentage of respondents selecting a rating

n = Maximum scale rating.

The frequency of use of food items were quantified by scoring. The daily used food items were given a score 30, those food items used thrice a week were given a score 12, twice a week as 8, once a week as 4, monthly twice as 2, monthly once as 1 and those that were used occasionally/never were given 0 score. Mean scores were calculated for each food group. The mean percentage score was calculated by dividing the mean score on the maximum score of 30 and multiplying by 100. The foods that scored above 90 per cent were grouped as daily used foods while those foods that scored below 15 per cent were classified as least frequently used foods. Frequently used foods were those items which scored between 75- 89 per cent and the less frequently used foods were those which got scores ranging between 15 – 74 per cent.

To assess the food adequacy among the respondents, the mean food intake of eleven food groups were computed from the mean food score obtained using the formula given below

Mean score for each group = $(R1S1 + R2S2 + \cdots + RnSn)/7$

The percentage of respondents using each food item was then computed and was compared with the quantity specified as per the recommended dietary allowances (RDA) of ICMR (2010) for the specified age, sex and activity. Based on their food adequacy, middle aged working women were further grouped into adequate (meeting 100% and above the recommended intake), marginally adequate, marginally inadequate (meeting 50 - 74.9% of RDA) and inadequate (meeting <50% of RDA) food intake categories.

66

3.5.3.1. Development of Diet Quality Index for Indian middle aged women (DQI-W)

A diet quality index (DQI-W) was formulated in the study aiming at the qualitative assessment of middle aged women's diet and to assess dietary risk factors of lifestyle diseases using the Indian dietary guidelines and recommendations of international dietary indices.

Scores were assigned to the four dimensions included in the DQI-W *viz.* (1). Dietary adequacy variables (45 scores) are composed of six components that assess the adherence to the major food groups, (2). Dietary moderation variables (15 scores) includes two components that need to be reduced in the diet: a) salt intake b) processed foods high in sugar, salt or fat. (3). Variables from 9 to 13 assess the healthy dietary practices (20 scores) such as: a) Inclusion of raw salads/fermented foods/sprouts/dietary fiber b) Water intake/day. c) Frequency of use of re-heated fats and oils. d) Weekly consumption of fish and e) Weekly consumption of nuts. (4) Dietary diversity variables (20 scores) were included to assess the variety of foods included from each food groups mentioned in the food square recommended by the Indian dietary guidelines (NIN, 2010). A maximum score was given for daily consumption of foods from all the four food groups.

Dietary assessment was done using a standardized and pre-tested food frequency questionnaire viz., daily, thrice a week, twice a week, once a week, monthly twice, monthly once, occasionally/never. The total DQI-W score ranged between zero (worst) to 100 (excellent). Based on percentiles the respondents were categorized to very poor, poor, average, good and excellent diet quality.

Validity of the scale

The validity of the scale was ascertained by assessing content validity by an extensive literature search and seeking the opinion of experts to cover the subject matter which is important for the variable under study. The final diet quality index (DQI-W) developed in the present study is given in Table 3.

Table 3. Diet quality index for middle aged women with corresponding scoring criteria

Sl.No.	DQI components	Scoring criteria (servings/day)	Score
3 a.	**Dietary adequacy variables**		
1.	Cereals and millets		
	Activity sedentary	9	10
		<3	0
	Activity moderate	11	10
		<3.5	0
	Activity Heavy	16	10
		<5	0
2.	Protein foods		
	Sedentary	≥ 2	10
	Moderate	2.5	10
	Heavy	3	10
		< 0.5	0
3.	Milk and its products	2- 3	5
		≤ 1	0
4.	Vegetables and Fruits	≥ 4	10
		< 1.5	0
5.	Sugar	≤ 6	5
		> 6	0
6.	Fats/Oils (visible)	≥ 4 to ≤ 6	5
		> 6	0
3 b.	**Dietary moderation variables**	**Scoring criteria**	
7.	Salt intake	≤ 2.5g/day	5
8.	Processed foods (high in salt, sugar, fat)	Daily or 5 times/week	0
		Never	10
3 c.	**Healthy dietary practices**	**Scoring criteria**	
9	Sprouts/ fermented foods/ salads /whole grains/ dietary fiber	≥2/ week	4
		< 0.5c/w	0
10.	Fish intake	200g/w or 30g/d or 1/w	4
11.	Water intake	2 l/d	4
12.	Re heated oils	Daily	0
		Never	4
13.	Intake of nuts	25g/w or 1/w	4
3 d.	**Dietary diversity variables**	**Scoring criteria**	
14.	Foods included from each food group of food square *viz.* Whole cereals and millets/ vegetables and fruits/ protein foods / oils, fats and nuts.	4+ 2-3+ ≤1+	20 10 0

***One serving of a food item was defined in terms of specific portion size, as per the Indian dietary guidelines**

****Maximum score for full adherence, zero for lack of adherence, with intermediate scores calculated to assess degree of adherence with dietary recommendations.**

3.5.4. Assessment of prevalence and occurrence of lifestyle diseases

Medical camps (six numbers) were organized for eliciting information regarding the occurrence and prevalence of lifestyle diseases by standardizing an interview schedule for this purpose and through medical checkups under the guidance of a registered medical practitioner. The schedule is given in Appendix II. The schedule recorded the following observations *viz*. personal disease history, history of non-communicable diseases, family history of lifestyle diseases, gynecological problems, undergoing medications/ treatments and the details of modified life /diet pattern followed. The list of major collaborating organisations and the list of places at which medical camps were organised are detailed in Table A and Table B respectively.

Table A. List of major collaborating organisations

Sl.No	Organisations/ Institutions
1	Directorate of census
2	District Collectorate
3	Directorate of Rural development
4	Directorate of Women and Child welfare
5	CPWD
6	Keltron
7	District Coorporation office and Panchayats
8	Kudumbasree mission
9	Weaving societies
10	Government and private hospitals in Trivandrum
11	Schools and Colleges

Table B. Details of medical camps conducted

Medical camp No.	Venue
1	Weaving society, Peringamala
2	CGO complex, Poonkulam
3	Govt. Ayurveda Hospital and Research Institute , Trivandrum
4	Govt. Ayurveda Hospital and Research Institute, Trivandrum
5	Govt. Ayurveda Hospital and Research Institute, Trivandrum
6	College of Agriculture, Vellayani

Plate 3. Glimpses of medical camp

3.5.5. Physical activity pattern assessment (GPAQ version 2 of WHO, 2013)

Physical activity was assessed using the Global Physical Activity Questionnaire (GPAQ version 2) suggested by WHO (2013). The questionnaire comprises of 16 questions to measure physical activity in 3 main domains namely work or occupation, transport and leisure or recreational activities. This standardised instrument could measure total physical activity (ie, leisure-time, occupational, housework, and transport-related activity), as well as the physical activity in each domain separately. Metabolic equivalents (MET) score were used for the analysis of the GPAQ data. MET is the ratio of a person's working metabolic rate relative to the resting metabolic rate. One MET is defined as the energy cost of sitting quietly and was equivalent to a calorie consumption of 1 Kcal/kg/hour (WHO, 2013). It is estimated that, compared to sitting quietly, the calorie consumption is four times higher when being moderately active and eight times higher when being vigorously active. For calculating the overall energy expenditure of an individual, 4 METs were given to the time spent in moderate activities, and 8 METs given to the time spent in vigorous activities. For estimating the categorical indicator, the total time spent on physical activity per week per the number of days and the intensity of physical activity were considered.

The GPAQ was interpreted based on the recommended guidelines. The respondents were classified as active if, throughout a week (including activity for work, travel and leisure), they engaged in at least 150 minutes of moderate intensity physical activity or 75 minutes of vigorous intensity physical activities or a combination of moderate and vigorous intensity physical activities achieving at least 600 MET minutes per week (WHO, 2013). Further, physical activity was classified into 3 activity groups based on MET scores as: Inactive/low PA (<600 MET/minutes), active (600-1200 MET/minutes) and highly active (> 1200 MET/minutes). The schedule is given in Appendix III.

3.5.6. Assessment of nutritional status

3.5.6.1. Anthropometric measurements

Anthropometric measurements used in this study included measurement of height, weight, waist circumference and hip circumference, waist to hip ratio and body fat percentage using standardized techniques for the entire population as detailed below. All the anthropometric equipment was calibrated at the start of every session.

(a) Measurement of weight

In the study weight was measured using a digital weighing balance. The weight was recorded to the nearest of 0.5 kg.

(b) Measurement of height

Height was measured using a fiberglass tape. The respondent was asked to stand straight on a leveled surface, without sandals, with heels together and toes apart with buttocks, shoulder and occiput against the wall. The height was recorded to the nearest 0.1cms.

Body mass index (BMI) was calculated using the formula, weight (in kilo-grams)/ height (meters squared) and were classified into different grades of nutritional status based on the classification suggested by World Health Organisation (WHO, 2004) for Asia- Pacific population.

(c) Waist and hip circumference

Waist was measured above the umbilicus that is the narrowest circumference and hip was measured in the broadest area of the hip. After recording the waist and hip circumferences, the waist-hip ratio (WHR) was calculated by dividing the waist circumference by the hip circumference.

(d) Measurement of body fat percentage

Plate 4. Assessment of nutritional status

Body fat percentage referred as the amount of body fat mass (kg) with regards to the total body weight (kg) expressed as a percentage was assessed using body fat monitor device (Model Omron HBF- 212, Accuracy of ± 1%). Measurements were taken on level and hard surface (entering data on age, gender and height), by standing straight, bare-footed on the device, feet placed on the foot electrodes with weights evenly distributed. The device uses Bio-impedance (BI) method to estimate body fat percentage. The results were interpreted based on the obesity values proposed by Lohman (1986) and Nagamine (1972).

3.5.6.2. Clinical examination

Clinical examination of the signs and symptoms of nutritional disorders and lifestyle diseases was carried out among the subsamples using a schedule formulated and standardized with the help of a medical practitioner (Appendix-IV).

The pre/post-menopausal symptoms were assessed using the standardised Green climacteric symptom scale. Green Climacteric Scale is a set of 21 questions gives a brief measure of menopausal symptoms. The original Green Climacteric Scale has 21 questions to elicit menopause related symptoms on the basis of severity of symptoms. It has mainly four domains such as psychological (1-11), somatic (12-18), vasomotor (19-20) and sexual (21).Psychological domains are divided into anxiety (1-6) and depression (7-11).The scale measures the presence of each symptoms by rating from not at all to extremely which ranges from 0-3 for each question in the scale. Not at all = 0, A little = 1, Quite a bit = 2, extremely = 3.The total score can range from 0 – 63. The higher score indicates that the higher the woman is bothered about menopause related symptoms. (Greene, 1998; Hakimi *et al.*, 2010; Bindhu *et al.*, 2013; Chattha *et al.*, 2008). Due to non- response the study has excluded question 21 in the final result. (Appendix V).

3.5.6.3. Biochemical examination

Plate 5. Clinical assessment of nutritional disorders and lifestyle diseases

Biochemical estimation of fasting blood glucose, blood hemoglobin, serum calcium and total cholesterol were done among the subsamples by trained technicians of Govt. approved laboratories using standard procedure and methodology. 10 ml of whole blood samples after an overnight fasting (>8 hours) were collected using venipuncture method, stored at ambient conditions and transported within 3- 4 hours to the Biochemistry Laboratory of DDRC/ RGCB (Rajiv Gandhi Center for Biotechnology)/ Government Ayurveda Hospital and Research Institute (Trivandrum) for biochemical assays. Fasting blood sugar was estimated by HK method (NHANES 2003-2004), Blood hemoglobin using Cyan meth Hemoglobin method (National Institute of Nutrition, 1990), serum calcium by OCPC method (Kessler and Wolfman, 1964) and total cholesterol estimated by CHOD PAP method (Deeg and Ziegenhorn, 1982).

3.5.6.4. Bio-physical measurement

Blood pressure was measured on the left arm in the sitting position with feet flat on the floor and arms positioned on the table at the heart level, after a rest of 5 minutes. Two readings were taken with an appropriate sized cuff connected to a digital blood pressure device (Model Omron HEM- 7121, Japan, Accuracy: ±3 mm Hg), and the means of the two readings taken for analysis.

Bone mineral density (BMD) of the calcus (angle) bone or heel BMD was performed by a trained technician using the bone densitometer and the interpretation of result is done using the WHO t-score classification (WHO, 2004).

Physical work capacity was determined using Harvard step test method (Brouha, 1943). The test procedure is as follows: The subject is asked to warm up for 10 min followed by measurement of resting heart rate. The respondents was asked to take steps for 3 min. or until exhaustion (on a 33 cm height step). The time was monitored using a stop watch. One minute after finishing test heart rate was measured which is recorded as pulse 1. Two minute and three minutes after

Plate 6. Estimation of bone mineral density

finishing test heart rate was measured consecutively which is recorded as Pulse 2 and Pulse 3respectively. Exhaustion is defined as when the respondent cannot maintain the stepping rate for 15 continuous seconds. Further, the physical work capacity is rated as poor, low average, high average, good and excellent using the calculation:

Fitness index = (100 x test duration in seconds) / (2 x sum of heart beats in the recovery period).

Vital capacity screening was done to measures the lung capacity of the subsamples using peak flow expiratory meter based on the following procedure: Insert the mouth piece in up straight position. The PEFR dial is brought to zero. The respondents are instructed to take deep breath in and to breathe out into the mouth piece with maximum exertion. Repeat 3 readings and record the highest point in ((L/min). Based on the readings the forced vital capacity of the respondents were categorized into Green Zone (safe zone), Yellow Zone (zone of alert) and Red Zone (zone of emergency).

3.5.6.5. Actual food and nutrient intake

To assess the actual food and nutrient intake 24 hour recall method was used. The procedure suggested by Thimmayyama and Rao (2003) was followed where a set of spoons and cups were standardized by the researcher. The respondents were asked about the types of food preparation on a meal –by- meal basis on the previous day of interview. Raw ingredients used in each of the food preparations and the quantity consumed by the respondents were measured using the standardised cups. These cups and spoons aid the respondents to recall the quantity of food prepared and consumed. From the data obtained, the quantity of each food item used by the respondent for the day was converted to its raw equivalent. The schedule is given in Appendix VI.

The food items were grouped under the ten food groups namely cereals, pulses, roots and tubers, other vegetables, green leafy vegetables, fruits, milk and

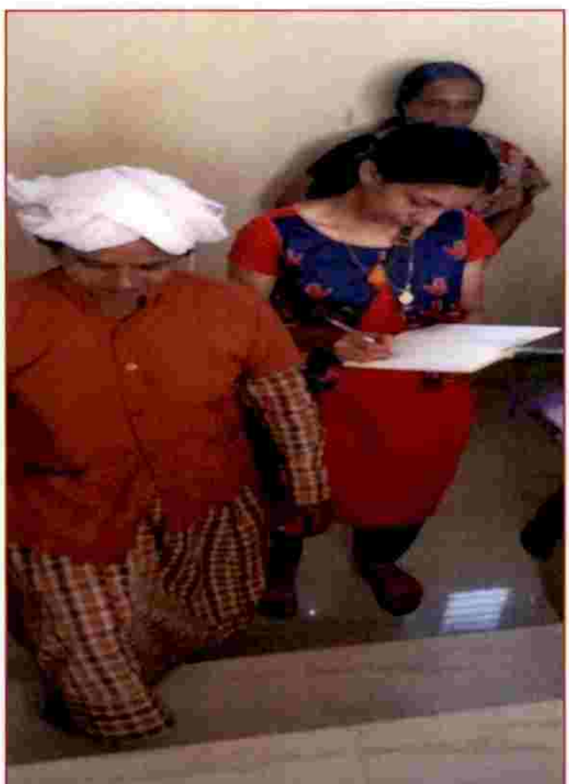


Plate 7. Assessment of physical work capacity of a women laborer

Plate 8. Assessment of vital capacity

milk products, non-vegetarian items (meat, fish and egg), sugar and jaggery and fats and oils. The quantity of different food groups consumed by the respondent was compared with the requirement suggested by ICMR (2010) for a balanced diet. The nutritive value of foods consumed was computed from the food composition database of NIN, ICMR (2017) using the Diet Cal software. The nutrient intake based upon age, sex and activity was compared with the RDA suggested by ICMR (2010). The percentage of RDA met was computed to find out the adequacy of food and nutrient intake.

3.5.7. Energy expenditure pattern and energy balance

Energy expenditure pattern based on variation in body weight and intensity of physical activity were determined using Satyanarayana method (IGNOU, 2006) among the subsamples. The energy requirement for an entire day of an individual is calculated by a minute-to-minute record of all the activities undertaken in a day. The energy cost of nine groups of activities (1-9 codes), called as Satyanarayana codes has been included along with the correction factor considered for the variation in individual weight. After coding, all the activities under different categories, the total time under each activity coded (1-9) is recorded and totalled to 1440 minutes, which are total minutes in 24 hours. Next, the energy cost of each category, is recorded on the coding sheet as MET value, which indicates Kcal/minute requirement for 60 kg person. Kcal/min/subject is calculated by multiplying the MET value with the correction factor using the formula:

$$\text{Correction factor} = \frac{\text{Subject's body weight (kg)}}{60\ \text{(kg)}}$$

The value so obtained for each code is then multiplied with total time spent in doing various activities of that group. These resulting values (for each code) are then added up to give energy expenditure of the day.

The total energy expenditure (TEE) was also determined using the BMR and PAL (Physical activity level for sedentary /light activity) value suggested as per the prediction equations proposed by the ICMR Expert Group for Indians (ICMR, 1990). The TEE thus obtained was compared with the energy intake of the respondents for a day obtained from 24 hour diet recall to find out the energy balance.

3.6. Derivation of prediction formulas and correlates

Derivation of prediction formulas and correlates among variables *viz.* socio-economic status, MSLI, stress index (SI), nutritional status, physical activity, DQI-W and prevalence of lifestyle diseases for the determinants of nutritional disorders and lifestyle diseases of middle-aged working women were done using suitable statistical techniques.

3.7. Development of Risk Factor Index (RFI) for lifestyle diseases and nutritional disorders.

Principal Component Analysis was carried out for generating a minimum data set of risk factors contributing to nutritional disorders and lifestyle diseases. Accordingly a risk factor scale was developed. The scoring procedure was based on priority weightage. The risk factor index for lifestyle diseases of the entire study population was assessed using the newly derived risk factor scale. The scale development and the scoring procedures are detailed in the result section (table 75).

3.8. Statistical analysis and interpretation of data

Statistical analysis was carried out using descriptive statistics, percentage analysis, 't' test, Chi-square statistics, Pearson correlation, Spearman correlation, Multinomial logistic regression and Principal Component Analysis. The data was analyzed using version 16.0 of Statistical Package for Social Sciences (SPSS). Principal Component Analysis was done using Minitab 17.

RESULTS AND DISCUSSION

4. RESULTS

The results of the study entitled "Determinants of nutritional status and life style diseases among middle aged working women" are presented in this chapter under the following headings.

4.1. Socioeconomic profile of the respondents.

4.2. Work pattern assessment, stress prevalence and Stress Index (SI).

4.3. Food consumption pattern and diet quality index (DQI-IW).

4.4. Prevalence of lifestyle diseases among middle aged working women.

4.5. Physical activity pattern

4.6. Nutritional status assessment

4.7. Energy balance studies

4.8. Correlates of nutritional disorders and lifestyle diseases.

4.9. Predictors for the determinants of lifestyle diseases using nutritional disorder and other contributory variables.

4.10. Risk Factor Index (RFI) of middle aged working women.

4.1. Social economic profile of the respondents

The social economic details of the middle aged working women with reference to their religion, marital status, family type, family size, educational status occupational status, average monthly income , monthly expenditure pattern, details of saving and indebtedness, socio economic status of the family, household conditions, possession details of consumer durables, personal habits, details of social participation were collected and the data is categorized under various occupation divisions from D1 to D9. The nine occupational division includes (D1)-senior officials, (D2)-professionals, (D3)-technicians, (D4)-clerks, (D5)-service workers, (D6)-agriculture and fishery workers, (D7)-craft workers, (D8)-machine operators and (D9)-construction workers. The assessment of standard of living index of the respondents belonging to 9 occupation divisions are furnished below.

4.1.1. Religion and marital status

Details of religion and marital status are presented in Table 4. Nearly three quarters of respondents (74.2%) belonged to Hindu community while 21 per cent were Christians and 5 per cent of the respondents were Muslims. Regarding marital status, 88 per cent of the respondents were married, 8 per cent were widow and 4% were either divorced or separated.

Table 4. Personal details of the respondents (N=360)

Details	Occupational divisions									Total
	D1	D2	D3	D4	D5	D6	D7	D8	D9	
Religion										
Hindu	27 (67.5)	25 (62.5)	33 (82.5)	32 (80)	25 (62.5)	25 (62.5)	36 (90)	33 (82.5)	31 (77.5)	267 (74.2)
Christian	13 (32.5)	13 (32.5)	4 (10)	7 (17.5)	10 (25)	13 (32.5)	2 (5)	6 (15)	7 (17.5)	75 (20.8)
Muslim	0	2 (5)	3 (7.5)	1 (2.5)	5 (12.5)	2 (5)	2 (5)	1 (2.5)	2 (5)	18 (5)
Marital Status										
Married	38 (95)	39 (97.5)	36 (90)	33 (82.5)	31 (77.5)	35 (87.5)	34 (85)	39 (97.5)	31 (77.5)	316 (87.8)
Widow	2 (5)	1 (2.5)	2 (5)	6 (15)	5 (12.5)	4 (10)	3 (7.5)	1 (2.5)	5 (12.5)	29 (8.05)
Divorced/ Separated	0	0	2 (5)	1 (2.5)	4 (10)	1 (2.5)	3 (7.5)	0	4 (10)	15 (4.17)
(Figures in parentheses are percentage)										

4.1.2. Family type and size of the respondents

As summarized in Table 5, nuclear family type was pre dominant (58.3%), whereas 36 per cent belonged to extended family type and the remaining (6%) were from joint family.

85

With respect to family size, major proportion of respondents (29.2%) had four members in their families, Around 25.8 per cent family had at least 2 members Almost an equal proportion of respondents had 3 members (16.9%) and 5 members (16.4%) respectively in their family. Rest of the respondents (11.66%) had more than 5 members in the family.

Table 5. Details regarding family type and family size (N=360)

Details	Occupational divisions									Total
Family Type	**D1**	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**	**D8**	**D9**	
Nuclear	27 (67.5)	34 (85)	23 (57.5)	29 (72.5)	11 (27.5)	14 (35)	31 (77.5)	26 (65)	15 (37.5)	210 (58.3)
Extended	13 (32.5)	4 (10)	15 (37.5)	10 (25)	26 (65)	21 (52.5)	7 (17.5)	14 (35)	19 (47.5)	129 (35.8)
Joint	0	2 (5)	2 (5)	1 (2.5)	3 (7.5)	5 (12.5)	2 (5)	0	6 (15)	21 (5.8)
Family size										
2	7 (17.5)	9 (22.5)	11 (27.5)	6 (15)	6 (15)	9 (22.5)	27 (67.5)	12 (30)	6 (15)	93 (25.8)
3	6 (15)	14 (35)	9 (22.5)	6 (15)	3 (7.5)	9 (22.5)	2 (5)	5 (12.5)	7 (17.5)	61 (16.9)
4	15 (37.5)	13 (32.5)	10 (25)	20 (50)	3 (7.5)	10 (25)	7 (17.5)	16 (40)	11 (27.5)	105 (29.2)
5	7 (17.5)	0	4 (10)	4 (10)	19 (47.5)	7 (17.5)	4 (10)	5 (12.5)	9 (22.5)	59 (16.4)
6	4 (10)	0	5 (12.5)	3 (7.5)	7 (17.5)	2 (5)	0	2 (5)	2 (5)	25 (6.94)
7	0	2 (5)	1 (2.5)	1 (2.5)	2 (5)	2 (5)	0	0	2 (5)	10 (2.78)
8	1 (2.5)	2 (5)	0	0	0	1 (2.5)	0	0	3 (7.5)	7 (1.94)
(Figures in parentheses are percentage)										

4.1.3. Educational status of the respondents

The educational status of the respondents showed considerable variations from below primary to professional qualifications (Table 6). Major proportion of respondents from occupation division D1 (45%) and D2 (100%) were professional qualified. Forty five per cent of technicians and associate professionals have completed higher secondary or diploma. Half of the clerical staffs were either graduates or post graduates. Major proportion of respondents employed as plant and machine operator have completed high school (40%) or middle school (30%).

Table 6. Distribution of respondents based on their educational status (N=360)

Educational status	Occupational divisions									Total
	D1	D2	D3	D4	D5	D6	D7	D8	D9	
Below primary	0	0	0	0	1 (2.5)	3 (7.5)	2 (5)	0	3 (7.5)	9 (2.5)
Primary	0	0	0	0	16 (40)	22 (55)	18 (45)	4 (10)	27 (67.5)	87 (24.17)
Middle School	3 (7.5)	0	0	0	17 (42.5)	8 (20)	8 (20)	12 (30)	9 (22.5)	57 (15.83)
High School	8 (20)	0	10 (25)	3 (7.5)	4 (10)	5 (12.5)	12 (30)	16 (40)	1 (2.5)	59 (16.39)
Higher Secondary or Diploma	7 (17.5)	0	18 (45)	12 (30)	2 (5)	2 (5)	0	3 (7.5)	0	44 (12.22)
Graduate/ PG	4 (10)	0	12 (30)	20 (50)	0	0	0	5 (12.5)	0	41 (11.39)
Professionals	18 (45)	40 (100)	0	5 (12.5)	0	0	0	0	0	63 (17.5)
(Figures in parentheses are percentage)										

The educational qualification of major proportion of the respondents of the study was found to be between primary to high school level and those came under occupation division D5 to D9.

4.1.4. Occupational status of the respondents

The details of occupational status of the respondents are given in Table 7. More than half of the respondents from D5 (72.5%), D6 (82.5%), D7 (100%), D8 (55%) and D9 (100%) were working on daily wage basis. Respondents employed as temporary or contract staff was higher among technicians and associate professionals (45%), followed by plant and machine operators (35%). Cent per cent of women professionals (D2) were permanent staffs. An equal proportion of women employed in D1 and D4 were working on either permanent or temporary basis (25%).

87

Table 7. Occupational status of the respondents in percentage (N=360)

Occupational status	Occupational divisions								
	D1	D2	D3	D4	D5	D6	D7	D8	D9
Daily wages	0	0	7.5	0	72.5	82.5	100	55	100
Temporary/Contract	25	0	45	25	27.5	17.5	0	35	0
Permanent	75	100	47.5	75	0	0	0	10	0

4.1.5. Average monthly family income

Details pertaining to the average monthly income of the families were collected and the respondents were distributed into 7 income categories based on Kuppuswamy's updated income scale (2018) and the results are given in the Table 8.

Table 8. Distribution of respondents based on average monthly family income (N=360)

Average monthly income (Rs.)	Occupational divisions									Total
	D1	D2	D3	D4	D5	D6	D7	D8	D9	
≤ 6326	0	0	0	0	32 (80)	28 (70)	20 (50)	10 (25)	34 (85)	124 (34.4)
6327-18,952	11 (27.5)	0	5 (12.5)	3 (7.5)	8 (20)	12 (30)	19 (47.5)	17 (42.5)	6 (15)	81 (22.5)
18,953 - 31,590	2 (5)	0	15 (37.5)	20 (50)	0	0	1 (2.5)	13 (32.5)	0	51 (14.2)
31,591-47,265	1 (2.5)	0	7 (17.5)	15 (37.5)	0	0	0	0	0	23 (6.4)
47,266-63,181	1 (2.5)	0	7 (17.5)	2 (5)	0	0	0	0	0	10 (2.8)
63,182-1,26,359	7 (17.5)	32 (80)	6 (15)	0	0	0	0	0	0	45 (12.5)
≥ 1,26,360	18 (45)	8 (20)	0	0	0	0	0	0	0	26 (7.2)
Total	40 (100)	40 (100)	40 (100)	40 (100)	40 (100)	40 (100)	40 (100)	40 (100)	40 (100)	360 (100)
(Figures in parentheses are percentage)										
(Kuppuswamy's updated income scale, 2018)										

Considerable variations were observed in the family income of the respondents due to diversity in the occupational status of the study populations. The average family income of majority of respondents from D1 (62.5%) and D2

(100%) was in the range of Rs 63,182/- to more than Rs. 1,26,360/-.The monthly family income of majority of respondents from D3 (85%), D4 (95%) and D8 (75%) ranged between Rs 6300/- to Rs 63,000/-. Whereas majority of the respondents belonging to D5 (80%), D6 (70%), D7 (50%) and D9 (85%) was earning a monthly income of less than Rs 6300/-.

4.1.6. Socio economic status of the families

Considering the three important variables of socio-economic status namely educational status, occupational status and average monthly income, the respondents were distributed into five socioeconomic categories using Kuppuswamy's updated Socio Economic Status (SES) scale (2018) (Table 9).

Table 9. Distribution of respondents based on socio- economic status of the family (N=360)

Socio-economic class (score)	Occupational divisions									Total
	D1	D2	D3	D4	D5	D6	D7	D8	D9	
Upper (26 -29)	21 (52.5)	40 (100)	0	0	0	0	0	0	0	61 (16.9)
Upper middle (16 -25)	18 (45)	0	28 (70)	30 (75)	0	0	0	0	0	76 (21.1)
Lower middle (11 - 15)	1 (2.5)	0	12 (30)	10 (25)	6 (15)	5 (12.5)	0	8 (20)	0	42 (11.7)
Upper lower (5 - 10)	0	0	0	0	34 (85)	35 (87.5)	40 (100)	32 (80)	40 (100)	181 (50.3)
Lower (<5)	0	0	0	0	0	0	0	0	0	0

(Figures in parentheses are percentage)

(Kuppuswamy's updated SES scale, 2018)

It is evident that majority of the respondents from D1 (52.6%) and D2 (100%) belong to upper socio economic class. The entire population from occupation division D3 and D4 belonged to upper middle and lower middle socio economic status. More than eighty per cent of the respondents from D5 (85%), D6 (87.5%), D7 (100%), D8 (80%) and D9 (100%) belong to upper lower socio economic status category. None of the respondents belong to lower socio economic status category.

4.1.7. Housing condition of the respondents

The details of the housing conditions of the respondents are furnished in Table 10. Majority of the respondents from D1 (60%), D2 (100%), D5 (55%) and D8 (62.5%) revealed ownership of houses, whereas major proportion of respondents from D3 (77.5%), D6 (57.5%), D7 (70%) and D9 (62.5%) did not have ownership of house.

All the respondents from D1 to D5 lived in a pucca house type while above 80 per cent of the respondents of D6 (90%), D7 (80%) and D9 (100%) lived in a semi-pucca house.

Separate room for cooking was observed in majority of the households of respondents from D1 to D8, whereas more than half (52.5%) of the respondents of D9 did not have separate room for cooking. All the households of the entire study population possessed electricity and improved toilet facility.

All the respondents from D1 to D4 (100%) and majority (60%) of D8 used LPG, electricity or biogas as the main fuel for cooking whereas most of respondents from D5 (70%), D6 (70%), D7 (75%) and D9 (72.5%) used wood as the main fuel for cooking.

More than sixty per cent of respondents from D1 (75%), D2 (100%), D3 (60%), D4 (100%) and D9 (60%) claimed availability of drinking water facility into their residence, with majority depending on improved water facility such as drinking water connection in the house, bottled or purified rain water. Nearly 2.5 to 20 per cent of the total population depend on own well or own hand pump as the main source of drinking water. Whereas, more than half to eighty per cent of the respondents from D5 (57.5%), D6 (77.5%), D7 (80%) and D9 (72.5%) had to depend on common sources of drinking water facilities such as common well, tap, tanker facility, common hand pump or other common open sources.

With regard to garbage and waste disposal, major proportion of the respondents, irrespective of the occupational class difference practiced improper waste disposal with a majority reporting burning of plastics as well as discarding waste at open spaces. Proper disposal of degradable and non-degradable waste was practiced by respondents from occupation division D1 (42.5%), D2 (22.5%), D3 (17.5%) and D4 (12.5%) respectively.

Table 10. Details of housing conditions of the respondents in percentage (N=360)

Housing conditions	Occupational divisions								
	D1	D2	D3	D4	D5	D6	D7	D8	D9
Ownership of house									
1. No	40	0	77.5	50	45	57.5	70	37.5	62.5
2. Yes	60	100	22.5	50	55	42.5	30	62.5	37.5
House type									
1. Semi-pucca	0	0	0	0	0	90	80	32.5	100
2. Pucca	100	100	100	100	100	10	20	67.5	0
Separate room for cooking									
1. Absent	0	0	0	0	37.5	42.5	27.5	10	52.5
2. Present	100	100	100	100	62.5	57.5	72.5	90	47.5
Electricity in house									
1. Present	100	100	100	100	100	100	100	100	100
Toilet facility									
1. Improved toilet facility	100	100	100	100	100	100	100	100	100
Main fuel used for cooking									
1. wood	0	0	0	0	70	70	75	32.5	72.5
2. coal, charcoal or kerosene	0	0	0	0	0	0	0	7.5	0
3. electricity, LPG or biogas	100	100	100	100	30	30	25	60	27.5
Source of drinking water									
1.Water source into the residence	75	100	60	100	42.5	22.5	20	60	27.5
a. Own well/hand pump	10	17.5	20	7.5	5	0	2.5	7.5	0
b. Piped water/bottled/ rain water	65	82.5	40	92.5	37.5	22.5	17.5	52.5	27.5

2. Common well/ tap/tanker/hand pump/ other open sources	25	0	40	0	57.5	77.5	80	40	72.5
Garbage / waste disposal									
1. Improper disposal	57.5	77.5	82.5	87.5	100	100	100	100	100
a. Burning of plastic	45	55	65	65	95	97.5	92.5	82.5	95
b. Discarding at public/ open spaces	12.5	22.5	17.5	22.5	5	2.5	7.5	17.5	5
2. Proper disposal of degradable and non bio degradable waste	42.5	22.5	17.5	12.5	0	0	0	0	0

4.1.8. Possession variables and consumer durables of the respondents

Possession details of consumer durables that are most relevant in Kerala living conditions were accounted in Table 11. The luxury amenities like a car, air conditioner, refrigerator, computer or a laptop was found to be mainly possessed by a major proportion of respondents belonging to occupational division D1, D2, D3 and D4. Possession of two wheelers was high among D4 (85%), D8 (52.5%) and D5 (40%) when compared to their counter parts.

Table 11. Details of possession variables and consumer durables of the respondents in percentage (N= 360)

Sl No.	Possession variables/ consumer durables	Occupational divisions								
		D1	D2	D3	D4	D5	D6	D7	D8	D9
1	Car	65	95	35	30	0	0	0	2.5	0
2	Two wheeler	30	17.5	35	85	40	32.5	22.5	52.5	32.5
3	Air conditioner	40	52.5	2.5	2.5	0	0	0	0	0
4	Refrigerator	75	100	87.5	77.5	7.5	0	0	50	0
5	Mobile phone	100	100	100	100	60	62.5	55	97.5	80
6	Computer or laptop	60	100	20	50	100	0	5	10	0
7	Colour TV	92.5	100	95	95	42.5	40	60	75	52.5
8	Labour saving devices	100	100	100	100	97.5	65	47.5	75	55

92

9	Bank/post office account	100	100	100	100	72.5	87.5	100	75	0
10	Credit card	77.5	100	100	100	0	2.5	7.5	45	17.5
11	Possession of agricultural/ non-agricultural land/parental property	55	30	10	30	25	12.5	7.5	5	0
12	Ownership of livestock	2.5	0	5	0	22.5	12.5	42.5	27.5	12.5

Possession of mobile phone ranged from 55 per cent to 100 per cent among various categories of the study population. Colour television and various labor saving devices were possessed by more than 40 per cent to 100 per cent of the entire study population.

A bank or a post-office account was possessed by major proportion of respondents from all occupation division with the least proportion seen in D9 (17.5%). A credit card was available with nearly half to cent per cent of respondents from D1 (77.5%), D2 (100%), D3 (100%), D4 (100%) and D8 (45%). In the remaining occupation division only negligible proportion of the respondents (D6 – 2.5%, D7 –7.5%, D9–2.5%, D5 – 2.5%) possessed a credit card.

Possession of agricultural or non-agricultural land or any parental property was revealed to be the highest among D1 (55%) followed by an equal proportion of respondents from D2 (30%) and D4 (30%) respectively. Ownership of livestock was observed to be the highest among D7 (42.5%) followed by D8 (27.5%) and D5 (22.5%).

4.1.9. Social participation of the respondents

The social participation details of the respondents are furnished in Table 12. Media exposure and active involvement in social issues were the two social variables considered. Exposure to radio/transistor, television or other social medias were observed in all occupation divisions with the highest proportion seen in D2 (97.5%) and D1 (85%). Irregular or total absence of newspaper reading habits was observed among 87.5%, 77.5% and 65% of respondents from D7, D9, and D5 respectively. Active involvement in various social issues was observed to be the highest in D1 (85%) followed by D7 (57.5%), D8 (55%) and D6 (47.5%) respectively.

Table 12. Details of social participation of the respondents in percentage (N= 360)

Sl No.	Social variables	Occupational divisions								
		D1	D2	D3	D4	D5	D6	D7	D8	D9
1.	**Media exposure**									
a	Irregular/No newspaper reading habits	15	2.5	62.5	22.5	65	75	87.5	55	77.5
b	Radio/transistor	2.5	0	10	45	20	10	7.5	10	12.5
c	Television/ social media	82.5	97.5	27.5	32.5	15	15	5	35	10
2.	**Social participation**									
a	Inactive/ Non member	15	80	87.5	77.5	62.5	52.5	42.5	45	65
b	Active participation	85	20	12.5	22.5	37.5	47.5	57.5	55	35

4.10. Expenditure pattern of the family

The economic status of the family depends not only on their income, but also on the expenditure pattern. Recurring expenditure covers the expenditure that occur repeatedly on a monthly or regular basis. These include the income spent on education, rent, water, fuel, electricity, transport and paid help. Non recurring expenditure includes the occasional expenditure incurred for maintenance, health, clothing, recreation and luxury. Total expenditure pattern of the family is the sum total of the expenditure in-cured for recurring, non-recurring and food expenditure. The results are depicted in Table 13.

Nearly 25-50 per cent of the total monthly income was spent on recurring expenditure by majority of the respondents belonging to occupation division D1 (82.5%), D2 (50%), D3 (62.5%), D4 (80%), D5 (67.5%), D6 (50%), and D8

(45%). Whereas D7 (82.5%) and D9 (40%) spend up to 25 per cent of the family income for recurring expenditure.

It was also observed that up to 25 per cent of the total income was incurred for non-recurring expenditure by majority of the respondents irrespective of the occupational class difference.

Expenditure on food is one of the important and unavoidable variable of family expenditure. The details of food expenditure pattern revealed that majority of the respondents from D1 (47.5%) and D2 (100%), spent less than 25 per cent of their total income for food. Majority of respondents from occupation division D3 (47.5), D4 (82.5%), D6 (55%), D7 (77.5%), D8 (62.5%) and D9 (52.5%) spent between 25-50 per cent of their total income for food. Whereas nearly half of the respondents of occupation division D5 spent between 51-75 per cent of total income for food.

Total expenditure pattern of the family revealed that majority of the respondents belonging to occupation division D1 (87.5%), D3 (62.5%), D5 (82.5%), D6 (80%), D7 (60%), D8 (72.5%) and D9 (95%) incurred more than 75 per cent of their total monthly income as expenditure. Majority of the respondents belonging to D2 (75%) and D4 (52.5%) incurred between 51-75 per cent of total income as expenditure.

4.1.11. Details of savings and indebtedness pattern on the family

Table 14 and 15 depicts the savings and indebtedness pattern of the family. The results revealed that 62.5 per cent and 50 per cent of the respondents belonging to occupation division D2 and D4 respectively have the habit of savings. Whereas majority of the respondents (62.2%) from the remaining occupation division reported that they do not have a regular savings pattern or habit. Nearly 11per cent of the total study population were reluctant to reveal their savings pattern. The study also observed that majority of the respondents

(56.7%) had indebtedness that need to be repaid on a monthly or single payment basis.

Table 13. Details of expenditure pattern of the family (N=360)

Sl No	Expenditure pattern	Occupational divisions								
		D1	D2	D3	D4	D5	D6	D7	D8	D9
1	**Recurring expenditure from total income**									
	<25%	3 (7.5)	20 (50)	5 (12.5)	7 (17.5)	8 (20)	20 (50)	33 (82.5)	13 (32.5)	16 (40)
	25 -50%	33 (82.5)	20 (50)	25 (62.5)	32 (80)	27 (67.5)	20 (50)	6 (15)	18 (45)	15 (37.5)
	51 -75%	4 (10)	0	7 (17.5)	1 (2.5)	5 (12.5)	0	1 (2.5)	7 (17.5)	9 (22.5)
	>75%	0	0	3 (7.5)	0	0	0	0	2 (5)	0
2	**Non-recurring expenditure from total income**									
	<25%	33 (82.5)	40 (100)	38 (95)	40 (100)	40 (100)	40 (100)	28 (70)	30 (75)	33 (82.5)
	25 -50%	7 (17.5)	0	2 (5)	0	0	0	8 (20)	9 (22.5)	4 (10)
	51 -75%	0	0	0	0	0	0	3 (7.5)	0	2 (5)
	>75%	0	0	0	0	0	0	1 (2.5)	1 (2.5)	1 (2.5)
3	**Food expenditure from total income**									
	< 25%	19 (47.5)	40 (100)	18 (45)	7 (17.5)	0	0	0	7 (17.5)	0
	25 -50%	14 (35)	0	19 (47.5)	33 (82.5)	16 (40)	22 (55)	31 (77.5)	25 (62.5)	21 (52.5)
	51 -75%	7 (17.5)	0	3 (7.5)	0	20 (50)	15 (37.5)	5 (12.5)	5 (12.5)	17 (42.5)
	>75%	0	0	0	0	4 (10)	3 (7.5)	4 (10)	3 (7.5)	2 (5)
4	**Total expenditure from total income**									
	< 25%	0	0	0	0	0	0	0	0	0
	25 -50%	1 (2.5)	10 (25)	1 (2.5)	0	2 (5)	0	3 (7.5)	4 (10)	0
	51 -75%	4 (10)	30 (75)	14 (35)	21 (52.5)	5 (12.5)	8 (20)	13 (32.5)	7 (17.5)	2 (5)
	>75%	35 (87.5)	0	25 (62.5)	19 (47.5)	33 (82.5)	32 (80)	24 (60)	29 (72.5)	38 (95)

(Figures in parentheses are percentage)

96

Table 14. Details of savings pattern of the family (N=360)

Savings pattern	Occupational divisions									Total
	D1	D2	D3	D4	D5	D6	D7	D8	D9	
Yes	13 (32.5)	25 (62.5)	14 (35)	20 (50)	7 (17.5)	4 (10)	3 (7.5)	10 (25)	0	96 (26.7)
No	19 (47.5)	10 (25)	25 (62.5)	15 (37.5)	33 (82.5)	30 (75)	33 (82.5)	22 (55)	37 (92.5)	224 (62.2)
No response	8 (20)	5 (12.5)	1 (2.5)	5 (12.5)	0	6 (15)	4 (10)	8 (20)	3 (7.5)	40 (11.1)
(Figures in parentheses are percentage)										

Table 15. Details of indebtedness pattern of the family (N=360)

Details of Indebtedness	Occupational divisions									Total
	D1	D2	D3	D4	D5	D6	D7	D8	D9	
Yes	9 (22.5)	12 (30)	15 (37.5)	17 (42.5)	24 (60)	22 (55)	35 (87.5)	30 (75)	40 (100)	204 (56.7)
No	31 (77.5)	28 (70)	25 (62.5)	23 (57.5)	16 (40)	18 (45)	5 (12.5)	10 (25)	0	156 (43.3)
(Figures in parentheses are percentage)										

4.1.12. Personal habits of the family

The details of unhealthy personal habits of the family members such as smoking, alcohol consumption, chewing betel leaves or pan are furnished in Table 16. Major proportion (58%) of the respondents belonging to occupation division D1 (70%), D2 (67.5%), D3 (87.5%), D4 (77.5%), D5 (42.5%), D7 (75%) and D8 (80%) did not report any unhealthy personal habits among family members. An equal proportion of respondents (27.5%) belonging to D6 and D9 revealed smoking habits among their family members.

A similar result was observed in case of alcohol consumption. Alcohol consumption was prevalent among the families of major proportion of the respondents belonging to D6 (42.5%) and followed by D9 (35%). Chewing betel leaves and pan was also found to be high among the family members of respondents belonging to occupation division D9 (27.5%). A higher prevalence of unhealthy habits were observed in D9 (90%) followed by D6 (87.5%) and D3 (57.5%).

Table 16. Distribution of respondents based on personal habits of the family (N=360)

Personal habits	Occupational divisions									Total
	D1	D2	D3	D4	D5	D6	D7	D8	D9	
Nil	28 (70)	27 (67.5)	35 (87.5)	31 (77.5)	17 (42.5)	5 (12.5)	30 (75)	32 (80)	4 (10)	209 (58)
Smoking	4 (10)	2 (5)	0	3 (7.5)	8 (20)	11 (27.5)	1 (2.5)	1 (2.5)	11 (27.5)	41 (11.4)
Alcohol consumption	8 (20)	11 (27.5)	5 (12.5)	6 (15)	13 (32.5)	17 (42.5)	6 (15)	6 (15)	14 (35)	86 (23.9)
Chewing betel leaves/pan	0	0	0	0	2 (5)	7 (17.5)	3 (7.5)	1 (2.5)	11 (27.5)	24 (6.7)

(Figures in parentheses are percentage)

4.1.13. Assessment of standard of living of the families using the developed standard of living index (SLI)

Based on the derived modified standard of living index, the respondents were categorized into low, middle and high SLI and the results are given in Table 17. The mean SLI was estimated to be 16.6. Majority of the respondents from occupation division D1 (65%) and D2 (100%) were categorized under high SLI with a score range of 21 to 30.

Table 17. Distribution of respondents based on standard of living index of the family (N=360)

SLI category and score range	Mean ± SD	Occupational divisions									Total
		D1	D2	D3	D4	D5	D6	D7	D8	D9	
Low (0-10)	16.6 ± 6.2	0	0	0	0	18 (45)	28 (70)	24 (60)	9 (22)	34 (85)	113 (31.4)
Medium (11-20)		14 (35)	0	33 (82.5)	23 (57.5)	22 (55)	12 (30)	16 (40)	30 (75)	6 (15)	156 (43.3)
High (21-30)		26 (65)	40 (100)	7 (17.5)	17 (42.5)	0	0	0	1 (2.5)	0	91 (25.3)
Chi-square	1128.63**										

(Figures in parentheses are percentage)

Major proportion of the respondents belonging to D3 (82.5%), D4 (57.5%), D5 (55%) and D8 (75%) were categorized under middle SLI. Major proportion of the respondents from occupation division D6 (70%), D7 (60%) and

D9 (85%) belong to low SLI. In total, two out of every fifth families belonged to middle SLI (43.3%). Statistical analysis revealed that standard of living index and occupational divisions were dependent on each other (Chi-square-1128.63**) indicating that higher order occupation status improves SLI and vice- versa.

4.2. Details of work pattern and stress prevalence among the respondents

The results pertaining to the work pattern of the respondents with respect to the nature of work sector, tenure of service, travel distance to work place, mode of conveyance, interest and motivation in the work, discrimination faced by women in the work place, occupational hazards, details of household stress, work stress, psychological distress and stress prevalence among the respondents are detailed in this section.

4.2.1. Details of work sector of the respondents

As indicated in Table 18, more than two fifth of the study population (44.2%) were employed in public sector with the highest representation from occupation division D8 (100%) and D7 (90%). Whereas 38 per cent of the total study population were employed in government sector with 100 per cent and 65 per cent representation from occupation division D1 and D2 respectively. Among the entire study population, 16.7 per cent were employed in private sector with cent per cent representation from D9. Out of 360 respondents only four women were self-employed.

Table 18. Distribution of respondents based on work sector (N= 360)

Work sector	Occupational divisions									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	Total
Government	40 (100)	26 (65)	16 (40)	17 (42.5)	16 (40)	22 (55)	0	0	0	137 (38)
Private	0	3 (7.5)	7 (17.5)	4 (10)	6 (15)	0	0	0	40 (100)	60 (16.7)
Public	0	11 (27.5)	17 (42.5)	19 (47.5)	18 (45)	18 (45)	36 (90)	40 (100)	0	159 (44.2)
Self employed	0	0	0	0	0	0	4 (10)	0	0	4 (1.1)

(Figures in parentheses are percentage)

99

4.2.2. Details of duration of service of the respondents

As illustrated in Table 19, nearly three out of five middle aged women claimed to have up to 10 to 20 years of work experience in the particular field.

Table 19. Distribution of respondents based on tenure of service (N=360)

Years of experience	Occupational divisions									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	Total
10-20 years	17 (42.5)	0	28 (17)	24 (60)	32 (80)	22 (55)	28 (70)	38 (95)	40 (100)	229 (63.6)
21-30 years	19 (47.5)	33 (82.5)	12 (30)	12 (30)	8 (20)	7 (17.5)	7 (17.5)	2 (5)	0	100 (27.8)
>30 years	4 (10)	7 (17.5)	0	4 (10)	0	11 (27.5)	5 (12.5)	0	0	31 (8.6)
(Figures in parentheses are percentage)										

Major proportion of the respondents belonging to occupation division D2 (82.5%) had 21 to 30 years of tenure of service. More than 30 years of service was observed to be high among middle aged women employed in occupation division D6 (27.5%).

4.2.3. Details of mode of conveyance and distance to work place

Table 20 and 21 explains the travel distance and the mode of conveyance to the work place. Half of the total study population depends on public vehicles like bus service, auto rickshaw or institute/office vehicles as their mode of conveyance.

Table 20. Distribution of respondents based on mode of conveyance (N=360)

Mode of conveyance	Occupational divisions									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	Total
By walk	0	0	8 (20)	12 (30)	19 (47.5)	18 (45)	22 (55)	11 (27.5)	23 (57.5)	113 (31.4)
Public vehicles	18 (45)	26 (65)	22 (55)	16 (40)	16 (40)	19 (47.5)	18 (45)	28 (70)	17 (42.5)	180 (50)
Private vehicles	22 (55)	14 (35)	10 (25)	12 (30)	5 (12.5)	3 (7.5)	0	1 (2.5)	0	67 (18.6)
(Figures in parentheses are percentage)										

100

Almost 32 per cent of the study population walked to their work place. Nearly one out of every 20 women in the study used private / personal vehicles such as car or two wheelers as their mode of conveyance to work place.

Almost half of the study population (48.6%) travel a distance of less than 5 Kms to reach their work place. Around 43 per cent women travel a distance between 5 to 15 kms to reach their work place. Only minor proportion (8.3%) of respondents travel more than 15 kms to reach their work place.

Table 21. Distribution of respondents based on travel distance to work place (N=360)

Travel distance in Kms	Occupational divisions									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	Total
<5	4 (10)	18 (45)	13 (32.5)	15 (37.5)	22 (55)	18 (45)	32 (80)	17 (42.5)	36 (90)	175 (48.6)
5.1- 15	32 (80)	19 (47.5)	23 (57.5)	22 (55)	18 (45)	11 (27.5)	8 (20)	18 (45)	4 (10)	155 (43.1)
>15	4 (10)	3 (7.5)	4 (10)	3 (7.5)	0	11 (27.5)	0	5 (12.5)	0	30 (8.3)
(Figures in parentheses are percentage)										

4.2.4. Assessment of motivation in work

The motivation of middle aged working women in work was assessed and are furnished in Table 22. Financial benefits were revealed to be the major motivation and interest in work by more than half of the middle aged women (55.8%). Nearly twenty per cent (19.7%) of the respondents revealed financial as well as personal benefits such as acquiring various soft skills as the main motivation and interest towards work. Along with financial benefits, social benefits were also revealed as an important motivation and interest towards work by almost 12 per cent of the study population.

Table 22. Distribution of respondents based on motivations and interest in work (N=360)

Motivations/ Interest in work	Occupational divisions									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	Total
Financial benefits	30 (75)	23 (57.5)	16 (40)	19 (47.5)	21 (52.5)	18 (45)	26 (65)	22 (55)	26 (65)	201 (55.8)
Social & financial benefits	2 (5)	4 (10)	3 (7.5)	5 (12.5)	4 (10)	9 (22.5)	6 (15)	5 (12.5)	4 (10)	42 (11.7)
Financial & personal benefits	5 (12.5)	6 (15)	18 (45)	16 (40)	6 (15)	7 (17.5)	4 (10)	4 (10)	5 (12.5)	71 (19.7)
Combinations of all benefits	3 (7.5)	7 (17.5)	3 (7.5)	0	9 (22.5)	6 (15)	4 (10)	9 (22.5)	5 (12.5)	46 (12.8)
(Figures in parentheses are percentage)										

4.2.5. Details of gender disparity faced by middle aged working women

The discriminations faced by middle aged working women in terms of wage, quantum of work and time are detailed in Table 23.

Table 23. Distribution of respondents based on gender disparity faced by women (N=360)

Gender disparity	Occupational divisions									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	Total
Nil	6 (15)	8 (20)	7 (17.5)	8 (20)	6 (15)	4 (10)	8 (20)	8 (20)	12 (30)	67 (18.6)
Wage based	5 (12.5)	4 (10)	8 (20)	5 (12.5)	3 (7.5)	6 (15)	9 (22.5)	4 (10)	25 (62.5)	69 (19.2)
Quantum of work / time	6 (15)	9 (22.5)	6 (15)	2 (5)	5 (12.5)	6 (15)	2 (5)	3 (7.5)	1 (2.5)	40 (11.1)
Combinations of wage, work and time	23 (57.5)	19 (47.5)	19 (47.5)	25 (62.5)	26 (65)	24 (60)	21 (52.5)	25 (62.5)	2 (5)	184 (51.1)
(Figures in parentheses are percentage)										

Almost nineteen per cent (18.6%) of middle aged women claimed that they do not face any discrimination at work place. Less than twenty per cent (19.2%) of respondents faced wage based discrimination with majority (62.5%) employed in construction and manufacturing works. More than half of the total study population (51.1%) claimed to face a combination of wage, work and time

102

based discrimination with the highest percentage of discrimination reported by respondents belonging to D5 (65%). Around 11 per cent of the middle aged women also faced work and time based discrimination at work place.

4.2.6. Prevalence of occupational hazards among the respondents

The prevalence of occupational hazards among the middle aged working women are in Table 24. None of the respondents from occupation division D1 to D4 conveyed any occupational hazards. Whereas 80 per cent and 70 per cent of the respondents employed in D6 and D9 respectively revealed to have occupation related health hazards.

Table 24. Prevalence of occupational hazards among middle aged working women (N=360)

Occupational hazards	Occupational divisions									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	Total
Yes	0	0	0	0	11 (27.5)	32 (80)	21 (52.5)	14 (35)	28 (70)	106 (29.4)
No	40 (100)	40 (100)	40 (100)	40 (100)	29 (72.5)	8 (20)	19 (47.5)	26 (65)	12 (30)	.254 (70.6)
(Figures in parentheses are percentage)										

4.2.7. Prevalence of household and work stress among respondents

The mean score and the ranking of middle aged working women based on household stress prevalence is detailed in Table 25.

Table 25. Ranking of middle aged working women based on household stress prevalence

Household stress index	Occupational divisions								
	D1	D2	D3	D4	D5	D6	D7	D8	D9
Mean score	67.29	50.42	69.27	57.40	68.44	66.98	62.29	54.06	66.56
Mean rank	III	IX	I	VII	II	IV	VI	VIII	V

The mean score of household stress ranged between 69.27 to 50.42. Based on the mean score the household stress intensity was ranked. The results

103

indicated that technicians and associate professionals had the highest household stress prevalence and professionals had the least household stress.

The mean score of work stress ranged from 61.25 to 39.79 (Table 26). The ranking of the work stress related mean score revealed that respondents employed in construction and manufacturing works had ranked work stress at the top most level. The least prevalence of work stress was observed among the middle aged women employed in occupation division D1.

Table 26. Ranking of middle aged working women based on work/job stress prevalence

Work stress index	Occupational divisions								
	D1	D2	D3	D4	D5	D6	D7	D8	D9
Mean score	39.79	41.88	58.54	51.88	53.75	57.60	51.35	43.23	61.25
Mean rank	IX	VIII	II	V	IV	III	VI	VII	I

4.2.8. Prevalence of psychological distress among respondents

The prevalence of psychological distress among middle-aged working women was studied and the results are illustrated in Table 27.

Table 27. Prevalence of psychological distress among middle aged working women (N=360)

Psychological distress (PD)	Occupational divisions									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	Total
PD absent	25 (62.5)	18 (45)	18 (45)	8 (20)	13 (32.5)	8 (20)	14 (35)	9 (22.5)	5 (12.5)	118 (32.8)
PD1 symptom	8 (20)	18 (45)	16 (40)	13 (32.5)	10 (25)	8 (20)	14 (35)	15 (37.5)	5 (12.5)	107 (29.7)
PD2 symptom	6 (15)	4 (10)	6 (15)	15 (37.5)	11 (27.5)	16 (40)	10 (25)	12 (30)	16 (40)	96 (26.7)
PD3 symptom	1 (2.5)	0	0	4 (10)	6 (15)	8 (20)	2 (5)	4 (10)	14 (35)	39 (10.8)
(Figures in parentheses are percentage)										

Nearly one third of the total study population did not have any symptoms related to psychological distress. Whereas around 30 per cent of the total study population was observed to have at least one symptom related to psychological

104

distress. An equal proportion of respondents belonging to D6 (40%) and D9 (40%) had the highest prevalence of psychological distress with the presence of at least two symptoms. The presence of any three symptoms related to psychological distress was observed to be high among D9 strata (35%).

4.2.9. Assessment of stress prevalence among respondents by using modified stress scale (MSLI)

The stress scale modified for this study was used to assess the prevalence of stress among the middle aged working women. The results are elaborated in Table 28. The mean stress score and the standard deviation of the total study population was found to be 28.4 $\pm$ 8.57. The highest mean score and standard deviation was observed among D9 (32.63 $\pm$7.50). Moderate stress was prevalent in majority of the study population (52.5%). Around 26 per cent of the total population were categorised under low stress category. Nearly 18 per cent (17.8%) of the study population were categorised under high stress category. Only negligible population (3.3%) were found to have very low stress. None of the respondents were categorized under very high stress category.

Table 28. Distribution of respondents based on stress prevalence (N=360)

Stress category (score range)	**Occupational divisions**									
	D1	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**	**D8**	**D9**	**Total**
Mean ± SD	**26.3 ± 7.4**	**22.8 ± 9.01**	**31.38 ± 10.21**	**27.6 ± 8.57**	**30.55 ± 4.95**	**31.55 ± 7.66**	**28.28 ± 6.79**	**24.55 ± 9.08**	**32.63 ± 7.50**	**28.4 ± 8.57**
Very low (0-12)	0	6 (15)	2 (5)	1 (2.5)	0	0	0	3 (7.5)	0	12 (3.3)
Low (13- 24)	14 (35)	14 (35)	8 (20)	12 (30)	7 (17.5)	8 (20)	9 (22.5)	15 (37.5)	8 (20)	95 (26.4)
Moderate (25- 36)	21 (52.5)	19 (47.5)	14 (35)	23 (57.5)	27 (67.5)	20 (50)	28 (70)	18 (45)	19 (47.5)	189 (52.5)
High (37- 48)	5 (12.5)	1 (2.5)	16 (40)	4 (10)	6 (15)	12 (30)	3 (7.5)	4 (10)	13 (32.5)	64 (17.8)
Chi-square	75.8**									
(Figures in parentheses are percentage)										

With respect to occupational divisions, major proportion of technicians and associate professional (D3 – 40%) and construction workers (D9- 32.5%) had high stress prevalence. The prevalence of the moderate stress was observed to be the highest among weavers (D7 – 70%) followed by service workers (D5 – 67.5%). Majority of the respondents employed as machine operators (37.5%) belonged to low stress category. A higher proportion of very low stress prevalence was observed among middle aged women professionals (D2-15%). The stress prevalence among middle aged working women was dependent on various occupational division as revealed by significant chi-square analysis (75.8**) indicating that various occupation strata contribute to stress prevalence.

4.3. Dietary profile of the respondents

The dietary profile of the respondents with respect to food habits, food consumption pattern, food use frequency, food purchase pattern and various healthy dietary practices adopted by the respondents are detailed in this section.

4.3.1. Details of food habits

More than ninety per cent (94.4%) of all the respondents selected for the study were found to be non-vegetarians. Nearly five per cent (4.7%) of the total population only constituted vegetarians (Table 29).

Table 29. Food habits of the respondents (N=360)

Food habits	Occupational divisions									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	Total
Vegetarian	2 (5)	3 (7.5)	2 (5)	4 (10)	0	0	4 (10)	2 (5)	0	17 (4.7)
Non vegetarian	37 (92.5)	36 (90)	38 (95)	35 (87.5)	40 (100)	40 (100)	36 (90)	38 (95)	40 (100)	340 (94.4)
Ovo vegetarian	1 (2.5)	1 (2.5)	0	1 (2.5)	0	0	0	0	0	3 (0.83)
Total	40 (100)	40 (100)	40 (100)	40 (100)	40 (100)	40 (100)	40 (100)	40 (100)	40 (100)	360 (100)
(Figures in parentheses are percentage)										

106

4.3.2. Details of food use frequency

The frequency of use of food items were quantified by scoring and the results are given in this section. The frequency mean score and the mean percentage intake of nineteen food items have been computed by the formula suggested by Reaburn *et al.* (1979).These nineteen food items were again grouped into 4 main food groups. *viz*. energy yielding foods, body building foods, protective foods, instant/ reheated / homemade and processed foods.

Cereals, roots and tubers, fats and oils and sugar constituted energy yielding foods (Table 30). The maximum score of 100 per cent was obtained for cereals in all occupation divisions. The percentage mean score of roots and tubers ranged between 18.67 to 46.67. The highest frequency of use was observed among clerks (D4) and the least consumption among service workers (D5). The frequency of use of fats and oils was more than 50 per cent in all occupation divisions and the highest use was observed among service workers (D5).

Table 30. Frequency of use of energy yielding foods (N=360)

Occupation divisions	Energy yielding foods									
	Cereals		Roots &tubers		Fats & oils		Sugar		Nuts/ Oilseed	
	Mean score	Per cent mean score	Mean score	Per cent mean score	Mean score	Per cent mean score	Mean score	Per cent mean score	Mean score	Per cent mean score
D1	30	100	11.35	37.83	19.55	65.17	17.35	57.83	6.98	23.27
D2	30	100	13.60	45.33	15.71	52.37	22.10	73.67	15.15	50.50
D3	30	100	13.00	43.33	18.70	62.33	18.75	62.50	4.18	13.92
D4	30	100	14.00	46.67	17.40	58.00	20.25	67.50	9.68	32.25
D5	30	100	5.60	18.67	19.83	66.10	24.00	80.00	2.23	7.42
D6	30	100	9.50	31.67	19.36	64.53	18.60	62.00	2.60	8.67
D7	30	100	7.05	23.50	18.44	61.47	19.82	66.10	5.50	18.33
D8	30	100	7.60	25.33	17.03	56.77	18.31	56.77	3.73	12.42
D9	30	100	7.68	25.60	19.70	65.67	19.50	65.67	3.50	11.67

The mean frequency of use of sugars ranged between 56.77 to 80 per cent. The use of sugar was also revealed high among service workers (D5). Nuts and oil seeds are considered as the concentrated source of energy. The frequency of use of these food items ranged from 7.42 to 50.5 per cent. Professionals (D2) show the highest use of nuts and oil seeds especially coconut and the least consumption observed among service workers (D5)

Table 31. Frequency of use of body building foods (N=360)

Occupation divisions	Body building foods									
	Pulses		Milk		Egg		Fish		Chicken & meat	
	Mean score	Per cent mean score	Mean score	Per cent mean score	Mean score	Per cent mean score	Mean score	Per cent mean score	Mean score	Per cent mean score
D1	11.85	39.50	6.50	21.67	3.20	10.67	20.05	66.83	3.48	11.60
D2	20.35	67.83	5.03	16.75	4.80	16.00	15.28	50.92	3.53	11.75
D3	15.95	53.16	5.70	19.00	1.80	6.00	21.05	70.17	1.68	5.58
D4	14.00	46.67	8.33	27.75	2.28	7.58	15.90	53.00	2.38	7.92
D5	2.18	7.25	1.75	5.83	2.18	7.25	26.55	88.50	1.40	4.67
D6	3.00	10.00	0.82	2.73	0.48	1.58	26.00	86.67	0.55	1.83
D7	13.10	43.66	3.75	12.50	0.30	1.00	19.90	66.33	0.23	0.76
D8	5.50	18.33	3.30	11.00	0.70	2.33	19.85	75.17	1.35	4.50
D9	4.88	16.25	1.48	4.92	0.73	2.42	24.45	81.50	0.95	3.17

With regard to the intake of body building foods such as pulses, milk, egg, fish, chicken and meat, the percentage mean frequency use of pulses was less than 20 per cent mean score among occupation division D5 (7.25%), D6 (10%), D8 (18.33%), and D9 (16.25%). Comparatively a better pulse consumption was observed among professionals (D2 - 67.83%) and technicians and associate professionals (D3 - 53.16%). It was observed that the percentage mean score for milk was less than 30 per cent among the respondents of all occupation divisions with less than 10 per cent intake observed in D5 (5.83%), D6 (2.73%) and D9 (4.92%). The percentage mean frequency of use of eggs was less than 11 per cent among all occupation division except D2 (16%). The fish consumption was comparatively better with more than 50 per cent intake observed in all occupation divisions. The percentage mean score of fish consumption ranged between 50.92 to 88.5 per cent. The percentage mean consumption of chicken and meat was found to be less than 12 per cent among the respondents of all occupation divisions (Table 31).

Among the 360 respondents surveyed, the frequency of use of protective foods like green leafy vegetables, other vegetables and fruits was studied (Table 32). The mean percentage score of consumption of green leafy vegetables was less than twelve per cent among all the respondents except those belonging to D2 (23.75%). The percentage mean score of other vegetables indicated a satisfactory consumption with more than 40 per cent intake observed among the respondents of all occupation division from D1 to D8. The frequency of use of fruit was more than 40 per cent among respondents belonging to occupation division D1 to D4 owing to their better purchasing power whereas least consumption was observed among D5 (6.33%).

Table 32. Frequency of use of protective foods (N=360)

Occupation divisions	Protective foods					
	Leafy vegetables		Other vegetables		Fruits	
	Mean score	Per cent mean score	Mean score	Per cent mean score	Mean score	Per cent mean score
D1	2.05	6.83	20.08	66.93	19.38	64.60
D2	7.13	23.75	23.20	77.33	24.90	83.00
D3	0.88	2.92	18.40	61.33	12.90	43.00
D4	3.38	11.25	22.88	76.25	19.55	65.17
D5	0.45	1.50	14.40	48.00	1.90	6.33
D6	0.38	1.25	13.07	43.57	4.00	13.33
D7	0.95	3.17	19.65	65.50	5.25	17.50
D8	0.83	2.75	13.48	44.92	8.60	28.67
D9	0.93	3.08	7.10	23.67	7.60	25.33

The frequency of use of spices, condiments and beverages was found to be satisfactory among respondents from all occupation divisions (Table 33). The percentage mean frequency score of spices and condiments almost ranged between 70 to 100 per cent and that of beverages was between 95 to 100 per cent.

Table 33. Frequency of use of condiments, spices and beverages (N=360)

Occupation Divisions	Food items			
	Condiments & spices		Beverages	
	Mean score	Per cent mean score	Mean score	Per cent mean score
D1	20.85	69.50	28.40	94.67
D2	30.00	100.00	30.00	100.00
D3	27.40	91.33	29.10	97.00
D4	21.65	72.17	29.25	97.50
D5	30.00	100.00	30.00	100.00
D6	25.50	85.00	30.00	100.00
D7	22.55	75.16	30.00	100.00
D8	21.00	70.00	25.50	95.00
D9	30.00	100.00	30.00	100.00

The frequency of use of instant foods, reheated foods, processed and preserved foods as well as homemade snacks among middle aged women was studied (Table 34). The results revealed the highest per cent mean score for instant fast foods was 51.75% noticed among construction workers and reheated foods (57%) among technicians and associate professionals. The frequency of use of processed and preserved foods among middle aged working women was at an alarming rate.

Table 34. Consumption pattern of instant, reheated, homemade, processed and preserved foods (N=360)

Occupation divisions	Food items							
	Instant/fast foods		Reheated/ refrigerated foods		Homemade snacks		Processed/ Preserved foods	
	Mean score	Per cent mean score	Mean score	Per cent mean score	Mean score	Per cent mean score	Mean score	Per cent mean score
D1	4.73	15.77	10.65	35.50	0.45	1.50	16.05	53.50
D2	5.48	18.25	5.30	17.67	9.45	31.50	6.60	22.00
D3	11.45	38.17	17.1	57.00	2.38	7.92	16.90	56.33
D4	5.58	18.58	8.83	29.42	1.65	5.50	8.85	29.50
D5	1.75	5.83	2.15	7.17	0.10	0.33	14.93	49.75
D6	0	0	3.10	10.33	0	0	12.85	42.83
D7	8.75	23.33	6.10	20.33	0.525	1.75	5.80	19.33
D8	7.00	23.33	2.10	7.00	0.35	1.17	1.81	33.00
D9	15.525	51.75	9.525	30.00	0.35	1.17	20.40	68.00

The percentage mean score was observed to be more than 45 per cent among respondents employed in occupation division D1 (53.5%), D3 (56.33%), D5 (49.75%), D6 (46.83%) and D9 (68%).

4.3.3. Classification of food items based on food scores

Frequency of use of various food items by the respondents were assessed by recording the use of different food using a frequency scale. These food items were further classified into 4 categories namely – daily used foods (score between 90 to 100%), frequently used foods (score between 75 to 89%), less frequently used foods (score between 15 to 74%), and least frequently used foods (score below 15%). The results are detailed in Table 35.

Cereals mainly rice, fats and oils and beverages are the daily used foods by the respondents belonging to all the occupation divisions with their frequency of use ranging between 90 to 100 per cent.

Fish was frequently used by the respondents of occupation division D5, D6, D8 and D9. Other vegetables were found to be frequently used only by division D2 and D4. Sugar was frequently used (75% - 89%) by respondents belonging to D2, D5, D6 and D8. Fruits were found to be used frequently only by the women professionals. Spices and condiments were frequently used by respondents belonging to occupational division D6, D7 and D9.

The frequency of use of pulses, other vegetables and fruits ranges between 15 to 74 per cent and these food items were classified as less frequently used foods. Fish was less frequently used by respondents belonging to occupation division D1, D2, D3, D4 and D7 with frequency of use below 75 per cent.

Green leafy vegetables, chicken and meat, egg, nut and oil seeds, roots and tubers and milk was least frequently used by majority of the respondents with less than 15 per cent use.

111

Table 35. Classification of food items based on food score

Groups	Occupation divisions								
	D1	D2	D3	D4	D5	D6	D7	D8	D9
Daily used foods (90- 100%)	Cereals Fats & Oils, Beverages	Cereals, Fats & Oils, spices & condiments Beverages	Cereals, Fats & Oils, spices & condiments, Beverages, Sugar	Cereals, Fats & Oils, Beverages	Cereals, Fats & Oils, spices & condiments, Beverages	Cereals, Fats & Oils, Beverages	Cereals, Beverages	Cereals, Fats & Oils, Beverages	Cereals, Fats & Oils, Beverages
Frequently used foods (75- 89%)	Nil	Other vegetables, fruits, sugar	Nil	Other vegetables	Fish, sugar	Fish, sugar, Spices & Condiments	Fats & Oils, Spices & Condiments	Fish, sugar	Fish, Spices & Condiments
Less frequently used foods (15- 75%)	Pulses, Other vegetables, fruits, sugar, roots & tubers, milk, fish, nuts & oilseeds, spices & condiments	Pulses, leafy vegetables, milk, fish, nuts & oilseeds, egg	Pulses, Other vegetables, milk, fish, fruits	Pulses, fruits, sugar, milk, fish, nuts & oilseeds, spices & condiments	Pulses, Other vegetables	Pulses, Other vegetables	Pulses, Other vegetables, fish, fruits sugar, nuts & oilseeds	Pulses, fruits Other vegetables spices & condiments	Pulses, fruits Other vegetables sugar, roots & tubers
Least frequently used foods (<15%)	leafy vegetables, egg, chicken & meat	chicken & meat, roots & tubers	leafy vegetables, egg, chicken & meat roots & tubers, nuts & oilseeds	leafy vegetables, egg chicken & meat roots & tubers	Pulses, leafy vegetables, fruits, roots & tubers, chicken & meat milk, nuts & oilseeds, egg	Pulses, leafy vegetables, fruits, roots & tubers, chicken & meat milk, nuts & oilseeds, egg	leafy vegetables, chicken & meat roots & tubers, milk, egg	leafy vegetables, chicken & meat roots & tubers, milk, egg, nuts & oilseeds	leafy vegetables, chicken & meat milk, egg nuts & oilseeds

4.3.4. Details of food adequacy among respondents

Based on the food consumption pattern of middle aged working women, the mean food intake was computed and was compared with the quantity specified as per the recommended dietary allowances (RDA) (ICMR 2010).

As more than sixty per cent of middle aged women from D1 to D8 was observed as inactive, their food intake was compared with RDA for active sedentary workers whereas D9 category were included in moderately active (D9) worker, their food intake was compared with RDA for moderate workers.

Based on their food adequacy, middle aged working women were further grouped into adequate (meeting 100% and above the recommended intake), marginally adequate, marginally inadequate (meeting 50 - 74.9% of RDA) and inadequate (meeting <50% of RDA) food intake categories (Table 36a & 36b).

The result indicated inadequate intake of protective foods like pulses, milk, roots and tubers, leafy vegetables, other vegetables and fruits among the respondents of all occupation divisions meeting only less than 50 per cent of the RDA.

Cereals intake was observed to be adequate in occupation division D1 as well as D5 to D9. Adequacy in the intake of fish was observed among middle aged women employed in division D1 to D7.

Nuts particularly coconut which is important ingredient of Kerala dishes was adequately taken by respondents belonging to only two occupation division *viz.* D2 and D4 whereas respondents from D5 to D9 showed inadequate to marginally inadequate intake.

Fats and oils were marginally adequate in all occupation divisions providing more than 75% of RDA. Sugar and jaggery was adequately taken by divisions D2, D4 and D5. Among all other occupation division, the intake was found to be marginally adequate. The results indicate that the lower intake of oils and sugar than the recommended level is probably due to a self-imposed restriction due to health awareness and as a preventive measure towards the occurrence of lifestyle diseases in middle age.

Table 36a. Distribution of respondents based on food adequacy

Food stuff	RDA (sedentary women)	Mean food intake (g/d) (% of RDA met from diet)							
		D1	D2	D3	D4	D5	D6	D7	D8
Cereals	270	273.58 (101.30)	232.10 (85.96)	249.05 (92.24)	237.88 (88.10)	312.08 (115.60)	327 (121.16)	296.21 (109.71)	282.7 (104.70)
Pulses	60	23.7 (39.50)	40.7 (67.80)	15.95 (26.6)	21 (35)	4.35 (7.25)	6 (10)	26.2 (43.70)	11 (18.30)
Milk	300	39 (13)	30 (10)	34.2 (11.4)	49.95 (16.65)	10.5 (3.5)	8.1 (2.7)	15 (5)	19.8 (6.6)
Roots and tubers	200	22.7 (11.4)	27.2 (13.6)	28 (13)	26 (14)	11.2 (5.6)	19 (9.5)	14.1 (7)	15.2 (7.6)
Leafy Vegetables	100	2.05 (2.1)	7.13 (7)	0.8 (0.8)	3.38 (3.4)	0.45 (0.5)	0.37 (0.40)	0.95 (0.95)	0.82 (0.82)
Other Vegetables	200	40.16 (20.1)	46.4 (23)	18.4 (9.2)	22.88 (11.4)	28.8 (14.4)	26.14 (13)	39.3 (19.7)	26.95 (13.48)
Fruits	100	19.38 (19.4)	24.9 (24.9)	12.9 (12.9)	19.55 (19.6)	1.9 (1.9)	4 (4)	5.25 (5.25)	8.6 (8.6)
Sugar	20	17.35 (86.75)	22.1 (110.5)	18.75 (93.75)	20.25 (101.25)	24 (120)	18.6 (93)	19.82 (99.10)	18.31 (91.55)
Oils	20	19.55 (97.75)	15.71 (78.55)	18.70 (87)	17.4 (93.50)	19.83 (99.15)	19.36 (96.80)	18.44 (92.20)	17.03 (85.15)
Fish	30	40.1 (133.6)	30.55 (101.8)	42.1 (140.3)	31.8 (106)	53.1 (177)	52 (173.3)	39.8 (132.7)	22.55 (75.17)
Nuts and Oil seeds	30	27.92 (93)	30.3 (101)	25.05 (83.5)	38.7 (129)	8.8 (29.30)	20.8 (69.3)	22 (73.3)	22.35 (74.5)

Adequate (≥100% of RDA),

Marginally adequate (75-99.9% of RDA)

Marginally inadequate (50-74.9% of RDA)

Inadequate (<50% of RDA)

Table 36b. Distribution of respondents based on food adequacy

Food stuff	RDA (moderately active)	Mean food intake (g/d) (% of RDA met from diet) D9 (N=40)
Cereals	330	351.42 (106.5)
Pulses	75	9.75 (13)
Milk	300	13.29 (4.43)
Roots and tubers	200	15.36 (7.7)
Leafy Vegetables	100	0.93 (0.9)
Other Vegetables	200	14.2 (7.1)
Fruits	100	15.2 (15.2)
Sugar	30	19.5 (97.5)
Oils	25	19.7 (78.8)
Fish	30	24.45 (81.5)
Nuts and Oil seeds	30	15 (50)
adequate (≥100% of RDA), - Marginally adequate (75-99.9% of RDA), - Marginally inadequate (50-74.9% of RDA), Inadequate (<50% of RDA)		
(Figures in parentheses are percentage)		

4.3.5. Details of dietary practices adopted by the respondents

Table 37 illustrated the various healthy dietary practices adopted by middle aged working women.

Table 37. Dietary practices adopted by middle aged working women (N=360)

Sl.No.	Dietary practices	Number	Percent (%)
1	Intake of nutraceutical/ fermented foods/ dietary fiber ≥ twice/ week	59	16.4
2	Fish intake - 200g/w or 30g/d or 1/w	231	64.2
3	Water intake (2 litres/d)	51	14.2
4	Use of re heated oils		
	Daily	42	11.7
	Never	12	3.3
	Occasionally	306	85
5	Intake of nuts		
	25g/w or 1/w	141	39.2
6	Intake of fruits and vegetables		
	≥ 400g/d	0	0
	<150g/d	291	80.8

115

It was observed that only less than 20 percent (16%) of the total study population claimed to include nutraceutical, fermented food or dietary fibers in their diet at least twice in a week whereas 3 out of every 5 middle aged women (64%) consumed fish at least once in a week. The intake of drinking water level was found to be miserable among middle aged working women.

Only 14 per cent of the respondents took the minimum recommended level of at least 2 liters of water per day. Nearly twelve (11.7%) per cent of the respondents used reheated oils daily which is an important contributor of oxidative stress and related degenerative diseases in the body.

Whereas, majority (85%) of the respondents used reheated oils frequently. Nearly two out of five middle aged working women (39.2%) included nuts at least weekly once in their diet. None of the respondents took the daily recommended intake of fruits and vegetables of $\geq$ 400g/d which is an essential preventive measure for controlling lifestyle diseases. Majority of the respondents (80.8%) took less than 150g of fruits and vegetables per day.

4.3.6. Assessment of diet quality index (DQI) of the respondents

Using the newly derived diet quality index, the qualitative assessment of middle aged women's diet was done and the results are furnished in Table 38. The highest mean score for DQI was observed in occupation division D1 (mean $\pm$ SD – 60.34$\pm$ 11.53). Nearly one fourth (25%) of the respondents from D5 had poor DQI. Majority of the respondents from D7 and D9 (85%) respectively have average diet quality. It was also observed that one third of middle aged women (35%) from occupation division D1 had good diet quality.

A minor proportion of respondents from D1 and D2 (7.5%) had excellent diet quality with DQI score more than 80. With respect to the entire study population an average diet quality was observed among three fourth (75.3%) of the middle aged working women. Diet quality and occupational divisions was found to be statistically dependent (chi – square -79.54**) on each other.

Table 38. Distribution of respondents based on Diet Quality Index (DQI)

DQI category (score range)	Occupational divisions									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	Total
Mean ± SD	60.34 ± 11.53	54.93 ± 1.02	52.39 ± 9.58	56.24 ± 11.73	44.18 ± 6.38	48.98 ± 6.22	51.41 ± 6.54	52.54 ± 8.9	46.15 ± 4.44	
Very poor (<20)	0	0	0	0	0	0	0	0	0	0
Poor (20.1 -40)	0	0	3 (7.5)	3 (7.5)	10 (25)	7 (17.5)	2 (5)	3 (7.5)	6 (15)	34 (9.4)
Average (40.1-60)	23 (57.5)	31 (77.5)	29 (72.5)	26 (65)	30 (75)	33 (82.5)	34 (85)	31 (77.5)	34 (85)	271 (75.3)
Good (60.1-80)	14 (35)	6 (15)	8 (20)	9 (22.5)	0	0	4 (10)	6 (15)	0	47 (13.1)
Excellent (80.1-100)	3 (7.5)	3 (7.5)	0	2 (5)	0	0	0	0	0	8 (2.2)
Chi-square	79.54**									
(Figures in parentheses are percentage)										

4.4. Prevalence and occurrence of lifestyle diseases

Nearly six medical camps were organized in various locations of Thiruvananthapuram district to collect the details on the prevalence and occurrence of lifestyle diseases. The results pertaining to personal diseases history, medical and family history of lifestyles diseases, gynecological problems, treatments undergone and lifestyle modifications adopted are elaborated in the following section.

4.4.1. Details of personal disease history

Details on personal disease history are furnished in Table 39. The major diseases and bodily complaints reported by the respondents were broadly categorized as neurological problems, musculo-skeletal problems, immunity and allergy related problems, gastro-intestinal disorders, cardio-respiratory diseases, metabolic and urological problems. Musculo-skeletal problems which is a major health issue of middle aged women, such as inflammatory joint diseases, arthritis and the related problems like difficulty in walking, climbing, leg and joint pains was prevalent in 60 to 85 per cent of the total study population.

Table 39. Personal disease history or bodily complaints in percentage (N=360)

Diseases history*	Occupational divisions									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	Total
Neurological problems	70	22.5	85	37.5	47.5	87.5	90	77.5	82.5	70
Musculo-skeletal problems	67.5	60	80	77.5	85	82.5	82.5	72.5	85	67.5
Immunity/ allergy related	17.5	12.5	20	35	20	42.5	47.5	22.5	15	17.5
Gastro intestinal	40	45	72.5	65	35	52.5	30	37.5	52.5	40
Cardio respiratory	32.5	47.5	27.5	45	52.5	35	27.5	52.5	55	32.5
Metabolic	45	37.5	30	42.5	32.5	22.5	12.5	35	37.5	45
Urological	15	12.5	7.5	20	27.5	7.5	25	15	17.5	15
Multiple response*										

Common neurological problems like headache, migraine and sinus were in the range of 22.5 per cent to 90 per cent among the study population. Gastro-intestinal problems like acidity, heart burn, gastritis, indigestion, ulcer, and constipation was prevalent among 30 per cent to 72.5 per cent of middle aged working women. Cardio-respiratory problems such as heart diseases, hyper tension, hyperlipidemia pulmonary and respiratory disorders were also prevalent among 27.5 per cent to 55 per cent of the total study population.

4.4.2 Prevalence of lifestyle diseases among middle-aged working women

The prevalence of three salient non-communicable diseases (NCD's) namely diabetes, hypertension, and hypercholesterolemia have been identified as the major lifestyle disease in the present investigation. The results related to prevalence of these lifestyle diseases are presented in the following sections.

Table 40.Prevalence of lifestyle diseases among middle- aged working women (N=360)

Lifestyle diseases	Occupational divisions									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	Total
Absence of disease	10 (25)	9 (22.5)	12 (30)	13 (32.5)	6 (15)	7 (17.5)	11 (27.5)	18 (45)	9 (22.5)	95 (26.4)
Presence of disease	30 (75)	31 (77.5)	28 (70)	27 (67.5)	34 (85)	33 (82.5)	29 (72.5)	22 (55)	31 (77.5)	265 (73.6)
Total	40 (100)	40 (100)	40 (100)	40 (100)	40 (100)	40 (100)	40 (100)	40 (100)	40 (100)	360 (100)
(Figures in parentheses are percentage)										

118

Table 40 shows the prevalence of selected lifestyle disease among middle aged women. The total prevalence of lifestyle diseases was found to be 73.6 per cent. Absence of disease was observed among 26.4 per cent of study population. Disease prevalence was the highest among occupation division D5 (85%) followed by D6 (82.5%). Absence of disease condition was high among occupation division D8 (45%) followed by D4 (32.5%). Statistical analysis revealed that the prevalence of lifestyle disease is independent of occupational division (Chi – square =13.16 NS).

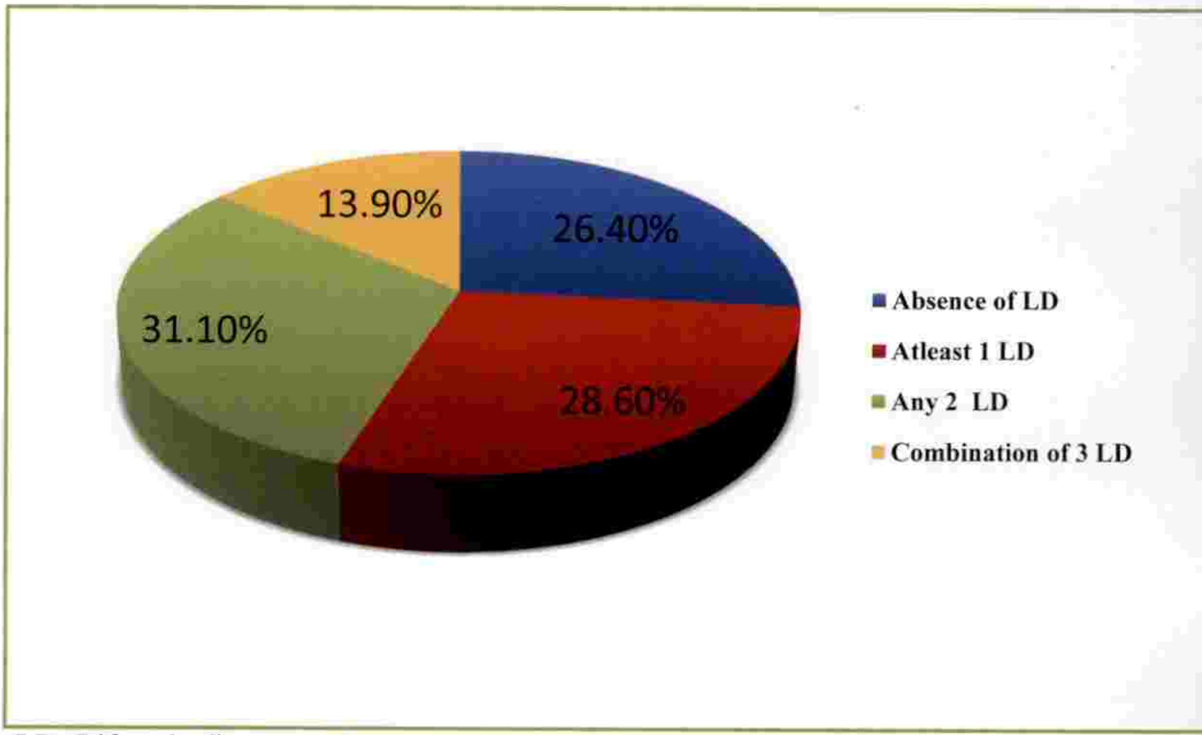
Figure 1. Illustrates the presence of at least one lifestyle disease among 28.6 per cent of middle aged working women. The presence of combination of any two lifestyle disease was found to be 31.1 per cent. The presence of combination of all the three selected lifestyles disease was revealed to be nearly fourteen per cent (13.9%).

Out of 74 per cent of the total prevalence of lifestyle disease, prevalence of combination of hypertension and hypercholesterolemia was determined to be the highest (24%) among the total respondents followed by combination of hypercholesterolemia and diabetes (12%). Almost 6 per cent of the respondents had combination of diabetes and hypertension. With reference to individual disease prevalence hypercholesterolemia alone was prevalent among one fifth (20.7) of the total respondents. An equal proportion of respondents had only diabetes (9%) and only hypertension (9%). Nineteen per cent respondents were diagnosed with all the three lifestyle diseases *ie*, hypercholesterolemia, diabetes and hypertension (Figure 2).

4.4.3. Details of family history of lifestyle diseases

Table 41 gives the details of family history of lifestyle disease among the middle aged working women. The result revealed that at least one of the parents of majority of the respondents from all occupation divisions had a history of lifestyle disease. Both parents of 22.5 per cent of respondents belonging to D8 had a history of lifestyle diseases. Higher proportion of family history of lifestyle

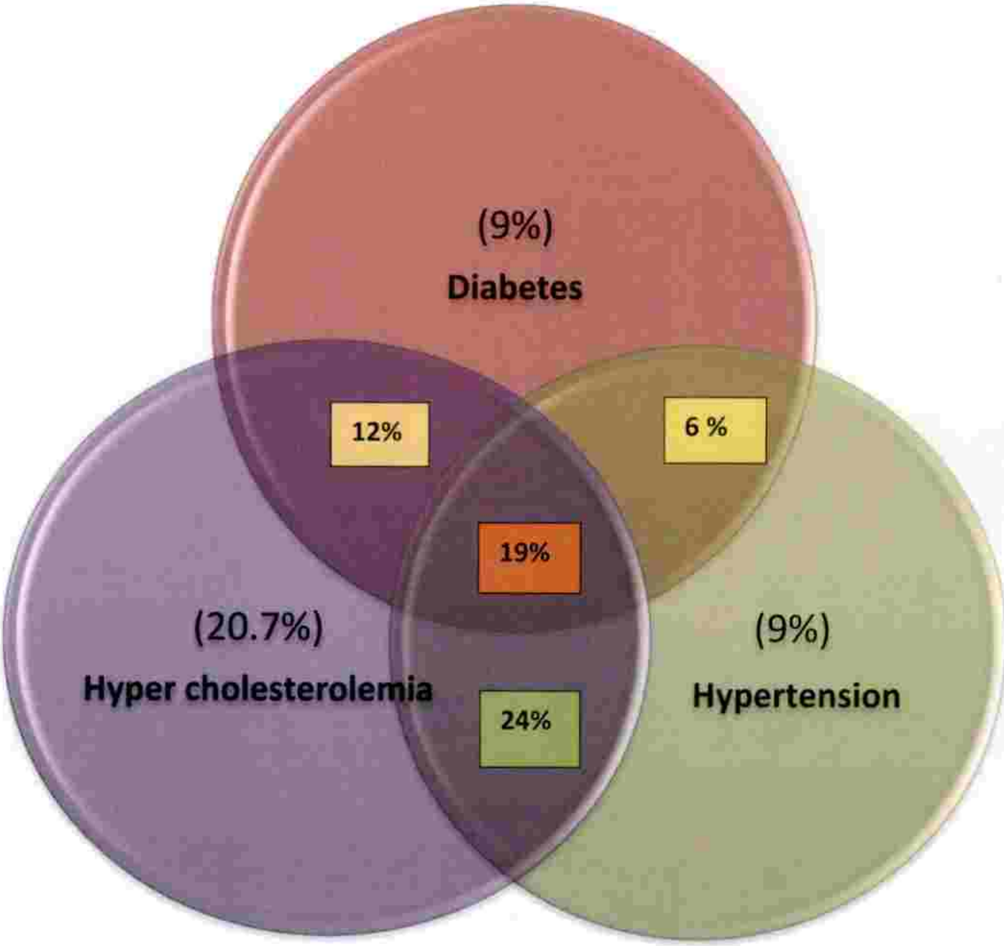
Figure 1. Prevalence of lifestyle diseases among middle aged working women



LD- Lifestyle disease

120

Figure 2. Prevalence of selected lifestyle diseases- Diabetes mellitus, Hypertension and Hypercholesterolemia



121

disease for both parents and siblings was reported among professionals (22.5%). Absence of family history of any lifestyle disease ranged between 12.5 per cent (D1) to 32.5 per cent (D7).

Table 41. Family History of lifestyle disease (N=360)

Relationship with the respondents	Occupational divisions								
	D1	D2	D3	D4	D5	D6	D7	D8	D9
None	5 (12.5)	9 (22.5)	12 (30)	11 (27.5)	9 (22.5)	8 (20)	13 (32.5)	10 (25)	6 (15)
Any one parent	25 (62.5)	18 (45)	15 (37.5)	15 (37.5)	21 (52.5)	23 (57.5)	22 (55)	17 (42.5)	24 (60)
Both parents	6 (15)	4 (10)	7 (17.5)	8 (20)	4 (10)	6 (15)	3 (7.5)	9 (22.5)	4 (10)
Parents and Siblings	4 (10)	9 (22.5)	6 (15)	6 (15)	6 (15)	3 (7.5)	2 (5)	4 (10)	6 (15)
(Figures in parentheses are percentage)									

4.4.4. Details of menopausal status of the respondents

The details of menopausal status are furnished in Table 42. The highest mean age of menopause was observed among professionals (mean age ± SD: 50.05 ±2.19) and the lowest mean age of menopause was observed among weavers (mean age ± SD: 45.37 ± 3.47).

Major proportion of respondents from occupation division D6 (42.5%) were (categorized as) pre-menopause since they reported regular menstrual cycle. Major proportion of respondents from D7 (30%) were in peri-menopause state with irregular menstrual cycle. The investigation observed that majority of the middle aged working women from all occupation division has attained menopause either natural or undergone hysterectomy.

Gynecological problems like fibroid, endometrial thickening or irregular bleeding were the major reasons reported for undergoing hysterectomy among the respondents.

Table 42. Menopausal status of the respondents (N=360)

Menopausal Status	Occupational divisions									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	Total
Mean age ± SD	49.63 ± 2.81	50.05 ± 2.19	49 ± 1.41	49.7 ± 2.8	48.18 ± 3.57	47.93 ± 2.20	45.37 ± 3.47	46.25 ± 3.97	48 ± 3.43	
Pre menopause	9 (22.5)	9 (22.5)	9 (22.5)	16 (40)	15 (37.5)	17 (42.5)	7 (17.5)	14 (35)	12 (30)	108 (30)
Peri menopause	7 (17.5)	3 (7.5)	9 (22.5)	3 (7.5)	8 (20)	3 (7.5)	12 (30)	9 (22.5)	9 (22.5)	63 (17.5)
Menopause (natural)	19 (47.5)	17 (42.5)	11 (27.5)	20 (50)	11 (27.5)	16 (40)	20 (50)	16 (40)	12 (30)	142 (39.4)
Hystrectomy	5 (12.5)	11 (27.5)	11 (27.5)	1 (2.5)	6 (15)	4 (10)	1 (2.5)	1 (2.5)	7 (17.5)	47 (13.1)
(Figures in parentheses are percentage)										

4.4.5. Details of treatments undergone

The results pertaining to the awareness and treatments undergoing for lifestyle disease are given in Table 43. More than 70 per cent of the respondents from all occupation divisions were aware of lifestyle disease.

Table 43. Details of treatments undergone (N=360)

Awareness of lifestyle disease	Occupational divisions									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	Total
Aware	40 (100)	40 (100)	40 (100)	40 (100)	31 (77.5)	29 (72.5)	40 (100)	40 (100)	40 (100)	340 (94.4)
Undergoing regular treatment										
No	0	0	3 (7.5)	1 (2.5)	12 (30)	16 (40)	11 (27.5)	13 (32.5)	19 (47.5)	75 (20.8)
Yes	30 (75)	31 (77.5)	25 62.5)	26 (65)	22 (55)	17 (42.5)	18 (45)	19 (47.5)	12 (30)	200 (55.5)
Disease under control										
No	6 (15)	0	0	4 (10)	10 (25)	19 (47.5)	16 (40)	1 (2.5)	20 (50)	76 (21)
Yes	24 (60)	31 (77.5)	28 (70)	23 (57.5)	24 (60)	14 (35)	13 (32.5)	21 (52.5)	11 (27.5)	189 (52.5)
Undergoing alternative treatment										
Yes	4 (10)	8 (20)	14 (35)	12 (30)	2 (5)	0	8 (20)	9 (22.5)	2 (5)	59 (16.4)
(Figures in parentheses are percentage)										

The results also revealed that 30 per cent to nearly 78 per cent of the respondents underwent regular treatment for lifestyle diseases. Almost 28 per cent to 78 per cent of the respondents claimed that their diseases were under

123

control. Less than 35 per cent of the respondents from various occupation divisions underwent alternative treatment methods like homeopathy, ayurveda and naturopathy.

4.4.6. Lifestyle and activity pattern

The lifestyle and activity pattern of middle aged working women are depicted in Table 44. More than half of the working women (56.7%) claimed that they do not receive family help in household work. Almost 68 per cent of working women spent at least 4 hours standing with major proportion observed among technicians and associate professionals (82.5%). The sedentary habits shows that close to two third of middle aged working women spent at least 4 hours/day sitting with the highest proportion observed among the weaving community (90%) followed by women employed in service work D5 (80%). Majority (66.4%) of the respondents spent 6-8 hours/day of sleep duration.

Table 44. Distribution of respondents based on Lifestyle and Activity pattern (N=360)

Lifestyle and activity patterns	Occupational divisions									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	Total
Family help in household work										
Nil	8 (20)	22 (55)	16 (40)	26 (65)	32 (80)	24 (60)	34 (85)	28 (70)	14 (35)	204 (56.7)
Yes	32 (80)	18 (45)	24 (60)	14 (35)	8 (20)	16 (40)	6 (15)	12 (30)	26 (65)	156 (43.3)
Time spent in standing (hours)										
<4	16 (40)	12 (30)	7 (17.5)	14 (35)	9 (22.5)	14 (35)	15 (37.5)	12 (30)	17 (42.5)	116 (32.2)
≥4	24 (60)	28 (70)	33 (82.5)	26 (65)	31 (77.5)	26 (65)	25 (62.5)	28 (70)	23 (57.5)	244 (67.8)
Sedentary habits(hours)										
<4	12 (30)	14 (35)	17 (42.5)	18 (45)	8 (20)	13 (32.5)	4 (10)	18 (45)	21 (52.5)	125 (34.7)
≥4	28 (70)	26 (65)	23 (57.5)	22 (55)	32 (80)	27 (67.5)	36 (90)	22 (55)	19 (47.5)	235 (65.3)
Duration of sleep										
≤ 5 (hours)	15 (37.5)	12 (30)	9 (22.5)	5 (12.5)	16 (40)	18 (45)	11 (27.5)	23 (57.5)	12 (30)	121 (33.6)
6- 8 (hours)	25 (62.5)	28 (70)	31 (77.5)	35 (87.5)	24 (60)	22 (55)	29 (72.5)	17 (42.5)	28 (70)	239 (66.4)

(Figures in parentheses are percentage)

124

4.4.7. Details of lifestyle modification adopted by the respondents

The results pertaining to lifestyle modifications practiced by middle aged working women are furnished in Table 45.

Table 45. Details of Lifestyle modifications adopted by the respondents (N=360)

Lifestyle modifications adopted	Occupational divisions									Total
	D1	D2	D3	D4	D5	D6	D7	D8	D9	
Observe lifestyle modifications										
No	6 (15)	8 (20)	5 (12.5)	7 (17.5)	12 (30)	11 (27.5)	9 (22.5)	8 (20)	12 (30)	78 (21.7)
Yes	34 (85)	32 (80)	35 (87.5)	33 (82.5)	28 (70)	29 (72.5)	31 (77.5)	32 (80)	28 (70)	282 (78.3)
Type of modifications										
Diet alone	6 (15)	4 (10)	3 (7.5)	3 (7.5)	4 (10)	5 (12.5)	6 (15)	4 (10)	3 (7.5)	38 (10.6)
Drug alone	7 (17.5)	6 (15)	5 (12.5)	6 (15)	5 (12.5)	4 (10)	3 (7.5)	5 (12.5)	5 (12.5)	46 (12.8)
Combinations of any 2 modifications	15 (37.5)	16 (40)	18 (45)	15 (37.5)	14 (35)	15 (37.5)	16 (40)	21 (52.5)	15 (37.5)	145 (40.2)
Combinations of diet+ drug + exercise	5 (12.5)	6 (15)	8 (20)	9 (22.5)	5 (12.5)	4 (10)	6 (15)	2 (5)	5 (12.5)	50 (13.9)
Exercise alone	1 (2.5)	0	1 (2.5)	0	0	1 (2.5)	0	0	0	3 (0.8)

(Figures in parentheses are percentage)

More than seventy eight per cent of middle aged working women claimed to observe lifestyle modifications. Majority of the respondents adopted a combination of any two modifications with respect to diet, drug and exercise for compacting and managing lifestyle diseases. Dietary modifications alone were followed by almost 11 per cent of the respondents. Nearly 13 per cent of respondents depend on only medications for management of lifestyle disease. Around 14 per cent of respondents managed their lifestyle diseases by adopting a combination of diet, drug and exercise regimens. Only negligible proportion of respondents (0.8%) claimed to manage their lifestyle disease by practicing only exercise.

4.5. Physical activity patterns of middle aged working women

Out of the total 360 respondents (45- 55 years) studied, 63 per cent were inactive, while 32.7 per cent were active and only 4.1 per cent were highly active. The occupational division- wise prevalence of physical inactivity was as follows: D1- 67.5%, D2- 72.5%, D3- 67.5%, D4- 77.5%, D5- 62.5%, D6- 72.5%, D7- 60%, D8- 62.5% and D9- 25%. Major proportion of inactivity is observed in the occupation division D4 (77.5 %), comprising of mainly clerical staff. This occupation division is characterized by a sedentary work pattern. This is followed by women professionals (D 2) and skilled workers (D 6) with 72.5 per cent respondents from each occupation division classified as inactive.

The most active subjects belong to the elementary occupation division D9 (60%) which mainly includes construction labourers. Forty per cent of middle-aged women employed in craft and related trade works were found to be physically active. An equal proportion of women employed in service works (D5- 37.5 %) as well as machine operators (D8-37.5 %) were also classified as active. The prevalence of highly active subjects (15%) was comparatively higher in the D9, constituting construction workers followed by D3 (12.5 %) comprising of technicians and associate professionals (Table 46). The statistical analysis revealed significant dependence of physical activity on occupational divisions indicating that a major proportion of physical activity in contributed from work/ occupation related activity.

Table 46. Distribution of respondents based on physical activity (GPAQ version2) (N=360)

Categories (MET-minutes/week)	Occupational divisions									
	D1	D2	D3	D4	D5	D6	D7	D8	D9	Total
Inactive (<600 MET)	27 (67.5)	29 (72.5)	27 (67.5)	31 (77.5)	25 (62.5)	29 (72.5)	24 (60)	25 (62.5)	10 (25)	227 (63)
Active (600-1200 MET)	13 (32.5)	11 (27.5)	8 (20)	8 (20)	15 (37.5)	8 (20)	16 (40)	15 (37.5)	24 (60)	118 (32.7)
Highly active (>1200 MET)	0	0	5 (12.5)	1 (2.5)	0	3 (7.5)	0	0	6 (15)	15 (4.1)
Total	40 (100)	40 (100)	40 (100)	40 (100)	40 (100)	40 (100)	40 (100)	40 (100)	40 (100)	360 (100)
Chi-square	55.73**									
(Figures in parentheses are percentage)										

4.6. Nutritional status of middle aged working women

Nutritional status reflects the health of an individual and is influenced by the quality of the food taken and the ability of the body to utilize these foods to meet its requirements. Assessment of nutritional status of 360 middle aged working women was done by recording the anthropometric profile, monitoring actual food and nutrient intake, clinical, biochemical and bio-physical examination. The results are detailed in the following sections.

4.6.1. Anthropometric profile

Anthropometric measurements are considered as the best tool for detecting the various degree of malnutrition among the population. In this study anthropometric measurements mainly height, weight, body mass index, waist circumference, waist-hip ratio and body fat percentage were determined.

The mean and standard deviation of height was revealed as 152.81 cm ± 6.02. The minimum and maximum height recorded were 135cm and 170cm respectively. The mean weight and standard deviation was recorded as 62.5 kg ± 10.2. The minimum and maximum weight recorded among middle aged working women were 41 kg and 89.4 kg respectively (Table 47).

Table 47. Mean height and weight of middle-aged working women (N=360)

Variables	Height (cm)	Weight (kg)
Mean	152.81	62.5
Standard deviation	6.02	10.2
Minimum	135	41
Maximum	170	89.4

The investigation determined that the prevalence of obesity was significantly high in the study population with a mean BMI score of 26.79. Overall, 65.6 per cent respondents have BMI $\geq$ 25 kg/m^{2}and nearly 19 per cent were pre-obese. In total only 15 per cent of the population were classified as normal. Only three women out of total 360 were categorized as underweight.

Women employed in construction works were more likely to be normal than their counterparts (22.5%). It is alarming to note that more than half of the population in all the 9 occupation divisions were obese with an exemption in D7 (craft and related trade workers), where 45 per cent were categorized as obese. Major proportion of obese women (87.5%) were employed in personal and protective services (D5) followed by women legislators and senior officials of D1, with three fourth of population classified as obese.

The mean and standard deviation of waist circumference of middle aged working women is estimated to be 93.26cm $\pm$ 9.93. The prevalence of abdominal obesity (95.6%) with a waist circumference above 80cms is significantly high in the total population. It is interesting to observe that over and above 85 per cent middle aged working women have elevated waist circumference across all occupation division.

The prevalence of elevated waist-hip ratio (81.7%) and high body fat percentage (BF % $\geq$ 30%) (96.9%) is significantly high in the study population. In the present study, the entire middle aged women employed as professionals, clerks and skilled workers have body fat percentage above 30 per cent. The mean WHR (0.9) and mean body fat per cent (36.44) is also high in the study population. Table 48 depicts the anthropometric measurements of middle aged working women.

Table 48. Distribution of middle- aged working women based on anthropometric measurements (N=360)

Physical parameters	Mean± SD	Occupational Divisions (NCO)									
		D1	D2	D3	D4	D5	D6	D7	D8	D9	Total (n=360)
Body Mass Index* (kg/m2) *(WHO, 2004)	26.798 ± 4.02										
Under weight (< 18.5)		0	0	0	0	0	0	2 (5)	1 (2.5)	0	3 (0.8)
Normal (18.5 – 22.9)		7 (17.5)	6 (15)	6 (15)	3 (7.5)	3 (7.5)	8 (20)	7 (17.5)	5 (12.5)	9 (22.5)	54 (15)
Pre- obese (23 – 24.9)		3 (7.5)	9 (22.5)	11 (27.5)	9 (22.5)	2 (5)	4 (10)	13 (32.5)	13 (32.7)	3 (7.5)	67 (18.6)
Obese (≥ 25)		30 (75)	25 (62.5)	23 (57.5)	28 (70)	35 (87.5)	28 (70)	18 (45)	21 (52.5)	28 (70)	236 (65.6)
Waist circumference (cms) ** (WHO, 2004)	93.2625 ± 9.93										
≤ 80		1 (2.5)	1 (2.5)	4 (10)	1 (2.5)	0	0	6 (15)	3 (7.5)	0	16 (4.4)
>80		39 (97.5)	39 (97.5)	36 (90)	39 (97.5)	40 (100)	40 (100)	34 (85)	37 (92.5)	40 (100)	344 (95.6)
Waist- Hip ratio	0.9013 ± 0.074										
≤ 0.85		5 (12.5)	6 (15)	13 (32.5)	7 (17.5)	11 (27.5)	5 (12.5)	8 (20)	5 (12.5)	6 (15)	66 (18.3)
>0.85		35 (87.5)	34 (85)	23 (67.5)	33 (82.5)	29 (72.5)	35 (87.5)	32 (80)	35 (87.5)	34 (85)	294 (81.7)
Body fat (%) # (Lohman, 1986 and Nagamine, 1972)	36.4424 ± 3.98										
≤ 30		1 (2.5)	0	3 (7.5)	0	1 (2.5)	0	4 (10)	1 (2.5)	1 (2.5)	11 (3.1)
>30		39 (97.5)	40 (100)	37 (92.5)	40 (100)	39 (97.5)	40 (100)	36 (90)	39 (97.5)	39 (97.5)	349 (96.9)

129

4.6.2. Clinical Examination

Clinical symptoms of nutritional disorders and lifestyle diseases were assessed among the subsamples (n=108) using an interview schedule standardized with the help of a medical practitioner. The pre/post- menopausal symptoms were assessed using the standardized Green Climacteric Symptom scale. The results are furnished in the following section.

The clinical examination revealed that the general appearance of hair of 84 per cent of subsamples were either thin, sparse or depigmented, while 80 per cent of respondents had skin changes such as scaly, dry and wrinkled skin as well as dark circles. These symptoms indicates clinical disorders of Vitamin A and Vitamin E deficiency as well as typical signs of ageing.

Clinical symptoms of iron deficiency anemia such as pallor conjunctiva were also noticed among 36 per cent women respondents respectively. General tiredness and fatigue which is a common symptom of middle age was observed among a major proportion (82%) of respondents.

Common symptom associated with calcium and Vitamin D deficiency such as joint and leg pains, difficulty in walking and climbing were also prevalent among 78 per cent of middle aged working women.

Another symptom most commonly observed among 47 per cent of population are oral cavity problems such as dental caries, tooth decay and bleeding gums which can be associated with poor oral hygiene, fluoride deficiency due to excess intake of sweets. Mottling and discolouration of teeth along with chalky teeth was noticed in women which could be due to fluorosis.

With regard to the appetite, majority of middle aged working women (54%) reported reduced appetite, while 43 per cent had normal appetite and only a minor population (3%) claimed to have increased appetite. The results are detailed in Table 49.

Table 49. Clinical manifestations of nutritional disorders among the respondents (n=108)

Clinical symptoms	Number (Per cent)
Thin/sparse/depigmented hair	91 (84)
Eye signs (pallor)	39 (36)
Oral cavity	51 (47)
Skin changes	86 (80)
Appetite	
Normal	47 (43)
Increased	3 (2.8)
Decreased	58 (54)
Tiredness/ fatigue	89 (82)
Joints/leg pains/difficulty in walking	84 (78)
Total	108 (100)
(Figures in parentheses are percentage)	

4.6.2.1. Clinical symptoms of lifestyle diseases

Details pertaining to the initial symptoms of lifestyle diseases mainly hypertension, diabetes, hypercholesterolemia and general symptoms related to common health issues of middle aged women are furnished in Table 50.

Headache which is a common symptoms associated with hypertension was prevalent in nearly 67 per cent of population. Palpitation, nausea/vomiting and giddiness was observed among 37%, 28.7% and 24% of respondents respectively.

Initial symptoms of diabetes such as increased thirst (38.9%), frequent urination (33%), increased hunger (23%), unintended weight loss (17.6%) as well as fatigue (7.4%) was also noticed among middle aged working women. Symptoms of raised blood cholesterol such as yellowish lumps or plaques around eyes and small lumps in the joints, medically known as xanthomas was observed in 20 per cent and 11 per cent of respondents respectively. General symptoms of cervical spondylosis such as difficulty in walking (51.9%), stiffness and pain in neck and joints (40.7%) was also noticed in more than forty per cent of population. Urinary incontinence or urinary urgency was also reported by nearly forty per cent of middle aged working women (39%).

Table 50. Distribution of respondents based on clinical symptoms of lifestyle diseases (n=108)

Clinical symptoms	Number (Per cent)
Symptoms of hypertension	
Headache	72 (66.7)
Nausea/ Vomiting	31 (28.7)
Giddiness	26 (24)
Palpitation	40 (37)
Symptoms of diabetes	
Increased thirst	42 (38.9)
Increased hunger	25 (23)
Increased urination	36 (33)
Unintended weight loss	19 (17.59)
Fatigue	8 (7.4)
Symptoms of hypercholesterolemia	
Yellowish lumpsaround eyes (Xanthelasma)	22 (20.4)
Small/ large lumps around joints of hands, legs or skin (Xanthomas)	12 (11)
Symptoms of cervical spondylitis	
Stiffness and pain in neck, arms, hands, legs or feet	44 (40.7)
Difficulty in walking	56 (51.9)
Urinary incontinence/urgency	36 (39)
(Figures in parentheses are percentage)	

4.6.2.3. Menopause related symptoms

Menopause signifies the end of a women's reproductive life. Menopause related symptoms were assessed using Green Climacteric Scale (GCS) (Table 51)

Among a total of 108 participants, 54.6percent of the respondents had moderate psychological symptoms, 85.2 per cent were determined to have severe somatic symptoms, and 68.5 per cent have severe vasomotor symptoms. On the whole, close to half of the study population (subsample) (49.4%) were moderately affected by menopause related symptoms.

132

Table 51. Distribution of respondents based on menopausal symptoms (n=108)

Menopause symptoms	Nil	Mild	Moderate	Severe
Total GCS	0	11(10.2)	49(49.4)	48(44.4)
Psychological symptoms	0	31 (28.7)	59 (54.6)	18 (16.7)
Somatic symptoms	0	1 (0.9)	15(13.9)	92 (85.2)
Vasomotor symptoms	11 (10.2)	14 (13)	9 (8.3)	74 (68.5)
(Figures in parentheses are percentage)				

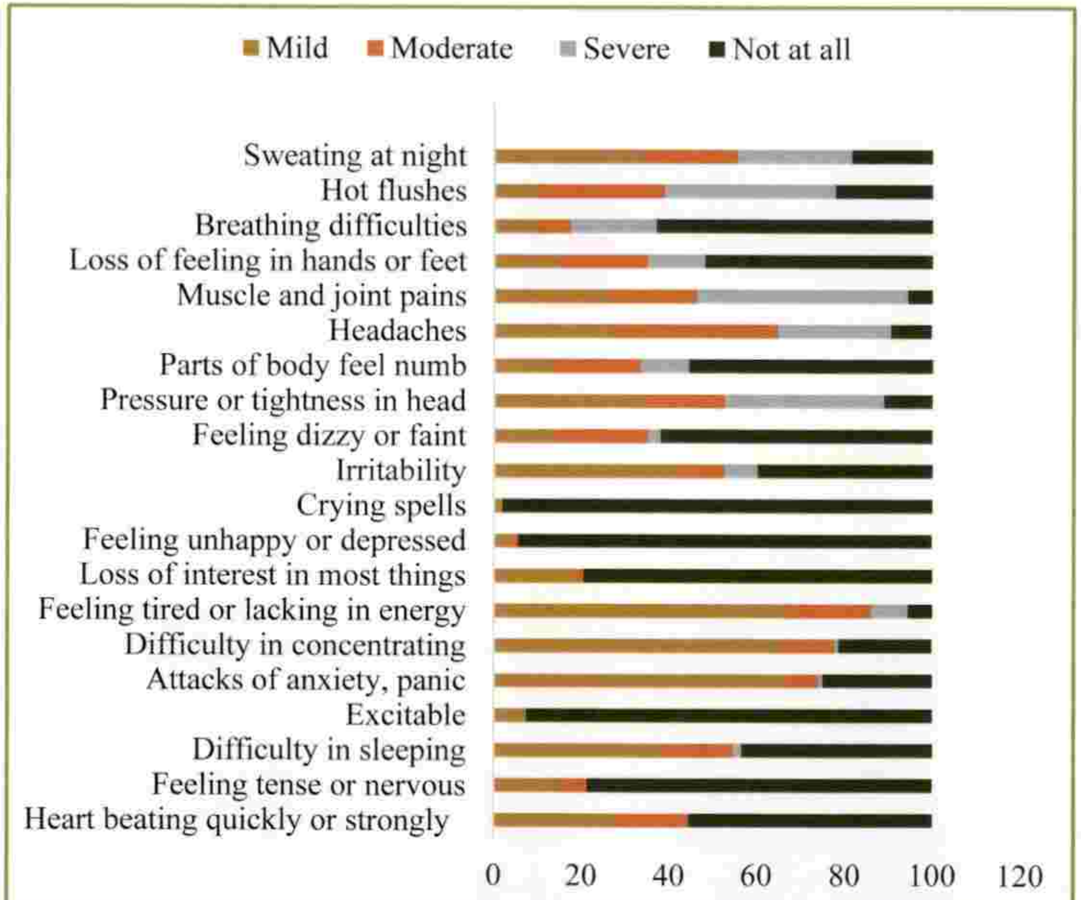
The most prevalent psychological symptoms affecting more than half of the study population were feeling tired or lacking in energy (94.4%), difficulty in concentrating (78.7%), attacks of anxiety or panic (75%), irritability (60.2%) and difficulty in sleeping (56.5%). The most prevalent somatic or physical symptoms observed were muscles and joint pains (94.4%) followed by headaches (90.7%). More than three fourth of women experienced vasomotor symptoms such as sweating at night (81.5%) and hot flushes (77.8%). These responses are represented in figure 3.

4.6.3. Biochemical profile

Biochemical estimation of blood for fasting glucose, heamoglobin, calcium and total cholesterol was conducted among 108 women respondents after obtaining oral as well as written consent. The biomedical profile of the participants are given in Table 52.

The average fasting blood glucose was estimated to be 157.56 mg/dl with a standard deviation of 78.35 mg/dl. Nearly 3 out of 5 middle aged women (55.6%) in study had impaired fasting glucose with fasting blood glucose ≥ 126mg/dl. Around 11 per cent of women also had raised fasting blood glucose (≥110mg/dl). The mean total cholesterol was estimated to be 215.54 mg/dl, with a standard deviation of 38.67 mg/dl. Raised total cholesterol (≥190mg/dl) was prevalent in more than three fourth of women respondents (76.9%).

Figure 3. Prevalence of menopausal symptoms among the respondents



134

One out of every twenty middle aged women (21.3%) were estimated to be anaemic with blood heamoglobin level less than 12gm%. The average serum calcium level and its standard deviation was estimated as 9.225 ± 0.49. The percentage prevalence of calcium deficiency (<8.7 mg/dl) was determined to be 15.7 per cent. The mean systolic and diastolic blood pressure with standard deviation was estimated to be 135.65 ± 14.78 and 88.75 ± 7.96 respectively. More than half of the population (53.7%) had raised systolic blood pressure ie. ≥ 140mm Hg. The prevalence of raised diastolic blood pressure was estimated to be nearly 72 per cent.

Table 52. Biochemical profile of middle aged working women (n=108)

Variables	Mean ± SD	Number (per cent)
Fasting blood glucose (mg/dl)	1.5756 ± 78.35	
Normal		36 (33.3)
Raised (≥ 110)		12 (11.1)
Impaired (≥ 126)		60 (55.6)
Total Cholesterol (mg/dl)	2.1554 ± 38.67	
Normal		25 (23.1)
Raised (≥ 190)		83 (76.9)
Systolic Blood pressure (mm Hg)	1.3565 ± 14.78	
Normal		50 (46.3)
Raised (≥ 140)		58 (53.7)
Diastolic Blood pressure (mm Hg)	88.75 ± 7.96	
Normal		30 (27.8)
Raised (≥ 90)		78 (72.2)
Haemoglobin (gm %)	12.5491 ± 1.18	
Normal		85 (78.7)
Anemic (<12)		23 (21.3)
Serum calcium (mg/dl)	9.2250 ± 0.49	
Normal		91 (84.3)
Deficient(<8.7)		17 (15.7)

(Figures in parentheses are percentage)

4.6.4. Bio-physical profile

The details pertaining to bio-physical assessment of bone mineral density, physical work capacity and vital capacity are furnished in this section.

4.6.4.1. Estimation of bone mineral density

Assessment of bone mineral density (BMD) was done using a bone densitometer. The interpretation of the result using the WHO T-score classification has revealed that nearly two out of every three middle aged women suffered from osteopenia with T- score range between -1.1 and -2.4. Osteopenia indicates low bone mineral density and is the midway between normal healthy bones and osteoporosis. Only one women out of 108 participants was identified with osteoporosis, indicating very poor bone mineral density with T- score below -2.5.(Table 53).

Table 53. Distribution of the respondents based on bone mineral density (n=108)

Bone mineral density (g/cm2)	WHO T-score classification	Number (per cent)
Normal	T-score up to -1	37 (34.3)
Osteopenia	T-score between -1.1 & -2.4	70 (64.8)
Osteoporosis	T-score below -2.5	1 (0.9)
(Figures in parentheses are percentage)		

4.6.4.2. Assessment of physical work capacity

A low average physical work capacity was estimated in majority of middle aged working women (45.37%) (Table 54). The results also revealed that 2 out of every 5 middle aged women were rated as having poor physical work capacity with fitness index below 55.

Table 54. Distribution of respondent based on physical work capacity (n=108)

Ratings	Fitness index	No. of respondents (per cent)
Excellent	> 90	0
Good	80- 89	0
High average	65-79	13 (12.04)
Low average	55-64	49 (45.37)
Poor	<55	46 (42.59)
(Figures in parentheses are percentage)		

4.6.4.3. Estimation of vital capacity

The screening for vital capacity was conducted using peak flow expiratory meter. Out of 108 women respondents more than half of middle-aged women were categorized under the alert zone of vital capacity (57.4%) indicating respiratory airways narrowing with forced vital capacity (FVC) range between 280 - 549 L/min. One third of middle aged working women also suffered from severe airways narrowing and were categorized under the zone of emergency with forced vital capacity below 280 L/min. Normal spirometry/lung capacity was observed in only a minor proportion (6.5%) of population (Table 55).

Table 55.Vital capacity profile of middle aged women using PEFR (n=108)

Forced vital capacity	Range (L/min)	No. of respondents	Results
Green Zone (safe zone)	≥ 550	7 (6.5)	Normal spirometry
Yellow Zone (zone of alert)	280 - 549	62 (57.4)	Respiratory airways narrowing
Red Zone (zone of emergency)	< 280	39 (36.1)	Severe airways narrowing
Total		108 (100)	
(Figures in parentheses are percentage)			

4.6.5. Actual food and nutrient intake of middle aged women

An in depth study was conducted among 108 middle aged working women (subsample) using 24 hour diet recall method to determine the actual food and nutrient intake and to assess the quantity and quality of food consumed. The nutritive value of foods consumed estimated from the food composition database of NIN, ICMR (2017) using the DietCal software version. The mean food and nutrient intake was compared with the RDA for a balanced diet for a sedentary woman suggested by ICMR (2010) and were statistically examined. Since the subsample selected comprises of only physically inactive respondents (based on GPAQ score), the RDA for sedentary / light activity women was used for the in depth study.

4.6.5.1. Actual food intake of middle aged women in comparison with the requirement

Among the various food items consumed by the respondents, the daily intake of cereals, pulses and fish was significantly above adequacy when compared with the corresponding Recommend Dietary Allowances or RDA. A preference for food preparations with cereal – pulse combinations like *idli, dosa* and also for fish in the region ensures the adequate intake of these food groups. The average consumption of protective foods like leafy vegetables (43.7%), other vegetables (44.68%), milk (45%) as well as roots and tubers (32%), which are rich sources of micronutrients was significantly lower providing only less than 50% of the RDA. The intake of fruits (71.9%), oil (74%) and nuts (67.5%) was also significantly inadequate to provide less than three fourth of the requirement. Although the intake of sugar (94.7%) was lower than the requirement, the decrease was found to be statistically insignificant (Table 56).

Table 56. Actual food intake (24- hour diet recall) (n=108)

Food group (g/ml)	RDA#	Mean food intake	SE	t value	% of RDA met from the diet
Cereals	270	517.99	10.51	23.587**	191.85
Pulses	60	95.87	8.18	4.386**	159.78
Milk	300	135.05	4.48	36.855**	45
Roots and tubers	200	64.61	5.94	22.812**	32
Leafy Vegetables	100	43.71	10.79	5.219**	43.71
Other Vegetables	200	89.35	8.85	12.509**	44.68
Fruits	100	71.97	3.86	7.261**	71.97
Sugar	20	18.95	0.58	1.816 NS	94.75
Oils	20	14.89	0.47	10.828**	74.45
Fish/Meat/Egg	30	81.96	4.21	12.333**	273.2
Nuts and Oil seeds	30	20.27	1.79	5.438**	67.57

** Significant at 1%,NS - Non significant, # ICMR 2010 for sedentary women, SE-Standard error

4.6.5.2. Actual nutrient intake of middle aged women in comparison with the requirements

The mean intake of macronutrients *viz* energy, protein, and fat was significantly above adequacy when compared with the requirement (Table 57). The intake of all the micronutrients, important anti-oxidants and dietary fiber was estimated to be lower than the RDA except for thiamine (101%) and niacin (119%). The micronutrients particularly important for middle aged women like calcium (39%), iron (37.9 %), B-carotene (7.8%), riboflavin (41.6%), vitamin E (19.9%), vitamin B12 (3.7%), biotin (15%), vitamin D (10.6%) and iodine (0.4%) was significantly less than 50% of the RDA.

4.6.6. Energy expenditure pattern

The energy requirement for an entire day is calculated for the subsamples by recording the energy cost of all the activities undertaken in a day using two methods. Namely Satyanarayan method and ICMR, Expert Group method. The results are furnished in Table 58-a, b & 59 respectively.

4.6.6.1. Energy expenditure pattern (Satyanarayan method)

As per the coding of the activities using Satyanarayan code the maximum energy cost per day is utilized for sedentary activities (code II) with a mean and SE of 875.11 and 11.64.

Table 57. Actual nutrient intake (24-hour diet recall) (n=108)

Nutrients	RDA#	Mean nutrient intake	SE	t value	% of RDA met from diet
Energy (K Cal)	1900	2267.91	31.32	11.747**	119.36
Protein (g)	55	62.93	1.14	6.972**	114.42
Fat (g)	20	30.00	1.12	8.915**	149.99
Calcium (mg)	600	235.65	10.90	33.438**	39.27
Iron (mg)	21	7.97	0.29	45.11**	37.97
Magnesium (mg)	310	248.74	8.52	7.192**	80.24
Potassium (mg)	3225	1571.44	47.16	50.504**	48.73
Sodium (mg)	1900	307.56	60.43	30.974**	16.19
Zinc (mg)	10	7.03	0.19	16.024**	70.32
Iodine (µg)	150	0.58	0.14	1060**	0.39
β carotene (µg)	4800	374.52	37.25	118.807**	7.80
Thiamine (mg)	1	1.01	0.03	0.445 NS	101.21
Riboflavin (mg)	1.1	0.46	0.01	48.392**	41.68
Niacin (mg)	12	14.33	0.29	8.177**	119.43
Folate (µg)	200	136.63	6.35	9.978**	68.31
Vitamin C (mg)	40	25.43	3.68	3.962**	63.56
Vitamin E (mg)	7.5	1.50	0.07	130.316**	19.98
Vitamin B12 (mg)	1	0.04	0.02	41.801**	3.71
Pantothenic acid (B5) (mg)	5	4.08	0.07	12.358**	81.57
Vitamin B6 (mg)	2	1.45	0.03	20.502**	72.27
Biotin B7 (µg)	30	4.60	0.20	124.158**	15.34
Vitamin D3 (µg)	10	1.07	0.14	62.085**	10.67
Dietary fibre (g)	30	29.03	0.88	1.096 NS	96.78

** Significant at 1%, NS - Non significant, # ICMR 2010 for sedentary women, SE- Standard error

140

The mean energy expenditure for code III activities that involves light activities and office work were 677.08 mean and 14.56 SE. An average energy expenditure of 475.44 is incurred for resting and sleep (code I). Around 381.69 mean energy output is utilized for performing moderate activities (code IV). Mean energy expenditure for manual work (code V) is estimated to be 104.67 with SE 9.69. The mean daily total energy expenditure is observed to be 2513.61 kilo calories with SE 33.02 as per Satyanarayan method (Table 58a)

Table 58a. Energy Expenditure pattern (Satyanarayan Method) n=108

Energy expenditure (K cal)	CODE I	CODE II	CODE III	CODE IV	CODE V	TEE
Mean	475.44	875.11	677.08	381.69	104.67	2513.61
SE	9.82	11.64	14.56	12.79	9.69	33.02
SE- standard error, TEE- Total energy expenditure						

The details presented in Table 58b revealed that as per Satyanarayan method more than half of the respondents (55.6%) were found to have a total energy expenditure pattern ranging between 2001 – 2500 kilo calories per day.

Table 58b. Distribution of women based on daily energy expenditure pattern (n=108)

Total energy expenditure pattern/day (K. calories)	Details of subjects	
	Number	Per cent
$\leq$ 2000	3	2.8
2001- 2500	60	55.6
2501- 3000	35	32.4
$\geq$ 3001	10	9.3
Total	108	100

It was also observed that nearly one third of the respondents (32.4%) had a total energy expenditure between 2501 and 3000 kilo calories. Close to 10 per cent of the population (9.3%) had a total energy expenditure above 3000 kilo calorie. Less than 3 per cent of respondents had a total energy expenditure below 2000 kilo calorie.

4.6.6.2. Energy expenditure pattern using ICMR Expert Group prediction equation for Indians.

The energy expenditure pattern assessment based on BMR equation and Physical activity level (PAL for sedentary/light activity) proposed by ICMR Expert Group is furnished in Table 59. The average total energy expenditure (TEE) per day was estimated to be 2051.42 kilo calories with standard error of 11.69. Comparatively a lower mean TEE was observed in ICMR method. Almost two third (64.8%) of the middle aged women had a daily total energy expenditure in the range of 2001 to 2500 kilo calories/day. Whereas 35 per cent of respondents had daily energy requirement below 2000 kilo calories. The result indicate that energy requirement decrease with increase in age.

Table 59.Distribution of women based on daily energy expenditure pattern (ICMR Expert Group) n=108

Total energy expenditure pattern/day (Kilo calories)	Details of subjects		
		Number	Per cent
Mean	2051.42		
Standard error	11.69		
≤ 2000		38	35.2
2001- 2500		70	64.8
Total		108	100

4.6.7. Energy balance of the respondents

The results pertaining to the daily energy intake and daily energy expenditure of the respondents (sub samples) are detailed in Table 60. The energy expenditure of the respondents varied from 1773 to 2323 kilo calories and energy intake varied from 1801 to 3103 kilo calories. The mean energy intake and SD was estimated to be 2267.9 ± 325.47. Majority of the respondents (90.7) was observed to have a positive energy balance whereas close to 10 per cent of respondents also had a negative energy balance.

Table 60. Energy balance sheet of the respondents (n=108)

Sl.No	Total energy requirement (BMR * energy expenditure)**	Energy intake (K. cal)	Energy balance (K.cal)
1	2177	2926.68	750
2	2171	2923.24	752
3	2006	2121.68	116
4	2138	2832.65	695
5	2068	2992.08	924
6	2044	2682.04	638
7	2056	2423.33	367
8	2006	2033.13	27
9	2029	2107.61	79
10	2139	2254.03	115
11	2177	2734.15	557
12	1954	1977.76	24
13	2154	2923.24	769
14	1928	1944	16
15	2126	2175.85	50
16	2177	2454	277
17	2126	2222.15	96
18	1827	1839.77	13
19	2018	2132.36	114
20	2154	2984.63	830
21	2261	2854.42	593
22	2148	2321.76	174
23	2148	2273.31	125
24	2228	2356.07	128
25	2064	2121.68	58
26	2055	2132.18	77
27	1992	1999.76	8
28	1984	2064.5	80
29	1904	1952.48	48
30	2027	2054.08	27
31	2017	2133.58	116
32	1904	1925	21
33	2149	2474.36	325
34	2120	2159.56	40
35	2158	2188.68	31
36	2098	2282.61	184
37	2053	2449.93	397

38	2163	2531.33	368
39	2044	2250.6	207
40	1974	2052.11	78
41	2133	2168.82	36
42	2190	2299.23	109
43	2030	2048.03	18
44	1894	1803.19	-91
45	2030	2596.8	567
46	1874	2054.08	180
47	2018	1847.17	-171
48	1853	2048.03	195
49	2032	2635.65	603
50	1924	1977.76	53
51	2018	2426.15	408
52	2209	2528.45	320
53	1917	2576.44	660
54	1929	2791.51	862
55	1891	1925	34
56	1942	2459.57	517
57	2030	2054.08	24
58	2203	2558.78	356
59	2026	2033.13	7
60	1839	2222.15	383
61	2176	2423.33	247
62	1929	1847.17	-82
63	2224	2734.15	510
64	1955	2054.08	99
65	2064	1925	-139
66	2102	2175.85	74
67	1966	2033.13	67
68	1949	1952.48	4
69	2177	1858.79	-318
70	1980	2503.85	524
71	1894	1906.5	13
72	2304	3103.21	799
73	2209	1848.31	-361
74	1929	1887.2	-42
75	2018	2923.24	905
76	2049	1877.87	-171
77	1968	2132.36	165
78	2044	1839.77	-204

79	2209	2273.31	64
80	1917	2107.61	191
81	2095	2132.18	38
82	2272	2454	182
83	2215	2356.07	141
84	2044	2064.5	21
85	2056	2321.76	265
86	1955	2133.58	179
87	2214	2254.03	40
88	1980	1999.76	19
89	1936	1944	8
90	2044	2188.68	145
91	2203	2832.65	630
92	2026	2282.61	257
93	1987	2159.56	173
94	1947	1803.19	-144
95	1921	2168.82	248
96	2176	2459.57	284
97	2247	2250.6	4
98	2224	2299.23	75
99	1891	1906.5	15
100	1888	2531.33	644
101	1891	2596.8	705
102	1773	1801.22	28
103	1955	2052.11	97
104	2323	2576.44	253
105	2072	2791.51	720
106	2203	2474.36	272
107	1828	1847.17	19
108	2176	2528.45	353

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4.7. Derivation of correlates

The correlates among variables *viz* socio-economic variables, SLI, stress index, nutritional status, physical activity, diet quality index for women and prevalence of lifestyle diseases were assessed using simple bivariate analysis. The level of significance for this statistical analysis was considered as $P < 0.05$ (at 5 per cent). The results are arranged in the following section

4.7.1. Correlation of socio-economic variables versus prevalence of lifestyle disease

The Spearman's rho correlation analysis of socio-economic variables such as standard of living index, family type, number of family members, educational status, socio-economic status, total expenditure pattern and food expenditure pattern versus prevalence of lifestyle diseases revealed that lifestyle disease shows significant positive correlation with food expenditure pattern (0176 **) at 1 per cent level and significant negative correlation with educational status (-0.152**). The result indicates that with improved educational status, the prevalence of lifestyle disease was low whereas with increased food expenditure the prevalence of lifestyle disease is also increased. The statistical analysis shows that with higher educational status, Standard of living index (SLI) (0.743**) and socio-economic status (0.905**) of the respondents were revealed to be better and in contrast food expenditure was to reduce (-0.569**). SLI was positively correlated with socio-economic status (0.804**) and negatively correlated with food expenditure (-0.514**) and nuclear family type (-0.218**). Food expenditure shows significant positive correlation with number of family members (0.112*) and total monthly family expenditure (0.411**). The analysis also reveals that prevalence of lifestyle disease is independent of standard of living index and socio-economic status (Table 61).

Table 61. Correlation of socio-economic variables and lifestyle disease prevalence

Variables	LD	SLI	FE	F.TYPE	No. of members	Ed. S	SES	TE
Lifestyle diseases (LD)	1							
Standard of living (SLI)	-0.043	1						
Food expenditure (FE)	.176**	-.514**	1					
Family type (F.TYPE)	0.007	-.218**	.202**	1				
No. of family members	0.029	-0.021	.112*	.667**	1			
Educational status (Ed.S)	-.152**	.743**	-.567**	-.231**	-0.034	1		
SES	-0.101	.804**	-.536**	-.196**	0.011	.905**	1	
Total expenditure (TE)	0.054	-0.022	.411**	.108*	.201**	-0.041	-0.032	1

***Correlation is significant at 5 per cent level, ** Correlation is significant at 1 per cent level, SES- socio-economic status**

147

4.7.2. Correlation of lifestyle diseases with other contributory factors (stress, diet quality index, and physical activity)

In this section the relation between the prevalence of lifestyle disease with various contributory factors such as prevalence of stress, diet quality and physical activity pattern have been depicted in Table 62. The presence of at least one lifestyle disease shows significant positively correlation with the prevalence of stress (0.104^{**}) at 5 per cent level. Physical activity and the combination of lifestyle diseases was negatively correlated with each other at 5 per cent level (-0.105^{*}). The result indicates that lack of regular physical activity is a significant contributing factor towards the occurrence of lifestyle diseases.

Table 62. Correlation of lifestyle disease with DQI, physical activity and stress (Spearman's rho)

Variables	LD 1	LD 3	DQI	PA	Stress
Lifestyle disease (LD 1)	1				
Lifestyle diseases (LD 3)	0.781^{**}	1			
Diet quality index (DQI)	-0.118^{*}	$-.111^{*}$	1		
Physical activity (PA)	- 0.073	$-.105^{*}$	0.048	1	
Stress	0.104^{*}	0.09	-0.05	0.02	1

*Correlation is significant at 5 per cent level, ** Correlation is significant at 1 per cent level

LD 1- Presence of at least one lifestyle disease, LD3- Presence of all 3 lifestyle diseases

With regard to the diet quality, the prevalence of lifestyle disease was negatively correlated with the diet quality index (-0.111^{*}) at 5 per cent level. The result point out towards the fact that poor diet quality is a significant determinant of lifestyle diseases.

4.7.3. Correlation of lifestyle diseases and nutritional anthropometry

The Spearman's rho analysis revealed that waist circumference shows significant positive correlation with lifestyle disease prevalence at P value <0.01 (0.146^{**}). While body mass index (0.081), body fat per cent (0.098) and waist-hip ratio was insignificantly related to the prevalence of lifestyle diseases.

Table 63. Correlation of lifestyle diseases and nutritional anthropometry (Spearman's rho)

Variables	Body mass index (BMI)	Waist circumference (WC)	Body fat % (BF)	Waist- hip ratio (WHR)	Lifestyle diseases (LD)
BMI (kg/m2)	1				
WC cms)	0.553**	1			
BF (%)	0.736**	0.564**	1		
WHR	0.135*	0.363**	0.152**	1	
LD	0.081	0.146**	0.098	-0.033	1
*Correlation is significant at 5 per cent level, ** Correlation is significant at 1 per cent level					

The correlation co-efficient of waist circumference with body mass index (0.553**), with body fat per cent (0.564**) and with waist-hip ratio (0.363**) were highly significant at 1% level. BMI was found to be significantly correlated with body fat per cent (0.736**) at P value <0.01 and with WHR (0.135*) at $P < 0.05$. Body fat percentage showed significant positive correlation with WHR (0.152**) at 1 per cent level (Table 63).

4.7.4. Correlation of nutritional anthropometry and physical activity

Table 64 depicts the correlation of physical activity with various anthropometric variables such as BMI, waist circumference, body fat percentage and waist-hip ratio. It is observed that body mass index (-0.213**) and body fat percent (-0.223**) showed a significant negative correlation with physical activity ($p < 0.01$). While abdominal obesity was negatively but insignificantly related to physical activity (-0.071). A significant positive correlation were observed between the various anthropometric measurements. The spearman's rho correlation co-efficient of waist circumference with body mass index (0.553**), with body fat percent (0.564**) and with waist – hip ratio (0.363**) were highly significant at 1% level. BMI was found to be significantly correlated with WC (0.553**) and body fat (0.736**) at P value < 0.01 and with WHR (0.135*) at p <.05. Body fat percentage also showed significant positive correlation with BMI

(0.736^{**}), WC (0.564^{**}) and WHR (0.152^{**}). The result clearly indicates that physical inactivity is an important risk factor for obesity.

Table 64. Correlation of nutritional anthropometric variables and physical activity (Spearman's rho)

Variables	Physical activity (PA)	Body mass index (BMI)	Waist circumference	Body fat %	Waist-hip ratio
BMI (kg/m2)	-0.213^{**}	1			
WC (cms)	-0.071	0.553^{**}	1		
BF (%)	-0.223^{**}	0.736^{**}	0.564^{**}	1	
PA (MET-min/wk)	1	-0.213^{**}	-0.071	-0.223^{**}	
WHR	0.055	0.135^{*}	0.363^{**}	0.152^{**}	1
*Correlation is significant at 5 per cent, ** Correlation is significant at 1 per cent					

4.7.5. Correlation of nutritional anthropometry and stress

The statistical analysis revealed that the prevalence of stress is positively correlated with central obesity (0.167^{**}) at P value <0.01 and with elevated body fat per cent (0.106^{*}) at P value <0.05. The analysis also revealed that psychological distress shows significant positive correlation with elevated waist circumference (0.153^{**}) and body fat per cent (0.112^{*}). The result indicates stress as an important determinant of nutritional status (Table 65).

Table 65. Correlation of nutritional anthropometric variables and stress (Spearman's rho)

Variables	BMI	WC	BODY FAT %	WHR	Stress	PD
BMI (kg/m2)	1					
WC (cms)	0.553^{**}	1				
BODY FAT %	0.736^{**}	0.564^{**}	1			
WHR	0.135^{*}	0.363^{**}	0.152^{**}	1		
Stress	0.068	0.167^{**}	0.106^{*}	0.024	1	
PD	0.059	0.153^{**}	0.112^{*}	-0.009	0.528^{**}	1
*Correlation is significant at 5 per cent level, ** Correlation is significant at 1 per cent level PD- psychological distress						

150

4.7.6. Correlation of nutritional anthropometry and diet quality index

Table 66 depicts the correlation between diet quality index (DQI-W for Indian women) and nutritional status of middle aged working women.

Table 66. Correlation of nutritional anthropometry and diet quality index

Variables	BMI	WC	BODY FAT %	WHR	DQI-W
BMI	1				
WC	0.553**	1			
BODY FAT %	0.736**	0.564**	1		
WHR	0.135*	0.363**	0.152**	1	
DQI-W	-0.036	-0.109*	-0.087	0.037	1
*Correlation is significant at 5 per cent level, ** Correlation is significant at 1 per cent level					

Diet quality index shows significant negative correlation with elevated waist circumference (-0.109*) at P value <0.05. The result underlines the fact that poor diet quality is a significant determinant of abdominal obesity. DQI shows negative but insignificant correlation with BMI (-0.036) and body fat per cent (-0.087). Similarly DQI and waist-hip ratio was insignificantly related to each other.

4.7.8. Correlation of nutritional anthropometry and standard of living index

The correlation coefficient of Standard of living index and waist circumference shows significant negative correlation (-0.115*) at 5 per cent level. SLI is independent of other anthropometric variables *viz*. BMI, body fat per cent, and WHR. The result indicated that lower standard of living index is associated with central obesity (Table 67).

Table 67. Correlation of nutritional anthropometry and standard of living

Variables	BMI	WC	BODY FAT %	WHR	SLI
BMI	1				
WC	0.553**	1			
BODY FAT %	0.736**	0.564**	1		
WHR	0.135*	0.363**	0.152**	1	
SLI	0.053	-0.115*	0.023	0.073	1
*Correlation is significant at 5 per cent level, ** Correlation is significant at 1 per cent level					

4.7.9. Correlation of nutritional anthropometry and biochemical parameters

The Pearson's correlation coefficient analysis revealed that elevated body fat per cent and fasting blood glucose shows significant positive correlation (0.222^{*}) at P value <0.05. Spearman's rho analysis shows significant positive correlation (0.197^{*}) between diastolic blood pressure and elevate body fat per cent at P value <0.05. All other anthropometric variables and biochemical parameters were insignificantly related to each other. The results are presented in Table 68.

Table 68. Correlation of nutritional anthropometry and biochemical parameters

Variable	BMI	WC	BF	WHR
Fasting blood glucose (FBS)	0.020	0.027	0.222^{*}	-0.123
Total Cholesterol	0.045	-0.030	0.004	0.034
Systolic blood pressure	-0.031	0.078	0.031	0.140
Diastolic blood pressure	0.019	0.012	0.197^{*}	0.186
Haemoglobin	0.058	-0.009	-0.074	-0.182
Calcium	0.013	0.061	-0.054	0.108
*Correlation is significant at 5 per cent level				

4.7.10. Correlation of standard of living index with physical activity, stress, and diet quality index

The Spearman's rho correlation analysis revealed that standard of living index (SLI) shows significant negative correlation with physical activity (-0.163^{**}), prevalence of stress (-0.259^{**}) and psychological distress (-0.292^{**}) at 1 per cent level. The result indicates that with better standard of living, the prevalence of stress as well as physical activity is reduced in the present study population. With regard to the diet quality index, improved diet quality index was estimated among the respondents with improved SLI. SLI versus DQI shows significant positive correlation at 1 per cent level (0.343^{**}) (Table 69).

Table 69. Correlation of standard of living with physical activity, stress and diet quality index

Variable	SLI	Stress	PD	PA	DQI-W
Standard of living (SLI)	1				
Stress	-0.259**	1			
Psychological distress (PD)	-0.292**	0.559**	1		
Physical activity (PA)	-0.163**	0.020	-0.001	1	
Diet quality index (DQI-W)	0.342**	-0.050	-0.097	0.048	1
** Correlation is significant at 1 per cent level					

4.7.11. Correlation of biochemical and bio-physical parameters

Pearson's correlation co-efficient analysis was done to find the association between various biochemical parameters and bio-physical parameters (Table 70). Fasting blood glucose shows significant positive correlation with total cholesterol (0.194*) and significant negative correlation with physical activity (-0.277**) as well as vital capacity (-0.232*). The result reveals that with an increase in total cholesterol, the fasting blood sugar level also simultaneously increases which may in turn, reduces the vital capacity.

Also, physical inactivity is identified as an important determinant of raised blood glucose. Systolic and diastolic blood pressure was positively correlated (0.629**) at 1 per cent level of significance. Blood hemoglobin and vital capacity was positively correlated (0.234*) at 5 per cent level indicating that improved hemoglobin status also improves the lung capacity. Whereas blood calcium shows significant positive correlation with total cholesterol (0.261**). Spearman's rho correlation revealed significant positive correlation of blood calcium and bone-mineral density at 1 per cent level (0.336**). The result indicates that respondents without calcium deficiency also had normal bone mineral density.

Vital capacity and menopausal status shows significant negative correlation at 5 per cent level (-0.204*). The result indicates that vital capacity tend to decrease among menopausal women. Bone mineral density and physical activity is positively correlated at P value <0.01 (0.283**) indicating that physically active respondents has normal bone mineral density when compared to their counter parts.

4.8. Derivation of predictors for determinants of lifestyle diseases using nutritional disorder and other contributory variables

Multinomial logistic regression analysis was done to derive the predictors for the determinants of nutritional disorders and lifestyle diseases (Table 71). It is a usual phenomenon that an individual will become aware of one's own defects of a particular mode of living only at the fag end of developing a disease or already having encountered with a disease.

The subjects under the present investigation are middle aged women (45 – 55 years) which is a very sensitive stage and state of life. The 3 stages of occurrence and progression of lifestyle diseases have been identified in the study along with the corresponding significant predictors. The first stage is characterized by the absence of disease condition to the initiation of any one of the lifestyle diseases under investigation (from 0 – 1 lifestyle disease. The second stage is characterized by further contracting an added lifestyle disease (from 1 – 2 lifestyle disease). The third and the final stage represents the occurrence progression towards all the three lifestyle diseases (from 2 – 3 lifestyle disease).

As revealed by the analysis, elevated waist circumference (WC), waist-hip ratio (WHR), lack of physical activity and low diet quality index are the significant determinants contributing to the occurrence of one of the lifestyle disease. The odds ratio and corresponding odds percentage were 0.930 (48%), 192.5 (99%), 1.002 (50%) and 2.439 (71%) respectively. This indicates that high WHR contribute up to 99 per cent and poor diet quality contribute up to 71 per cent for the initiation of a lifestyle disease. Diet quality index was estimated to be significant at 20 per cent level.

Table 70. Correlation of biochemical and biophysical parameters

Variables	FBS	T. Chol	SBP	DBP	Hb	Calcium	BMD	Menopausal status
FBS	1							
T. Chol	.194*	1						
SBP	-0.115	-0.029	1					
DBP	-0.139	-0.055	.629**	1				
Hb	-0.085	0.123	0.111	-0.059	1			
Calcium	0	.261**	-0.16	-0.087	0.181	1		-0.131
BMD	0.12	-0.019	-0.032	-0.004	0.035	.336**	1	-0.168
PA	-.277**	-0.109	0.028	-0.027	-0.016	-0.142	.283**	-0.054
Vital capacity	-.232*	0.063	0.123	0.189	.234*	-0.08	-0.056	-.204*

***Correlation is significant at 5 per cent level, ** Correlation is significant at 1 per cent level**
FBS- Fasting blood glucose, T. Chol- Total Cholesterol, SBP- Systolic blood pressure, DBP- Diastolic blood pressure
BMD- bone mineral density, Hb- Haemoglobin

155

Table 71. Derivation of predictors for determinants of lifestyle diseases using nutritional disorders and other contributory variables (Multiple logistics regression) (N=360)

Stages of lifestyle diseases	Predictors/determinants	Odds ratio	Odds Percentage (%)
0 – 1 lifestyle disease	Waist circumference	.930 (.005)*	48
	Waist-hip ratio	192.557 (0.084)*	99
	Physical activity	1.002 (0.041)*	50
	Diet quality index	2.439 (0.191)*	70.92
1 – 2 lifestyle diseases	Body mass index	1.087 (0.183)*	52
	Waist circumference	0.917 (0.001)*	48
	Waist-hip ratio	1.598 (0.013)*	62
2 – 3 lifestyle diseases	Waist circumference	0.925 (0.002)*	48
	Body fat percentage	1.112 (0.088)*	53
	Waist-hip ratio	342.796 (0.049)*	99
	Standard of living	0.941 (0.051)*	49

*** Significant odds ratio**

For further encountering one more lifestyle disease, the significant determinants identified were elevated body mass index (BMI), waist circumference and WHR. The contribution of these three predictors to the next stage of progression of lifestyle disease as per odds ratio and odds percentage were 1.087 (52%), 0.917 (48%) and 1.598 (62%) respectively.

The significant predictors leading to the final stage of developing a high susceptibility towards all the three lifestyle diseases as per the odds ratio and odds percentage were elevated WC (0.925, 48%), body fat per cent (1.112, 53%), WHR (342.79, 99%) and high SLI (0.941, 49%). The contribution of these four determinants are close to 50 per cent and above.

4.8.2. Identification of risk factors for lifestyle disease

The risk arises usually due to a multiplicity of causative factors acting on an individual so that the individual develops a disease.

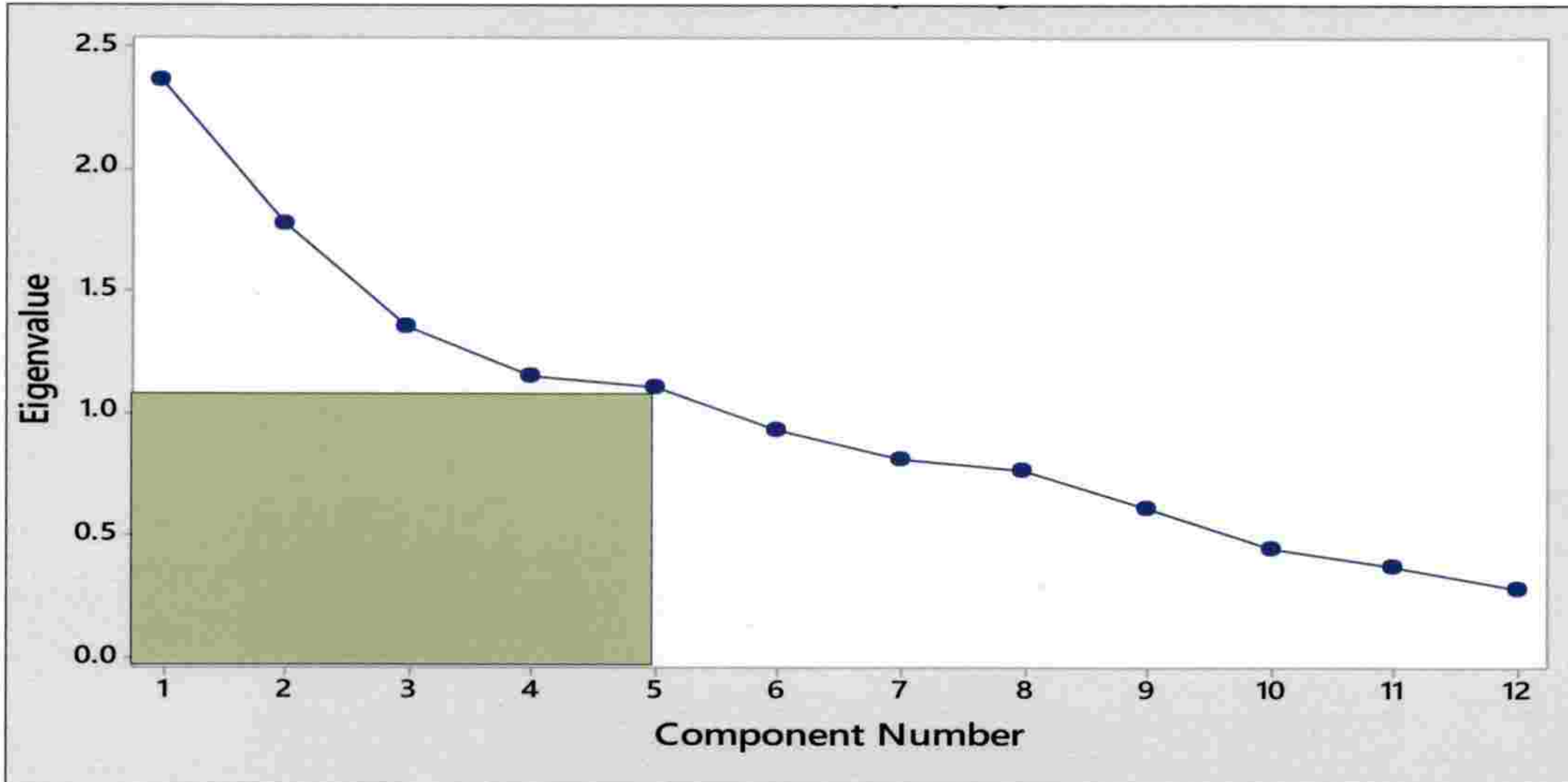
Table 72. Eigen analysis of the correlation matrix

Eigen value	2.3647	1.7801	1.3575	1.1571	1.1104	0.9337	0.8176	0.7643	0.6109	0.4482
Proportion	0.197	0.148	0.113	0.096	0.093	0.078	0.068	0.064	0.051	0.037
Cumulative	0.197	0.345	0.459	0.555	0.647	0.725	0.793	0.857	0.908	0.945

In the present study principle component analysis (PCA) which mainly aims in the reduction of dimensionality of a problem, was done to elucidate the minimum data set and the inter-relationship with various causative factors. The principal component analysis revealed that the first five component risk factors with Eigen value ≥ 1 were the most important as evident from the component loading of the scree plot (figure 4). The results of PCA are given in Table 72 and 73. Thus the significant risk factors variables identified under the 5 minimal data set generated are as follows:-

- 1st data set (eigen value – 2.3647) (PC1) – BMI, WC and BF%.
- 2nd data set (eigen value – 1.7801) (PC2) – Systolic blood pressure and Diastolic blood pressure.
- 3rd data set (eigen value – 1.3575) (PC3) – Physical activity and fasting blood glucose
- 4th data set (eigen value – 1.1571) (PC4) – WHR, total cholesterol, daily vegetable and fruit intake.
- 5th data set (eigen value – 1.1104) (PC5)- Stress and diet quality

Figure 4. Scree plot of risk factors of lifestyle diseases



158

Table 73. The five principal components/ minimum data set

Variables	PC1	PC2	PC3	PC4	PC5
Body mass index	0.487	0.154	-0.204	-0.035	0.095
Waist circumference	0.520	0.070	-0.215	-0.125	-0.095
Body fat percent	0.486	0.196	0.077	0.069	-0.031
Waist Hip Ratio	0.347	-0.153	-0.081	-0.442	-0.043
Physical activity	-0.120	-0.221	-0.456	-0.198	0.391
Stress score	0.090	0.036	0.240	0.120	0.675
Fasting blood glucose	0.059	0.412	0.451	0.145	-0.150
Total cholesterol	0.005	0.214	0.416	-0.453	0.142
Systolic blood pressure	0.151	-0.562	0.311	-0.029	-0.159
Diastolic blood pressure	0.176	-0.563	0.350	0.037	-0.031
Daily vegetable and fruit intake	0.175	-0.084	-0.165	0.645	-0.155
Diet quality index	-0.159	0.066	-0.108	-0.291	-0.527

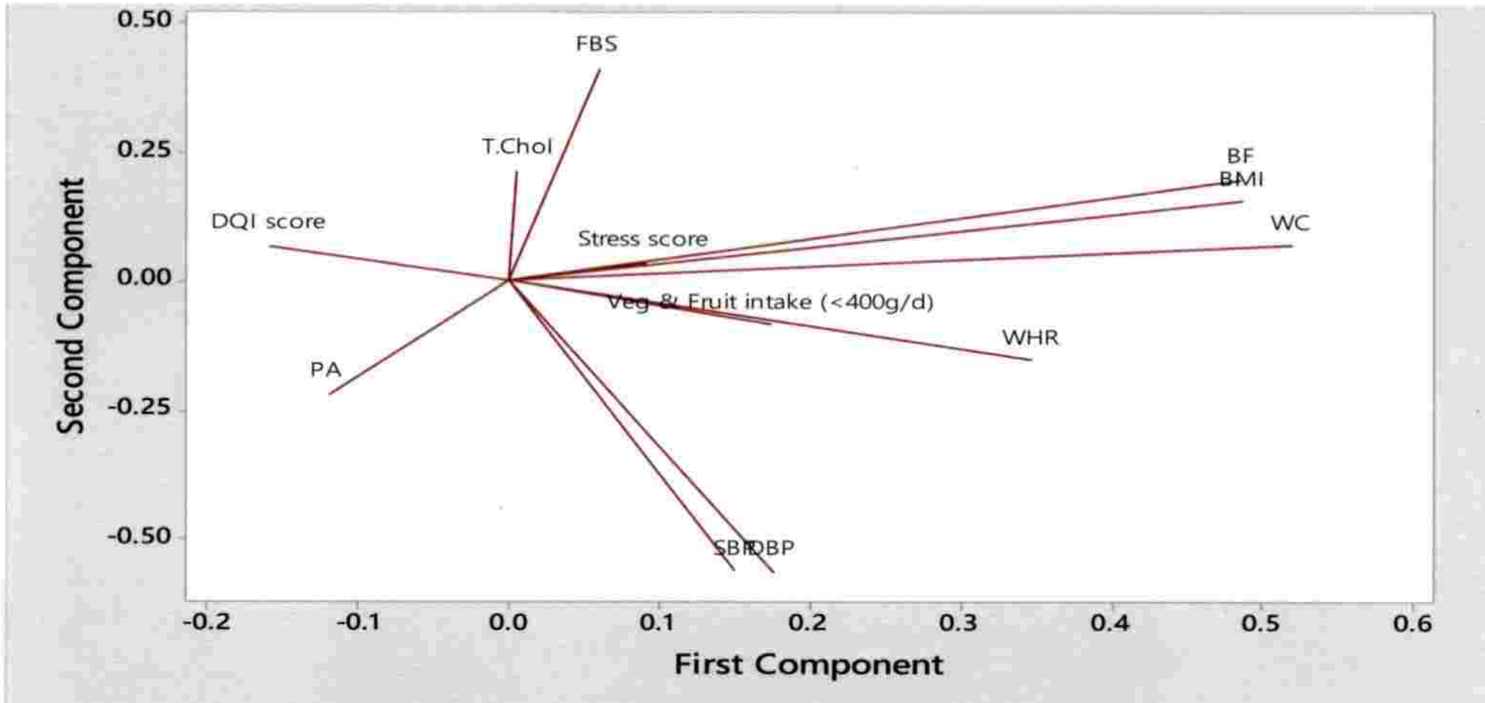
Anthropometric variables namely Body Mass Index, Waist Circumference, Body Fat Percent and Waist Hip Ratio, stress and daily intake of fruits and vegetables are the highly correlated risk factors. Total cholesterol and fasting blood sugar are highly correlated risk factors. Systolic and diastolic blood pressure are the another set of correlated risk factors. Diet quality index score and physical activity are identified as totally independent risk factors as per figure 5.

4.8.3. Derivation of prediction formulas for lifestyle diseases

Using the newly generated 5 minimal data set of risk factors, five corresponding prediction formula along with the reference cut off value for each of the risk factors data set have been derived. The reference cut off value is derived by multiplying the normal value of each risk factor with the corresponding principal component value. The negation operant is given for parameters which are having positive impact on lifestyle which includes physical activity, daily vegetable and fruit intake and diet quality index score. The normal value of each risk factor is taken as following: BMI (22.9 kg/m^2), WC (79 cm), BF% (29), systolic blood pressure (89 mmHg), diastolic blood pressure (139mmHg), physical activity (600 met), FBS (125 mg/dl), WHR (0.85), total

159

Figure 5. Correlations among risk factors of lifestyle diseases



BF- Body fat percentage	**DQI**- Diet quality index
BMI- Body mass index	**T.Chol**- Total cholesterol
WC- Waist circumference	**FBS**- Fasting blood sugar
WHR- Waist-hip ratio	**SBP**- Systolic blood pressure
PA- Physical activity	**DBP**- Diastolic blood pressure

160

cholesterol (189 mg/dl), daily vegetable and fruit intake (400g), average stress score (25) and good diet quality index score (60). The 5 prediction formula for lifestyle diseases are given in Table 74.

Table 74. Derivation of prediction equations for lifestyle diseases

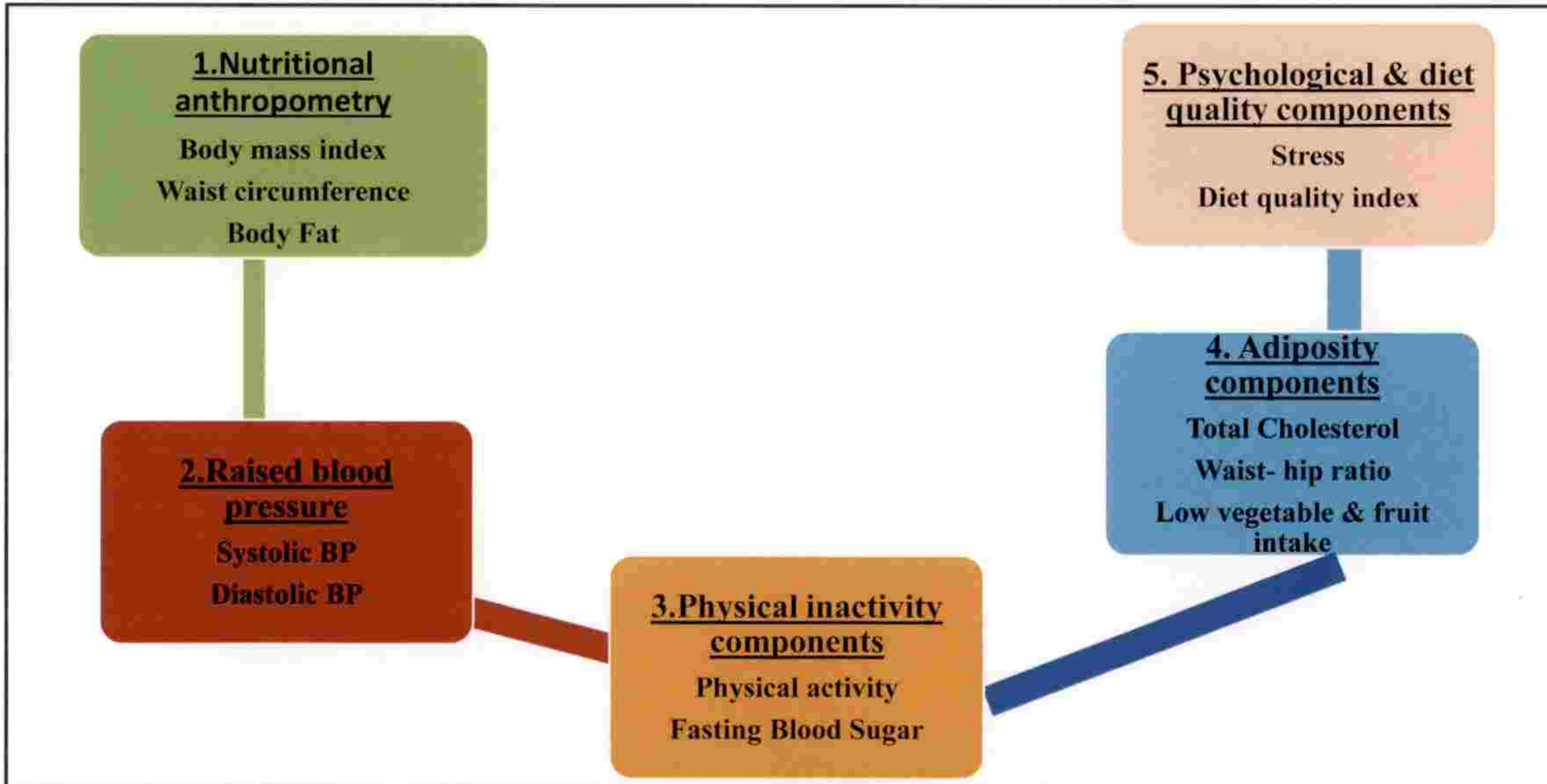
Data set	Expression/ prediction equations	Reference cut-offs
1st data set	BMI*0.487 + WC*0.520 + BF*0.486	66.33
2nd data set	Systolic BP*0.562 + Diastolic BP*0.176	74.48
3rd data set	(-Physical activity*0.456)+ FBS*0.451	-217.23
4th data set	WHR*0.442+ Total cholesterol *0.453- daily vegetable & fruit intake	-172
5th data set	Stress*0.675- DQI*0.527	-14.745
(The negation operant is given for parameters which are having positive impact on lifestyle)		

4.9. Development of risk factor index (RFT) for lifestyle disease and nutritional disorder

Principal component analysis was carried out for generating the five significant risk factor dimensions contributing to nutritional disorders and lifestyle diseases. These five dimensions identified in the present study was included in the development of risk factors scale. The composite risk factor index is illustrated in figure 6. Scores were assigned to each of the 12 variables/items included in the dimensions based on priority weight. The dimensions are as follows: (1) Nutritional anthropometry (4 scores) are composed of 3 items/components related to nutritional status. (2). Raised blood pressure (2 scores) composed of two items/components. (3). Physical inactivity factors (3 scores) are composed of two risk factor items. (4). Adiposity factors (3 scores), are composed of three items and (5). Psychological and diet quality factors (4 scores) are composed of two risk items that aims to assess the stress prevalence and diet quality. The total RFI scale score ranged between 0 (lowest risk) to 16

161

Figure 6. Composite risk factor index



162

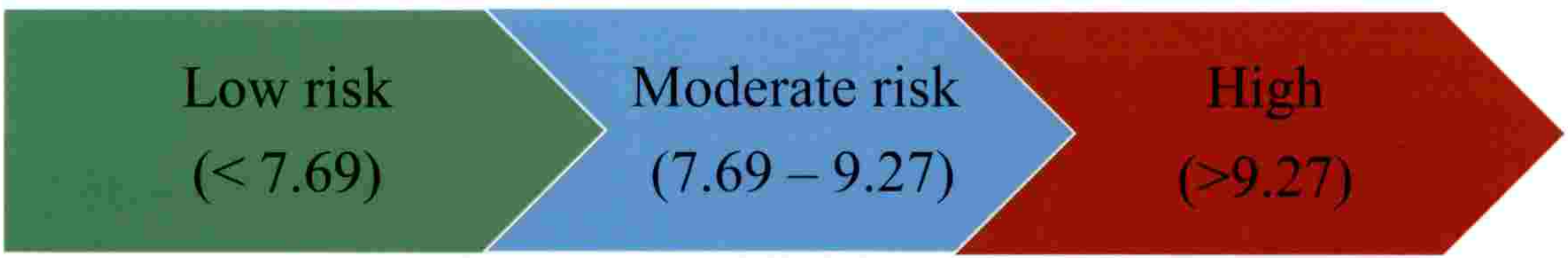
(highest risk). Accordingly a risk factor scale for lifestyle diseases and nutritional disorder assessment was developed (Table 75 and figure 7).

Table 75. Development of risk factor scale for lifestyle diseases (RFI) and nutritional disorders and the corresponding scores

Risk factors	Conditions	Scoring procedure
Body mass index (kg/m2)	Normal	0
	Pre obese	1
	Obese	2
Waist circumference (cms)	<80	0
	≥ 80	1
Body fat percentage (%)	<30	0
	≥30	1
Systolic Blood Pressure (mm Hg)	≥140	1
	<140	0
Diastolic Blood Pressure (mm Hg)	≥90	1
	<90	0
Physical activity	Inactive	1
	Active	0
Fasting blood sugar (mg/dl)	Normal (<110)	0
	Raised (≥ 110)	1
	Impaired (≥ 126)	2
Waist-hip ratio	≥0.85	1
	<0.85	0
Total cholesterol (mg/dl)	Normal (<190)	0
	Raised (≥ 190)	1
Daily intake of vegetables & fruits	≥400g/d	0
	<400g/d	1
Stress score	Low	0
	Moderate	1
	High	2
Diet quality index	Good	0
	Average	1
	Poor	2

163

Figure 7. Lifestyle disease risk factor scale



164

The application of the developed risk factors scale among the 360 middle aged working women revealed that close to one third of the study population (30 per cent) were categorized under high risk index category with score range above 9.27. Nearly two out of every five middle aged women had moderate risk (39 per cent) with a RFI score range between7.69 to 9.27. Whereas, 31 per cent of the total population were categorized under low risk category with a score range below 7.69 for developing lifestyle disease and nutritional disorders. Occupational division wise risk factor index analysis estimated that women employed as construction workers had the highest risk index for developing lifestyle diseases and nutritional disorders whereas those employed as machine operators showed the least risk factor index for lifestyle diseases and nutritional disorders (Table 76 and 77).

Table 76. Distribution of middle aged women based on lifestyle disease risk index (N=360)

Lifestyle disease risk type	Score range	Number	Per cent
Low risk	<7.69	113	31.4
Moderate risk	7.69-9.27	139	38.6
High risk	>9.27	108	30
Total		360	100

Table 77. Occupational division-wise ranking of middle aged working women based on lifestyle disease risk index (N=360)

LD risk index	Occupational divisions								
	D1	D2	D3	D4	D5	D6	D7	D8	D9
Mean score	53.44	57.66	54.53	56.71	64.84	66.09	53.28	51.86	66.40
Mean rank	VII	IV	VI	V	III	II	VIII	IX	I

LD- Lifestyle disease

5. DISCUSSION

The discussion pertaining to the findings entitled **"Determinants of nutritional status and lifestyle diseases among middle aged working women"** is presented in this chapter under the following headings:

5.1. Socioeconomic profile of the respondents

5.2 Work profile and stress prevalence of the respondents

5.3. Food consumption pattern

5.4. Prevalence of lifestyle diseases among middle aged working women

5.5. Physical activity patterns

5.6. Nutritional status of middle aged working women

5.7. Energy expenditure and energy balance studies

5.8. Correlates and determinants of nutritional disorders and lifestyle diseases

5.9. Risk factors of lifestyle diseases

5.1. Socioeconomic profile of the respondents

The socio economic status (SES) is an important determinant of health, nutritional status as well as mortality and morbidity (Gupta *et al.,* 2005). Assessment of socioeconomic status is a vital prerequisite of community based studies as several diseases are directly or indirectly related to socioeconomic status (Saleem, 2018). Socio economic profile comprises of age, religion, marital status, educational status, standard of living index, family income, food expenditure pattern and food habits have significant influence in the productive activities of an individual (Karuppusamy and Karthikeyan, 2017).The socio economic profile of middle aged working women indicated a sizable proportion of respondents (74 %) belonged to Hindu community. This is in accordance with the demographic profile of Kerala state and specifically Thiruvananthapuram district. As per census (2011), Hinduism is the major religion in Kerala state as well as in Thiruvananthapuram district with 54.73 % and 66.46% followers respectively. Various studies conducted in Thiruvananthapuram district by Chandran (2005), Renjini (2008), Sheethal (2011), Anila (2014), Das (2014), Priya (2016) and Aiswarya (2017) also indicated the predominance of Hindu community. The third repeat survey of NNMB (2012) carried out in the 10 states of India including Kerala, also showed that majority of the households in Kerala belonged to Hindu religion (71.6%).

Rapid urbanization and socio demographic transitions resulted in disintegration of joint family system in different communities of Kerala. Unlike other states, small family norm has become very popular in Kerala probably due to better medical and educational facilities and the constant exposure of the public to small family norm through different media. In the present study also, nuclear family system was observed among 58 per cent of the families with majority families (29.2%) having only four members. Similar findings were observed among the different labour communities of Kerala by Anil *et al*. (2001), Ukkuru (2001), Pratheesh (2002), Jyothi (2003), Lawrence (2003), Vijayan (2003), Krishnaroopa (2003), Chandran (2005), Renjini (2008), Shiji (2009), Deepa (2009), Latheef (2011), Sheethal (2011), Athulya (2012), Krishnedhu (2012), Anila (2014), Das (2014), Priya (2016), and Aiswarya (2017). The National Family Health Survey (2015-2016) also reported that households in Kerala are comprised of four members on average. This small family norm has a great social significance, since it has a direct impact on the per capita income availability, as well as food which in turn have a favourable influence on the nutritional status of women.

"A woman with more education, tends to have a better paid job, better control over her fertility, and better health indicators for herself and her children" Sen (1990). Education is not only one of the most important socioeconomic factors that can influence individual behaviour and attitudes, but is a fundamental indicator of a country's level of human capital development. The present study observed that middle aged women employed in higher order occupation divisions (D1, D2, D3 and D4) were professionally qualified whereas majority of those employed in middle and lower order occupation divisions (D5 – D9) had at least primary to high school level of education. The educational status of women aged 15-49 as captured by National Family Health Survey-4 (2018) also revealed a positive picture of Kerala (97.9%) in comparison to the all India average (68.4%). The percentage of women who completed 10 years of schooling and more in the state (72.2%) is more than double that of India (35.7%) (Economic review, 2017). Average literacy rate of Thiruvananthapuram district in Census 2011 were 93.02 per cent and gender wise analysis shows the female literacy was 91.17 per cent. Higher educational status of women was also observed in various studies conducted among Kerala population by Krishnaroopa (2003), Chandran (2005), Renjini (2008), Sheethal (2011), Krishnedhu (2012), Blossom (2013), Anila (2014), Priya (2016), and Aiswarya (2017).

According to UN (1973) definitions, unemployed persons seeking paid jobs are considered as the part of the labour force, but persons engaged in non-income producing activities, like women engaged in domestic work in own home, are excluded from it. With respect to the indicators of women's development, Kerala would stand different from the rest of the country. Kerala is a State known for its positive sex ratio, high female literacy, life expectancy and mean age at marriage for women when compared with women in the rest of the country as per the 2011 census (Economic review, 2017). However, the patterns of educational and occupational trends for Keralite women are dramatically contradictory on comparison with many other Indian states. This suggests a paradoxical situation, where the achievements of women in education and their health status remain quite impressive while at the same time their economic and political position remains below average. The report on Human development and economic growth of Kerala (2005), indicated a higher growth of population in the late working age group of 45-59 and is projected to reach 21 per cent in 2021.The investigation thus focus on the occupational status of middle aged working women. The study includes women employed in diverse occupation divisions as well as those engaged in different nature of occupation such as professionals, technicians, clerks, machine operators, weavers and agriculture and construction workers. All the women professionals in the study had a regular means of earnings. Priya (2016) observed similar findings in her study. The NFHS-4 (2018) indicated that in Kerala, 21 per cent of all women in the age group of 15-49 years were employed as well as 89 per cent of these employed women worked in non-agricultural occupations. The major proportion of women employed in agriculture and allied sectors or other non-agriculture sectors in the study were either daily wage earners or employed as temporary or contract staff. Another study pointed out that the rise in casual works in Kerala has severely affected the job security of women (Eapen, 1994). Devi (2002) gives an overall picture of education, employment and job preference of women in Kerala indicating that majority of the employed women are casual laborers (37.8%) working in poor working conditions with extremely low paid occupations and 33.4 per cent have regular or permanent jobs.

"Being poor does not mean living below an imaginary poverty line, it means having an income level that does not allow an individual to cover certain basic necessities" Amartya Sen (2001). There are geographical, biological and social factors that amplify or reduce the impact of income on each individual. He observed that the poor generally lack a number of elements, such as education, access to land, health and longevity, justice, family and community support, credit and other productive resources, a voice in institutions and access to opportunity. Monthly income is a major factor influencing socio economic status and in turn food and nutritional security of households. Average monthly income of family varied from below Rs. 6326/- to a high income of more than Rs. 1, 26,360/. NNMB (2012) indicated Kerala had the highest per capita monthly income of Rs. 2,556. In the present study, majority of women employed in higher order (D1, D2) and middle order occupations (D3, D4) respectively belonged to upper socio economic status and middle SES. Further, more than 80 per cent women employed in primary and secondary work sectors like agriculture, fishery, construction and manufacturing belonged to upper lower socio economic status since they worked as casual labours or on daily wages. The diversity in the nature of occupational status is the major reason for the variations observed in the socio economic status of the present study. The study also observed that none of the respondents belonged to lower SES category. The success of Kerala in poverty reduction is reflected in the sharp reduction in the proportion of poor both in rural and urban areas (Economic review 2017, State Planning Board, Thiruvananthapuram). This is in line with the findings of Jyothi (2003), Aneena (2003), Lawrence (2003), Deepa (2009) and Anusha (2012) among the different labour categories and priya (2016) in her study among different income groups of Kerala.

Access to basic amenities, such as proper housing, safe drinking water and sanitation, and clean cooking fuel, is not only an important measure of the socioeconomic status of the household but is also fundamental to the health of its members (NFHS-3). Better housing conditions and consumer durables were possessed by women belonging to upper and middle socioeconomic status than those employed in the lower order occupation strata (*i.e.* D5, D6, D7 and D9). More than half of women from occupation strata D1, D2, D5 and D8 own a house whereas 57.5 per cent to 77.5 per cent of women from strata D3, D6, D7 and D9 do not own a house. The NFHS-4 (2018) reported around 29% of women in Kerala own a house and the trend of ownership increases with women's age.

The type of house is considered as an index of economic status of the household. Majority of women from occupation strata D1 to D5 and D8 were living in pucca houses while the proportion of women living in semi-pucca houses was more than 80 per cent in occupation strata D6, D7 and D9. The proportion of households living in pucca houses was highest in Kerala (47.8%) as per NNMB (2012) survey in rural areas of the state. The findings of the study are in accordance with the latest report of National Family Health Survey (2018), indicating almost ninety per cent of households in Kerala (89%) live in a pucca house and almost all households (99%) have electricity and use an improved sanitation facility (98%). Chandran (2005) observed that among middle aged women of BPL families a rapid transition of rural community in housing also reflected in their changing standard of living.

More than sixty per cent of households from occupation strata D1 to D4 and D8 have access to drinking water facility in the household premises. Meanwhile, more than half to fourth fifth of households of service, agriculture, craft and construction workers depend on common sources of drinking water facility. As per NFHS report (2018), more than ninety per cent (94%) of households use an improved source of drinking water in Kerala, whereas only 20 per cent have drinking water piped into their dwelling, yard, or plot.

More than sixty per cent of households from occupation strata D1 to D4 and D8 use a clean fuel for cooking (mostly LPG or natural gas) when compared to the state proportion of fifty seven per cent. The study also observed that higher proportion of households from strata D5 to D7 and D9 use wood as the main fuel for cooking.

An alarming finding from the study is the higher proportion of households irrespective of occupation strata indicate practicing improper waste /garbage disposal and burning of plastics. Varma (2007), the Executive Director of Suchitwa Mission, Trivandrum, Kerala opined the excessive accumulation of solid wastes in the urban as well as rural areas, typical to Kerala, is a major challenge and poses serious threat to environment and health.

Facilities available within the house go a long way in deciding the quality of life and also in reducing drudgery and providing healthful living environment for the family. Household possession details shows a higher proportion of women belonging to upper and middle SES (D1, D2, D3, D4) possessed most of the luxury amenities like car, air conditioner, refrigerator and computers when compared to their counter parts. Major proportion of working women possessed a bank or a post office account moreover all respondents in strata D2, D3 and D4 had personal credit cards. More than seventy per cent (71%) of women have a bank or savings account that they use by themselves as per NFHS-4 (2018) report. Higher proportion of women employed as senior officials and legislators (55%) possessed either land or parental property when compared to the state overall of twenty three per cent women. Blossom (2013) observed 56.25 per cent of families owned land in a study among the BPL families of central Kerala. However only 36 per cent of farm labour households of Kuttanad possessed land (Anusha, 2012).

Availability of livestock is considered as an additional source of income for many households. Nearly forty three per cent women employed in craft and related trades own livestock mean while less than 30 per cent of women employed as machine operators and construction workers own livestock. Results indicate higher proportion of ownership of livestock among the households of lower occupation strata. The lack of livestock among majority of the families might be due to the lack of proper space or land required for rearing the animals and unavailability of time among working women. Overall 30.9 per cent of households in Kerala possess a livestock as per NFHS-4 report. The same was observed to be 33 per cent (Blossom, 2013) and 55 per cent (Anusha, 2012) respectively in studies conducted among Kerala population.

Media exposure was observed among all employed women with highest proportion noticed among women professionals (97.5%). Similar results were observed in the National level survey that revealed more than 9 in 10 women watch television at least once a week (NFHS-4). Higher proportion of senior officials and legislatures (85%) were found to be actively involved in various social issues. The reason could be partly attributed to the nature of their occupation which mainly deals with public issues and administration. Sachana (2015), observed in her study among the livelihood issues of tribal women of Palakkad district, Kerala that introduction of Kudumbasree program had brought in significant changes to the women in their attitude as well as in their approach to the various social activities.

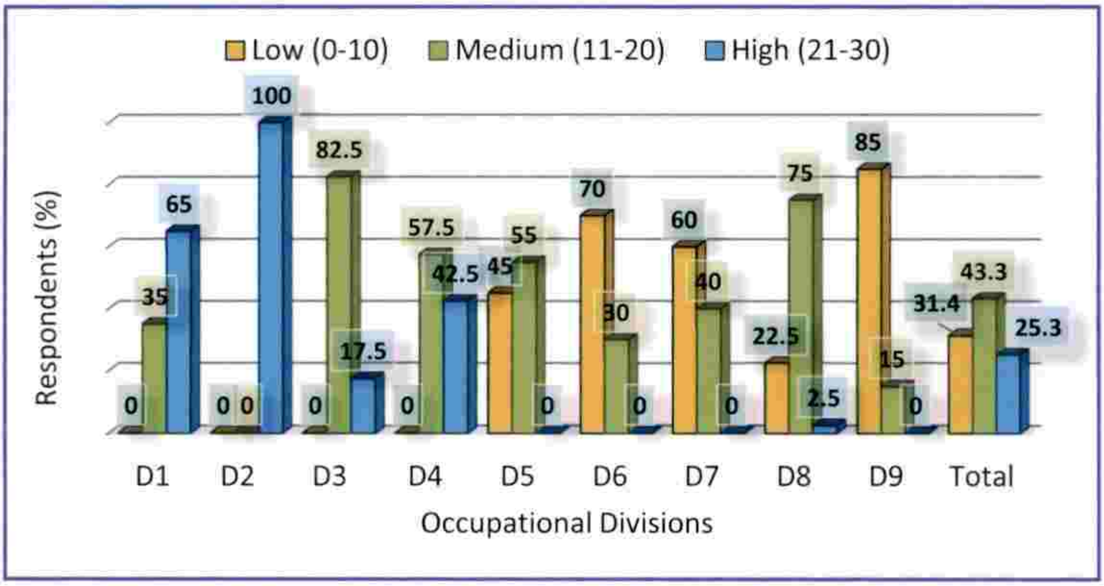
The data on consumption (covers both food and non-food items) expenditure is one of the indicators of standard of living of the households. Consumption is an important activity undertaken at the household sector. Whatever personal income obtained, from one or the other source, is spent either on consumption or is saved. Monthly per capita expenditure estimates of the family revealed that up to fifty per cent consumption incurred for recurring expenditure among more than two fifth of women employed in occupation strata D1 to D6 and D8. Whereas majority of construction workers showed only up to 25 per cent consumption. It was also observed that irrespective of occupational strata, difference up to 25 per cent of consumption was incurred in non-recurring expenditure in all households. The recurring and the non-recurring expenditure together constitute the non-food consumption expenditure of the household. Food consumption expenditure showed that women from upper socio economic status incurred only less than 25 per cent consumption expenditure. In contrast to this, up to 50 per cent consumption was incurred in food expenditure for major proportion of households belonging to middle and lower socio economic status. It is noted in the 68th round of National Sample Survey (NSS, 2013) that Kerala recorded the highest per capita consumption expenditure per month in both food and non-food among the Indian states. The non-food expenditure remained higher than food consumption expenditure as observed in the present study. Joseph (2012) studied the change in the consumption pattern of Kerala household between 2000 and 2010 and observed prominent increase among the non-food items housing, education, and petrol/diesel, recreational and miscellaneous expenditure in both rural and urban areas. The fast growing non-food rural consumption has partly been fired by surge in rural wages through government sponsored employment guarantee schemes and rural focused government spending. The higher consumption rates has forced the state to import number of consumer goods from the rest of the country, there by Kerala turning into a consumer state. Heena and Rajani (2013) observed a positive relation between household income and consumption expenditure in rural part of India. Meanwhile Vardhan (2013) in an analysis of consumption expenditure among various social groups in Kerala as well as India showed that the differences in consumption expenditure among social groups were more pronounced in Kerala than that of India. The study revealed that the average monthly per capita consumption expenditure of scheduled caste and scheduled tribes were lower than the general population both in Kerala and India. This indicates that the fruits of growth are confined to certain section of the society specifically to certain income groups. The present study also established the fact that the share of food in the expenditure basket of the poor household was very high, regardless of the occupation and the source of livelihood of the household.

Information related to both savings and indebtedness pattern of the family revealed a negative picture. Overall only less than thirty per cent of families indicated the habit of savings. Higher savings pattern was seen from women professionals (D2) and clerical staffs (D4). Almost fifty seven per cent of women revealed of indebtedness that need to be repaid on monthly or single payment basis. Savings habit was comparatively better among high and middle socio economic status families when compared to their counter parts. Meanwhile, indebtedness was observed to be more than fifty per cent among the families of service, agriculture and fishery, craft, machine operators and construction workers. Vijayan (2003) pointed out that families borrowed money to meet their daily household and food expenditure, and also opined that negative balance shown in their budget was partially due to their borrowing habit. The findings of NSSO (2006) survey clearly indicated that the poor in the state of Kerala had a high incidence of indebtedness in the rural areas at 39 as against the National average of 27 in 2002.Similarly the average amount of cash borrowings per household was much higher in the state (Rs.11,066/-) than the national average (Rs. 3,726/-). Though, the families earned better income, in the present study most of the families did not found to be saving money for future needs. The trend is similar to those observed by Lawrence (2003), Jyothi (2003), Deepa (2009) and Blossom (2013).

Estimation of unhealthy personal habits of family members such as smoking, alcohol consumption, chewing betel leaf and pan indicated higher proportion of these unhealthy habits among the family members of agriculture, fishery (D6) and construction workers (D9). Anish *et al.* (2010) indicated that the prevalence of pan chewing habit among females to be 26 per cent among tribal population. Vijayan (2003) in a study found that landless agriculture labourers in Thiruvananthapuram spent an amount between Rs.50 to Rs.840 every month for unhealthy habits. This practice was found to drain their income, and if it is diverted to procure food could definitely improve the food security of these families. Another community based study from Thiruvananthapuram district reported a current smoking prevalence of 43.7 per cent in the age group of 35-64 and the prevalence of chewing was 26.2 per cent among men and 6.7 per cent among women (Thankappan *et al.*, 2006).

The Standard of living index (SLI) gives a more accurate and realistic picture of the socio economic status of the family and hence should be the scale recommended for the classification of socio economic status in urban and rural setting (Masthi *et al.*, 2013).The analysis of standard of living index (SLI) of the family revealed high disparity among the various occupation strata. Further, SLI was found to be significantly dependent on occupation divisions of middle aged women. Majority of women (65%) from higher order occupation division (D1 and D2) belonged to high standard of living whereas major proportion (50%-83%) of women from occupation strata D3 to D5 and D8 belong to middle standard of living. Meanwhile more than sixty per cent of women laborers from occupation strata D6, D7 and D9 belonged to low standard of living index. Overall, the study observed middle standard of living in major proportion (43.3%) of families. A similar trend was observed in the study conducted by Saikia and Ram (2010), with a higher proportion of middle income families (47.95%). In contrast to the present study Priyadarisini *et al.* (2016) compared the

Figure 8. Distribution of respondents based on Standard of Living Index



144

176

standard of living in a semi urban area of Mangalore and estimated that majority (62%) belonged to high SLI. Also according to NFHS-3 (2006) data 63 per cent of the Indian population was above poverty line. By virtue of the unique development path followed in the State, the poverty index of Kerala shows that only 11.3 percent of population falls under the poverty line as compared to 29.5 per cent in the country in 2011-12. The success of Kerala in poverty reduction is reflected in the sharp reduction in the proportion of poor both in rural and urban areas (Economic review, 2017). In Kerala, factors such as land reforms, spread of education, and health care, decentralisation, pension schemes, public distribution system, Kudumbashree, and the consolidated efforts through plan schemes have played an effective role in reducing the poverty ratios. Safraj *et al.* (2012) studied the relationship between socioeconomic position (SEP) on the basis of household assets and prevalence of diabetes in a rural population in Kerala. The result indicated that the prevalence of diabetes increases as one moves up the socioeconomic ladder in the rural community (figure 8).

5.2 Work profile and stress prevalence of the respondents

Employment is critical for poverty reduction and for enhancing women's status. The decision of a woman to participate in the labour force depends upon her personal and family characteristics and other intervening influences (Devi, 2002).The 55th round of National Sample Survey (1999-2000) observes that increase in women's work participation rates in Kerala (22.9) was confined to the age group of 35-54 years in the urban areas alone. This is, of course, an indication that women's ability to take up work is enhanced when their reproductive responsibilities cease to some extent at least after the child bearing age (Human development and economic growth of Kerala, 2005). Many studies have pointed out that there is no age specification pertaining for working in unorganized sector and mostly women belonged to middle age (Ranganathan, 1996, Rammohan and Sundersan, 2003., and Deepa, 2009). Work pattern was analyzed in the present study and middle aged women employed in both organized as well as unorganized sectors of occupation have been included in the study. The results indicated that more than two fifth of women (44.3%) were employed in public sectors which comprises the sub sectors of general government as well as public corporations. Whereas a higher proportion of senior officials and professionals were employed in government sector where all units are owned by the government and provide permanent jobs. Overall 17 per cent women were employed in private sectors which consist of enterprises that are owned, by an individual or a group of individual. All the construction workers belonged to private sector. Women entrepreneurs constituted only 11 percent. The above finding that majority of middle aged women belong to the public sector indicate that a higher proportion of women are employed on temporary basis. Absence of transfers, likelihood of shifting to flexible work schedule, probability of age relaxation for entry into public sectors as well as the viability of informal work adjustments could be the factors contributing to the preference for public sector. A high proportion of women in Kerala are employed in the tertiary or service sector which is a salient feature of women employment in the State (Devi, 2002). Bhatia (2004) observed in that among women workers of agro based industries of Punjab that majority of women workers were (65%) employed on contract basis while only 15.5 per cent were regular employees.

Major proportion of women has at least 10-20 years of tenure of service with 100 per cent representation from construction and manufacturing workers. As per SEWA in Ahmedabad suggested that women construction workers although were working as casual laborers were able to secure longer term contracts than men primarily attributed to the interest of security. Women are much more likely than men to accept poorly paid work that is more stable (Baruah, 2008). More than 20 years of service was observed for women employed mainly in government sector whereas more than 30 years of service was noticed among majority of agriculture and fishery laborers (27.5%) as well as women professionals (17.5%). It is seen that there exist association between age of the respondents and year of entry in service. Women employed in primary sectors like agriculture and fishery have revealed that they are habituated to do this work since their early age and they mostly chose this occupation out of need under the economic compulsion and indebtedness.

Mode of conveyance indicated that almost half of working women depend on public coveyance like KSRTC buses, auto rickshaw or institution vehicles with majority (46.6%) travelling less than a distance of 5 Kms to reach their work place. A sizable proportion (43%) also travelled a distance of 5-15 Kms daily to reach their work place. Proximity to home is identified as an important factor constituting the job preference of working women of Kerala (Devi, 2002). The 50th round NSS (1993-94) data also corroborate this finding. As per the report, up to thirty per cent of the rural women and almost twenty seven per cent of urban women were willing to work in their household premises. One of the significant reasons for female unemployment in Kerala is documented in earlier studies as the preference to get employed near home (or the reluctance for mobility of women in Kerala) (Frank and Chasin, 1996). This is quite natural observation in the case of women, due to their commitment to family responsibilities. Women indicated that provision for institution buses and proximity to home is improtant in time management and for maintaining work life balance.

Women's economic productivity is a critical factor for enhancing their status and ensures empowerment as well as economic independence. Financial benefits are revealed as the major motivation and interest towards work by more than half of middle aged working women (55.8%). As per the latest NFHS-4 (2018) data two out of every five women (40%) in Kerala have some money that they can decide on how to use. The proportion of women with money which they control is slightly higher among urban women (42%) than rural women (38%). Moreover it increases sharply with age, and is the highest among women who are employed for cash (86%) (NFHS, 2018). Adequacy of remuneration is documented as an important factor in job preference (Devi, 2002). Baruah (2008) inferred that economic burden is a major factor that forces women to enter into paid labor force such as construction sector. Lilly (2000), also noticed a similar trend among female agriculture laborers of Palakkad district. Less than twenty per cent women also indicated that apart from financial security employment has improved their social status as well as embedded them with many personal benefits like decision making, problem solving skills, technical knowhow, managerial and leadership qualities.

Working women face various forms of discrimination, including job typing that pushes them into low paying jobs (Srivastava and Srivastava, 2010). The analysis of discrimination faced by working women indicate more than half of women face discrimination (51.1%) in terms of wage, work as well as time with a major proportion observed among service workers (65%), machine operators (62.5%) and clerical staff (62.5%). In India, various research findings have pointed out significant gender disparities with respect to wages across all occupation sectors and regions. (Rustagi 2005; Duraisamy and Duraisamy, 1999 and 2014; Kingdon and Unni 2001; and Mukherjee and Majumdar, 2011). Both the Census and NSSO estimates depict a picture of low work participation rates of women. But, the work participation of women is much higher than what is measured, given the invisibility or non-recognition of economic work that women do at home (Eapen, 2004).

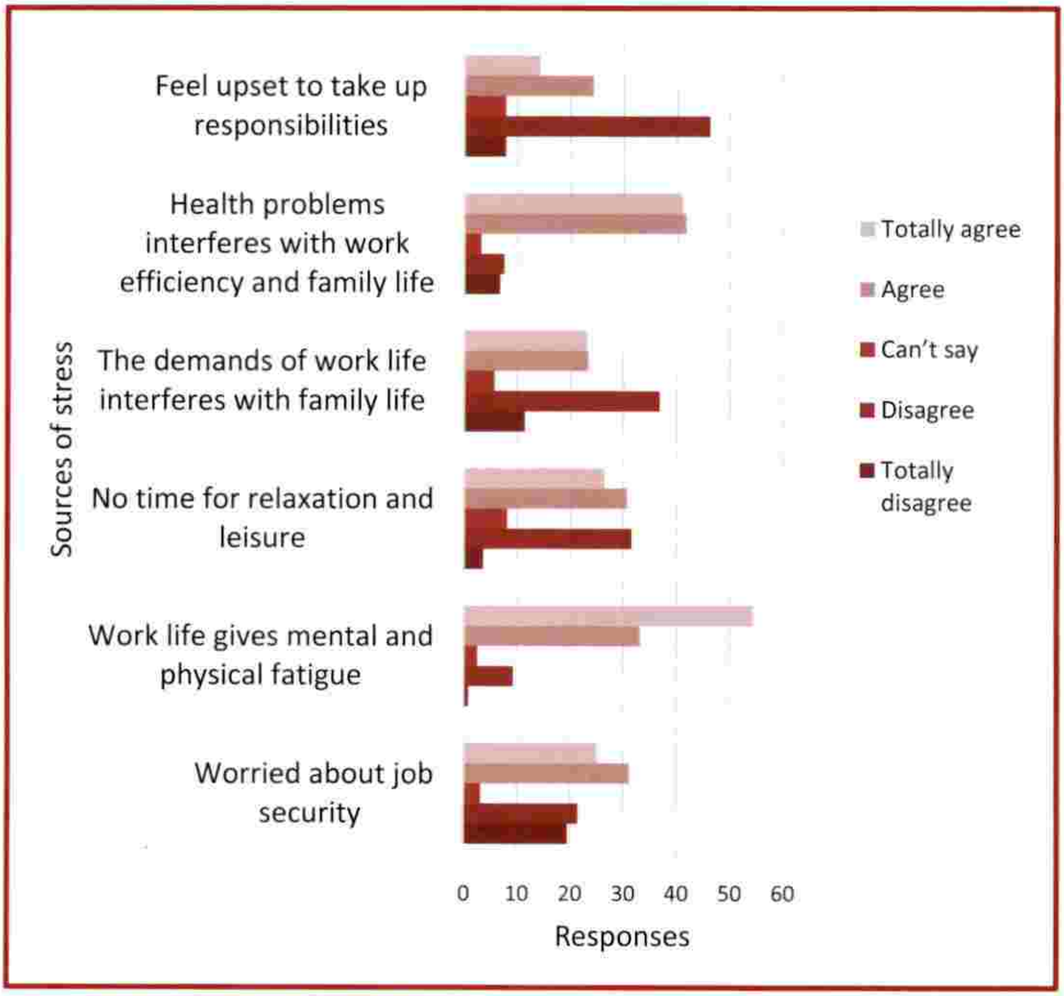
Overall thirty per cent of middle aged working women reported occupational health hazards with the highest proportion observed among agriculture and fishery laborers (80%) and construction and manufacturing workers (70%). A study of cashew processing units in Kerala pointed out the deplorable physical working conditions such as unhygienic floors, dirty work surroundings, stinking latrines and occasional accidents (Thresia, 2007). A study conducted by the TD Medical College in Alleppy indicated the higher morbidity among female coir workers compared to workers in other sectors (Kumar and Devi, 2010). Prevalence of symptomatic diseases such as rheumatism, chest pain, joint pain, bronchial asthma was observed to be higher among coir workers, particularly those engaged in spinning coir yarn. The report of planning commission (2008-09) indicated that the work environment of agricultural and plantation women labourers are not conducive to good health. For example,

180

women working in fish processing industry work in unhealthy and unhygienic conditions. Further, the need for continuous work often in uncomfortable and improper sitting position and sitting on the wet floor increases the chances of morbidity. Many had skin diseases, especially on hands, as they usually work without wearing gloves and the tasks are performed with abundant use of ice cold chlorinated water.

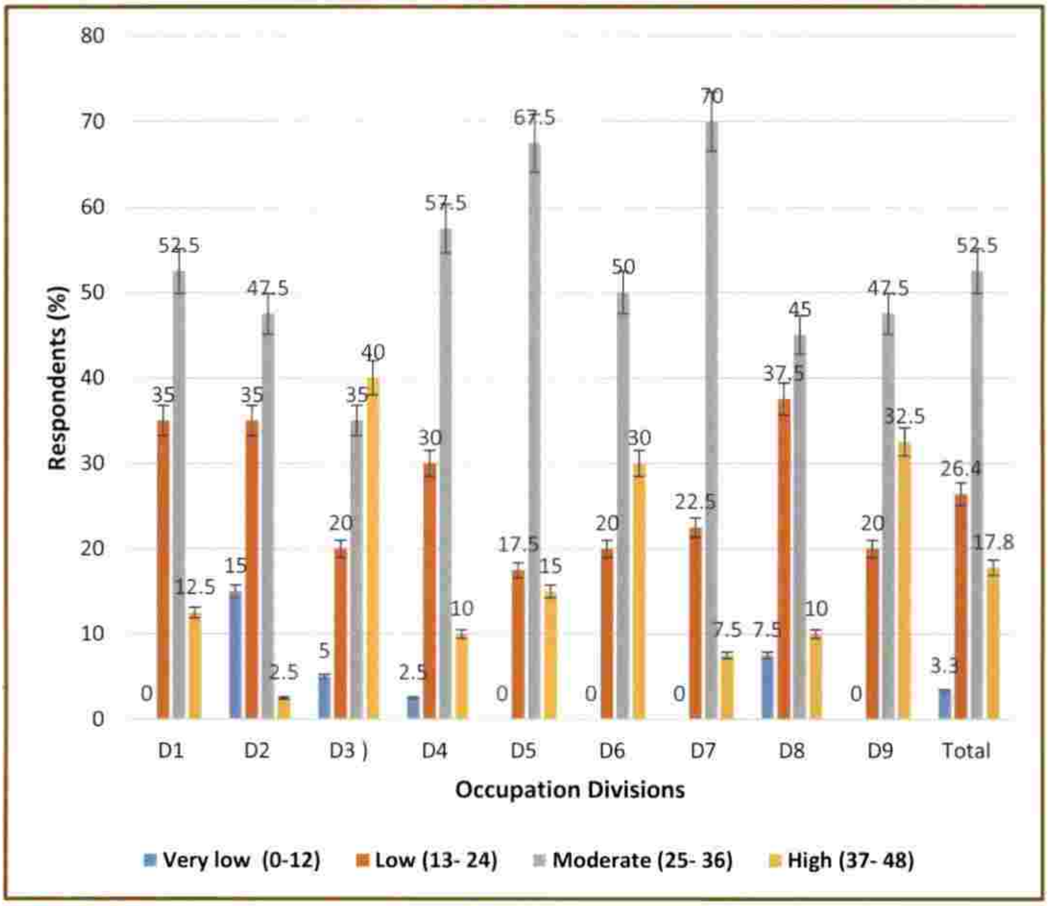
Middle age is filled with challenges and unique stress particularly for working women, which affects their psychological well-being and health status. In the present study prevalence of stress was found to be significantly dependent on occupational strata. Overall, more than half of working women (52.5%) indicated moderate stress prevalence. Almost 18 percent indicated high stress. The analysis of household and work stress prevalence among middle aged working women revealed that technicians and associate professionals were ranked at the top with respect to household stress. Work stress prevalence was perceived highest by construction and manufacturing workers. Psychological distress was also observed to be highest among construction (40%), agriculture and fishery workers (40%). A study on occupational stress among police personnel of Kerala indicates both operational and organisational stress was significant among the police officers with higher prevalence among women than men and majority having moderate to high levels of stress (Ragesh *et al.*, 2017). A woman performing multiple roles also face work-family conflict that further lead to the problem of psychological pressure, stress and associated health problems resulting in declining work efficiency (Ramya, 2013). The World Health Organizations (2004), Global Burden of Diseases Survey 2 estimates that mental disease including stress related disorders will be the second leading disability by the year 2020. Watson (2013) conducted a survey across 15 countries, including India and identified stress as the top lifestyle risk factor in nearly all the countries. The stress scale derived in the present study is a valuable tool in assessing work life, household as well as psychological distress with special reference to working women (figure 9 and figure 10).

Figure 9. Prevalence of work and household stress sources among the respondents



182

Figure 10. Distribution of respondents based on stress levels



183

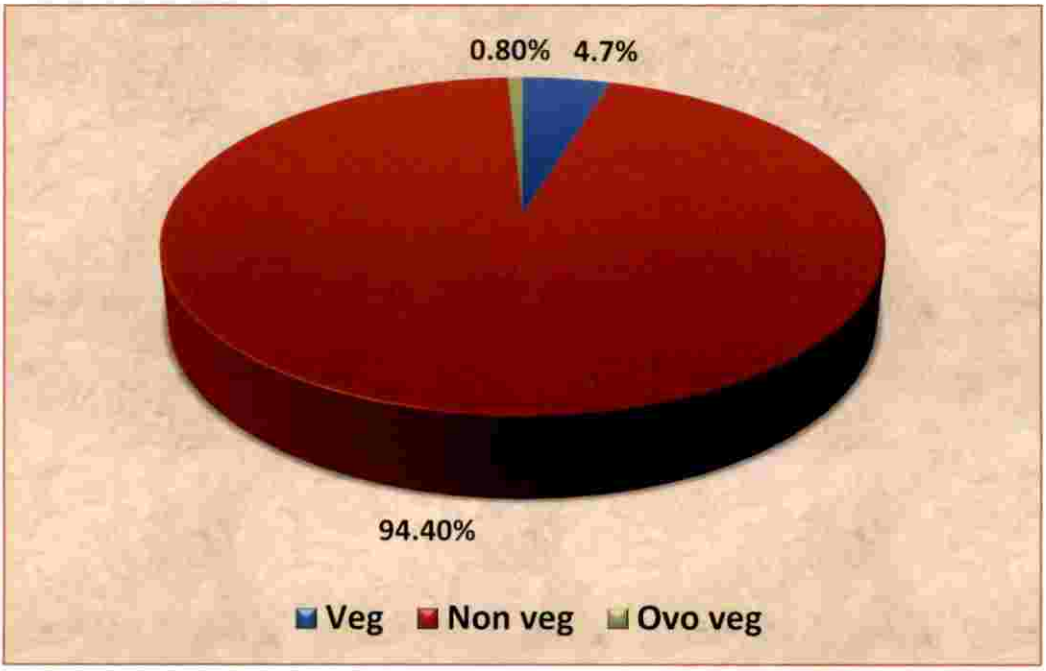
5.3. Food consumption pattern

Food is our regional identity, for it symbolises health and social wellbeing. A complex set of socio-cultural, economic, psychological and environmental factors influence the food habits, food consumption pattern, diet quality, quantity and healthy dietary practices adopted by an individual. Accurate information on the food consumption pattern is essential not only for assessing the nutritional status of middle aged working women but also for elucidating the association of food habits with the occurrence of lifestyle diseases.

The present study showed that more than ninety per cent (94.4%) of all women are habituated to non-vegetarian foods (figure 11). The study is supported by the findings of Karuna (1993), Smitha (1999), Lawrence (2003), Aneena (2003), Vijayan (2003), Reshmi (2007), Unnithan (2008), Latheef (2011), Athulya (2012), Krishnedhu (2012), Anusha (2012), Blossom (2013), Anila (2014) and Priya (2016) among the various occupation categories of Kerala.

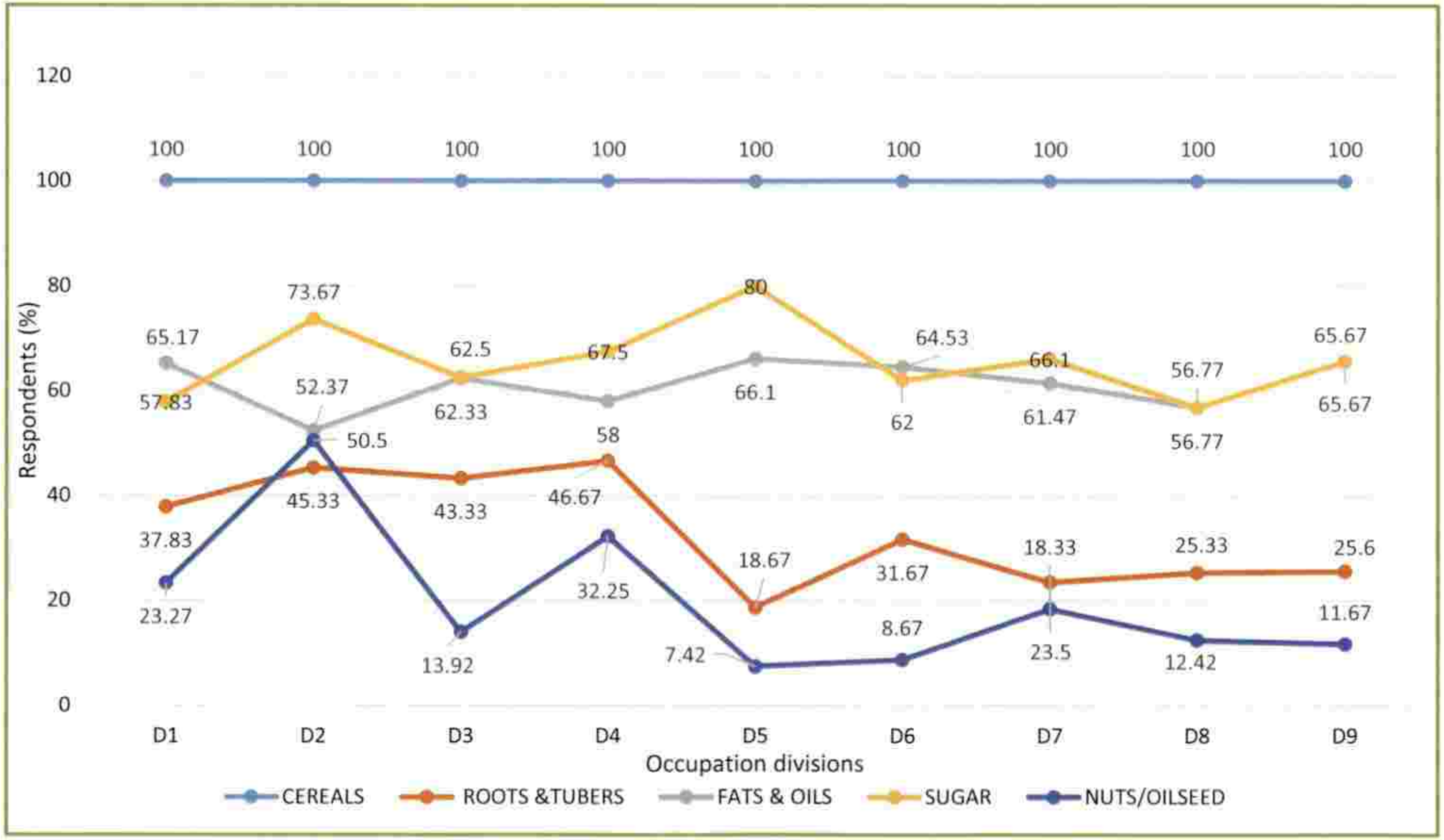
The consumption pattern of energy yielding foods indicated that cereals formed the bulk of diet in all occupation divisions (figure 12). The result is in line with the National Institute of Nutrition report (2017), indicating that the average cereal consumption of the country is 69.6 per cent. Cereal intake was adequate except for three occupation divisions *viz.* D2, D3 and D4. Various findings on food consumption in India indicated that the per capita consumption of cereals falls whereas consumption of high value foods like milk, meat, egg, fruit and nuts increased with a proportionate rise in income (Radhakrishna and Ravi, 1992; Sethi, 2001; Ray, 2005; Prasad, 2005; Deaton and Dreze, 2008; Chatterjee, 2010). According to the NSSO data from the year 1993–2005, indicated in Misra *et al.* (2011), the intake of cereals has declined in both rural and urban areas over the past two decades. The decreasing consumption of cereals indicated a shift towards more energy dense, processed and unhealthy fast foods as a source of energy in the diets.

Figure 11. Food habits of the respondents



185

Figure 12. Mean percentage intake of energy yielding foods

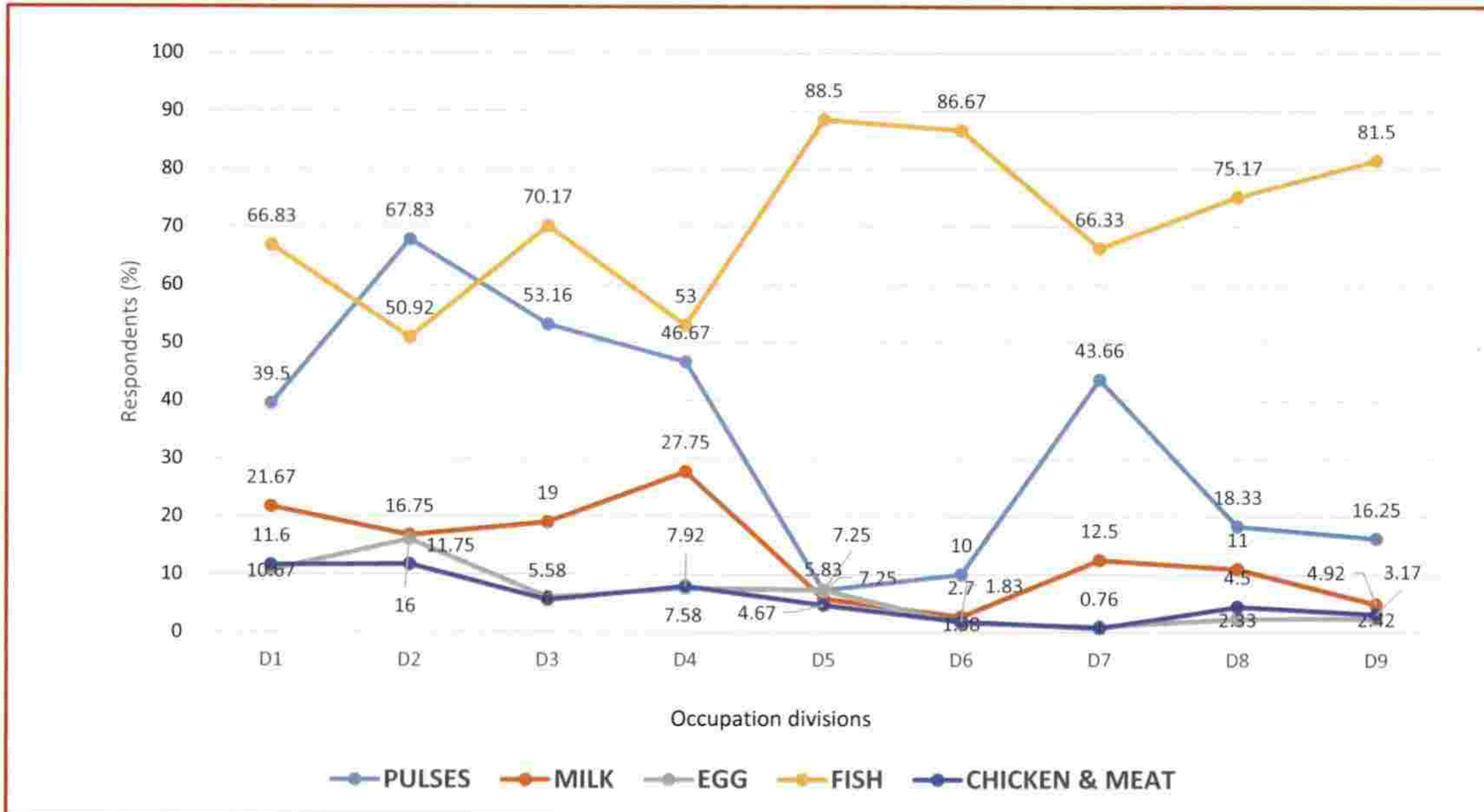


186

In general, the average consumption of fats and oils and sugar and jaggery were more than 50 per cent and that of roots and tuber consumption more than 18 per cent in all occupation strata. Deaton and Dreze (2009) analysed the food intake trends during the past 25 years among Indians and observed that fats are the only major nutrient group whose per capita consumption is unambiguously increasing. Misra *et al.* (2011) studied the nutrition transition in India for a period of 30 years (1973–2004), and observed decline in energy derived from carbohydrates and rise in energy derived from fats. Region wise analysis also revealed high intake of both invisible and visible fat in south India than compared with other regions (Gupta *et al.*, 2006). In the present study fats and oils was marginally adequate in all occupation divisions providing more than 75 per cent of RDA. National Sample Survey the Directorate of Economics and Statistics (DES) (2010), estimated that monthly per capita quantity of consumption of edible oils decreased by 12.4 per cent in rural and increased by 24.18 per cent in urban Kerala between 2004-05 and 2009-10. Rising incomes have also led to an increase in the availability and consumption of energy dense, high fat diets in developing countries (WHO/FAO, 2003). Another study among other ethnic groups pointed out a positive association between total fat intake and metabolic syndrome (Freire *et al.*, 2005). As per NSSO (2002), the consumption of sugar in 11 out of 20 Indian states was found to be higher than ICMR norms. In contradiction to this finding, the present study observed that sugar and jaggery was adequately taken only by D2, D4 and D5. Probably a preventive measure adopted against diet related chronic diseases.

Nuts and oilseed consumption was less than 25 per cent in all occupation strata except for two strata *i.e.* D2 (50.5%) and D4 (32.25%). It should be noted that these two divisions are characterized by better purchasing power owing to their better SES. The consumption of nuts particularly coconut even though a vital ingredient in Kerala cookery was reduced owing to the hike in the price of coconut among the lower income strata. Even though earlier

Figure 13. Mean percentage intake of body building foods



188

studies have established evidences regarding no specific role for coconut or coconut oil in the causation of coronary heart diseases among Keralities (Kumar,1997), a minor proportion revealed a restricted intake of coconut and coconut oil self-imposed by women as a part of their health care habits. Divakar (1999) also observed a similar finding among women cashew workers who consider coconut as a luxury item of their food basket. As per the Directorate of Economics and Statistics (DES) (2010), the per capita urban consumption of cashew nut and ground nut exceeded rural consumption whereas the per capita consumption of coconut was higher in rural Kerala. Pandey *et al.* (2013), inferred in his study among middle aged women in India that dietary calorie intake is more in rural women but proportionate intake of total fats, saturated fats and other fats is more in the urban women.

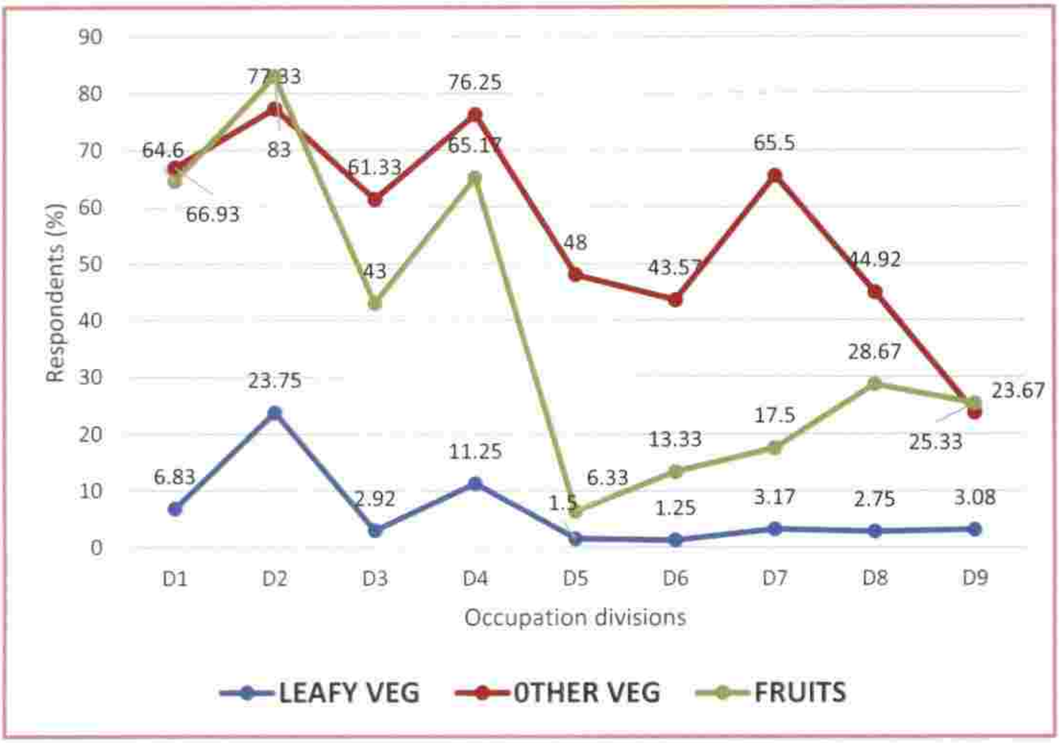
Protein intake among Indians is influenced by the vegetarian status of the majority of Indians whose protein is derived, apart from milk, from a combination of cereals and pulses. The consumption pattern of protein foods like pulses, milk, egg, meat and chicken also showed variations across the occupation divisions (figure 13). The fish consumption was comparatively better with more than 50 per cent frequency of consumption observed among all occupation divisions. As Kerala is having a costal line of 590 km, the availability of sea food is high and fish is comparatively cheaper than other animal food. High fish intake was observed by Priya (2016), Krishnedu (2012), Sheethal (2011), Unnithan (2008), Reshmi (2007), Shiny (2004), Shanmukhapriya (2005), Krishnaroopa (2003), Nirmala (2002) and Singh *et al.* (2000) due to its easy availability and preference for the same in Kerala. Another cross sectional study among Indians observed that one in five people (5.2%) in Kerala consume pesco vegetarian diet (dominated by fish) (Agrawal *et al.*, 2014).

The frequency of pulse consumption was less than 20 per cent in majority of the lower strata occupation divisions (D5, D6, D8 and D9) mainly due to a poor preference owing to its gas and acidity formation tendency after consumption. Sensory perception of food is a dominant factor influencing the food choices and dietary patterns (Eertmans *et al.*, 2001). A better pulse consumption of more than 50 per cent was observed only among D2 and D3. The frequency of pulse consumption was observed to be weekly thrice in the findings of Roopa (2003), Divakar and Nirmala (2014) and Priya (2016).

The frequency of consumption of milk and its products was unfavorable with less than 30 per cent consumption in all occupation divisions. The frequency of consumption of egg, chicken and meat was also poor among majority of middle aged women. As indicated in the dietary guidelines for Indians (NIN, 2010) though the per capita availability of various foods stuffs is comparable to RDA, the distribution of foods, both within the community and the family, may be unfavorable to some vulnerable groups (women and children) due to low income and purchasing power. According to NSS (2004-2005) the consumption pattern of meat and related products is linked to the socio economic status of the family. Only occasional use of other protein foods *viz.,* pulses, meat, egg, milk and milk products were observed in the studies conducted by Karuna (1993), Jyothi (1993), Kavitha (1999) and Chandran (2005). Similar to the present study they also recorded that the use of milk and milk products in the dietaries was confined to tea or coffee drinking habits of the respondents.

The frequency of consumption of protective foods also shows a declining trend (figure 14). Leafy vegetables, even though the cheapest and rich source of micronutrients, frequency of consumption was less than 12 per cent. Consumption pattern of other vegetables was satisfactory with more than 40 per cent consumption in majority of women. With the view of high cost, frequency of fruit consumption was satisfactory (> 40 %) only among the higher order occupation strata (D1 to D4). Arlappa *et al.* (2010) observed that the diets of rural population in India were grossly deficient in vegetables and pulses. The study also pointed out that 60 per cent, 94 per cent and 49 per cent of households in Kerala consumed pulses, leafy vegetables and other vegetables below 50 per cent of recommended dietary intake (RDI). The present study also estimated an inadequate intake of protective foods like pulses, milk, roots and tuber, leafy

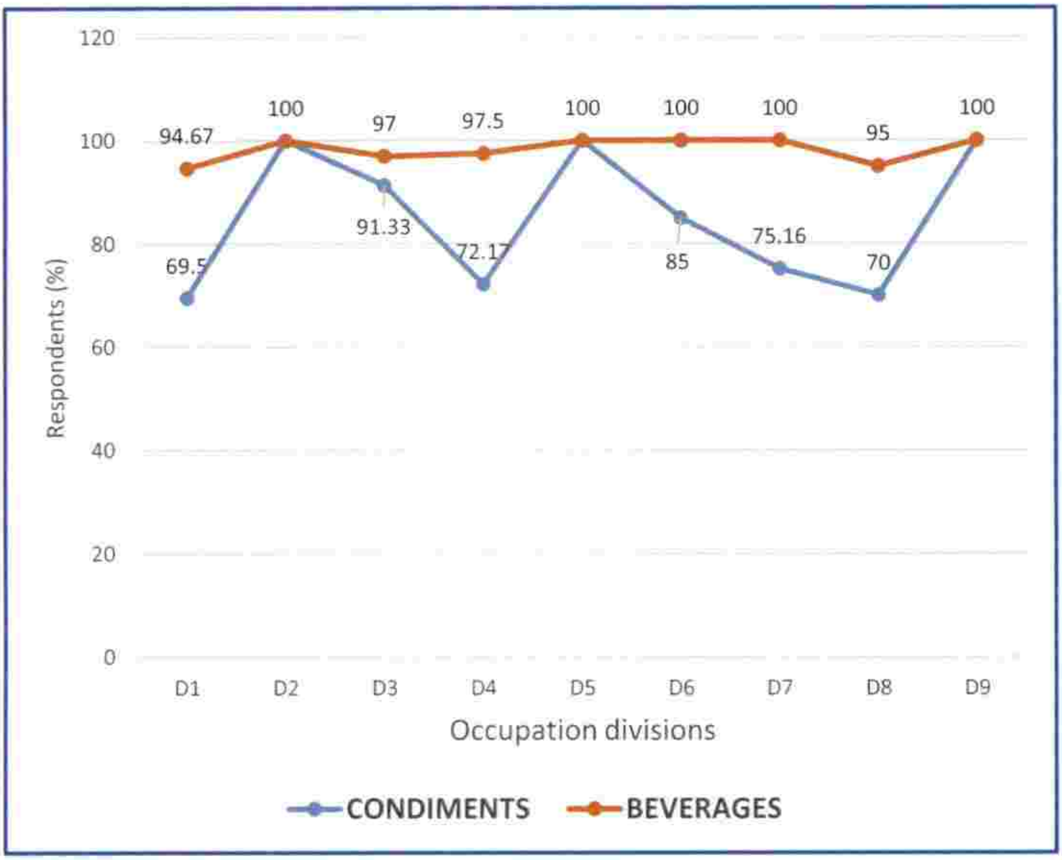
Figure 14. Mean intake of protective foods



vegetables, other vegetables and fruits providing less than 50 per cent of the RDA. According to National Sample Survey Organisation (2010), carried out in 1000 household in India, vegetable consumption was found to be adequate in both rural and urban areas whereas a low fruit intake was recorded among both rural and urban residents. The National Health and Nutrition Examination (2003-2004) showed that only 3.5 per cent of adult women met their dietary guidelines for both fruit and vegetable (Kimmons *et al.*, 2009). Non communicable disease (NCD) risk factor survey carried out in seven states of India showed a higher fruit consumption in urban areas but no significant difference in vegetable consumption across rural-urban divide (National Institute of Medical Statistics, 2009). A poor consumption of raw fruits and vegetables mainly due to lack of money was reported in the studies of Udaya (1996), Smitha (1999), Jyothi (2003), Anusha (2012) and Blossom (2013). Chandran (2005) observed in the study among middle aged women of Trivandrum district that the rare use of leafy vegetables and fruits could be related to their habitual pattern of diet consisting of rice and fish.

Eating culture has changed over the years. Change in the taste of the household members, fast food, restaurant meals, easy availability of all items, change in the level of income and lack of time among employed women tempt the people to opt for readymade and convenient foods. The present study also observed a significant proportion of working women consumed processed, preserved, instant foods like pickles, pappad, dry fish, other salted foods, fried savory snacks (like *bajji, bonda, banana fry, vada* etc.) and sweets available from institution/office canteens or cafeterias mostly at a subsidized rate as well as reheated foods. In India, there is increasing demand for processed food products since they can be prepared easily and are reasonably priced (Bullis, 1997). Moreover, the national policy aimed to increase the level of food processing from 10 (2010) to 25 per cent in 15 years and this market is growing at 14 per cent per annum (Directorate of Economics and Statistics, GOI, 2016 and Ministry of Food Processing Industries, GOI, 2017). A cross sectional study carried out in the

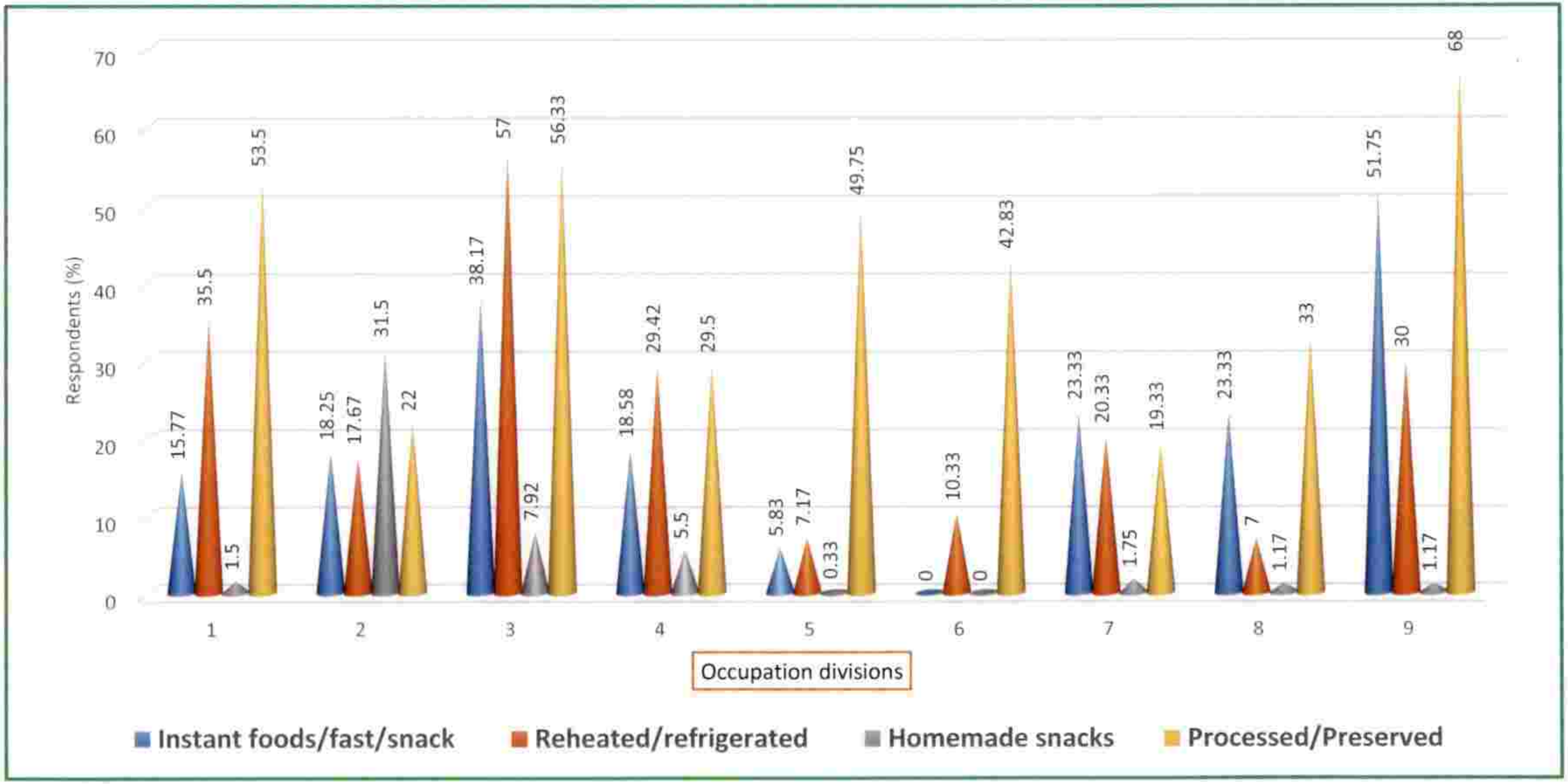
Figure 15. Mean intake of condiments and beverages



regions of Delhi, Mumbai and Trivandrum identified that the dietary patterns characterized by animal products, fried snacks, or sweets was positively associated with abdominal adiposity and pre diabetes (Daniel *et al.*, 2011). Mathew and Goyari (2011) explored the impact of labour force participation of Indian women on the consumption expenditure of their households. The analysis showed that per household monthly expenditure on time saving non durable goods including instant food and semi cooked foods and time saving services including maid, laundry, facilities for children and elderly care together was notably higher among the households where there was a working wife (figure 16)

Dietary pattern is rapidly changing in India owing to changing lifestyle, and is contributing to an ''epidemic'' of diet related lifestyle diseases. The study hence analysed the healthy dietary practices adopted and practiced by middle aged working women. It is noteworthy that in spite of better health indicators and health awareness among Kerala women, only a minor proportion of women (<20%) in the present study adopted healthy food choices which includes fruits and vegetables, dietary fiber, health foods, fermented foods at least twice per week and also adequate drinking water for preventing non communicable diseases. It is alarming to observe that majority (85%) of women used reheated oils frequently. Gulati and Misra (2017) reviewed that changing lifestyle and diet patterns can be attributed to the increasing trend of obesity, abdominal obesity, metabolic syndrome, early onset insulin resistance, and diabetes in Asian Indians. The study further identified significant dietary imbalances that included increased intake of saturated, trans fat and reheated oils, use of deep fried foods mostly rich in sugar and refined carbohydrates accompanied by a low intake of protein and fiber rich foods. Evidence showed that cereal fiber intake is inversely associated with the risk of T2DM in women (Salmeron *et al.*, 1997). Evidence support that consumption of three or more servings of high fiber cereals and millets, along with whole pulses, fruits and vegetables are less likely to develop insulin resistance and metabolic syndrome (Misra *et al.*, 2009). Goyal and Yusuf (2006) indicated that South Asians had a lower daily intake of fruits and vegetables

Figure 16. Mean intake of processed, reheated and homemade foods

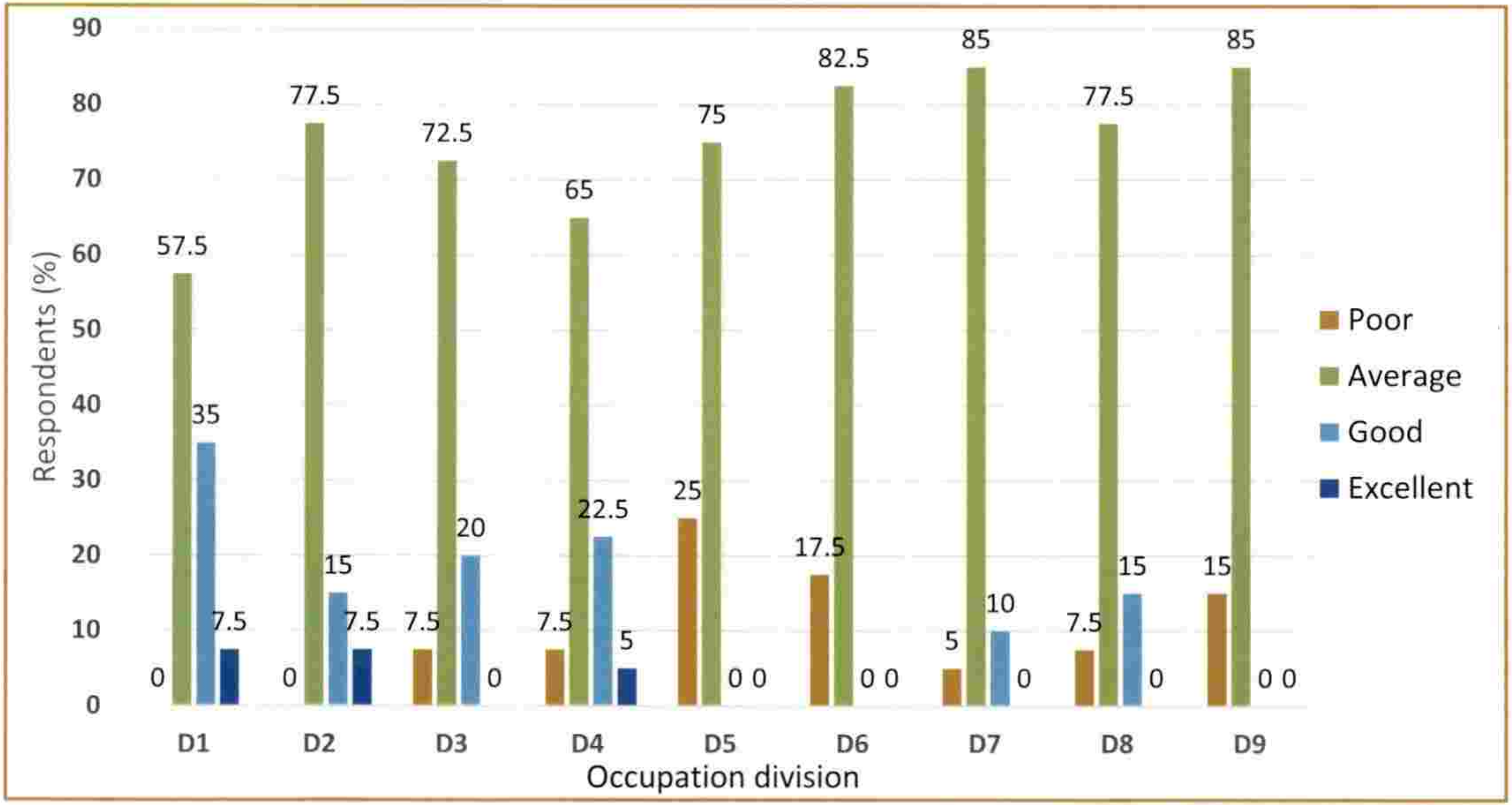


195

compared to non- South Asian countries. Radhika *et al.* (2008), observed that a higher intake of fruits and vegetables predicted 48 per cent of the protective effect against cardiovascular risk factors among South Indians. Nearly 40 per cent of women in the study included nuts at least once in a week. Sabate and Ang (2009) pointed out a long term nut consumption been associated with lower body weight and lower risk of obesity. It is important to note that majority (64%) of women in the study consumed fish at least once in a week. Studies on the fatty acid profile of plasma and platelet phospholipids in healthy Indians indicate the necessity to increase the intake of n–3 PUFAs (Poly unsaturated fatty acids) (Ghafoorunissa, 1996). Common dietary sources of n–3 PUFAs include fish, seafood, chicken, eggs, green leafy vegetables, and oils (mainly canola, soybean, peanut, and mustard), whole pulses have more n–3PUFAs than cereals (Ghafoorunissa, 1989). Metabolic studies carried out in Indians using blended oils and/or long chain n–3 PUFA from fish oils not only improved the n–3 PUFA nutritional status, but reduced platelet aggregation (Ghafoorunissa *et al.*, 2002).

The relationship between diet and health is very complex and cannot be attributed to a single dietary component. A composite measure of diet has been preferred to an index of a single nutrient or food in the area of dietary assessment. Diet quality indices are mathematical algorithms used for nutritional epidemiology, aimed at quantifying the extent to which real food and nutrient intake complies with the reference intake values recommended in national dietary guidelines which are established based on scientific facts assuring an optimal state of health while preventing occurrence of chronic diseases. Similarly, indices allow analysing dietary pattern of target population and its consumption trends (Gil *et al.*, 2015). A high quality diet may be defined as one which is hygienic, nutritious, balanced and adapted to individual requirements in order to prevent disease and ensure a good state of health as well as optimal development and growth (Pelletier *et al.*, 2017). In the present study, overall an average diet quality was observed among three fourth (75.3%) of middle aged working women. Thirty five per cent and 7.5% women belonging to upper order occupation strata

Figure 17. Distribution of respondents based on diet quality index



197

(D1 and D2) had good and excellent diet quality index respectively (figure 17). Pimenta *et al.* (2015) assessed the association between adherence to several dietary indices and risk of metabolic syndrome. The study revealed that moderate adherence to the pro vegetarian diet was significantly associated with a lower risk for developing metabolic syndrome among women. Studies have identified significant associations between dietary guideline index (DGI) score and age, higher income, better socio economic status and inversely associated with the waist to hip ratio among women (McNaughton *et al.*, 2005). The present study also estimated significant association between diet quality index and occupational divisions. The results are supported by previous studies (Tur *et al.,* 2004, Chiplonkar and Tupe, 2010). The total DQI score was significantly correlated with food and nutrient intakes as observed by Stookey *et al.* (2000). Studies have also identified dietary diversity score to be related to several chronic disease risk factors (Kant *et al.,* 1993). Reedy *et al.* (2014) examined the relationships between 4 commonly used dietary indices and the result indicated that a higher diet quality index score is associated with decreased risk of cardiovascular disease and cancer mortality among older adults.

5.4. Prevalence of lifestyle diseases among middle aged working women

Women are predisposed to various diseases based on their way of living and occupational habits. Along with the psycho physiological alterations, many chronic lifestyle diseases like cardiovascular diseases, diabetes, osteoporosis, obesity, etc increase when women reach their middle age. According to World Health Organization's report (2014) on global status of non-communicable diseases an estimated 38 million deaths occur every year globally due to non-communicable diseases (NCDs) commonly known as lifestyle disease, such as cancer, cardiovascular disease, chronic respiratory diseases, and diabetes. Among these deaths nearly three quarters are estimated to occur in low and middle income countries such as India. Kerala has also witnessed a rapid nutritional transition in recent years (Shetty, 2002) with studies showing that it has one of the highest rates of some major lifestyle disease risk factors in India (Thankappan *et al.*, 2010 and Sathish *et al.*, 2012). Identification of risk factors through screening is an important tool in the fight against chronic diseases.

Musculoskeletal disorders are the major cause of disability and long term pain worldwide (Smith *et al.*, 2014 and Miranda *et al.*, 2012). It adversely affects the health related quality of life of people (Murray *et al.*, 2013; Palazzo *et al.*, 2014; Woolf, 2015 and Mathew *et al.*, 2011). The most common bodily complaints found in this study were related to musculo skeletal problems affecting 60 to 85 per cent of middle aged working women. Work related musculoskeletal disorders have been identified as the prominent challenge in occupational health (Macdonald, 2012). Work related fatigue and repetitive strain injuries are more in women compared to men (WHO, 2006). Observational studies have indicated that the prevalence of osteoarthritis not only increases with age, but also is higher in women especially after menopause (Tsai and Liu, 1992; Verbrugge, 1995 and Li *et al.*, 2002). Krishnan (2016) estimated the prevalence of musculoskeletal pain among middle aged women from Thiruvanathapuram district to be 63.3 per cent. Another community based study in South India observed that knee was the commonest self-reported musculoskeletal pain site followed by elbow and low back and this adversely affect the ability to perform the individual tasks of climbing stairs, squatting, sitting cross legged, standing up from a chair and reaching for objects. These observations are in line with the findings of this study. The main health problems among women employed in various informal sectors were demonstrated as back injuries from carrying heavy loads, respiratory disease from inhaling dust, musculoskeletal disorders, skin problems and allergies, urinary tract infection, eye disease, headache, sore throat and cervical pain (Keerthiga, 2017; Bharara *et al.*, 2012; Tiwary 2011; Jayakrishnan *et al.,* 2013; Nelson *et al.* 2016; and Banu and Kumar, 2018). Karmakar *et al.* (2017) who conducted a study on quality of life among menopausal women in West Bengal reported consistent findings that 84 per cent of women experienced musculoskeletal pain (84%), pain in the neck and headache (76%), low back pain (69%) and frequency in urination (63%). Apart from this varying proportion of middle aged women in the study also reported gastrointestinal problems, diabetes mellitus, hypertension, hyperlipidemia, heart diseases and thyroid problems. Similar findings were reported by Shunmukhapriya (2005), Valdez *et al.*, (2010), Divakar (1999) and Priya (2016).

Kerala seems to have entered into the fourth stage of the epidemiological transition and studies have pointed out that life style related diseases are on the rise in Kerala (Navaneetham *et al.*, 2009). The present study assessed the prevalence of three prominent lifestyle diseases namely diabetes mellitus, hypertension and hypercholesterolemia. These lifestyle diseases are the commonest cause of death and disability worldwide (WHO, 2014) including India (Sen *et al.*, 2015; Gupta, 2016 and Gupta *et al.*, 2012). Estimates from the present study (73.6%) and NSSO indicate high morbidity rate and a steady rise over the years (Kannan *et al.*, 1990; NSSO, 1995-96; Kunhikannan and Aravindan, 2000; Navaneetham *et al.*, 2009 and Thankappan *et al.*, 2010). Kerala reports one of the highest levels of morbidity. The morbidity rate of Kerala is twice the all India average in the rural areas and over 50 per cent higher in the urban areas (Kerala Planning Commission, 2008). Navaneetham *et al.* (2009) compared the morbidity patterns of three districts in Kerala namely Thiruvananthapuram, Kannur and Malappuram. Among the three districts, morbidity prevalence was recorded highest in Thiruvananthapuram district. It is estimated that the risk of morbidity for females is lower than males till the age of 35 years and thereafter it reverse (Navaneetham *et al.*, 2009 and Government of Kerala, Statistical abstract, 2019). The prevalence was highest among D5 (85%) and D6 (82.5%) and least among D8 (45%) and D4 (32.5%). The findings are consistent with the other community health survey conducted in Kerala (Kannan *et al.*, 1990, KSSP, 2006; Navaneetham *et al.*, 2009) indicating that agriculture laborers, casual workers and those from poor SES in Kerala have greater risk for morbidity. The analysis clearly showed that the prevalence of combination of any two lifestyle diseases was the highest (31.1%) which can further aggravate the morbidity burden of middle aged women. The prevalence of a combination of

200

hypertension and hypercholesterolemia was the highest (24%) followed by a 12 per cent prevalence of combination of hypercholesterolemia and diabetes mellitus. To add on with this 19 per cent of women reported the presence of all the three lifestyle diseases, indicating the prevalence of metabolic syndrome in the population. Cardiovascular disease is the most important cause of death in middle aged women (Registrar General of India, 2009). The reasons for high cardiovascular disease (CVD) in women is attributed to the high prevalence of multiple cardiovascular risk factors hypertension, diabetes, dyslipidemias (Connor, 1997) and metabolic syndrome (Misra and Khurana, 2009). A nationwide study conducted by Pandey *et al.* (2013) determined the prevalence of CVD risk factors in middle aged Indian women and found that the prevalence of hypertension (38.9%), hypercholesterolemia (20%), impaired fasting glucose (13.6%) as well as diabetes (9.3%) are significantly greater in urban women. With regard to individual disease condition, the prevalence of hypercholesterolemia was estimated to be the highest (20.7%) in the present study. A similar trend was observed among women population in the study conducted by Kinra *et al.* (2010) and Thankappan *et al.* (2010). Most of these diseases are potentially preventable and modifiable ones. Further, the study also found that lifestyle diseases are not associated with occupational divisions. In other words, lifestyle diseases were prevalent among women across all occupational classes. A similar finding was observed in the study conducted by Priya (2016) also.

Information on family disease history can be used as a tool to stratify risk for common chronic diseases and thereby identify individuals with increased disease susceptibility leading to improved disease prevention (Yoon *et al.*, 2003). Earlier studies showed that family history of a common chronic disease is associated with relative risks ranging from 2 to 5 times those of the general population (King *et al.*, 1992). Early cardiovascular related events such as coronary heart disease, stroke, hypertension, and diabetes occur in families with a positive family history of cardiovascular disease (Williams, 2001). The present investigation showed that majority of women across all occupation divisions had family history (at least one of the parents) of lifestyle disease. The results were in concordance with the findings of Misra and Khurana (2009) and Priya (2016). Valdez *et al.* (2010) also observed that family history is considered as a high risk factor for many lifestyle diseases such as cancer, cardiovascular disease and diabetes.

Menopause is perhaps the most significant event occurring during the mid dle age in women and represents the end of women's reproductive life. The World Health Organization (1996) defines natural menopause as the permanent cessation of menstruation resulting from the loss of ovarian follicular activity without an obvious intervening cause and is confirmed only after 12 consecutive months of amenorrhoea. In general, the natural menopause occurs between 45 and 55 years of age. The present study observed that majority of women from all occupation divisions has attained menopause (52.6%) either natural or undergone hysterectomy. The mean age of natural menopause across the occupation divisions ranged from a minimum age of 45.37 to a maximum age of 50 years (SD: 2.19 and 3.47 respectively). Pallikadavath et *al.* (2016) observed that 49.1 per cent women in the age group of 45-49 years have attained natural menopause. A cross sectional study conducted in a rural area of New Delhi among middle aged women determined the mean age of menopause as 46.24 years. Borker *et al.* (2013) observed the mean age of menopause as 48.26 years at a rural community in Kerala.

A high level of awareness, treatment and control of lifestyle diseases are crucial in reducing the morbidity related disability and mortality. Awareness of lifestyle disease was found to be high among the working women (94.4%). This has been attributed to increased level of health consciousness, better access to health service facilities and various intervention programs implemented by the government that emphasize on screening and early detection of lifestyle diseases. Various studies showed high awareness rates of more than 60 per cent in Mumbai and Kerala (Kalavathy *et al.,* 2000; Bharucha and Kuruvilla, 2003 and Zachariah *et al.,* 2003). Overall, more than half of women underwent regular treatment (55.5%) and had their disease adequately controlled (52.5%). A consistent result was observed in the study conducted in five Indian cities including Thiruvananthapuram by Singh *et al.* (2011). Thankappan *et al.* (2010) reported on the awareness, treatment and adequacy of control of hypertension and diabetes among women in Kerala indicating that regardless of the place of residence, women were more likely to be aware of the condition and more likely to be treated when compared to men with the condition. Women also showed better control rates for hypertension whereas diabetes control rates were much lower. A variation from the above result was observed among two occupation divisions *viz.* D9 and D6 where a sizable proportion of women were less likely to be treated regularly (47.5% and 40% respectively) as well as their disease control rates were much lower. Previous studies from India and other low income countries have also reported poor treatment and control status. The reasons indicated that people are loathe or unwilling to seek treatment and also discontinue the treatments (Kearney *et al.*, 2004 and Joshi *et al.*, 1996). Other determinants of poor treatment and control were associated to healthcare providers, availability of chronic care, financial status of the family and other social determinants of health (Wood *et al.*, 2009). In contradictory to the findings of the study, Gupta *et al.* (2012) observed a high prevalence and very low awareness, treatment and control of hypertension in Asian Indian women.

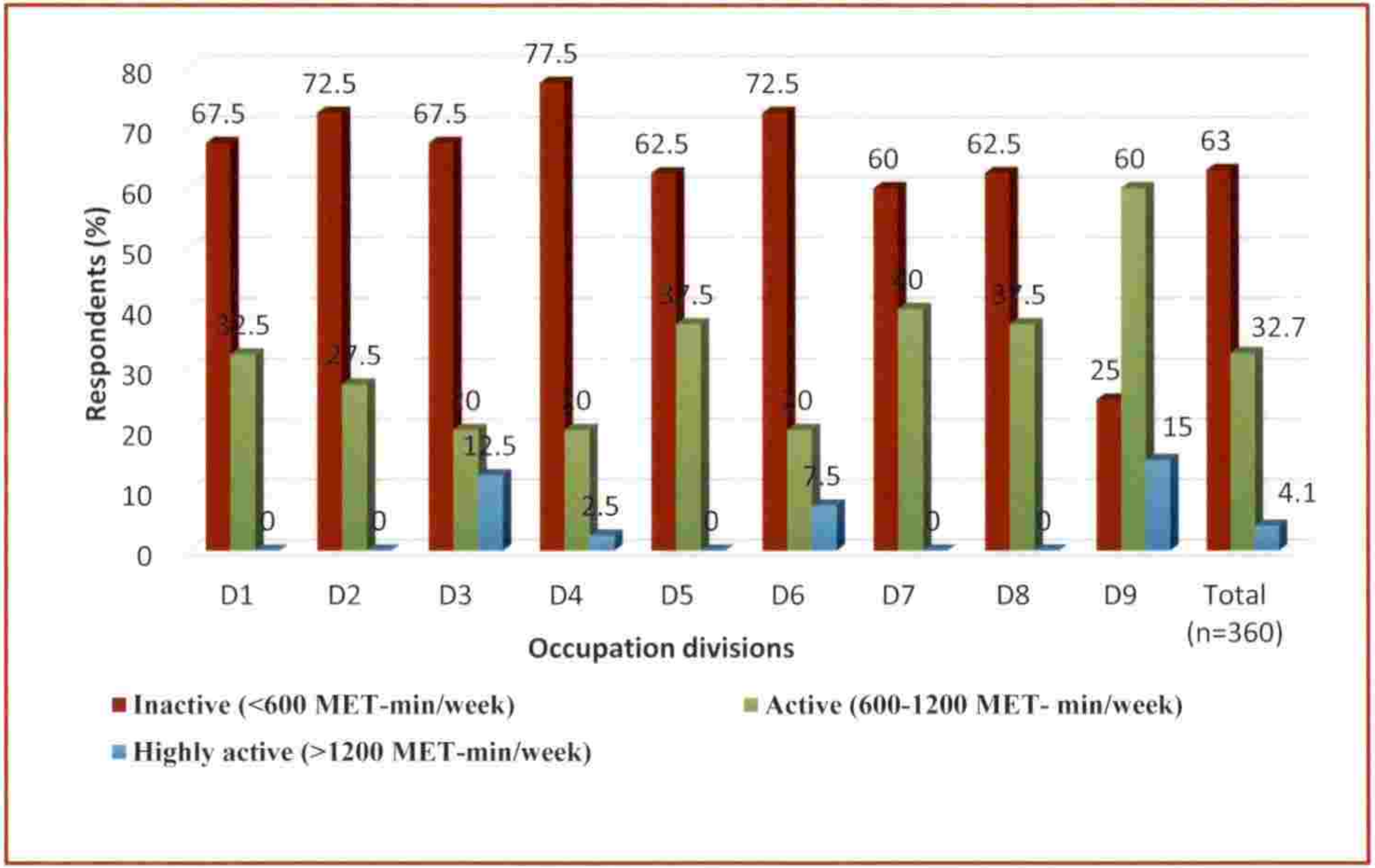
Lifestyle and activity pattern significantly influence the general well-being and health status of individual. A sizable proportion of working women (43.3%) received family help in household work indicating that the family support and involvement is essential for balancing the double burden of work - life on employed women. Asha (2014) observed a similar finding in her study that role conflict will be relatively less among working women if the responsibility of household management is shared with other members of the family. While remaining half of working women (56.7%) in this study managed the core household responsibilities alone. Working woman's total hours of work increased at the expense of her leisure time and such a time use pattern has adverse effect on the health of working women (Ramya, 2013). Working long hours and demanding household chores limit the time working women are able to allocate in leisure time activity (Popham and Mitchell, 2006).

Over the past few decades, a huge number of the working population has shifted from manual labour to physically less demanding office jobs that has to a greater extent increased 'sedentarinism' or the adoption of sedentary behavior among individuals. The present study found that a major proportion of women spent at least 4 hours in a day each for standing (67.8%) as well as for sedentary activities (65.3%). Population based studies have reported the daily sitting time ranging from 3.2 to 6.8 hours across 32 European countries (Bennie *et al.*, 2013). The results from the Indian migration study carried out in four large cities from the north, centre and south of India comprising 6,447 participants also observed a higher sedentary behavior ranging from 7 hours/day among rural, 8 hours/day among migrant and 8.4 hours/day among urban population. Further, the results revealed that women had lower levels of total activity and increasing age was associated with lower total activity and sleep but higher sedentary behaviour (Sullivan *et al.*, 2011). Studies have observed that the prevalence of diabetes, metabolic syndrome and hypertension was significantly higher among individuals with sedentary or light physical activity compared to those having heavy physical activity (Mohan *et al.*, 2003; Mohan *et al.*, 2005; Chu and Moy, 2013).There is evidence that prolonged periods of sedentary activity such as sitting and television viewing are independent risk factors for chronic lifestyle diseases (Hamilton *et al.,* 2008). The maximum proportion of women reporting at least 4 hours of standing in the study belonged to D3 (technicians and associate professionals) and at least 4 hours of sedentary habits belonged to D7 (craft and related trades). The disparity in the time utilization can be attributed mainly to their nature of occupation and work pattern. Additionally, evidence suggest that the time spent standing may be an independent health risk factor (Katzmarzyk, 2014). It was also observed in the present study that at least 6 hours in a day was spent in sleeping by majority of women (66.4%). Evidence shows that both too short and too long duration of sleep may increase health risks for various lifestyle diseases such as obesity, weight gain, type 2 diabetes, heart diseases, hypertension, stroke as well as some cancer (Cappuccio *et al.*, 2008; Knutson, 2010; Gallicchio and Kalesan, 2009). It is suggested that the optimal amount of sleep for adults is on average 7-8 hours per day, although sleep needs may vary substantially between individuals (National Heart Lung and Blood Institute, US, 2011). Pedisic (2014) recommended the Activity Balance Model (AB model) suggesting a balance between sleep duration, sedentary behaviour, standing and activity have association with positive health outcomes.

Lifestyle modification should be the first choice to prevent or delay the occurrence of chronic disease. Lifestyle disease as the name indicates can be prevented and well managed by adopting suitable lifestyle and behaviour modifications. The current study observed that more than 78 per cent of women adopted one or the other lifestyle modifications with majority (40.2%) practicing a combination of any two modifications with respect to diet, drug and exercise for combating and managing lifestyle diseases. Only close to 14 per cent adopted combinations of diet, drug and exercise for management of lifestyle diseases. Clinical trials have demonstrated the benefits of smoking cessation, healthy diet, physical activity and mild dose of medication, alone or in combination, on the substantial reduction in the recurrence of events in patients with established cardiovascular diseases and stroke (World Health Organization, 2001). Toobert *et al.* (2002) documented the enhancing effect of a comprehensive lifestyle management intervention based on dietary factors, physical activity, social support and stress management among middle aged women with type 2 diabetes who are at elevated risk for coronary heart disease. Lifestyle intervention improved lipid parameters of the metabolic syndrome (fasting triglycerides and high-density lipoprotein cholesterol), and reduced the incidence of hypertension (Hamman *et al.*, 2006). Chiasson *et al.* (2002) estimated that both lifestyles reduced the incidence of diabetes in Asian Indians with Impaired glucose tolerance (IGT)

Physical inactivity and unhealthy diets are the two leading modifiable risk factors for chronic lifestyle diseases (World Health Organisation, 2012). Physical activity is any bodily movement produced by skeletal muscles that result in calorie expenditure (Aust *et al.*, 1985). Evidence suggest that maximum health benefits occur when activity is of at least moderate intensity like (walking briskly, cycling) (Ainsworth *et al.*, 2000) and in at least 10 minutes duration. The assessment of physical activity is an essential part of understanding the patterns and multifaceted behaviour as well as in the planning of public health interventions (Biddle *et al.*, 2011). In the current study more than sixty per cent (63 %) of middle aged women were inactive with inactivity ranging from 25 per cent (D9) to 77.5 per cent (D4) in various occupation divisions. The overall active population was only 32.7 per cent and ranged from a minimum of 20 per cent (D3 and D4) to a maximum of 60 per cent (D9) in various occupation divisions. The findings in this study are comparable with other studies. In the ICMR (2016) surveillance study carried out in 8 Indian states in rural and urban populations the prevalence of low physical activity among women was found to be 79.9 per cent in Andhra Pradesh, 52 per cent in Madhya Pradesh, 87.7 per cent in Maharashtra, 82.4 per cent in Mizoram, 86.2 per cent in Kerala, 74.2 per cent in Tamilnadu and 69.7 per cent in Uttarakhand. Gupta *et al.* (2012) reported less than moderate level physical activity in 46.1 per cent women across 8 cities in country. Ravikiran *et al.* (2010) found that 61.3 per cent of Asian Indians were inactive, whereas Anjana *et al.* (2014) observed that 59.6 per cent and 71.2 per cent of women from rural and urban India respectively were inactive, which is comparable to findings of the present study. Agrawal *et al.* (2015) observed that the prevalence of physical inactivity significantly increased with increasing age among urban middle aged women with inactivity prevalence ranging from 46.6 per cent in 40-49 years women to 60.2 per cent in 50-59 years women. The findings are in accordance with the current study that as women age they

Figure 18. Distribution of respondents based on physical activity



frequently become sedentary. The findings that physical activity is significantly associated with occupational divisions here are consistent with the previous research of Sullivan *et al*. (2011) indicating higher levels of physical activity among those involved in manual occupations when compared to those involved in non-manual or professional occupations. Factors like higher levels of income, less physically demanding occupations and increased availability of mechanized transport and household appliances among higher order occupation divisions could be the reason for this disparity in physical activity across various occupation divisions. According to Hinrichs *et al.* (2014) vigorous occupational physical activity in midlife had greater risk of a unit increase in mobility limitation in old age, while those engaged in vigorous leisure time physical activity had lower risk of mobility limitation than inactive midlife population. Chu and Moy (2013) observed a low activity levels in occupational, transport and household domains were associated with significantly higher risk for metabolic syndrome among middle aged adults (figure 18).

5.5. Nutritional status of middle aged working women

Maintaining optimal nutritional status at any age is essential and can contribute to preventing chronic diseases, frequent episodes of illness, shorter and less expensive hospital stays, fewer complications, and a higher survival rate. The nutritional assessment of a community should aim at discovering facts and guiding action intended to improve nutrition and health (Jelliffe, 1966).The nutritional status of women were assessed using a combination of anthropometry, dietary and clinical examination, biochemical and biophysical assessment.

Anthropometric measurements are measure of the human body size and proportion. It helps in assessing the nutritional status, identifying individuals at risk, monitoring the efficacy of a nutrition intervention, and in providing information about the body's stores of fat and muscle (Raj and Kurpad, 2015). As per National Nutrition Monitoring Bureau (NNMB, 2012), the mean height of Indian women above 40 years of age were recorded as 151.5 cm ± 5.69 and mean weight of 49.1 kg ± 10.64. The mean height is almost similar to the findings of the study whereas the mean weight is much higher than those recorded in NNMB study. The mean height in the current study was revealed as 152.81 cm ± 6.02 and the mean weight was recorded as 62.5 kg ± 10.2. ICMR (2010) recommends the weight of Indian reference woman as 55 kg for a height of 161cm and BMI of 21.2. In the present study, mean weight of women were found to be higher than the ICMR (2010) values and the mean height is comparatively lower than the standard. A study by (Isaac, 2013) showed a mean height of 157.9 cm ± 4.7 and a mean weight of 63.8 kg ± 7.6 among women in the age group of 45-55 years in Kochi. The study also observed an increasing trend in weight with the advancement of age similar to the present study. The probable reason could be increase in fat accumulation associated with physical inactivity and menopause without any decrease in energy intake during middle age. A common fact that is observed in the aging population worldwide is height decline with age which is particularly true in the case of middle aged women. Chandran (2005) indicated that as age increased, weight also increased among middle aged women. Priya (2016) observed the trend of having a higher weight for height value among the women population of Trivandrum which is in concordance with the study findings. Bikai *et al.* (2015) confirmed a significant association of height and bone density decline with age among middle aged population.

Body mass index is a good indicator of nutritional status. The prevalence of obesity was significantly high in the study population (65.6 %) with a mean BMI score of 26.79. A decreasing trend in the prevalence of underweight and an increasing trend in the proportion of overweight or obesity was observed over the last decade in India as well as in Kerala based on the NFHS 3 and 4 reports. Forty two percent of women in Kerala were malnourished and among them 32 percent were either overweight or obese when compared to 10 percent of undernourished women (NFHS, 2018). The latest National Nutrition Monitoring Bureau (NNMB, 2017) survey indicated the overall prevalence of chronic energy deficiency decreased in urban India and 44 per cent of women were either overweight or

Figure 19. Distribution of respondents based on body mass index

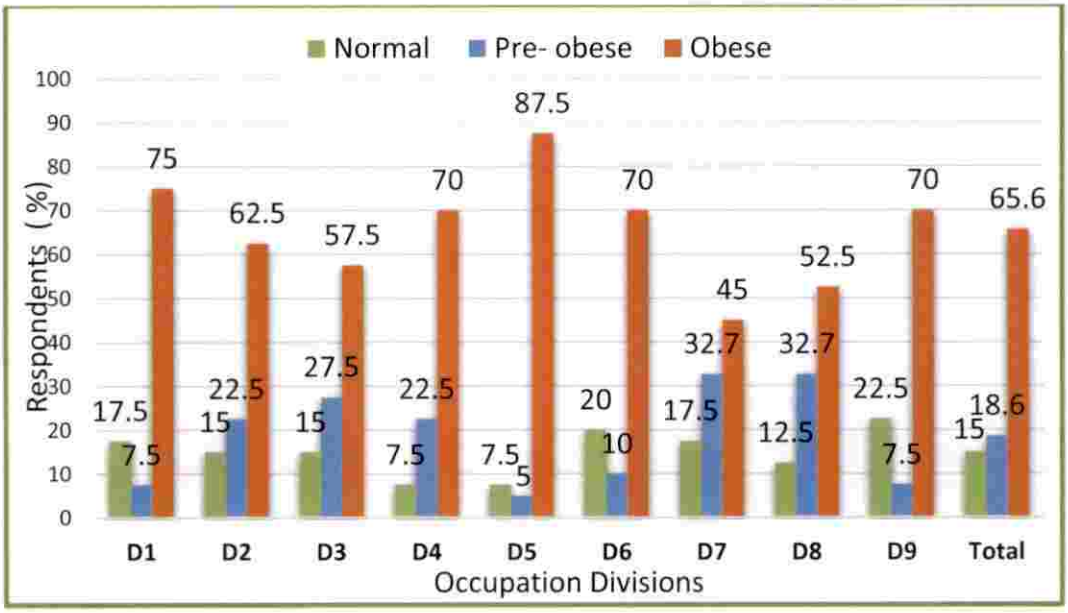
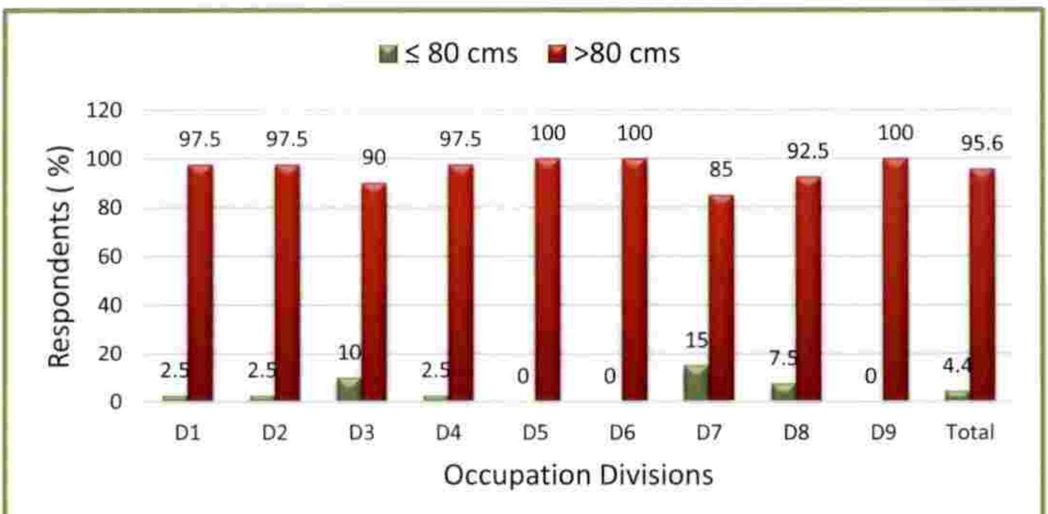


Figure 20. Distribution of respondents based on waist circumference



210

obese. According to WHO Asian cut offs (WHO, 2004a) ($BMI \geq 23$) 59 per cent urban women were overweight and obese. In Kerala, more number of urban women were overweight and obese (52.1%) than men (36.6%). Sengupta *et al.* (2015) investigated the evolution over time of overweight and obesity among Indian women and the results from the selected states, indicated that the overweight problem has started expanding from urban and well off women to the poor and rural people, while the rural urban and rich poor difference has disappeared. Ramesh and Jareena (2009) estimated that overweight (20.9%) exceeded underweight (18.9%) among women in Kerala. Isaac (2013), documented that only 55.4 per cent of women were found to have normal weight and the increasing burden of overweight and obesity is a cause of concern, with regard to higher propensity of Indians in general and people of Kerala particularly to develop lifestyle diseases. The study further shows a positive correlation between age and BMI that is BMI increases with increase in age which again supports the findings of the present study (figure 19).

Waist circumference is a good indicator of intra-abdominal fat and its accumulation has been linked to increased health risks and metabolic disorders. The cut off points in waist circumference recommended by International Diabetes Federation for South Asian group (International Diabetes Federation, 2006) as well as the World Health Organisation (WHO, 2011) is 80cm for women (figure 20).

The prevalence of abdominal obesity (95.6%), elevated waist hip ratio (WHR-81.7%) and high body fat percentage (96.9%) was significantly high among middle aged women in the study. Age is a crucial factor associated with body composition. Kaur *et al.* (2012) observed a gradual increase ($p \leq 0.05$) in anthropometric and body composition among women such as weight, waist circumference, hip circumference, body mass index, fat mass and visceral fat percentage with the advancement of age. Meanwhile, the lean body mass decreased significantly ($p \leq 0.05$) as the age progressed. Meshram *et al.* (2015)

Figure 21. Distribution of respondents based on waist-hip ratio

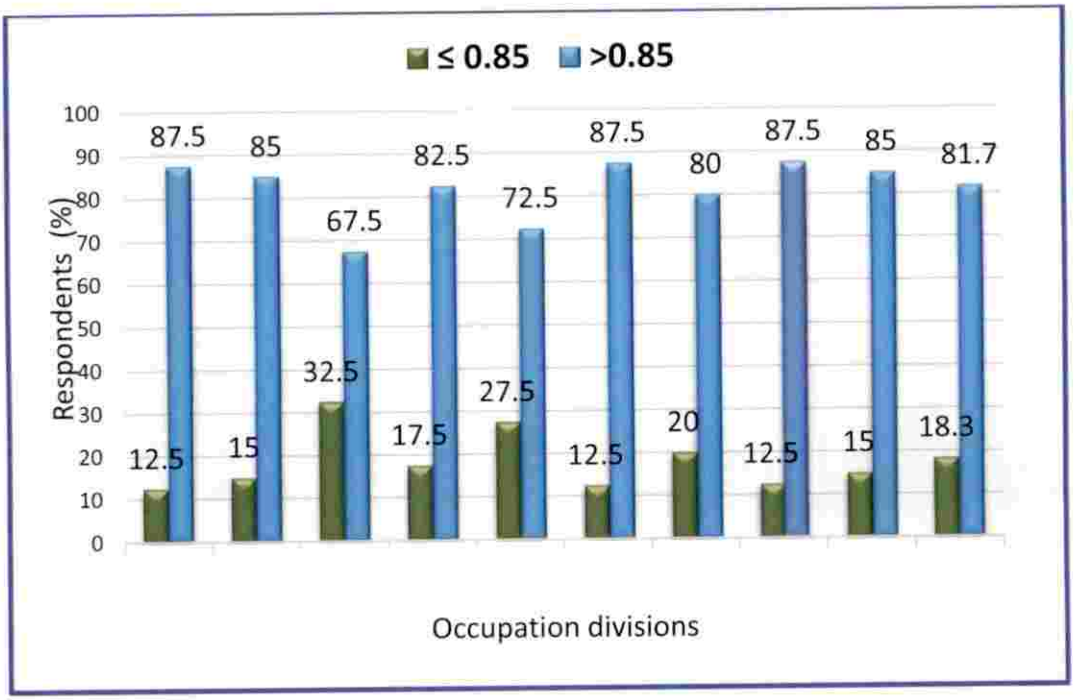
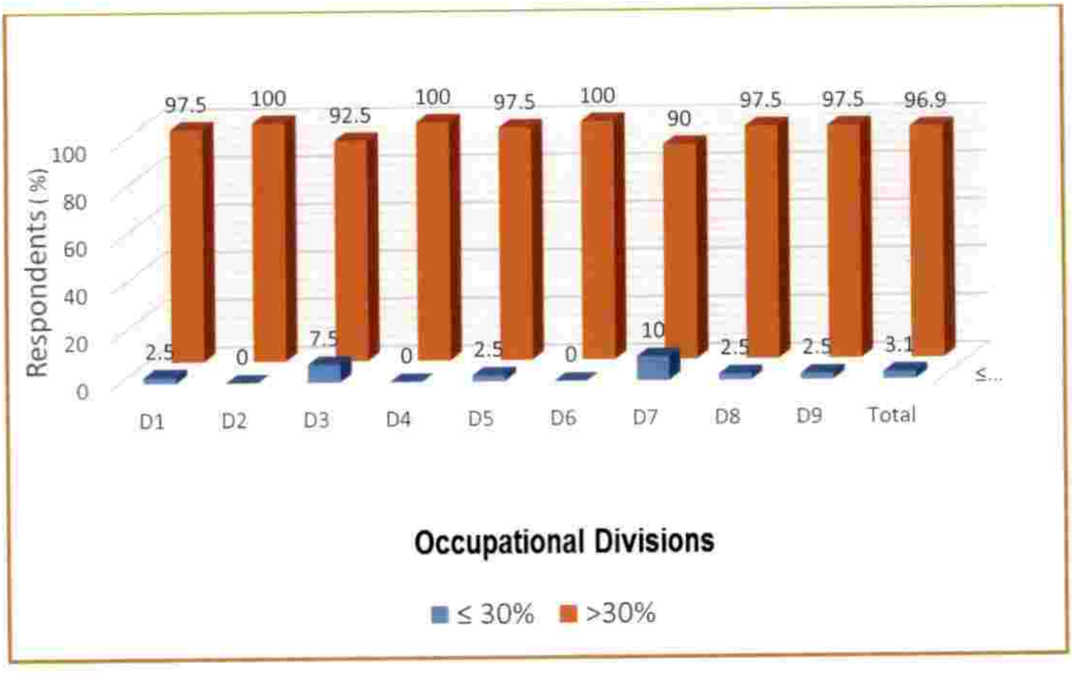


Figure 22. Distribution of respondents based on body fat percentage



212

predicted the probability of overweight/obesity and abdominal obesity was significantly ($P<0 \cdot 01$) higher among middle aged women (40–60 years), literate women, women engaged in service and business, and those having higher per capita income. The present study also observed significant occupational class difference in abdominal obesity but no significant difference was observed with respect to BMI, WHR and body fat percentage among various occupational divisions. The result indicated that obesity, elevated WHR and high body fat was prevalent among middle aged women irrespective of occupation divisions. (figure 21 and 22).

High correlation between waist circumference and BMI (Bigaard *et al.*, 2005) indicated that WC is more appropriate in predicting upper body adiposity (Isaac, 2013), the findings are in line with the observations of the present study. Misra *et al.* (2006) documented that high waist circumference was a prominent risk factor for women and is a better indicator of other risk factors defining the metabolic syndrome. The prevalence of abdominal fat accumulation among women was observed to be 91.5 per cent by Gupta *et al.* (2011).

According to Isaac (2013), 34.3 per cent women with normal BMI and 88.6 per cent of overweight women were in increased risk category based on waist circumference cut off recommended by WHO (2011). Sathish *et al.* (2017) analysed the longitudinal change in risk factors for non-communicable diseases in rural areas of Thiruvananthapuram district for a period of seven years and the findings reflected a significant increases in all the anthropometric variables including weight, BMI, waist circumference, waist to hip ratio, obesity, central/abdominal obesity along with physical inactivity, unhealthy personal habits and unhealthy food habits are the probable reason for the high prevalence of diabetes (Thankappan *et al.*, 2010) and high mortality due to cardiovascular disease in Kerala (Registrar General of India, 2009), particularly rural Kerala.

As per NNMB (2012) survey among the Indian states, Kerala recorded the highest prevalence of both abdominal (WC $\geq$80cm) and central obesity (WHR

≥0.80) among women with 53.5 per cent and 88.4 per cent prevalence respectively. According to recent National Nutrition Monitoring Bureau report on urban population (2017), 39.1 per cent and 29.8 per cent urban women with hypertension and diabetes respectively had elevated abdominal adiposity. Further, 34.1 per cent and 26 per cent urban women with hypertension and diabetes respectively had high body fat percentage. Studies have documented that Asian Indian phenotypes have high body fat with relatively less BMI, less lean body mass and marked abdominal obesity (Kasliwal *et al.*, 2004). Adiposity was more predominant among women which could be partly due to the hormonal changes associated with menopause. The findings substantiate the high prevalence of elevated anthropometric parameters in midlife women of the current study.

Clinical examination remains an important practical method for assessing the nutritional status of a community. The method involves examination for changes that can be seen or felt in superficial epithelial tissues like skin, eyes, hair, buccal mucosa or in organs near the surface of the body such as the parotids and thyroid glands (Jelliffe, 1966). The most pronounced clinical signs and symptoms affecting close to eighty per cent of middle aged women were related to skin and hair changes, excess tiredness/fatigue and pain in joints and legs. These clinical manifestations could be associated with micronutrient deficiencies of vitamin A, E, D, B complex, calcium or iron as well as typical signs of ageing. Apart from this other signs of iron deficiency anemia such as pallor conjunctive and skin was also prominent in one third of women studied. More than half of women had reduced appetite. Priya (2016), observed lack of lustre, depigmentation and easy puckability in hair, skin changes such as dry, pale and wrinkled skin, pallor tongue, observable thyroid gland enlargement and general anaemia as the prominent clinical symptoms among women belonging to various income groups. Manifestations of calcium deficiency as weakness in legs and back pain, dental caries, symptoms of vitamin C and B complex deficiency, iron deficiency in the form of koilonichia and anaemia were the major nutritional disorders found among women cashew workers (Divakar, 1999).

A major proportion of women (47%) in the present study had symptoms of oral cavity problems such as dental caries, tooth decay, bleeding gums, mottling and discolouration of teeth along with chalky teeth. These symptoms indicated the incidence of poor oral hygiene, fluoride deficiency, or vitamin C deficiency. Different studies conducted by Udaya (1996), Smitha (1999), Lawrence (2003), Jyothi (2003), Chandran (2005), Anusha (2012) and Bloosom (2013) also noticed dental caries as the most important clinical manifestation among women. Karuna (1993) and Nirmala (2002) also observed deficiency symptoms related to anaemia, dental caries and Vitamin C and B complex deficiency in their studies.

Deepa (2009) observed conjuctival xerosis, angular stomatitis, chalky teeth, dental carries, loss of luster in hair, edema on dependent part and pale tongue as the most important deficiency symptoms among the women working in coir sector with higher incidence of symptoms among those employed in unorganized sector. Godwin (2010) revealed a steady decline in moderate anaemia with the rise in standard of living index of women. In contrast to the present study, NNMB (2012) rural survey reports that although majority of the nutritional deficiency symptoms were not noticed in any of the women from Kerala, the most prevalent nutritional deficiency signs observed were related to iron deficiency, dental caries, palpable thyroid gland and Phrynoderma.

The finding of the present study identified headache was prevalent among women with hypertension (66.7%). Strong association between hypertension and headache was predominantly described in previous studies (Cirillo *et al.*, 1999; Amico *et al.*, 2013). In contradictory to the findings Fuchs *et al.* (2003) headache and hypertension were not associated with each other. The most frequently reported initial symptoms of diabetes in the current study were increased thirst, urination, hunger, weight loss and fatigue. Coffman *et al.* (2012) identified

215

headaches, extreme fatigue, intense thirst, excessive urination and hunger, vision problems and nausea as the most frequently reported symptoms of diabetes. Yellowish plaques on the eyelids (xanthelasma) and joints (xanthoma) were the most frequent symptoms of raised cholesterol noticed in the study. Sharma *et al.* (2013) found that in patients with xanthelasma or yellowish plaque on eyelids, the mean lipid profile was significantly (p value: 1%) high compared to the control group. Many studies have noticed a female predominance in the development of xanthelasma (Pedace and Winkelmann, 1965; Segal *et al.*, 1987; Watanabe *et al.*, 1981 and Sharma *et al.*, 2013). Similar to the present study Kavoussi *et al.* (2016) indicated that xanthoma are a common manifestation of lipid abnormality, found more commonly in middle aged females. Other common symptoms of middle age such as body pains and stiffness, difficulty in walking and urinary urgency observed in the study corroborates with the findings of Nag *et al.* (2016) who studied the health problems of five informal occupation sectors of India and Borker *et al.* (2013) who studied the health and menopausal problems of middle aged women of Kerala. Tripathi *et al.* (2017) indicated that age had a significant association with health problems such as back pain, joint pain, shoulder pain and pain in legs or feet with workers between the age group of 40–60 years being two times more likely to have health problems due to their occupation.

Menopause is a major transition in women's reproductive and emotional life and can lead to the onset of varied physical and psychological symptoms. The study observed that majority of women experienced severe somatic (68.5%) and vasomotor symptoms (68.5%) as well as moderate psychological symptoms (54.6%). The most prevalent menopause related symptoms reported in the study were muscles and joint pains, feeling tired, headaches, difficulty in concentrating, anxiety, irritability, difficulty in sleeping, night sweats and hot flushes. Agarwal *et al.* (2018) assessed the menopausal symptoms and coping strategies among middle age women of India and the most prevalent symptoms found were similar to the present study that include joint and muscular discomfort, physical and mental exhaustion, sleeping problems, symptoms of anxiety and irritability, hot flushes and sweating, depressive mood and urinary incontinence. Sajitha (2017) assessed the menopause related symptoms of women in Kollam District, Kerala using Green Climacteric Scale. The results indicated that overall 58.3 percent of the women were severely affected by menopause related symptoms and close to half of women experienced severe psychological, somatic and vasomotor symptoms. Bindhu *et al.* (2014) reported the prevalence of menopausal symptoms to be high among women in the rural areas of Kottayam, Kerala as well as about 88.8 per cent of post-menopausal women and 62.5 per cent pre-menopausal women had at least one menopause related symptom. In concurrent to the findings of the study muscle or joint pain, fatigue/lack of energy, easily get irritated and hot flashes were the frequently occurring symptoms among women of rural Kottayam.

Diabetes Mellitus is common in the South Indian state of Kerala with an estimated community prevalence of 16 to 20 per cent (Kutty *et al.*, 1999 and Menon *et al.*, 2006). The present study estimated more than half of middle aged women (55.6%) having impaired fasting glucose with fasting blood glucose ≥ 126mg/dl as well as 11 per cent also had raised fasting blood glucose (≥110mg/dl). Raised total cholesterol (≥190mg/dl), systolic blood pressure (≥ 140mm Hg) and diastolic blood pressure was 76.9 per cent, 53.7 per cent and 72.2 per cent respectively in the current study. Analysis of a community based cross sectional study on the prevalence of metabolic syndrome indicated that 14 per cent, 26 per cent and 23 per cent of women had impaired fasting glucose, hypertension and hypercholesterolemia respectively (Harikrishnan *et al.*, 2018). The study conducted in rural central Kerala indicated the prevalence of diabetes with fasting plasma glucose level (FBS) ≥ 126 mg/dL was 14.6 per cent and that of impaired fasting glucose (100-125 mg/dL) was 5.1 per cent. The crude prevalence of hypertension (BP≥ 140/90) and hypercholesterolemia (fasting total serum cholesterol ≥ 200 mg/dL) was 36.1 percent and 37 percent respectively (Vijayakumar *et al.*, 2009). Another community based study in rural and urban

Tamil Nadu revealed that prevalence of diabetes, hypertension and hypercholesterolemia was significantly associated with increasing age (Oommen *et al.,* 2016). As per NFHS 4 data (2018), In Kerala, four per cent and 5 per cent of women (15-49 years) estimated with elevated blood glucose levels and very high blood glucose levels respectively. Further, nine per cent of women also reported hypertension, with 6 per cent, 1 per cent and 0.5 per cent suffer from stage 1, stage 2 and with stage 3 hypertension respectively. Hypertension showed positive association with age and negatively associated with the level of schooling in women. According to NNMB survey (2017), among the Indian states, Kerala remains first in the prevalence of high total cholesterol levels (≥ 200mg/dL) among urban women (38.6%). The higher biochemical profile observed in the study with respect to fasting blood glucose, blood pressure and total cholesterol can be attributed to the increased age (middle age) as well as the micro sample selection criteria that specify on the presence of at least one of the above lifestyle diseases.

As per the recent NFHS (2018) report, prevalence of anaemia is directly proportional to the physical and mental work capacity, morbidity and infectious rates among adult women of Kerala. In the present study, one out of every twenty middle aged women (21.3%) were estimated to be anaemic. A similar result was observed by Priya (2016) among females belonging to various income groups of Thiruvananthapuram district. Blossom (2013) estimated mild anaemia among 40.82 per cent women and moderate anaemia among 12.24 per cent women. Ismail *et al.* (2016) indicated that among females increasing age more than 40 years, low socio economic class and menorrhagia to be significantly associated with anaemia prevalence. Chandran (2005) observed that 66 per cent of middle aged women were having a haemoglobin level below 12g/dL and further indicated that the insufficiency of iron rich foods quantitatively and qualitatively, vitamin C rich foods coupled with parasitic infections has superimposed into the development of anemia among middle aged women. Joseph and Ramesh (2013) documented that weekly dose of Iron Folate supplementation with Vitamin C in the workplace can prevent anaemia in women employees and probably improve worker efficiency. According to recent NFHS 4 report (2018), over one third (34%) of women in Kerala are anaemic, which includes 30 per cent with mild anaemia, 4 per cent with moderate anaemia, and 0.3 per cent with severe anaemia. Among the total prevalence 22.5 per cent women in Thiruvananthapuram district were anaemic, which is accordance with the findings of the study.

Calcium deficiency resulting from inadequate intake or poor intestinal absorption is one of the vital causes of reduced bone mass and osteoporosis (Cashman, 2002). The prevalence of calcium deficiency (<8.7 mg/dL) was observed to be 15.7 per cent in the present study. Majority of middle aged women in the study had a normal serum calcium concentration. Similar to the findings of the study Harinarayan *et al.* (2007) observed the average serum calcium concentration of the urban (9.68 mg/dL) and rural women (9.98mg/dL) of southern Andhra Pradesh within the normal range. Earlier researches have suggested that only in extreme circumstances, such as severe malnutrition or hyperparathyroidism, is the serum calcium concentration below the normal range (British Nutrition Foundation, 1986). The study conducted among the semi urban group of postmenopausal women in southern India also indicated a normal mean serum calcium concentration but a high prevalence of osteoporosis, vitamin D insufficiency and much lower mean dietary calcium intake (Paul *et al.*, 2008).

Osteoporosis characterized with reduced bone mass and the disruption of bone architecture that results in increased risks of fragility fractures (Kanis *et al.*, 1997) is a major public health problem in Indian women (Malhotra and Mithal, 2008). Khadilkar and Mandlik (2015) reviewed that low calcium intakes with extensive prevalence of vitamin D deficiency, increasing longevity, early menopause, genetic predisposition, lack of diagnostic facilities, and poor knowledge of bone health even among educated women have contributed towards the high prevalence of osteoporosis among women in India. The findings of the present study indicated a high overall prevalence of low bone mineral density (65.7 per cent) among middle aged women with 64.8 per cent having osteopenia and one women out of 108 having osteoporosis based on World Health Organizations T score classification. Prevalence of osteoporosis ranging from 8 per cent to 62 per cent in women of different age groups has been reported by various studies carried out in India (Gandhi and Shukla, 2005; Shatrugna *et al.*, 2005; Sharma *et al.*, 2006; Chhibber *et al.*, 2007; Babu *et al.*, 2009; Praveena, 2009 and Unni *et al.*, 2010). Sundaravalli (2012), observed a highly significant association on the prevalence of osteoporosis with increasing age among women and further indicated that the relative risk of developing osteoporosis was 1 to 2.4 times more as age increased from 46-60 years compared to 41-45 years in women.

Metabolic demands in working life today remain high. An individual's capacity for strenuous work is an important determinant of successful work performance. Physical work capacity assessment indicated that majority of middle aged working women in the present study had a low average (45.37%) and poor (42.6%) physical work capacity with fitness index score below 64 and 55 respectively. In accordance to the findings of the study Karlqvist *et al.* (2003) observed that the physical fitness is low for two thirds of men and for more than one half of working women. In addition, women in the group with the highest job demands had significantly lower muscle endurance and worse coordination than women in the group with the lowest job demands. Arstrand (1988) showed that the lower the work capacity, the higher the heart rate. More over signs of work related problems in the form of fatigue, aching legs, etc. are more pronounced in people with low physical work capacities. Earlier studies among middle aged and older workers support the findings that long term physically demanding work activities might have a deleterious effect on physical work capacity, possibly in combination with aging (Nygard *et al.*, 1987, 1988; Miettinen and Louhevaara, 1994). Savinainen *et al.* (2004) ascertained that the perceived physical work capacity decreased from good to moderate among middle aged working women (>45 years) over a 10 year follow up study. The study also proposed to promote workers physical capacity to enhance work ability and functional ability with increasing age.

Peak expiratory flow rate is a simple, reliable and easily reproducible and measurable lung function test (Dhillon *et al.,* 2011).The results of the study observed that more than half of middle aged women were under the alert zone of vital capacity (57.4%) indicating respiratory airways narrowing with forced vital capacity (FVC) range between 280 - 549 L/min. In Tiwari *et al.* (2016) study majority of the subjects (49.45%) were diagnosed with chronic obstructive pulmonary disease using peak flow meter. Puranik *et al.* (1995) also observed a low mean PEFR (382 ± 4.45 LPM) for non-pregnant women. Earlier studies have observed height, age, weight, muscle strength, airway resistance, body fat content and anaemia affect PEFR. (Gupta and Mathur, 1982; Primhak *et al.,* 1984).

The actual food and nutrient intake of the selected women were assessed by conducting 24 hour diet recall method in order to determine the quality and quantity of foods consumed. From the actual food intake it was seen that except for the quantity of cereals, pulses and fish, all other food groups consumed were significantly lower than the requirement. A preference for food preparations with cereal – pulse combinations like *idli, dosa, sambar* and also for fish in the region ensures the adequate intake of these food groups. The protective foods namely green leafy vegetables, other vegetables, milk, roots and tubers, nuts and fruits which supply most of the vitamins and minerals met less than 50 per cent to three fourth of their commended requirement. Fish was the only flesh food consumed over and above the adequacy. The actual nutrient intake also showed a similar trend. The intake of macronutrients namely energy, protein, and fat was significantly above adequacy whereas the intake of most of the micronutrients, antioxidants and dietary fiber which are particularly important for middle aged women namely calcium, magnesium, potassium, iron, Beta carotene, riboflavin, vitamin E, vitamin C, vitamin B^2, B^5, B^6, B^{12}, biotin, folate, vitamin D and iodine were lower than the suggested requirement.

Previous research showed the energy intake from carbohydrates particularly cereals is higher in Asian Indians as compared to other ethnic groups (Misra and Vikram, 2004; Burden and Ahuja, 1994). The consumption of total food as well as wheat, rice and millets was significantly greater among women in Trivandrum and Bombay compared to other Indian cities (Singh *et al.*, 2000). Studies done by Ranganath (1996) among coir workers and Vijayan (2003) among agricultural households observed that the intake of protein was especially high among these groups mainly due to the intake of fish, which is in accordance with the present findings. It is documented that a high intake of carbohydrate (more than 55 per cent of energy), even with a low fat intake, may lead to high serum triglyceride levels, hyperinsulinemia (Misra *et al.*, 2009) and low levels of high density lipoprotein cholesterol (HDL C) (Misra *et al.*, 2005). Although the intake of cereals were adequate, a low intake of coarse cereals and millets has important implications for the low dietary fiber observed in the present study. The deleterious effect of refined grains (predominantly white rice) in developing diet related non-communicable disease was shown in a large, population based, cross sectional study from South India (Mohan *et al.* 2009). National Sample Survey Organization (NSSO) reports from 1999– 2012, show a rising trend in the per capita calorie and fat intake, not only at national level but in every major state, both in urban and rural populations (Issac, 2013). Godwin (2010) observed the mean food intake of women in the slums of Kerala was found to be totally inadequate in almost all food items except fats and oils and fish/meat where the intake exceeded RDA.

The findings of the study pointed out towards the prevalence of hidden hunger among the respondents. Hidden hunger, also known as micronutrient deficiencies, affects more than 2 billion individuals, or one in three people, globally with highest prevalence seen in African and South Asian countries including India ((FAO/IFAD/WFP, 2014). The major cause of hidden hunger is attributed to the nutrition transition from traditional diets based on minimally processed foods to highly processed, energy dense, micronutrient poor foods and drinks, which lead to obesity and diet related chronic diseases (Anderson, 2008). Various studies indicated that these micronutrient deficiencies mainly iron, iodine, vitamin A, zinc, calcium, vitamin D, and B vitamins, such as folate can coexist with overweight/obesity when a person consumes too much dietary energy from macronutrients such as fats and carbohydrates (Guralnik *et al.,* 2004; Allen *et al*., 2006). ICMR (2011) recommends a higher intake of calcium, iron, zinc, vitamin A and antioxidants to prevent age related degenerative diseases and for healthy ageing.

An analysis study done among women in Kerala shows that lifestyle diseases such as overweight and obesity prevails mostly among the non-consumers of fruits, egg, milk or curd, pulses or beans, dark green vegetables and daily users of fish and chicken or meat (Moli and Mini, 2012). Evidence based study on food, consumerism and cardiovascular disease in Kerala concluded that the unique secular nature of this Indian state encourages participation in religious and family functions where energy dense fried foods, rich in sugar, salt and meat products, are offered free and consumed in large amounts despite widespread recognition of the relationship between diet, exercise and heart disease among the population (Wilson, 2010). Issac (2013) ranked the desire to eat followed by taste as the strongest motivating factor to consume food. In contrast to the study findings, National Institute of Nutrition (NIN, 2017) reports inadequate intake of cereals and millets, while the intake of pulses and legumes was on par with the suggested level where as the intake of green leafy vegetables, milk and milk products and sugar and jaggery were lower than the Recommended Dietary Intake.

5.6. Energy expenditure and energy balance studies

Total daily energy expenditure (TEE) reflects the average amount of energy spent in a typical day (FAO/WHO/UNU, 2004). The total energy expenditure of majority of middle aged women were in the range of 2001 to 2500 kilo calories/day. Issac (2013) observed almost similar TEE among female population ranging between 2182 Kcal to 2552 Kcal, moreover, a rising trend in energy expenditure with increase in BMI was also noticed. The maximum energy expenditure in the current study was spent for sedentary activities followed by office work and rest/sleep. Various studies observed that maximum time in a day was spend for employment outside home followed by doing household activities and for rest/sleep (Seema 2001; Kumari, 2004; Chandran, 2005 and Priya, 2016).

The results of the present study revealed a positive energy balance among major proportion of women which underlines the necessity of reducing energy intake with increasing age. The finding is reflected in the high anthropometric parameters and low physical activity pattern observed in the study. ICMR (2011) also recommends the need of a reduced amount of calories, as lean muscle mass and physical activity decrease with ageing. Panicker (1999), observed that the nutrition transition in Kerala over the last three decades was characterized by a positive energy balance driven by marketed products. Further, the per capita calorie consumption in Kerala increased from 1600 Kcals to more than2200 Kcals per day over this same period, when energy needs steadily declined because of mechanization at the work place and increasing sedentary lifestyle, which were comparable to the present study findings. Priya (2016) observed a positive energy balance among women belonging to low income and high income families and a negative energy balance among women from middle income families irrespective of their activity pattern. Issac (2013) indicated that overweight women exhibited a positive energy balance in comparison with their underweight counter parts. Poehlman (1993) observed gender differences in metabolic rates, with women having 5 to 10 per cent lower metabolic rates due to their increased fat mass. In order to promote weight loss, Raj and Kurpad (2015) recommended that, regardless of the type of diet, it is important to reduce the energy intake to achieve weight loss and once weight loss is achieved, the lower energy intake has to be sustained to prevent weight gain and for maintaining an optimum energy balance.

5.7. Correlates and determinants of nutritional status and lifestyle diseases

The study gave an insight to the various correlates and determinants of nutritional status and lifestyle diseases among middle aged working women. The analysis of socio economic variables shows that lifestyle disease is independent of standard of living index (SLI) and socio economic status, indicating that lifestyle disease is prevalent among middle aged working women regardless of their standard of living or socioeconomic status. The results were comparable to the studies conducted by Manjrekar *et al.* (2014) among working and non-working women of urban slums, Menon *et al.* (2015) among the BPL families of rural Kerala, Sengupta *et al.* (2015), Deepa *et al.* (2011) in rural, semi urban and urban India, Vijayakumar *et al.* (2009) and Navaneetham *et al.* (2009) indicated that non communicable diseases are mounting irrespective of socio economic conditions.

Educational status and food expenditure pattern were found to be significantly associated with lifestyle diseases in the current study. The prevalence rate was higher among those with lower educational status and higher food expenditure. The study done by Navaneetham *et al.* (2009) observed a similar finding in Kerala. Further, food expenditure showed significant positive association with number of family members and total monthly family expenditure and in contrast a negative association with high SLI. The results are in accordance with the findings of Divakar (1999) among women cashew workers.

The analysis also revealed low SLI as a significant determinant of stress prevalence among middle aged working women. A possible explanation is that individuals from lower socioeconomic status may experience stress as a result of their relative social standing (Cohen *et al.*, 2006) and because they are embedded in environments characterized by chronic, psycho social stressors. The present investigation also identified stress, physical inactivity and low diet quality index as significant contributory factors of lifestyle diseases. Various studies also reported a similar finding (Oommen *et al.*, 2016; Sugathan *et al.*, 2008; Sivasankaran and Thankappan, 2013 and Gupta *et al.* 2016).

With respect to nutritional anthropometry, elevated waist circumference was identified as the significant contributory factor towards the occurrence and prevalence of lifestyle diseases. The present study observed that lifestyle diseases are independent of body mass index, body fat and waist hip ratio. Oommen *et al.* (2016) observed that increasing age, BMI $\geq$25kg/m2 and central obesity were independently associated with both hypertension and diabetes. The finding also showed that waist circumference had significant positive association with BMI, body fat, waist hip ratio and stress, while a negative association with standard of living index. Further, body mass index, body fat and WHR were seen to be independent of SLI, indicating that overweight, obesity and elevated body fat was widely prevalent, regardless of the standard of living. Wyshak and Lawrence (1983) also found a similar observation. Whereas, Sugathan *et al.* (2008) showed that higher position in the social hierarchy was associated with higher BMI. The finding of the study was comparable with the findings of Issac (2010), that BMI has significant positive association with WC, body fat and WHR. Stress and body fat also showed a significant positive association. Moore *et al.* (2012) reviewed that higher stress was associated with less healthy dietary behaviors and with higher body weight among women.

The study documented the relevance of physical activity in maintaining optimum health and nutritional status. Physical activity showed a significant negative association with body mass index and body fat percentage. The findings established that physical inactivity is an important determinant of nutritional status as well as obesity among middle aged working women. Further, physical activity was negatively related with the prevalence of lifestyle diseases. Thus, physical activity and healthy diet formed the two salient cost effective measures in the prevention and control of non-communicable diseases. Moreover, the investigation observed that women from low standard of living (SLI) were more likely to be physically active than their counter parts. Also, physical inactivity was identified as an important determinant of raised fasting blood glucose indicating that diabetes can be controlled with regular physical activity.

Consistent with the study finding, Oommen *et al.* (2016), also indicated that physical inactivity was associated with hypertension, body mass index (BMI) ≥25 kg/m2, central obesity and dyslipidaemia in rural and urban Tamil Nadu.

The research findings underline the fact that diet quality is a significant determinant of abdominal obesity and lifestyle diseases. Diet quality index showed significant negative correlation with elevated waist circumference and prevalence of lifestyle diseases. Improved diet quality index was also observed among the respondents with high SLI in the study. In consistent with the study findings, Serido *et al.* (2004); Cohen *et al.* (2006); Burdette and Hill, 2008 and Sugathan *et al.* (2008) also stated that individuals in higher socio economic positions tended to have lower stress levels and healthier eating patterns. Oommen *et al.* (2016) observed the consumption of fruits and vegetables was equally poor in both rural and urban population of south India. Sivasankaran and Thankappan (2013), recommends the adoption of healthy diet and physical activity in a life course approach, especially by women for the prevention of non-communicable diseases in Kerala.

Daivadanam *et al.* (2013) and Arya *et al.* (2015) identified unhealthy diet, stress, lack of physical activity, overweight and obesity as the important risk factors for developing a spectrum of cardiovascular disorders among the Government officials. Sathish *et al.* (2012) indicated that high to normal blood pressure, central obesity and current smoking were significantly associated with incident hypertension.

Analysis of biochemical and bio physical parameters revealed that raised fasting blood glucose was positively associated with total cholesterol and body fat percentage whereas negatively associated with vital capacity. Whereas, the study done by Vijayakumar *et al.* (2009), found that raised fasting blood glucose was positively associated with both hypercholesterolemia and raised blood pressure. The significant positive association of blood hemoglobin and vital capacity indicate that women with improved hemoglobin status also had better lung capacity. Further, vital capacity tends to decrease among menopausal women. A significant positive correlation of blood hemoglobin status and the endurance capacity as the function of nutritional status was observed among adolescent rural girls (Panjikkaran and Usha, 2010).Various studies also observed that anaemia adversely affect the work capacity and work productivity (Basta *et al.,* 1979; Scholz *et al.*, 1997 and Beard, 2001). The results indicating a significant positive association between systolic and diastolic blood pressure in the study is comparable with previous research findings in India (Anchala *et al.,* 2014; Gupta *et al*., 2012 and Nethan *et al*., 2017).

The calcium status of middle aged women in the study was identified as a significant determinant of their bone mineral density and cholesterol level. Those with adequate serum calcium also had high bone mineral density. Similar observations were found in the study done by Hu *et al*. (1993) and Harinarayan *et al*. (2007). Further, physically active respondents had normal bone mineral density when compared to their counter parts indicating that physical activity can improve the bone health status of middle aged women. The study done by Mithal *et al*. (2014) and Khadilkar and Mandlik, (2015) also found a similar result. In accordance with the study, Meeta *et al*. (2013) indicated that physical exercise, especially weight bearing exercise, helps to improve and maintain muscle and bone strength and also helps to improve body balance. Aggarwal *et al.* (2011) and Agrawal and Verma, (2013) determined lack of exercise to be significantly associated with lower BMD in Indian women.

5.8. Risk factors of lifestyle diseases

As per Principal component analysis, the present study identified five significant risk factor dimensions and overall 12 individual risk factors contributing to nutritional disorders and lifestyle diseases among middle aged working women.

The application of risk factor scale determined that majority of middle aged women had moderate risk (39 per cent), also one third of the study population (30 per cent) were categorized under high risk index category for developing lifestyle disease and nutritional disorders. Occupational division wise risk factor index analysis estimated that women employed as construction workers (D9) had the highest risk index for developing lifestyle diseases and nutritional disorders whereas those employed as machine operators (D8) showed the least risk factor index for lifestyle diseases and nutritional disorders. The erotic food and lifestyle habits coupled with inconsistent prevention and treatment measures of lifestyle diseases are the probable reasons for high risk index among construction workers.

Various national/state level surveys in India include single or multiple risk factors in developing non-communicable diseases. In accordance with the study findings, Sugathan *et al.* (2008) revealed a substantially high rate of prevalence of behavioural risk factors such as stress, overweight, unhealthy dietary intake, smoking and alcohol consumption among the respondents with lower socio economic background except in the case of physical inactivity and obesity. This may be a reflection of the lack of awareness about the ill effects of these risk factors on health among the people with the low socio economicbackground. Further, their environment is conducive for stress development. Similar to the present study, Sivasankaran and Thankappan (2013), Oommen *et al.* (2016), Deepa *et al.* (2011) observed similar findings. In addition to the above mentioned risk factors, various biochemical risk factors such as raised blood pressure (Nethan *et al.*, 2017; Sathish *et al.*, 2012), raised fasting blood glucose and raised total cholesterol were also identified as significant risk factors in various other studies (Vijayakumar *et al.*, 2009 and Gupta *et al.*, 2012).

SUMMARY

230

6. SUMMARY

The present investigation entitled "**Determinants of nutritional status and lifestyle diseases among middle aged working women**" was undertaken to assess the nutritional status, work stress, standard of living and prevalence of lifestyle diseases among middle aged. The study also envisages in deriving risk factor index, correlates and prediction formulae for the determinants of nutritional disorders and lifestyle diseases of middle-aged working women.

The study was conducted among a total of 360 middle aged (45-55 years) working women of Thiruvananthapuram district. Forty middle aged working women were selected from each of the nine divisions of occupation as envisaged in the National Classification of Occupation (NCO, 2004). The nine occupational division includes (D1)-senior officials, (D2)-professionals, (D3)-technicians, (D4)-clerks, (D5)-service workers, (D6)-agriculture & fishery workers, (D7)-craft workers, (D8)-machine operators and (D9)-construction workers. The In depth investigations were conducted among 30 per cent of the respondents (n=108) identified to be the most vulnerable.

The socio-economic and personal profiles revealed that 74 percent of the respondents belonged to Hindu community and 88 percent were married. Nuclear family system was predominant in 58% of the families followed by extended family type (36%). Majority of the families (29.2%) had four members. Educational status of the respondents varied from below primary education to professional qualifications. Major proportion of respondents from occupation division D1 senior officials (45%) and D2 professionals (100%) were professionally qualified. The educational qualification of major proportion of the respondents employed as service, agriculture, fishery, craft, construction workers and machine operations ranged between primary to high school level. The occupational status revealed that more than half of the women employed in service (72.5%), agriculture (82.5%), craft (100%), machine operators (55%) and construction (100%) sector were working on daily wages. Majority of the women technicians and associate professionals (45%) were employed as temporary or contract staffs. All the women professionals were permanent staffs.

Considerable variations were observed in the family income of the respondents due to diversity in the occupational status. Average monthly income of the family varied from less than Rs 6326/- to more than Rs 1,26,360/-. More than half (52.6%) of senior officials legislators and cent per cent of professionals belonged to upper socio economic class. All the respondents employed as clerks, technicians and associate professional belonged to middle SES. More than 80% of respondents employed in service (85%), agriculture and fishery (87%), craft (100%), machine operations and construction work belonged to upper lower SES.

Better housing conditions and consumer durables were possessed by respondents belonging to upper and middle socio-economic status than women employed in service, agriculture, craft and construction sector. Major proportion of women technicians (77.5%), agriculture laborers (57.5%), craft (70%) and construction workers (62.5%) did not own a house when compared to thus counter parts. Majority of the respondents from occupation division D1 to D5 and D8 lived in pucca house. Whereas more than 80 per cent of agriculture and fishery laborers (90%), craft (80%) and construction workers (100%) lived in semi-pucca house. Majority of the households had separate room for working with electricity and improved toilet facilities.

LPG, electricity or biogas was the main fuel used for cooking by majority of the respondents belonging to D1 to D4 (100%) and D8 (60%) whereas over 75 per cent of their counter parts used wood as the main fuel for cooking. Majority of the respondents (above 60 per cent) from D2 to D4 and D8 had availability of drinking water facility in their residence. Whereas, more than half of the respondents from division D5 to D7 and D9 had to depend on common sources of drinking water facilities. Major proportion of respondents from all occupation divisions practiced improper waste/garbage disposal along with burning of plastics.

Possession details revealed that car, air conditioner, refrigerator, and computer were mainly possessed by a major proportion of senior officials, professionals, technicians and clerical staffs when compared to their counterparts. Majority of the study population possessed a bank or a post-office account. All the respondents belonging to D2, D3 and D4 had a personal credit cards. Possession of land or any parental property was revealed to be highest among senior officials and legislators (55%). Ownership of livestock was found to be high among women weavers (D7 – 42.5%).

With respected Media exposure was observed among respondents from all occupation divisions with the highest proportion noticed among women professionals (97.5%), whereas 85% of senior officials and legislators claimed to be actively involved in various social issues.

The family expenditure pattern shows that majority of the respondents from D1 (87.5%), D3 (62.5%) and D5 to D9 spent more than 75 percent of their monthly income as expenditure. A higher proportion of respondents from D1 to D6 and D8 spent nearly 25 – 50 per cent of their monthly income for recurring expenditure. Up to 25 per cent of the total income was used for non-recurring expenditure by majority of the study population. Respondents belonging to upper SES spent less than 25 per cent of total income on food, whereas, respondents belonging to middle and lower SES spent between 25 to 50 per cent of income on food. The result indicated that a major part of per capita family income was incurred as food expenditure.

Major proportion of professionals (62.5%) and clerks (50%) had the habit of savings whereas 56.7% of respondents also revealed of indebtedness. A minor proportion of women (11%) were reluctant to reveal their savings pattern.

Unhealthy personal habits such as alcohol consumption, smoking and chewing betel leaves and pan was higher among the family members of agriculture, fishery and construction workers. The proportion ranged from nearly eighteen per

233

cent to forty three per cent. Chewing betel leaves and pan was also reported by the women respondents of these occupation divisions.

The standard of living index of the family was significantly dependent on the occupational strata of the women respondents. More than 65 per cent of the women from higher order occupation division (ie, D1 and D2) belong to high standard of living. More than half to eighty three per cent of respondents from occupation strata D3 to D5 and D8 belonged to middle SLT. More than sixty per cent of women employed in agriculture, fishery, craft and related trades and construction workers belonged to low standard of living index. Overall, a medium/middle standard of living was observed in majority (43.3%) of families.

The work pattern analysis of middle aged women indicated that majority (44.2%) of women were employed in public sector or semi-govt sectors with highest representation from machine operators and craft workers (90%). A major proportion of senior officials (100 %) and professionals (65%) were employed in Govt. sector. Overall, 17 per cent women were employed in private sector with 100 per cent representation from construction workers. Women entrepreneurs constituted only eleven percent.

Nearly sixty four percent women have atleast 10 – 20 years of tenure of service with 100 per cent representation from women construction workers. Major proportion of women employed in Govt. sector (D1 – 47.5%, D2 – 82.5%) have more than 20 to 30 years of tenure of service. Majority of the agriculture and fishery laborers (27.5%) and women professionals (17.5%) had more than 30 years of tenure of service.

Half of the working women depended on public vehicles as their mode of conveyance with majority (46.6%) travelling less than a distance of 5kms to reach their work place. It was also observed that forty three per cent women had to cover a distance of 5 to 15kms daily to reach their work place.

Financial benefits was revealed as the major motivation towards work by more than half of middle aged working women (55.8%). Less than 20 per cent of women also reported personal and various social benefits as their major motivation factors towards work.

The analysis of discrimination faced by the respondents indicated more than half of women (51.1%) face discrimination terms of wage, work as well as time with the higher proportion found among service workers (65%), machine operators (62.5%) and clerical staff (62.5%).

Overall, thirty per cent of middle aged working women reported occupation health hazards with the highest proportion observed among agriculture and fishery laborers (80%) and construction and manufacturing workers (70%).

The household and work stress prevalence among middle aged working women was ranked based on mean scores. Technicians and associate professionals were ranked at the top and professionals were ranked lowest with respect to household stress index. Work stress prevalence was perceived highest by construction and manufacturing workers and least by senior officials and legislatures. Nearly one third of women did not show any symptoms related to psychological distress. Psychological distress was highest among construction (40%), agriculture and fishery workers (40%) with the presence of at least two related symptoms of distress.

The prevalence of stress was found to be significantly dependent on occupational strata. In total, more than half of middle aged women (52.5%) had moderate stress. Almost eighteen per cent indicated high stress and 26 per cent were estimated to have low stress. The study also observed that only a negligible proportion of middle aged working women have the two extremes of stress levels (ie very high and very low stress). Majority of technicians and associate professionals (40%) fall under high stress category. Two out of every three service and craft workers were estimated to have moderate stress. Women professionals were found to have the least stress prevalence (15%).

Food habits of the respondents indicated that more than ninety percent (94.4%) of all women were non-vegetarians. Food consumption pattern of middle aged women shows variations across the occupation divisions. The frequency of use of energy yielding foods viz. cereals, root and tubers, fats and oils and sugar reveals that except for roots, tubers, nuts and oil seeds the consumption of other energy yielding foods were observed to be high among the service workers (D5). Professionals (D2) were found to have the highest intake of nuts and oil seeds especially coconut.

The frequency of use of body building foods revealed that pulse consumption was found to be less than 20 per cent among the occupation division D5, D6, D8 and D9 whereas the consumption was more than 50 per cent among D2 and D3. The milk consumption was less than 30 per cent among all occupation divisions. The frequency of consumption of egg, chicken and meat was less than 11 per cent and 12 per cent respectively among majority of the study population. The frequency of consumption of fish ranged between 53 to 88.5 per cent among various occupation divisions. The frequency of consumption of protective foods also shows a declining trend with green leafy vegetable consumption less than twelve per cent in majority of the occupation division. The frequency of consumption of other vegetable was more than 40 per cent in majority of occupation divisions. The frequency of consumption of spices and condiments ranged between 70 – 100 per cent and that of beverages between 95 – 100 per cent. The frequency of consumption of instant or fast food and re-heated foods were comparatively high among women technicians and associate professionals (D3) with 38.17% and 57% respectively. The frequency of consumption of processed and preserved food were more than 45 per cent among occupation division D1, D3, D5, D6 and D9 with highest consumption observed among D9(68%).

Rice, fats and oils and beverages were the daily used foods by all women irrespective of the occupation division with frequency score of use ranging between 90 – 100 per cent. Fish was frequently used by women belonging to D5, D6, D8 and D9 whereas the remaining strata used it less frequently. Other vegetables were frequently used only by D2 and D4 while women from the remaining strata used it less frequently. Fruits were frequently used only by women professionals (D2) while their counterparts used it less frequently. Pulses were less frequently used by majority of middle aged women. Green leafy vegetables, chicken and meat, egg, nut and oil seeds, roots and tubers and milk was less frequently used food items by majority of the respondents with less than 15 per cent use.

The estimation of food adequacy of middle aged women indicated inadequate intake of protective foods like pulses, milk, roots and tubers, leafy vegetables, other vegetables and fruits that provided only less than 50 per cent of the recommended dietary allowances (RDA). Cereal intake was adequate in D1 as well as D5 to D9 meeting 100% RDA. Adequacy in the intake of fish was observed among D1 to D7. Nuts was adequately taken only by D2 and D4. Fats and oils was marginally adequate in all occupation divisions providing more than 75 per cent of RDA. Sugar and jaggery was adequately taken by D2, D4 and D5.

The analysis of various healthy dietary practices adopted by middle aged working women indicated that only less than 80 per cent of women included nutraceuticals fermented food or dietary fiber at least twice in a week in their diet. Sixty four per cent of women consumed fish at least once in a week. At least 2 liters of water/day was taken by only 14 per cent of women. Majority of women (85%) used reheated oils frequently. Nuts was used weekly once by 39.2 per cent women. None of the respondents took the daily recommended intake of fruits and vegetables of $\geq$ 400g/d.

A diet quality index (DQI) was formulated in the study aiming at the qualitative assessment of middle aged women's diet and to assess dietary risk factors of lifestyle diseases using the Indian dietary guidelines and recommendations of international dietary indices. Scores were assigned to the four dimensions included in the DQI *viz.* dietary adequacy variables (45 scores), dietary moderation variables (15 scores), healthy dietary practices (20 scores) and dietary diversity variables (20 scores) with a maximum score of 100. Based on the DQI scores, respondents were categorized to very poor, poor, average, good and excellent diet quality. In the present study overall an average diet quality was observed among three-fourth (75.3%) of middle aged working women. Thirty five per cent and 7.5% women belonging to upper order occupation strata (D1 and D2 respectively) had good and excellent diet quality index respectively. The present study also estimated significant association between diet quality index and occupational divisions.

The study organized medical camps to determine the prevalence of lifestyle diseases along with details pertaining to self- reported personal disease history and bodily complaints, family history of diseases, gynecological problems, treatments undergone and lifestyle modifications adopted by middle aged working women. The most common bodily complaints found in this study was related to musculo skeletal problems which affects 60 to 85 per cent of middle aged working women. Health problems related to neurological, gastro-intestinal, metabolic and urological complaints were reported by majority of the respondents. Prevalence of lifestyle diseases *viz.* diabetes, hypertension and hypercholesterolemia was 73 per cent and prevalence of combination of two of the lifestyle diseases was 31 per cent which can further aggravate the morbidity burden of middle aged women. The prevalence of a combination of hypertension and hypercholesterolemia was highest (24%) followed by a 12 per cent prevalence of combination of hypercholesterolemia and diabetes mellitus. To add on with this 19% of women reported the presence of all the three lifestyle diseases indicating the prevalence of metabolic syndrome in the population. With regard to individual disease condition, the prevalence of hypercholesterolemia was estimated to be highest (20.7%) in the present study. Further, the study also found that lifestyle diseases are not associated with occupational divisions. In other words, lifestyle diseases were prevalent among women across all occupational classes. Information on family disease history showed that women across all occupation divisions, 37.5 per cent to 62.5 per cent. had family history (at least one of the parents) of lifestyle diseases.

Awareness of lifestyle disease was found to be high among the working women (94.4%). Overall, more than half of women underwent regular treatment (55.5%) and had their disease adequately controlled (52.5%). Women also showed better control rates for hypertension whereas diabetes control rates were much lower. A variation from the above result was observed among two occupation divisions *viz*. D9 and D6 where a sizable proportion of women were less likely to be treated regularly (47.5% and 40% respectively) as well as their disease control rates were much lower. Minor proportion of respondents from all occupation divisions adopted alternative treatment modalities.

The details of menopausal status found that majority of the middle aged working women (52.6%) from all occupation division has attained menopause either natural or undergone hysterectomy. Gynecological problems like fibroid, endometrial thickening or irregular bleeding were the major reasons reported for undergoing hysterectomy among the respondents. The mean age of natural menopause across the occupation divisions ranged from a minimum age of 45.37 to a maximum age of 50 years (SD: 2.19 and 3.47 respectively).

The lifestyle and activity pattern reveals that more than half of the working women (56.7%) claimed that they do not receive family help in household work. Almost 68 per cent of working women spent at least 4 hours standing with major proportion observed among technicians and associate professionals (82.5%). The sedentary habits shows that close to two third of middle aged working women spent at least 4 hours/day sitting with the highest proportion observed among the weaving community (90%) followed by women employed in service work D5 (80%). Majority (66.4%) of the respondents spent 6-8 hours/day of sleep duration.

The findings pertaining to lifestyle modifications practiced by middle aged working women indicated that more than seventy eight per cent of middle aged working women claimed to observe lifestyle modifications. Majority of the respondents adopted a combination of any two modifications (35 % to 52.5 %) with respect to diet, drug and exercise for compacting and managing lifestyle diseases.

Physical activity was assessed using the Global Physical Activity Questionnaire (version 2, WHO, 2013). Metabolic equivalents (MET) scores were used to classify the physical activity of respondents into three activity groups *viz.* Inactive/low (<600 met/minutes), active (600-1200 met/minutes) and highly active (> 1200 met/minutes). The study observed more than 60 per cent of respondents from all occupation divisions to be inactive or less active attaining less than 600 MET scores/week. An exemption was noted in D9 where 60 per cent of construction workers were classified as active. The statistical analysis revealed significant dependence of physical activity on occupational divisions indicating that a major proportion of physical activity was contributed from work/ occupation related activity.

Assessment of nutritional status of 360 middle aged working women was done by recording the anthropometric profile, monitoring clinical, biochemical and bio-physical examination and by measuring actual food and nutrient intake. Anthropometric profile revealed higher prevalence of abdominal obesity (95.6 per cent), elevated body mass index (65.6 per cent), waist - hip ratio (81.7 per cent) and body fat percent (96.9 per cent) among middle aged women irrespective of the occupational class difference. Waist circumference (WC) and occupational divisions were found to be statistically dependent on each other. Overall, 65.6 per cent respondents have BMI ≥ 25 kg/m^2 and nearly 19 per cent were pre-obese. In total only 15 per cent of the population were classified as having normal BMI. Women employed in construction works were more likely to be normal than their counterparts (22.5%).

The most pronounced clinical signs and symptoms affecting close to eighty per cent of middle aged women were related to skin and hair changes, excess tiredness/fatigue and pain in joints and legs. These clinical manifestations could be associated with micronutrient deficiencies of vitamin A, E, D, B-complex, calcium or iron as well as typical signs of ageing. Apart from this other signs of iron deficiency anemia such as pallor conjunctive and skin was also prominent in one third of women studied. More than half of women had reduced appetite. A major proportion of women (47%) in the present study had symptoms of oral cavity problems such as dental caries, tooth decay, bleeding gums, mottling and discolouration of teeth along with chalky teeth. These symptoms indicated the incidence of poor oral hygiene, fluoride toxicity or vitamin-C deficiency.

Among the details pertaining to the initial symptoms of lifestyle diseases, majority of women (66.7%) were reported to have head ache and was identified as a symptom of hypertension. The most frequently reported initial symptoms of diabetes in the current study were increased thirst, urination, hunger, weight loss and fatigue. Yellowish plaques on the eyelids (xanthelasma) and joints (xanthoma) were the most frequent symptoms of raised cholesterol noticed in the study. Other common symptoms of middle age such as body pains and stiffness, difficulty in walking and urinary urgency were also observed in the study.

Menopause related symptoms were assessed using Green Climacteric Scale (GCS). The scale measures psychological, somatic and vasomotor symptoms on a four point symptom scale viz. Not at all, mild, moderate and severe. Among a total of 108 participants, 54.6 per cent of the respondents had moderate psychological symptoms, 85.2 per cent were determined to have severe somatic symptoms, and 68.5 per cent have severe vasomotor symptoms. On the whole, close to half of the study population (49.4%) were moderately affected by menopause related symptoms.

Biochemical profile indicated that more than half of the study population had raised fasting blood sugar (55.6%), total cholesterol (76.9%), systolic blood pressure (54%) and diastolic blood pressure (72.2%). Anemia was observed in 21 per cent and calcium deficiency in 15 per cent of the sample.

The details pertaining to bio-physical assessment of bone mineral density, physical work capacity and vital capacity revealed a high overall prevalence of low bone mineral density (65.7 per cent) among middle aged women with 64.8 per cent having osteopenia and one women out of 108 having osteoporosis based on World Health Organizations T-score classification. Physical work capacity assessment indicated that majority of middle aged working women in the present study had a low average (45.37%) and poor (42.6%) physical work capacity with fitness index score below 64 and 55 respectively. The vital capacity of the respondents were measured using the peak expiratory flow rate (PEFR) and found that majority of the respondents had moderate (57%) to poor (36%) lung capacity.

The actual food and nutrient intake of the selected women were assessed by conducting 24-hour diet recall method in order to determine the quality and quantity of foods consumed. The nutritive value of foods consumed were estimated from the food composition database of NIN, ICMR (2017) using the Diet Cal software. From the actual food intake it was seen that except for the quantity of cereals, pulses and fish, all other food groups consumed were significantly lower than the requirement. The protective foods namely green leafy vegetables, other vegetables, milk, roots and tubers, nuts and fruits which supply most of the vitamins and minerals were not adequately met. Fish was the only flesh food consumed over and above the adequacy. The actual nutrient intake also showed a similar trend. The intake of macronutrients namely energy, protein, and fat was significantly above adequacy whereas the intake of most of the micronutrients, anti-oxidants and dietary fiber which are particularly important for middle aged women namely calcium, magnesium, potassium, iron, Beta-carotene, riboflavin, vitamin E, vitamin C, vitamin B2, B5, B6, B12, biotin, folate, vitamin D and iodine were lower than the recommended requirements. The findings of the study point out towards the prevalence of hidden hunger among middle aged women.

The total energy expenditure of majority of middle aged women were in the range of 2001 to 2500 kilo calories/day. The maximum energy expenditure in the current study was spend for sedentary activities followed by office work and rest/sleep. The results of the present study revealed a positive energy balance among major proportion of women which underlines the necessity of reducing energy intake with increasing age.

The correlates among variables *viz* socio-economic variables, SLI, stress index, nutritional status, physical activity, diet quality index for women and prevalence of lifestyle diseases were assessed using simple bivariate analysis. The analysis of socio economic variables shows that lifestyle disease is independent of standard of living index (SLI) and socio-economic status, indicating that lifestyle disease is prevalent among middle aged working women regardless of their standard of living or socioeconomic status. Educational status and food expenditure pattern were found to be significantly associated with lifestyle diseases in the current study. The prevalence rate was higher among those with lower educational status and higher food expenditure. Further, food expenditure shows significant positive association with number of family members and total monthly family expenditure and in contrast a negative association with high SLI. The analysis revealed low SLI as a significant determinant of stress prevalence among middle aged working women. The present investigation identified stress, physical inactivity and low diet quality index as significant contributory factors of lifestyle diseases.

With respect to nutritional anthropometry, elevated waist circumference was identified as the significant contributory factor towards the occurrence and prevalence of lifestyle diseases. The present study observed that lifestyle diseases are independent of body mass index, body fat and waist-hip ratio. The finding also showed that waist circumference had significant positive association with BMI, body fat, waist-hip ratio and stress, while a negative association with standard of living index. Further, body fat, body mass index and WHR were seen to be independent of SLI, indicating that overweight, obesity and elevated body fat was widely prevalent, regardless of the standard of living. Stress and body fat also showed a significant positive association.

The study documented the relevance of physical activity in maintaining optimum health and nutritional status. Physical activity showed a significant negative association with body mass index and body fat percentage. Further, physical activity was negatively related with the prevalence of lifestyle diseases. Thus, physical activity and healthy diet forms the two salient cost effective measures in the prevention and control of Lifestyle diseases. Moreover, the investigation observed that women from low standard of living (SLI) were more physically active than their counter parts. Also, physical inactivity was identified as an important determinant of raised fasting blood glucose indicating that diabetes can be controlled with regular physical activity.

The research findings underlines the fact that diet quality is a significant determinant of abdominal obesity and lifestyle diseases. Diet quality index showed significant negative correlation with elevated waist circumference and prevalence of lifestyle diseases. Improved diet quality index was also observed among the respondents with high SLI in the study.

Raised fasting blood glucose was positively associated with total cholesterol and body fat percentage whereas negatively associated with vital capacity. The significant positive association of blood hemoglobin and vital capacity indicate that women with improved hemoglobin status also had better lung capacity. Further, vital capacity tend to decrease among menopausal women. The results indicated a significant positive association between systolic and diastolic blood pressure. The calcium status of middle aged women in the study was identified as a significant determinant of their bone mineral density and cholesterol level. Those with adequate serum calcium also had high bone mineral density. Further, physically active respondents had normal bone mineral density when compared to their counter parts indicating that physical activity can improve the bone health status of middle aged women.

Multinomial logistic regression analysis was done to derive the predictors for the determinants of nutritional disorders and lifestyle diseases. The 3 stages of occurrence and progression of lifestyle diseases have been identified in the study along with the corresponding significant predictors. The first stage is characterized by the absence of disease condition to the initiation of any one of the lifestyle diseases under investigation (from 0 – 1 lifestyle disease. The second stage is characterized by further contracting an added lifestyle disease (from 1 – 2 lifestyle disease). The third and the final stage represents the occurrence progression towards all the three lifestyle diseases (from 2 – 3 lifestyle disease). As revealed by the analysis, elevated WC, WHR, lack of PA and low DQI are the significant determinants contributing to the occurrence of one of the lifestyle diseases. The odds percentages were 48%, 99%, 50% and 71% respectively. The elevated BMI, WC and WHR had significantly higher probability for further encountering another lifestyle disease as per the odds percentage were 52%, 47.8% and 61.5% respectively. The significant predictors leading to the final stage of developing a high susceptibility towards all the three lifestyle diseases as per the odds percentage were elevated WC (48%), body fat per cent (53%), WHR (99%) and high SLI (49%).

Principal Component Analysis was carried out for generating a minimum data set of risk factors contributing to nutritional disorders and lifestyle diseases. The five significant risk factor dimensions identified in the present study were nutritional anthropometry (3 items), raised blood pressure (2 items), physical inactivity factors (2 items), adiposity factors (3items) and psychological and diet quality factors (2 items) with total of 12 risk factor items/variables. The application of the developed risk factor scale among the study population (n=360) revealed that majority of the respondents (39%) had moderate risk, 31 per cent had low risk and 30 per cent had high risk for developing lifestyle diseases and nutritional disorders. Construction workers showed highest risk factor index and machine operators showed least risk factor index for lifestyle diseases in the present study.

The study gave an insight to the nutrition transition that middle aged working women are undergoing. Alarmingly high prevalence of overweight and obesity coupled with a high burden of life style diseases was observed in the study. Intervention strategies for early detection and modification of risk factors identified in the study *viz.* unhealthy diet, sedentary life style, household as well as work life stress, poor fruit and vegetable consumption, lack of regular physical activity, abdominal or central obesity and high body fat should be advocated both at community and household level. Adoption of cost-effective measures for the prevention and control of life style diseases such as dietary modification, regular physical activity and life style changes should be encouraged throughout women's lives to promote healthy midlife and ageing.

The tools and indices developed in the study will be useful for various epidemiological studies and can be applied to the general population. These tools will provide an updated measure to evaluate the socio-economic, health and nutritional status of middle aged women. The study strongly recommend to consider middle aged women as vulnerable population and requires policy attention and age specific nutritional intervention programmes.

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257

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APPENDICES

APPENDIX I A

INTERVIEW SCHEDULE TO COLLECT DETAILS OF SOCIO- ECONOMIC PROFILE OF MIDDLE AGED WORKING WOMEN

1. General information

Name and address of the respondent:
Contact No.:
Age (years):
Gender :
Religion : Hindu / Christian / Muslim
Marital status: Married/Widow/Separated
Area of residence:
Educational Qualification:
Type of family : Nuclear / Joint / Extended
Details of the family members :

Sl. No	Name	Sex	Age	Education	Occupation	Income

Indicate the type of house : Own/Rented/Govt. Quarters

Occupation / Designation :

Do you have any debts: yes/ no

Possession of agricultural or non- agricultural land/ parental property:

Do you have possess any livestock: yes/ no

Have you availed any loan? : yes / no.

Do you have any savings: yes/ no

Salary / Wages

Total monthly income of the family: Rs. -------------------

II. Monthly expenditure pattern of the family

Sl.No	Item	Amount (Rs.)
1.	Food	
2.	Health	
3.	Education	
4.	Rent	
5.	Housing maintenance	
6.	Water	
7.	Fuel	
8.	Electricity	
9.	Repaying loan	
10.	Transport	
11.	Clothing	
12.	Recreation	
13.	Jewellery	
14.	Others (Stationary ,cosmetics, homecare products, decorative items, gifts etc.)	
15	House maid/ other service providers	

III. Indicate the following

No of rooms : 1/2/3/4/more

No of separate bed rooms : 1/2/>2/Nil

Wall : thatched /mud/ brick/others

Floor : mud/ cement/tiled/marble/granite

Roof: thatched/tiled/terraced

Separate kitchen : yes/no

Source of drinking water : own well / public tap/ public well/ neighbours /others

Lavatory facilities : yes/ no If yes, Own/ Public/ open area/pit

Drainage facilities : yes/ no

Electricity facilities : yes/ no

Do you have problems of waste accumulation in your surroundings? please indicate the following:

Properly disposed at home/ disposed at open spaces/taken by garbage collectors/ burns plastic

Does your surroundings have the problem of water logging : Yes/No

Fuel used for cooking : Gas stove/ Kerosene/ Electric heater/ Wood/Biogas/others

Ownership of following equipment/implements

(Please put a tick (√) mark)

Pressure cooker	
TV	
A/c	
Bank/post office account	
Induction stove	
Washing machine	
Fridge	
Cooler	
Vacuum cleaner	
Modular kitchen	
A mobile phone	
Any other telephone	
A computer/ laptop	
Credit card	
A two wheeler	
A four wheeler (1/ >1)	
Solar water heater	
Water purifier	
Water harvesting plant	
Labour saving devices	

Do you or any of the family members have the following habits?

Sl No.	Habits	Yes/ No	Whom	Frequency of use	
				Daily	Occasionally
	Smoking Use of alcohol Use of narcotics/drug Use of tobacco Use of betel leaves/pan others ,specify				

Does anybody in your family have any health problems related to unhealthy habits : Yes/No. If yes, give the details

Do you involve actively in social activities:

a. Participate in Residents Associations

b. Participate/member/office bearer in Political Organizations

c. Participate/member/office bearer in Voluntary Organizations (NGOs)

d. Participate in Religious Organizations

e. Other social groups (Kudumbasthree, Ayalkootam)

f. No participation

g. any other

Type of activity engaged : Sedentary / Moderate/ Heavy

Do you receive family help in household activities: Yes/ No

Do you have regular habits of: reading newspaper/watching television/listening to radio/any others?

Duration of sleep at night: (specify): Less than 6 hrs / 6-7 hrs / 8 hrs / > 8 hrs

APPENDIX I B

INTERVIEW SCHEDULE TO COLLECT DETAILS OF WORK PROFILE OF MIDDLE AGED WORKING WOMEN

I. Basic Information

Name of respondent:

Place of work:

Type of work: Permanent/Temporary or contract / Daily wages

Employed in which sector : Private/Public/Own enterprises/Govt

No. of years of service in the present field :

Distance from home to work place :

Mode of conveyance :

Details of duty timings :

What are your motivations and interest in work?

Do you face any discrimination at work place?

Do you suffer from any occupational health hazards?

II. Work life stress, Household stress and Psychological distress scale with corresponding score (SI)

Sl. No	Items of Work stress	Totally disagree (0)	Disagree (1)	Can't say (2)	Agree (3)	Totally agree (4)
1	I am worried about job security					
2	Work life gives mental and physical fatigue					
3	I have no time for relaxation and leisure					
4	The demands of work life interferes with my family life (Eg: time spent with children, attending family functions)					
5	My health problems interferes with work efficiency and family life					
6	I feel upset to take up responsibilities					

Sl. No	Items of Household stress	Totally disagree (0)	Disagree (1)	Can't say (2)	Agree (3)	Totally agree (4)
1	I do not receive families help in household activities					
2	I am not satisfied with my family relationship (husband, children, in-laws, others)					
3	I am always worried about family issues (Eg: financial problems, children's future, ill health of family members)					
4	I feel negligence/ lack of understanding from family members					
5	The demands of family interferes with work life (reaching duty on time, overtime duties)					
6	Household stress interferes with my efficiency to perform job/work related duties					

General Health Questionnaire

Sl.No	Items of Psychological distress	Less than usual (0)	No more than usual (0)	More than usual (1)	Much more than usual (1)
1.	Felt under constant strain				
2.	Feeling unhappy and depressed				
3.	Lost sleep over worry				
4.	Could not overcome difficulties				
5.	Not enjoying day-to-day activities				
6.	Lost confidence in self				
7.	Not playing a useful role				
8.	Could not concentrate				
9.	Not feeling happy				
10.	Felt worthless				
11.	Could not make decisions				
12.	Could not face problems				

APPENDIX IC

INTERVIEW SCHEDULE TO ELICIT INFORMATION ON DIETARY HABITS AND FOOD CONSUMPTION PATTERN

1. Name of the respondent :
2. Age :
3. Vegetarian / Lacto- vegetarian / Ovo- Vegetarian / Non- vegetarian
4. Total monthly expenditure on food: Rs.
5. Food expenditure pattern

Food item	Daily	Weekly	Monthly	Quantity purchased	Expenditure (Rs.)
Cereals					
Pulses					
Vegetables					
Green leafy vegetables					
Fruits					
Meat					
Fish					
Egg					
Milk & milk products					
Roots & tubers					
Fats & edible oil					
Sugar/Jaggery/ Honey					
Miscellaneous/ Processed					

6. Frequency of use of different food commodities

Sl. No	Food items	D	2/w	3/w	1/w	Fort nightly	M	Occasionally	Never
I	Cereals								
II	Pulses								
III	Vegetables								
IV	Meat								
V	Fish								
VI	Egg								
VII	Fruits								
VIII	Milk &milk products								
IX	Coffee/ Tea								
X	Juice / soft drinks								
XI	Homemade snacks								
XII	Fast foods/ Preserved foods								
XIII	Processed foods : Instant mixes Ready to eat foods Ready to cook foods Any other, specify								
XIV	Condiments and spices								
XV	Beverages								

7. No. of meals taken per day?

Two times / three times / four times / above

8. Do you plan your meals in advance?

Yes / No

If No, Give reasons:

Reasons	
Lack of time Planning done by other members Unaware	

9. Indicate the source of water used for cooking / drinking

10. Actual intake of the respondent (24 hour recall method)

Meal pattern	Menu	Raw quantity of each ingredient (g/ml)	Individual intake
Breakfast			
Mid-morning			
Lunch			
Tea time			
Dinner			
Bedtime			

11. Do you and your family maintain a regular time for taking meals?

Yes / No

12. Do you have the habit of skipping meals?

Yes / No

15. Do you take meals outside home regularly?

Yes / No

a. If yes, please indicate: Breakfast / Lunch / Tea / Dinner

16. Indicate the amount of water taken / day:

17. Do you include raw vegetables and fruits in your daily diet? Yes / No

   a) If No, give reasons:

   b) If Yes, specify the quantity consumed (>400g/d or <400g/d):

18. Do you refrigerate cooked food items? Yes / No

   If yes, how often

Food Items	No. of days stored	Reheat foods	
		Yes	No

19. Do you use reheated oils? If yes, how often:

20. Do you use any of the following?

   Food supplements

   Neutraceuticals

   Fermented foods

   Dietary fiber.

   If yes, indicate the frequency of use.

APPENDIX II

INTERVIEW SCHEDULE TO ELICIT INFORMATION ON HEALTH, MORBIDITY AND LIFESTYLE DISEASE PREVALENCE

1. Name of the respondent :
2. Age:
3. Personal disease history of the respondents (last 3 months):

Sl No.	Common Diseases/ Illnesses	Frequency		
		Regular	Occasional	Never
	Joint pain Back pain Muscle pain Cold Fever Head ache Anaemia Jaundice Acidity Allergy Thyroid problems Gastrointestinal problems Urological problems Constipation Asthma Any other			

4. Have you undergone any clinical tests regarding lifestyle diseases?

Yes / No If yes, specify

Regular (Once in 3-6 months) / Irregular (Occasional)

5. Are you aware of lifestyle disease:

6. Menopausal status: Pre/Peri/ Post menopause

7. Lifestyle diseases /Non communicable disease history:

Lifestyle diseases	Yes	No	Details of treatment (Allopathic/Ayurveda /Homeopathy/Any other)	Details of modification (If any) (Diet/Drug/Exercise/Any other)
Diabetes				
Cardiac problem				
Hypertension				
Hyper lipidemia				
Arthritis				
Cancer				
Obesity				
Osteoporosis				
Any other				

8. Do you have a family history for any of the above listed lifestyle diseases?
Yes / No. If yes, specify the detail:

9. Indicate whether you have any gynecological problems:

10. Is your disease under control?

11. How long do you spend time in standing?

II Anthropometric details

12. Height (cm)

13. Weight (Kg)

14. BMI (Kg/m_2)

15. Waist circumference (cm):

16. Hip circumference (cm):

17. W-H ratio:

18. Body fat percentage:

APPENDIX III

Global Physical Activity Questionnaire

Questions		Response	Code
Activity at work			
1	Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like [carrying or lifting heavy loads, digging or construction work] for at least 10 minutes continuously? [INSERT EXAMPLES] (USE SHOWCARD)	Yes 1 No 2 If No, go to P 4	P1
2	In a typical week, on how many days do you do vigorousintensity activities as part of your work?	Number of days └─┘	P2
3	How much time do you spend doing vigorous-intensity activities at work or a typical day?	Hours : minutes └─┴─┘ : └─┴─┘ hrs mins	P3 (a-b)
4	Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking [or carrying ligh loads] for at least 10 minutes continuously? [INSERT EXAMPLES] (USE SHOWCARD)	Yes 1 No 2 If No, go to P 7	P4
5	In a typical week, on how many days do you do moderateintensity activities as part of your work?	Number of days └─┘	P5
6	How much time do you spend doing moderate-intensity activities at work on a typical day?	Hours : minutes └─┴─┘ : └─┴─┘ hrs mins	P6 (a-b)

Travel to and from places			
7	Do you walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places?	Yes 1 No 2 If No, go to P 10	P7
8	In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?	Number of days └─┘	P8
9	How much time do you spend walking or bicycling for travel on a typical day?	Hours : minutes └─┴─┘ : └─┴─┘ hrs mins	P9 (a-b)
Recreational activities			
10	Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like [running or football,] for at least 10 minutes continuously? [INSERT EXAMPLES] (USE SHOWCARD)	Yes 1 No 2 If No, go to P 13	P10
11	In a typical week, on how many days do you do vigorousintensity sports, fitness or recreational (leisure) activities?	Number of days └─┘	P11
12	How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?	Hours : minutes └─┴─┘ : └─┴─┘ hrs mins	P12 (a-b)

318

Physical Activity (recreational activities) contd.			
Questions		Response	Code
13	Do you do any moderate-intensity sports, fitness or recreational (leisure) activities that causes a small increase in breathing or heart rate such as brisk walking,(cycling, swimming, volleyball)for at least 10 minutes continuously? [INSERT EXAMPLES] (USE SHOWCARD)	Yes 1 No 2 If No, go to P16	P13
14	In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (leisure) activities?	Number of days └┘	P14
15	How much time do you spend doing moderate-intensity sports, fitness or recreational (leisure) activities on a typical day?	Hours : minutes └┴┘: └┴┘ hrs mins	P15 (a-b)
Sedentary behaviour			
The following question is about sitting or reclining at work, at home, getting to and from places, or with friends including time spent [sitting at a desk, sitting with friends, travelling in car, bus, train, reading, playing cards or watching television], but do not include time spent sleeping.			
16	How much time do you usually spend sitting or reclining on a typical day?	Hours : minutes └┴┘: └┴┘ hrs min s	P16 (a-b)

APPENDIX IV

MEDICAL AND CLINICAL ASSESSMENT SCHEDULE

General Information

Participant:

Name ____

Address ____

CLINICAL SYMPTOMS

Check list (please put tick mark if you have any of the following symptoms):

Headache
Nausea/ Vomiting
Giddiness
Palpitation
Increased thirst
Increased hunger
Increased urination
Unintended weight loss
Fatigue
Yellowish lumps around eyes (Xanthelasma)
Small/ large lumps around joints of hands, legs or skin (Xanthomas)
Stiffness and pain in neck, arms, hands, legs or feet
Difficulty in walking
Urinary incontinence/urgency
Do you sometimes get out of breath when sitting still or sleeping?
Has a doctor ever told you your cholesterol level was high?
Thin/sparse/depigmented hair
Eye signs (pallor)
Oral cavity
Skin changes
Appetite
Tiredness/ fatigue
Joints/leg pains/difficulty in walking

APPENDIX V

THE GREENE CLIMACTERIC SCALE

Please indicate the extent to which you are bothered at the moment by any of these symptoms by placing a tick in the appropriate box

SYMPTOMS	Not at all	A little	Quite a bit	Extremely	Score 0-3
1 . Heart beating quickly or strongly					
2 . Feeling tense or nervous					
3 . Difficulty in sleeping					
4 . Excitable					
5 . Attacks of panic					
6 . Difficulty in concentrating					
7 . .Feeling tired or lacking in energy					
8 . Loss of interest in most things					
9 . Feeling unhappy or depressed					
10 . Crying spells					
11 . Irritability					
12 . Feeling dizzy or faint					
13 . Pressure or tightness in head or body					
14 . Parts of body feel numb or tingling					
15 . Headaches					
16 . Muscle and joint pains					
17 . Loss of feeling in hands or feet					
18 . Breathing difficulties					
19. Hot flushes					
20 . Sweating at night					
21 . Loss of interest in sex					

P (1-11) = ☐ A (1-6) = ☐

S (12-18) = ☐ D (7-11) = ☐

V (19-20) = ☐ S (21) = ☐

APPENDIX VI

SCHEDULE FOR INDIVIDUAL FOOD WEIGHMENT SURVEY
(ONE DAY WEIGHMENT METHOD)

1. Name of the respondent:
2. Age of the respondent:
3. Details of food consumption:

Meal pattern	Menu	Food Consumption		
		Weight of raw ingredients	Weight of total cooked food (g)	Weight of total cooked food used by the individual (g)
Breakfast				
Mid-morning				
Lunch				
Tea time				
Dinner				
Bedtime				

$$\text{Individual intake in terms of raw equivalents (g)} = \frac{\text{Total raw amount of each ingredient (g)}}{\text{Total cooked amount (g)}} \times \text{Individual intake of cooked amount (g)}$$

DETERMINANTS OF NUTRITIONAL STATUS AND LIFESTYLE DISEASES AMONG MIDDLE AGED WORKING WOMEN

By

SIJI, M. S.
(2015 - 24 - 002)

ABSTRACT

Submitted in partial fulfilment of the requirements for the degree of

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(FOOD SCIENCE AND NUTRITION)

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323

ABSTRACT

Middle age is a phase of transition from young age to old age. Along with the psycho-physiological transitions of midlife, many chronic diseases like hypertension, diabetes, osteoporosis, cardiovascular problems, obesity etc. increase when women reach their middle age. The hectic schedule of balancing home, work, along with balancing social and personal needs could lead middle aged working women to ignore their health until their health problems become chronic or fatal. The present investigation entitled **"Determinants of nutritional status and lifestyle diseases among middle aged working women"** was undertaken to assess the nutritional status, work stress, standard of living and prevalence of life style diseases among middle-aged working women. Risk factor index, correlates and prediction formulae for the determinants of nutritional disorders and lifestyle diseases were also derived.

The study was conducted among a total of 360 middle aged (45-55 years) working women of Thiruvananthapuram district. Forty middle aged working women were selected from each of the nine divisions of occupation as envisaged in the National Classification of Occupation (NCO, 2004). The nine occupational division includes (D_1)-senior officials, (D_2)-professionals, (D_3)-technicians, (D_4)-clerks, (D_5)-service workers, (D_6)-agriculture & fishery workers, (D_7)-craft workers, (D_8)-machine operators and (D_9)-construction workers. The In depth investigations were conducted among 30 per cent of the respondents (n=108) identified to be the most vulnerable.

The socio-economic status assessment showed that nuclear family system was predominant. High variability in educational status, socio-economic status and housing conditions were observed among the occupational categories. Using the baseline data, a modified Standard of Living Index (MSLI) was derived. MSLI is based on 4 dimensions *viz*. Individual characteristics (2 items), housing conditions (8 items), consumer durables (7 items) and social variables (2 items)

with a total of 19 items. Scores were assigned for each variable in ascending order. Based on these scores, respondents were classified into upper, middle and lower standard of living. MSLI assessment revealed that more than 75 per cent of the respondents in D1, D2, D3, D4 and D8 had medium to high SLI. While a major proportion of respondents from D5, D6, D7 & D9 belonged to low SLI.

Nutritional status assessment revealed higher prevalence of abdominal obesity (95.6 per cent), elevated body mass index (65.6 per cent), waist - hip ratio (WHR) (81.7 per cent) and body fat percent (96.9 per cent) among middle aged women irrespective of the occupational class difference. An assessment of household stress, work stress and psychological distress was studied, by standardising the stress scale. The significant item-total correlation and high Cronbach's alpha confirms the validity and reliability of the developed stress index (SI). The application of the stress index revealed moderate to high stress prevalence among the major proportion of the respondents. Statistical analysis confirmed the inter-dependence of stress and occupational divisions.

Physical activity (PA) was assessed using the Global Physical Activity Questionnaire, version 2 (WHO, 2013). Metabolic equivalent (MET) scores were used to classify the physical activity of the respondents. It was observed that more than 60 per cent of the respondents from all the occupation divisions were inactive or less active. An exception was noted in D9 where 60 per cent of construction workers were classified as active. Physical activity and occupational divisions were statistically dependent on each other. The physical work capacity of the respondents revealed that majority of the middle aged women had below average work capacity (45%). The vital capacity of the respondents were measured using the peak expiratory flow rate (PEFR) and found that majority of the respondents had moderate (57%) to poor (36%) lung capacity.

Medical camps were organized to assess the occurrence and prevalence of lifestyle diseases. Health problems related to neurological, musculo-skeletal, gastro-intestinal and urological complaints were reported by majority of the respondents. Prevalence of lifestyle diseases *viz.* diabetes, hypertension and hypercholesterolemia was 73 per cent and prevalence of combination of two of the lifestyle diseases was 31 per cent. More than half of the study population had raised fasting blood sugar (55.6%), total cholesterol (76.9%), systolic blood pressure (54%) and diastolic blood pressure (72.2%). Anemia was observed in 21 per cent and calcium deficiency in 15 per cent of the sample. More than 60 per cent of the respondents were osteopenic indicating low bone mineral density and increased risk of fractures. More than 40 per cent of the respondents attained menopause with almost 50 per cent experiencing moderate menopausal symptoms. Prevalence of lifestyle diseases was statistically independent of the occupational status and SLI of the respondents. Majority of the respondents were aware of their lifestyle diseases and were also undergoing regular treatments.

Inadequacy in the intake of quality foods mainly pulses, milk, roots and tubers, leafy vegetables, other vegetables and fruits were noticed among all the occupational divisions. A diet quality index (DQI) was formulated in the study aiming at the qualitative assessment of middle aged women's diet and to assess dietary risk factors of lifestyle diseases using the Indian dietary guidelines and recommendations of international dietary indices. Scores were assigned to the four dimensions included in the DQI *viz.* dietary adequacy variables (45 scores), dietary moderation variables (15 scores), healthy dietary practices (20 scores) and dietary diversity variables (20 scores) with a maximum score of 100. Based on the DQI scores, respondents were categorized to very poor, poor, average, good and excellent diet quality. More than half of the middle aged women from all occupation divisions had an average DQI. DQI was dependent on occupational status. Higher DQI scores showed significant negative correlation with waist circumference and prevalence of lifestyle diseases. Lifestyle disease incidence was positively correlated with elevated waist circumference and stress index. Significant negative correlation was observed between lifestyle disease prevalence and physical activity. All anthropometric variables were highly correlated with each other.

As revealed by the multinomial logistics regression analysis, the elevated WC, WHR, lack of PA and low DQI are the significant determinants contributing to the occurrence of one of the lifestyle diseases. The odds percentages were 48%, 99%, 50% and 71% respectively. The elevated BMI, WC and WHR had significantly higher probability for further encountering another lifestyle disease as per the odds percentage were 52%, 47.8% and 61.5% respectively. The significant predictors leading to the final stage of developing a high susceptibility towards all the three lifestyle diseases as per the odds percentage were elevated WC (48%), body fat per cent (53%), WHR (99%) and high SLI (49%).

Principal Component Analysis was carried out for generating a minimum data set of risk factors contributing to nutritional disorders and lifestyle diseases. The five significant risk factor dimensions identified in the present study were nutritional anthropometry, raised blood pressure, physical inactivity factors, adiposity factors and psychological & diet quality factors with total of 12 risk factor items/variables. Accordingly a risk factor scale was developed. The application of the developed risk factor scale among the respondents revealed that 39 per cent had moderate risk, 31 per cent had low risk and 30 per cent had high risk for developing lifestyle diseases and nutritional disorders. Construction workers showed the highest risk factor index and machine operators showed least risk factor index for lifestyle diseases.

The study gave an insight to the nutrition transition that middle aged working women are undergoing. Alarmingly high prevalence of overweight and obesity coupled with a high burden of life style diseases was observed in the study. Intervention strategies for early detection and modification of risk factors identified in the study *viz.* unhealthy diet, sedentary life style, household as well as work life stress, lack of regular physical activity, poor fruit and vegetable consumption, abdominal or central obesity and high body fat should be advocated both at community and household level. Adoption of cost-effective measures for the prevention and control of life style diseases such as dietary modification, regular physical activity and life style changes should be encouraged throughout women's lives to promote healthy midlife and ageing.

The tools and indices developed in the study will be useful for various epidemiological studies and can be applied to the general population. These tools will provide an updated measure to evaluate the socio-economic, health and nutritional status of middle aged women. The study strongly recommend to consider middle aged women as vulnerable population and requires policy attention and age specific nutritional intervention programmes.