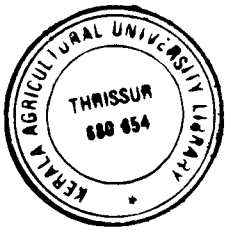
IMPACT OF NUTRITION EDUCATION ON MUSHROOM CONSUMPTION



By

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2000

DECLARATION

I hereby declare that this thesis entitled "**Impact of nutrition education on mushroom consumption**" is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award of any degree, diploma, associateship, fellowship or other similar title, of any other university or society.

College of Agriculture,
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Date : 10-10-2000

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CERTIFICATE

Certified that this thesis entitled "**Impact of nutrition education on mushroom consumption**" is a record of research work done independently by Ms. Cicil Mary John under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to her.

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Cicil Mary John

Dedicated

To

My Family

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INTRODUCTION

1. INTRODUCTION

Fungi is a source of food to bridge the food and energy crisis and medicine in the field to combat diseases (Mascarenhas and Inamdar, 1991). Mushrooms are plants which belong to a group called "Fungi". Generally the term "Mushroom" is used to denote the fleshy body of higher fungi. Mushrooms have been valued as both food and medicine through out the world for thousands of years (Hobbs, 1995). Our relationship with mushroom is long and fascinating. The Egyptians believed that they were a gift from the God Osiris, while the ancient Romans thought that they resulted from the lightning thrown to earth by Jupiter during storms, which explained their sudden appearance as if by magic. But there are records going back to the Chinese Chow Dynasty revealing that mushrooms were in use 3,000 years ago for food and medicine (Oatman, 2000).

Though mushrooms are highly priced as food delicacies and are eagerly sought after for their innate flavour and taste appeal, they represent one of the world's greatest untapped resources of nutrition and palatable food. Over all progress in mushroom cultivation is slow and yield levels are far below the international standards. Despite the availability of raw material, cheap labour and suitability of agro-climatic conditions, the total mushroom production in our country is approximately 25,000 MT which is very low as compared to 20 lakh tonnes in China and 50,000 tonnes in Korea (Chadha and Sharma, 1995).

Apart from being an easy source of food at home, it has the potential of being cultivated as a profitable commercial crop without much investment (Nair, 1988).

'Mushroom production' is one of such activities which can easily be taken especially, by farm women and un employed youth which provides substantial income. Initially only wild mushrooms were collected and consumed whereas their domestication started around 1700 years in France (Devi, 1982). In India commercial cultivation is extended to three mushrooms namely button mushroom (*Agaricus bisporus*), Paddy straw mushroom (*Volvariella volvacea*) and oyster mushroom (*Pleurotus sajor caju*). Oyster mushroom (*Pleurotus* species) is the fourth important cultivated mushroom in the world and constitute about 2.7 per cent of the total production of fresh mushroom (Singh, 1988). Most part of South India is ideal for cultivation of oyster mushroom (Tewari and Pandey, 1991). As among the different cultivated edible fungi, species of *Pleurotus* mushroom are the easiest and cheapest to grow (Chadha, 1994) and are better in consumer aspects than the generally grown button mushroom (Sohi, 1986), the demonstration of cultivation technology of oyster mushroom was enlightened in the present study.

Suresh (1998) stressed the need for popularisation of oyster mushroom consumption as it is a store house of many nutritive and therapeutic compounds which are yet to be discovered. For the popularisation of mushroom consumption, the only way is to educate the people about the benefits of mushroom use. Mittal *et al.* (1982) found that nutrition education becomes an integral component of all community development, extension and education activities. Thus desirable food habits and optimum health can be fostered among the vulnerable groups, thereby improving the nutrition and health status of the nation. Rajammal ($1982_{(b)}$) revealed that women were keen in learning nutrition contributed to the health and well-being of their

families. If motivated and guided properly they can be instrumental in fostering desirable changes in their homes, ultimately resulting in improvement in the nutritional status of the community at large. As mushroom being the 'vegetable of the future' (as it is cholesterol free and protein rich), it should be popularised among the local community through nutrition education on values of mushroom consumption.

The most important use of mushroom is as an article of food and its value as condiments of food accessories. Mushrooms are among the most appetising table delicacies and add great flavour to food when cooked with them (Purkayastha, 1987). Apart from being tasty, edible mushrooms are cheap sources of high quality protein, vitamins, minerals, fibres and several growth promoting substances and add value to the vegetarian diet (Ranganathan and Somasundaram, 1998). They are blended with other food products and made more tastier and nutritious. Mushroom tikkis, mushroom omelette, mushroom pakora and baked tomatoes with mushroom are some of the delicacies made with mushroom (Oberoi, 1989). Mushroom pickles and Ketch up were also well accepted products (Padmavathy, 1991).

Mushrooms possess significant nutritional and medicinal properties and are being referred as ' neutraceuticals' (Rai, 1995). A sufficient caloric intake does not guarantee a good standard of nutrition. Food containing minerals, vitamins and enough of the right kind of protein is necessary in addition to furnishing energy. Though the protein is synthesised tremendously by green plants, the concentration of protein in plants with a few exceptions is quite low in terms of the per cent of total weight. Mushroom provide a rich

addition to the diet in the form of proteins, valuable salts and vitamins. Mushroom proteins are comparable to muscle protein in nutritive value. Mushrooms are well suited to the supplement diets which lack protein and in the sense they have rightly been called 'vegetable meat'.

Due to unique chemical composition, mushrooms are suited to the specific groups suffering with some ailments/ disorders. As a low calorie-high protein diet with almost no starch and sugars; mushrooms are the 'delight of diabetic'. Due to high potassium : sodium ratio, few calories and low fat (rich in linoleic acid and lacking cholesterol), mushrooms are the choice of the dietician for those with obesity, hypertension and atherosclerosis. Alkaline ash and high fibre contents make them suitable for those suffering from hyper acidity and constipation (Rai and Sohi, 1988). Investigations by Lintzel (1990) indicate that 100 to 200 g of mushrooms (dry weight) are required to maintain nutritional balance in a normal human being weighing 70 kg. In the era of 'healthy eating' by cutting down the calories, saturated fat and cholesterol, mushrooms were bound to attract the attention. Mushrooms have long been considered, especially in the orient, to have medicinal values. In fact, early herbalists recommended mushrooms more due to their medicinal value than nutritional value (King, 1993). Mushrooms are probiotic as they assist our body to strengthen itself and its own immunities and fight off illness by maintaining physiological homeostasis. (Oatman, 2000).

In India, average percapita mushroom consumption is below twenty grams. Mushrooms along with pulses and soyabeans can ultimately help in warding off protein malnutrition especially in a cereal based country like India

(Kurade *et al.*, 1998). India has all the requisites of low cost, labour, favourable temperature, plentiful supply of straw, spawn and other inputs to become a leading mushroom produce. For promoting mushroom production, trade and consumption in India, Prakash and Tejaswini (1991) suggested the extension of the support to the mushroom research and extension education programme and also vigorous educative and promotional activities to popularise mushroom and increase domestic consumption. Again on reviewing available literatures related to various aspects of mushrooms in Kerala reveals that research on cultivational aspect have been taken care of but studies pertaining to its consumption are scarce. Hence, an attempt is made here primarily to generate awareness about the benefits of mushroom consumption through popularisation of standardised recipes among the Thiruvananthapuram city dwellers and also to assess the impact of imparted knowledge on consumption of the same.

Future Perspectives / Scope of the study

The cultivation of mushrooms has a great potential as mushroom production does not demand land, but helps in the bio conversion of potential pollutants like agro-wastes to useful and nutritive food for human consumption which is essential to a developing country like India. It is the only industry which contributes effectively in the disposal of the cellulosic agro wastes. Mushroom foods can serve to improve the nutritional status of Indians and help in alleviating protein deficiency in children.

Mushrooms are one of the fore most items of the international commerce as fresh as well as in dried and processed food form mainly because

the rate of growth in their consumption and production is the highest among the agricultural commodities internationally. In developed countries of the west, labour has been more expensive and so these countries are depending more and more on the import of mushroom from the Asian countries to meet their domestic demands (Chakravarthy, 1993). In the near future, India with a lowest labour, requisites temperature, abundance of plant materials like straw can produce mushrooms at a much cheaper rate and can use them as one of the prime tools of agricultural development in the international market as well as fighting malnutrition in the country.

However, its consumption in India is very limited. Some important points needing emphasis for the improvement in the status of this industry in our country are :

- To bring an over all awareness among the people about its nutritive and medicinal values.
- To provide training programmes for the transfer of the latest technology for mushroom cultivation.
- To open spawn centres for the supply of better quality spawn for mushroom growers.
- Marketing of 'Spawned-beds' which ensures the availability of fresh mushroom without being cheated and at a lower cost. Again consumer can make use of the entire yield from multiple harvests rather than buying a fixed quantity of mushroom at a single purchase.
- To popularise the mushroom usage through advertisements, nutrition education camps and also through cooking demonstrations.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

Literature pertaining to the title 'Impact of nutrition education on mushroom consumption' is presented under the following heads.

2.1 Nutrition education

2.2 Production and consumption patterns of mushroom

2.3 Cultivation of mushrooms

2.4 Nutritive value of mushroom

2.5 Medicinal value of Mushroom

2.1 Nutrition education

Nutrition deals with all that makes a man healthy functioning, creative human being through a well chosen diet. Education is one of the major means of bringing about the transformation of Society (Merchant, 1999). Tara and Subadra (1987) defined nutrition and health education as educational measures for inducing desirable behavioural changes for the ultimate improvement in the nutritional and health status of individuals. Unlike the impact of other nutritional intervention like supplementary feeding or prophylaxis with vitamin and mineral supplements, nutrition education has long term effects.

A study by Awasthi *et al.* (1991) on the developmental block of Amaniganj of Faizabad district for the assessment of dietary intake pattern and nutritional status of the children revealed that the under nutrition was prevailing in more than 70 per cent of children because of various socio-economic and transfer of technology constraints pertaining to nutritional

awareness in the target population group. Ghosh (1977) pointed out that, the reason for malnutrition is not so much due to lack of food, but because of the child's dependence on his mother, who had no knowledge of his nutritional needs. Gupta (1983) had reported that vast majority of mothers including those well educated are ignorant about the modern nutrition concepts. Rau *et al.* (1982) remarked that unless the health and nutrition knowledge of the mothers were not improved, better nutrition cannot be achieved. Gopaldas (1982) was of the opinion that nutrition education found to be very effective in preventing malnutrition.

Khanolkhar *et al.* (1989) and Vasudeva and Sunderlal (1979) had stressed the need for strengthening health education. Neglect in nutrition health education component was reported by Tandon (1980) also. According to Bauer (1998) there is a need for the public in general and educators and policy makers in particular to understand the link between a fundamental physical building block of human beings-nutrition and the well- being of our country. The need for public support of food and nutrition programmes continues as an increasing number and proportion of the population continue to be at risk of under nourishment (Braun, 1997). ICN (1992) suggested that the government should encourage the adoption of nutrition and consumer information and intervention programmes to differences in socio-economic conditions, language barriers and cultural beliefs and attitudes regarding foods, health and disease. The experts also stressed that nutrition education is a primary means of protecting and promoting the nutritional well-being of the public. USDA (1995) is of the opinion that nutrition education is needed to

literate and improve knowledge in the selection of a safe and adequate diet and of food production, processing, storage and handling techniques at all levels, especially in the house hold level.

FAO (1995) trusts that nutrition education package contributes to a better understanding of food and nutrition issues and facilitates the development of appropriate dietary guidance. Nutrition education aims at preparing the adolescent girls and boys to fulfil their future role as well-nourished, productive adults and parents and are helpful in delivering positive nutrition improvement messages and eliminating harmful food taboos. They also provides information on proper food preparation, nutritional value and bio- availability and other factors that affect micro nutrient status especially of the young and to promote the consumption of foods that are rich in micro nutrients.

Soebekti (1983) viewed that properly managed nutrition programmes can be used as a spearhead for development of primary health care. According to Kalyan (2000) nutrition education properly conducted can have a profound influence on change in knowledge, attitude and practice relating to food habits. Rajammal *et al.* ($1982_{(a)}$) stated that nutrition and health education is an important ingredient of good family living. Their works on health and nutrition education of rural women and children revealed that, rural women adopted desirable health practices as a result of their exposure to the education programmes. Rajammal *et al.* ($1982_{(b)}$) revealed that rural women were keen in learning nutrition. Since they realized that good nutrition contributed to the health and well being of their families. If motivated and guided properly they

can be instrumental in fostering desirable changes in their homes, ultimately resulting in improvements in the nutritional status of the community at large.

Nutrition education becomes an integral component of all community development, extension and education activities. Thus desirable food habits and optimum health can be fostered among the vulnerable groups, there by improving the nutrition and health status of the nation. (Mittal *et al.*, 1982).

2.2 Production and consumption patterns of mushroom

Due to the spread of mushroom cultivation
advances in the mushroom cultivation and proc
tremendous increase in the production of edible mushrooms (Singh *et al.*, 1995). They estimated the global production of mushrooms in 1990 as about 3.7 million tonnes. USA was the largest producer with 21 per cent of the production, while China and France accounted for about 14 per cent and 12 per cent respectively. According to Shanmugham (1993) the total world production of cultivated mushrooms is surveyed to be around 20 lakh tonnes in 1987, 21 lakh tonnes in 1991 and excess of one million tonnes in 1993. Singh (1994$_{(b)}$) reported that of the world's mushroom production, 37.7 per cent, in both production and consumption, is of the button mushrooms. The oyster mushroom follows closely with a share of 24.1 per cent, while the shitake and *Auricularia* tie at 10.6 per cent apiece and the paddy straw variety trails in at 5.5 per cent. However, India does not figure on the International scene.

Though the mushroom production in India has increased from 100 tonnes in 1970 to about 25,000 tonnes in 1995, over all progress in mushroom cultivation is slow in India and yield levels are far below the international standards (Chadha and Sharma, 1995). He also reported that China alone has shown an increase of over 700 per cent in oyster mushroom production and that oyster mushrooms are becoming popular in South India and Tamil Nadu alone is producing about 3500 MT per annum. According to Sharma and Rai (1994) the total production of mushroom in India during the year 1992-93 is about 11,520 tonnes and among the different states Uttar Pradesh is the highest producer with 2500 tonnes and Kerala ranks the 6th with 300 tonnes mushroom production. Dhar (1997) reported about 40,000 tonnes mushroom production during the year 1996-97 and Tamil Nadu as the highest producer with 10,000 tonnes and Kerala and Rajasthan, the least with 100 tonnes and 50 tonnes respectively.

In India, average mushroom consumption is below 20 g in comparison to 2.42-70.6 kg in some advanced countries (Singh, $1994_{(a)}$). Various mushroom foods viz., mushroom pulao, stuffed omelette, pickle, bujia, pakodas, samosas, paneer and chicken curries are already popular in the cuisine of the big fast food chains and restaurants all over India (Chang and Miles, 1993). According to Ghosh (1994) the diversification of mushrooms to various products for consumption is now met through the preparation of different mushroom foods like pickles, chutneys, ketchups, soups, chips, toasts, sweetmeats, mushroom snacks, mushroom chicken, butter and various other processed foods. Mushrooms, popularly regarded as vegetarian meat are

now available in fresh, frozen, canned and dried forms. They are ideal for inclusion in both vegetarian and non- vegetarian diets (Sharma, 1995). Sethi *et al.* (1995) observed a marginal shift in the consumption of fresh mushrooms by institutional users like pizza parlours.

Some industries are also consuming mushrooms to extract mushroom flavours, mycoprotein, proteolytic enzymes, extraction of some medicinal compounds, preparation of tonics, cosmetic products and health drinks (Noble, 1990). Hadar and Dosoretz (1991) discusses the production of mushrooms by submerged fermentation for food flavourings.

Currently the trend is moving towards the development of mushroom nutraceuticals - a new class of compounds extractable from mushrooms which may be used in the prevention and treatment of various diseases and which can serve as dietary supplements to improve human health (Chaudary, 1993). Recently two Japanese companies, Garuda international and Maruzen pharmaceuticals co, have successfully produced extracts of two mushrooms - Reishi and Shitake for marketing them in tablet forms as speciality health foods (Perkin, 1994).

Mushroom production does not demand land, but helps in the bio conversion of potential pollutants like agro-wastes to useful and nutritive food for human consumption which is essential to a developing country like India (Verma, 1995).

2.3 Cultivation of mushrooms

In India, Newton was the first to grow mushroom (Devi, 1988). Growing of mushrooms can go a long way in the efficient utilisation of agricultural wastes (Suharban, 1987). Ranganathan and Somasundaran (1998) stated that mushroom can be grown under different climatic conditions and on agricultural and industrial wastes. The spent substrate after mushroom cultivation can also be used as an animal and poultry feed or as a soil conditioner. As mushroom is completely free from pesticide residues, and risk due to its consumption is eliminated. According to Vyas (1999), mushroom can be cultivated in-doors and does not need large space. Besides they can be produced in large quantities in a short time per unit area, it grows independent of sunlight and feed on organic matter with out requiring the fertile soil. Apart from being an easy source of food at home, it has the potential of being cultivated as a profitable commercial crop without much investment (Nair, 1988).

The major mushroom cultivating areas in India are Punjab, Haryana, Uttarpradesh, Bihar, Karnataka, Orissa, Andra Pradesh, Madhya Pradesh, Tamil Nadu and Kerala. Among these states the first four states were cultivating mainly white button mushroom whereas the following four states mainly cultivates oyster and paddy straw mushrooms. All the three mushrooms (white button mushroom, oyster mushroom and paddy straw mushroom) were cultivating in both Tamil Nadu and Kerala (CFTRI, 1994).

Chadha (1994) opined that among different cultivated edible fungi; species of *Pleurotus* mushroom are the easiest and cheapest to grow. Oyster mushrooms can be grown in any household in any part of the country during any season due to a break through achieved in farming techniques of the oyster mushroom at the National Centre for Mushroom Research and Training (Sohi, 1986). He also viewed that oyster mushrooms are better in cultivation and consumer aspects than the generally grown button mushroom. Oyster mushroom is bigger and brighter with a larger shelf life, suited for tropical paddy growing areas, and they thrive well on temperature ranging between 70^0 and 100^0 F with 65-80 per cent humidity (Pathak, 1986). Lakshmanan and Dharmalingam (1996) reported that a net profit of Rs. 5000 per month on an investment of Rs. 10,000 could be realised through oyster mushroom cultivation.

The cultivation of oyster mushroom or *Pleurotus* species as a class of edible mushroom has gained popularity in recent years (Bano and Rajarathnam, $1982_{(b)}$). Oyster mushroom (*Pleurotus* species) is well known as Dhingari in India. There are about half a dozen species being artificially cultivated in different parts of world viz., *Pleurotus ostreatus*, *Pleurotus florida*, *Pleurotus flabellatus*, *Pleurotus citrinopileatus*, *Pleurotus sajor caju*, *Pleurotus eous* etc. They grow in nature in temperate, subtropical and tropical forests on dead and decaying woods. Their fruiting bodies are shell or spatula shaped with different colours viz., white, cream, pink, grey, yellow, light brown etc. However colour is enfluenced by the light. (Jandaik, 1988 and IIHR, 1999). Among the already known cultivated species, *Pleurotus sajor*

caju and *Pleurotus platypus* are found to be adopted for cultivation all through the year (Balakrishnan, 1994). Shanmugham (1989) reported that the recently released *Pleurotus* species- *Pleurotus citrinopileatus* has become very popular among the growers in Coimbatore in a very short time.

Bano and Nagarajan (1976) first developed "Polythene bag " method for *Pleurotus* cultivation. This method was further modified by Bhaskaran (1978) and named as "compact bag method " and they have reported an average yield of 1500 g/ kg of substrate by this method. Zadrazil and Schneidereit (1980) reported that oyster mushrooms can be cultivated in plastic bags, different types of trays as well as in special containers, and he also suggested that for rural areas, use of plastic bags are the cheapest technology. Polythene bags are helpful to retain moisture content and also protect from air borne weed mould and flies. Most parts of South India is ideal for cultivation of oyster mushroom (Tewari and Pandey, 1991).

Bano *et al.* (1971) found paddy straw to be the best substrate for the production of *Pleurotus sajor caju*. Although different industrial methods of oyster mushroom production have been developed, further probing on innovative methods like use of locally available substrate and simplification of available methods of cultivation, which may bring about an increased yield and bioefficiency of oyster mushrooms are to be encouraged (Sethi and Anand, 1991).

Ranganathan and Somasundaran (1998) recognised mushroom production as one of such activities, which can easily be taken especially by

farm women and unemployed youth which provides substantial income. For eg:- if it is continuously cultivated in an area of 5-10 cents, the net profit might be 10 times more than that of continues cropping of vegetables in one acre. Successful cultivation of mushrooms on a commercial basis calls for an exposure of the future growers to mastery of technology so that it will provide avenue for a profitable self-employment (Rahiman *et al.*, 1991). India has all the requisites of low cost labour, favourable temperature, plentiful supply of straw, spawn and other inputs to become a leading mushroom produce. For promoting mushroom production and trade in India; Prakash and Tejaswini (1991) suggested the extension of the support to the mushroom research and extension education programme and also vigorous educative and promotional activities to popularise mushroom and increase domestic consumption.

2.4 Nutritive value of mushroom

Mushroom represent one of the world's greatest un tapped resources of nutrition and palatable food and its growing is at present gaining momentum in our country (Bahl, 1984 and Swaminathan, 1987). The most important use of mushroom is as an article of food and its value as condiments of food accessories. Mushrooms are among the most appetising table delicacies and add great flavour to food when cooked with them (Purkayastha, 1987).

According to Hobbs (1995) mushrooms have been valued as both food and medicine through out the world for thousands of years. Fungi is a source of food to bridge the food and energy crisis and medicine in the field in combat of disease (Mascarenhas and Inamdar, 1991). Rai (1995) reported that mushrooms possess significant nutritional and medicinal properties and are

being referred as 'nutra-ceuticals'. Mushrooms have no deleterious effect at cellular level even when they are consumed regularly in plenty (Satinder *et al.*, 1991). They are highly priced as food delicacies and are eagerly sought for their innate flavour and taste appeal (Pathak, 1986 and Suharban, 1987).

Although the use of mushroom as food is probably as old as civilization, they were earlier preferred only for their flavour and taste while the nutritive value was recognised later (Sohi, 1986).

The nutritional analysis of 3 edible mushrooms, namely *Agaricus bisporus*, *Pleurotus flabellatus* and *Pleurotus sajor caju* was reported by Bano and Sivaprakasam (1986). The nutritive value of *Pleurotus* species were evaluated and the biological efficiency of these species were reported to ranged from 12.5-72.4 per cent with high protein (Turner, 1993).

Sivaprakasam (1986) considered the nutritive value of mushroom as intermediate between vegetables, egg and meat protein. The mushrooms have a very high food value i.e., "twice that of fresh vegetables or half that of lean meat". In common with most vegetables, mushrooms contain a high proportion of water (Wittingerova, 1991). Investigations by Lintzel (1990) indicates that 100 to 200 g of mushrooms (dry weight) are required to maintain nutritional balance in a normal human being weighing 70 kg. They equated the nutritive value of mushrooms to that of muscle protein.

Mushroom is a cheap source of high quality protein, vitamin, minerals, fibres and several growth promoting substances (Ranganathan and Somasundaram, 1998). Chang (1996) observed mushrooms as a valuable

health food- low in calories, high in vegetable proteins, chitin, iron, zinc, fibre, vitamins and minerals. They are high in B vitamins, phosphorus and potassium. Wild mushrooms are rich in fat and carbohydrates compared with the cultivated mushroom which is rich in proteins (Ereifj and AL-Raddad, 1999). Alar (1990) studied on the nutritional value of the field mushroom *Agaricus campestris*. The protein content exceeded that of other vegetables except legumes and the contents of certain minerals such as potassium, iron and calcium were high. Mushrooms can there-fore, make an important contribution to human nutrition. Khader and Padmavathi (1991) reported that the dried mushroom contains high nutrient contents when compared with immature and mature stages because during drying process, the food also looses moisture and there is an increase in concentration of nutrients in the remaining mass. In general 100 g of mushrooms contains 89.9 g of water, 1-5 g of carbohydrates, 2-8g of protein, 1-2 g of fibre, 0.2-1g of fat 5-15 g of vitamins, 0.5-lg of minerals and the caloric value of mushroom is 18-29 kcal/100g (Henze, 1991 and Geetha and Suharban, 1997).

Mainly due to their low dry matter, the mushrooms are basically a low-calorie food (25-30 calories/ 100 g fresh weight) and fit in well in this era of healthy eating by cutting down the calories (Kurade *et al.*, 1998). The calorific value has been reported to be about equal to that of apples (Singer, 1961). According to Sivapraksam (1989) mushrooms contain appreciable amounts of energy value, about 30.8-33.6 Kcal.

Mushrooms have a low carbohydrate content. The carbohydrate in the mushrooms are at a level of 4.5 to 5 per cent but are in the form of glycogen,

chitin and hemicellulose instead of starch (Bano, 1967 and Kovalev and Mogilny, 1989). Highest concentration of the sugars was noticed in pinhead stage, which decreased with the fruit body development (Rai *et al.*, 1990). Bano and Rajarathnam ($1982_{(b)}$) reported the carbohydrate content ranged from 46.6 to 81.8 per cent in *Pleurotus* species. Mushroom has 3.8 g per cent of complex carbohydrate (Starton, 1990). Starch found to be 0.02-0.3 per cent (Shanmugham and Jayarajan, 1990).

Protein Advisory Group of UNO (1970) has suggested that protein from micro-organisms offer best for a major source of protein independent of agriculture. Mushrooms, due to high quantity and quality of protein, have been recognised by the Food and Agriculture Organisation as food contributing to the protein nutrition of the countries depending largely on cereals. They can easily replace other animal proteins like milk and meat which are expensive (FAO, 1972 and 1977). Bahl ($1991_{(a)}$) opined that mushrooms may be one of the important source of vegetable protein combating the growing shortage of protein in India. The high concentration of lysine and tryptophan in mushroom protein makes them an ideal food to supplement cereal diet (Shanmugham and Jayarajan, 1989 and Rai, 1995).

Mushroom contains not only higher percentage of protein than cereals and pulses but its digestibility is also comparable to them (Lintzel, 1941; Eggum 1973; Hayes and Haddad, 1976). Zakhary (1990) reported that the supplementary value of mushroom protein in vegetarian diet is of considerable significance. Mushrooms are relatively high in digestible proteins among

vegetable foods. (Ereifj and AL-Raddad, 1999). They also reported that the wild mushroom contained low protein content than the farm mushroom.

Chang and Miles (1989) have suggested that total protein content of 3.5 to 4 per cent in commercial edible mushrooms may be more representative, which means that the protein in mushrooms, in general, is about twice that in asparagus and cabbage, and 4 and 12 times those in oranges and apples, respectively. On a dry weight basis 19-35 per cent protein in mushrooms compares well with 7.3 per cent in rice, 13.2 per cent in wheat and 25.2 per cent in milk. Quality of mushroom protein is far superior to the vegetable proteins and is as good or just inferior to animal proteins. It is because all the essential aminoacids are present in mushroom (Gopalan *et al.*, 1981). Aminoacids such as cystine (1.74 mg/ 100 g fresh weight), histidine (2.25 mg), lysine (4.77 mg) arginine (12.13 mg), methoinine (5.56 mg) phenylalanine (5.46 mg) and leucine (5 mg) and fifteen bound amino acids-cystine, histidine, lysine, aspartic acid, serine, glycine, glutamic acid, alanine, hydroxy proline, methionine, proline, phenyl alanine, valine, isoleucine and leucine were detected (Shanmugham, 1989 and Ogawa, 1993).

According to Lintzel (1943), 72-83 per cent of the total nitrogen would be in the form of digestible protein. Protein upon fractionation are reported to release albumins, globulins, prolamines and glutelins (Jayarajan, 1989(a)). Cultivated *Agaricus bisporus* contained most of the essential aminoacids with values ranging from methionine 0.40 to lysine 8 per cent on dried mushroom. Free amino acids constitute 10 per cent of a total dried mushroom with protein content of 19.44 per cent, total nitrogen content 5.64 per cent with protein

nitrogen 54.2 per cent of total nitrogen which is higher than most vegetables (Srinkut, 1989). The protein content ranges about 26.72 to 28.47 per cent on dry weight basis (Jayarajan, $1989_{(b)}$).

The crude protein content of *Pleurotus* species ranges from 14.4- 33.24 per cent (Rangaswamy and Mehta, 1986). According to Bano (1986) protein content in *Pleurotus* species has been documented to range between 8.9 and 38.7 per cent on dry weight basis. *Pleurotus* mushrooms are reported to contain about 0.3 to 0.5 per cent free amino acids (Rai *et al.,* 1988). In *Pleurotus tuber reguim,* cystine, methionine, serine, arginine and lysine were low (Nwokolo, 1988).

Mushroom contains low calories, but do provide a source of dietary fibre (Dikie, 1989). Chitin ('fungus cellulose') a polymer of N- acetyl glucosamine, is the structural component of cell wall and constitutes the major fraction of the fibre content of mushrooms. The chitin nitrogen is responsible for high protein values derived with usual 6.25 factor (Crisan and sands, 1978; Bano and Rajarathnam, $1982_{(b)}$ and Rai *et al.,* 1988). Kelvin (1991) found out the crude fibre content to be 0.95-1.10 per cent on fresh weight basis and 13.7-15.6 per cent on dry weight basis. The fibre content in almost all the mushrooms is very high. Fibre content in *Pleurotus* species ranged between 0.7 and 1.3 per cent on fresh weight basis and was highest in *Pleurotus membranaceus*. On dry weight basis, *Pleurotus* species are reported to contain 7.5 to 27.6 per cent fibre against 10.4 per cent in *Agaricus bisporus* (Turner, 1993).

Moisture content of the fresh cultivated mushrooms varies between 90 and 94 per cent (6 to 10 per cent dry matter) and 90 per cent may be considered as an average moisture of the mushrooms (Crisan and Sands, 1978).

According to (Starton, 1990) mushrooms have almost no fat. The crude fat content is reported to range from 0.25 -20 per cent. (Mehta, 1989). Mushrooms with high proportion of unsaturated fatty acids, especially linoleic acid, with no cholesterol, may be regarded as 'health food'. Among the sterols, ergosterol is most abundant and the cholesterol is non-existent in mushrooms. Most common sterols found in the commercial mushrooms were identified to be provitamin D_2 (ergosterol), Provitamin D_4 (22- dihydro-ergosterol) and γ-ergosterol (Huang *et al.*, 1985). Ergosterols present in mushrooms can be converted to vitamin D with ultraviolet radiation. Analysis by Hughes (1982) disclosed that mushrooms are rich in linoleic acid which is an essential fatty acid. There is some evidence that the cream varieties contain more fat than the white varieties.

The determination of fatty acids of the lipids of mushrooms like *Pleurotus ostreatus* and *Agaricus bisporus* was done (Stancher, 1992). Jorgy (1993) determined the free and bound fatty acids in cultivated mushrooms and found that they differed only to small extent. On fresh weight basis, the fat content of 0.10 to 0.19 per cent in *Pleurotus* species has been reported (Rai *et al.*, 1988). Crude fat content in the range of 1.08 to 9.4 per cent with an average of 2.85 per cent has been reported in *Pleurotus* species (Bano and

Rajarathnam, $1982_{(b)}$). Mushrooms are low fat food with 2 to 8 per cent crude fat on dry weight basis (Crisan and Sands, 1978).

Mushrooms are excellent sources of vitamins especially the B complex vitamin- riboflavin, niacin, thiamine, pantothenic acid and ascorbic acid, vitamin D and Vitamin K (Sethi and Anand, 1985 and Chang and Miles, 1989). Australian Mushroom Growers Association, in their recent mushroom promotion campaign, has concentrated on the importance of vitamin B_{12} for vegetarians, the poster reads 'The delicious dose of vitamin B_{12} contains no cholesterol' (Miller, 1993). Bano and Rajarathnam (1988) viewed the thiamine content as 1.4 to 2.2 mg, niacin 6.06-7.0 mg, ribofavin 6.7-9.0, mg, pantothenic acid 21.2-33.3 mg and folic acid 1.2-1.4mg/100 gm of dried weight of mushroom. They also reported that mushroom contain vitamin C. The ascorbic acid content ranged from 11.4- 47.73 mg/ 100g fresh weight. Niacin which is the most abundant vitamin, range from 81 -135 mg / 100g of dried mushroom (Stroller and Hall, 1988).

According to Anderson and Fellers (1982) mushrooms are rich in vitamins. In *Agaricus bisporus* they found 8.6 mg ascorbic acid, 5.82 mg nicotonic acid, 2.38 mg Pantothenic acid, 0.12 mg thiamine, 0.52 mg riboflavin and 0.018 mg biotin per 100 gm fresh weight. Mushroom is reported to be an excellent source of riboflavin and nicotonic acid and a good source of pantothenic acid. It also contains appreciable amount of thiamine and folic acid. Miller and Groche (1980) also reported the vitamin contents of *Agaricus* species and reported that the retention of vitamins after canning and stored for 2 months was 78 per cent and 85 per cent and after 6 to 12 months it

was 60-70 percent. Oatman (2000) opined that a handful of regular button mushrooms (*Agaricus*) will supply all the Vitamin B_{12} you need for the day. According to Kazeli (1984) the vitamin content of *Pleurotus* species on dry weight basis include thiamine 4.8 mg, riboflavin 4.7 mg and niacin 108.7 mg. Rai and Saxena (1989) states that vitamin C content in *Agaricus bisporous*, *Pleurotus sajor caju* and *Pleurotus ostreatus* were found to be 8,4 and 3 mg respectively per 100 g fresh weight.

Like most vegetables, mushrooms are rich in minerals as may be evident from their ash content-8-10 per cent in *Agaricus bisporus*, 5-15 per cent in *Pleurotus* spp. 11-5 per cent *Volvariella volvacea* and 7.0 per cent in *Lentinus edodes*. Mineral of highest content is potassium (45 per cent of total ash content), followed by phosphorus, sodium, magnesium and calcium which together constitute about 56 to 70 per cent of total ash content (Chang and Miles, 1989).

The presence of different mineral elements in mushroom increase the food value. 100 g of fresh mushrooms contains 3-20 mg of calcium, 1.5 mg of iron, 0.1-1.2 mg of copper, 0.1 -0.5 mg of zinc, 18-70 mg of phosphorous and 20 – 30 mg of Sulphur (Anderson and Fellers, 1982). They also stated that mushrooms contain high amounts of potassium, phosphorous, copper and iron but the calcium percentage is quite low. Losato (1988) reported that the magnesium and calcium content ranged from 57.4 - 106.2 and from 11.8-162.2 mg/100 g of dried mushroom and the sodium and Potassium content ranged from 23.8 -162.8 and from 2132 - 5809 mg/100 g dried mushroom respectively. Selinium content ranged from 0.63 to 16.08 mg per kg dried

mushroom (Losato, 1990). The selenium content of various other species of mushrooms were determined. Highest selenium contents were in *Boletus edulis* (17 mg/kg DW). Other mushrooms are *Lepiota rhacodes* (5.6 mg), *Lepiota procera* (4.8 mg), wild *Agaricus* (2.7 mg), *Marasmius oreades* (1.6 mg). A single meal of *Boletus edulis* may contain more selenium than the recommended daily intake of 200 mg (Zakhary, 1993).

Kalac (1989) reported the content of seven biogenic trace elements in edible fungi. Two hundred samples of 19 species belonging to 6 families were analysed for copper, manganese, zinc, iron, cadmium, chromium and nickel contents. The results showed a very high copper contents in *Lepiota procera*, *Lepiota rhacodes* and *Lepiota nuda*. The iron content of *Boletus variegatus* has 1160.3 mg/ kg. DW. Among edible mushrooms, *Agaricus bisporus* has the highest sodium content (Seegar,1985). Though it has high cadmium content a large ingestion of *Agaricus* fungi do not cause toxicity in humans (Schellman *et al.*, 1992).

Chang and Hayes (1988) reported the mineral content of some of the edible mushrooms of which the calcium content of *Pleurotus* species is 98 mg, phosphorus - 476 mg, iron - 8.5 mg and sodium - 61 mg. The mineral content of *Pleurotus sajor caju* on dry weight basis was reported by Agarwala and Jandaik (1989). The calcium content being 20 mg, phosphorus -760 mg, potassium - 3260 mg, iron -124.0 mg, zinc - 129 mg, copper - 12.2 mg and lead - 3.2 mg/100g. Haque and Chakrabarti (1982) reported the bioavailability of iron in mushrooms using anaemic rats. Iron is present in appreciable amounts in *Pleurotus* species. About one third of total iron in mushroom is in

the available form (Anderson and Fellers, 1942). Besides potassium, sodium, phosphorus, magnesium and calcium; copper, zinc, iron, manganese, cadmium and lead make up for the rest of the ash component. The copper content in *Pleurotus* mushrooms is a bit higher (12.2 to 21.9 ppm) as compared to other mushrooms (Bisaria *et al.*,1987).

There is surprisingly little work published about the volatile part of flavour of mushrooms. The researchers are not aware of the enormous strength of the compounds actually responsible for the flavour. Hansenn (1983) reported that the following compounds such as guanosine 5-monophosphate telenthinonine, methyl mercapton, hydrogen sulphide, aldehyde and acids, 1 octen 3 ol, Phrazines, 7-2 formyl pyroles, benzaldehyde and octanol are associated with the flavour of mushrooms. Frost (1989) studied the maintenance and improvement of good flavour in edible mushrooms. The distinctive flavours of edible mushrooms may be affected by various factors during cultivation including the use of chemical treatments, the presence of undesirable substances in the substrate, the use of chemical fertilizers and indiscriminate use of growth hormones.

2.5 Medicinal value of mushroom

Mushroom have been used since early ages by man as food or medicine and reference to such a use have been make even in ancient Indian Medical Ireatise Samhita or Atrea chavalla dating back to 3000 ± 500 B.C. (Pandey and Singh, 1978). According to Jones ($1997_{(b)}$) mushrooms have a long history of use in traditional Chinese medicine.

Oatman (2000) reported that, in accordance with some estimates, there may be 20,000 species of mushrooms of which 2000 are nutritious and edible. Of these edible mushrooms, 300 are known to be medically active. These mushrooms are probiotic as they assist our body to strengthen itself and its own immunities and fight off illness by maintaining physiological homeostasis. Thus they can promote good health, vitality and increase our body's adaptive abilities.

Mushroom nutraceuticals can provide a regular benign challenge to the immune system by presenting many different molecules to the data base in a non- hostile manner. It has been remarked that with mushrooms supplements we have a "24 hour Nautilus for our immune system" (David, 1996). Mushrooms, due to their active principles as well as high fibre, rejuvenate the immune system improving the health and longevity (Rai, 1995). According to Dharmandra (1996) many of the compounds found in shitake, reishi, cordyceps and some other mushrooms are classified as Host Defense Potentiators (HDP). These compounds include: hemicellulose (AHCC), poysaccharides, Polysaccharide- peptides, nucleosides, titerpeniods, complex starches, and other metabolites. It is believed that combinations of these products target the human immune system as well as aid in neuron transmission, metbolism, hormonal balance and the transport of nutrients and oxygen. Through a host mediated (T cell) immune mechanism, they help the body regulate the development of lymphoid stem cells and other important defense responses. Both cellular components and secondary metabolites of a large number of mushrooms have been shown to effect the immune system of

the host and there fore could be used to treat a variety of disease states (Chilton, 1993).

Hobbs ($1997_{(a)}$) reported that in Japan, Russia, China and U.S.A. several different polysaccharide antitumour agents have been developed from the fruiting body, mycelia, and culture medium of various medicinal mushrooms (*Lentinus edodes*, *Ganoderma lucidum*, *Schizophyllum commune*, *Trametes versicolor*, *Inonotus obliquus* and *Flammulina velutipes)*. Complex sugars and their derivatives in mushrooms has immune enhancement properties as they are able to stimulate a higher level of cytokine production in humans. Cytokines are proteins produced by the imune system to facilitate communication between cells (Mc Dougall, 1998). Hobbs (1995) also reported the presence of complex polysaccharides in mushroom structure that have the unique ability to act as immuno-modulators and are researched for their potential role in cancer and AIDS treatment. Nanba and Kuroda (1987) stated that the primary Polysaccharide, beta-D- glucan is well absorbed when taken orally and is currently under review for the prevention and treatment of cancer and as a supportive tool for HIV infection.

Due to unique chemical composition, mushrooms are suited to the specific groups suffering with some ailments / disorders. As a low calorie - high protein diet with almost no starch and sugars, mushrooms are the 'delight of diabetic'. Due to high potassium: sodium ratio, few calories and low fat (rich in linoleic acid and lacking cholesterol), mushrooms are the choice of the dietician for those with obesity, hypertension and atherosclerosis. Alkaline ash and high fibre contents make them suitable for those suffering from

hyperacidity and constipation (Rai and Sohi, 1988 and Josh, 1996). Chang and Miles (1989) have reviewed the literature on antibiotic activities (anti-fungal, anti-viral, anti-protozoal, anti-bacterial), anti-tumour, hypolipidemic effects but most significant medicinal effects having attracted the attention and publicity recently are the anticancer, hypolipidemic, hypocholesterolaemic and anti hypertension effects of the mushrooms. The ability of various edible fungi to lower blood cholesterol was first reported by Kaneda and Tokuda (1966). The absence of starch in mushrooms makes it an ideal food for diabetic patients and for persons who wish to remove excess fat from their body. Moconnel and Esselen (1981) reported that fresh mushrooms contain 0.95 mannitol, 0.28 per cent reducing sugars, 0.59 per cent glycogen and 0.91 per cent hemicullulose. Hayes and Haddad (1985) reported that mushrooms are grouped in the category of foods which are low in calories. Hence they are recommended, in the diets given to heart patients and diabetic patients. Mushrooms are rich in fibre and fibre rich foods are helpful for slimming as they act as bulk, giving a feeling of fullness and is useful in preventing many non-nutritional disorders like constipation, diverticulitis and duodenal cancer (Dikie, 1989).

Some types of mushrooms are capable of controlling fever causing germ. Another type of mushroom is capable of reducing blood cholesterol level and helps in maintaining vigour and vitality. Tablets and tonics prepared out of mushrooms are widely marketed in countries like Japan, Korea and Taiwan (Medivison, 2000). According to Sastry (1991) some varieties are used for rapid circulation of blood, for anaesthesia, for swollen glands,

epilepsy, heart ailment and rheumatoid arthritis. A watery extract of the whole mushroom is reported to hinder blood coagulation (Hobbs, 1997$_{(a)}$).

Importance of *Ganoderma lucidum*, *Coriolus versicolour*, *Herinium erinaceus*, *Armillariella mellea*, *Agaricus tabesiens*, *Marasmius*, *Tremella fuciformis* and *Lentinus edodes* in Chinese medicine has been described by Yang and Jong (1989). Extracts and powders of these mushrooms in the form of capsules or sugar coated tablets are being marketed. Active principles are said to be immuno stimulating poly saccharides, strengthening health and immunity. Compounds extracted from *Agaricus bisporus*, *Lentinus edodes*, *Coprinus comatus* and *Oudemansiella mucida* have been reported to have antifungal and antibacterial properties (Buswell and Chang, 1993).

The medicinal value of the black mushroom was known since 15th century. *Lentinan* extraction is a potential weapon against the dreaded disease AIDS and it reduces the development and spread of polio and herpes viruses, reduces the blood pressure and strengthens cell immunity to cancer and decreases the development of certain tumours (Edwards, 1990). A rat study on the hypocholestrolaemic activity of mushrooms, suggested that feeding of *Lentinus edodes* reduced the plasma cholesterol (Tanaka, 1993). An extract (*Lentinan)* from shitake (for centuries called "Elixir of Life") has been licensed as a anti-cancer drug by the Japanese FDA. *Lentinan* has shown some effect on bowel cancer, liver cancer, stomach cancer, ovarian cancer and lung cancer (Ikekawa *et al.*, 1969 and Jones, 1997$_{(a)}$). According to Jones (1997$_{(b)}$) shitake mushrooms may lower blood pressure in those with hypertension, lower serum cholesterol levels, increase libido, stimulate the production of

interferon which has anti-viral effects and has proven effective against hepatitis in some cases. Shitake is also reported to be rich in several anti-oxidants (selenium, uric acid and vitamin A, E and C) as well as vitamin D.

Reishi (*Ganoderma lucidum*) and Maitake (*Grifola frondosa*) have received the attention of the researchers recently (Nanba, 1993). *Ganoderma lucidum* 'Reishi' in Japan and 'Lino Shi' in China is believed to contain a treasure chest of immune regulating compounds. It is known as the 'mushroom of immortality' in Japan and the 'longevity mushroom' in Korea (King, 1993). Beinfield (1997) stated that 'Reishi' has been called as immune potentiator and can increase the production of interleukin – 1 & 2. It has been reported that reishi extracts "exerted an inhibition effect on tumour growth". Recent studies have also indicated that reishi can have a number of other effects : analgesic, anti-inflammatory, antioxidant, antiviral through inducing interferon production, lowers blood pressure, cardiotonic action through lowering serum cholesterol, expectorant and antitussive, liver (Hepatitis) – protecting and detoxifying protection against ionizing radiation, antibacterial and anti-HIV activity. Hypoglycaemic actions and anti tumour actions of *Ganoderma lucidun* are also reported (Sughara, 1993). Reishi contains calcium, iron and phosphorus as well as vitamins C, D and B – including pantothenic acid, which is essential to nerve function and the adrenal glands (Chang, 1996). Long Star Grower and its marketing arm organotech of USA expected to grow about 1500 pounds of reishis in 1992, make them into pills and market most of them in Japan (Rai, 1995). Stanislaus (1996) reported that when more than 2000 Chinese patients with chronic bronchitis were given

reishi syrup in tablet form during the 1970s, 60 to 90 per cent showed a marked improvement in health, including increased appetite.

Maitake means "dancing mushroom" in Japan and people who found the mushroom were said to dance with joy because it could be exchanged for its weight in silver (Smith, 1994). He also observed that in ancient times maitake has been used as a tonic and adaptogen. Along with other medicinal mushrooms such as shitake and reishi, maitake was used as a food to help promote wellness and vitality. Traditionally, consumption of the mushroom was thought to prevent high blood pressure and cancer.

According to Wiley (1995) maitake has also been shown to be beneficial in blood pressure, cholesterol, obesity, diabetes and constipation. In preliminary trials at the National Caner Institute, USA, maitake extract has been shown to kill AIDS virus and enhance the activity of helper-T-cells. Maitake extract was as effective in HIV as the widely used toxic drug AZT. Maitake extract exhibits anti-tumour effect by potentiating anti-tumour cellular functions by directly enhancing various mediators such a slymphokines and IL-1 (Chilton, 1993). Maitake can be found in gourmet restaurants, dried and packaged in gourmet grocery stores and increasingly in prepared products in the united states, Asia, and Europe. As a general health supplement, Hobbs recommended taking 3 to 7 g of maitake per day in tea or in soups and other dishes (Hobbs, 1995).

The right species of *Cordyceps* can be a powerful stimulant for macrophage activity, strengthening your immune systems' ability to fight

against bacterial and viral infection. It can be used as an effective medicine for treatment of high cholesterol, poor libido/impotence, arrhythmia, lung cancer and chronic kidney failure. It is also reported that cordyceps causes smooth muscle relaxation. This can make it especially helpful for treating chronic coughs, asthma and other bronchial conditions (Hobbs, $1997_{(b)}$).

Certain components contributing to the hypo cholesterolaemic action was dreshed in *Polyporus* mushroom (Sugiyamma, 1993). *Polyporus officinalis* was used internally as a universal remedy for all complaints and disorders and applied externally to stop bleeding, used for chronic diseases of breast and throat inflammation (Bahl, $1991_{(b)}$).

Recent human clinical studies have indicated that *Tremella fuliformis* (Bai Mu Erth) stimulates the immune system (Weil, 1996). Other recent studies have indicated that *Tremella fuciformis* demonstrates anti-tumour activity, lowers LDL cholesterol, protects the liver and is anti-inflammatory and may slow the aging process.

The significance of tryptophan in mushrooms and its medicinal uses are briefly discussed. It is antidepressant dietary additive and painkiller. *Agaricus bisporus* was shown to be especially rich in tryptophan : other *Pleurotus* species, *Coprinus comatus* and some other mushrooms were also good sources of trytophan (Chang, 1992).

An aqueous extract from *Pleurotus sajor caju* has been shown to exhibit hypotensive action, reduce the rate of nephron deterioration which may extend life span of chronic renal failure patients (Tam *et al.*, 1986).

An anti-tumour active branched (1-3) β-D. glucon from *Volvariella volvacea* was extracted and purified (Sone, 1992).

Coprinus comatus is reported to exert a hypoglycaemic effect which may benefit the treatment of diabetes mellitus (Hayes, 1988).

Currently, the total world worth of the pharmaceutical and nutraceutical products derived from mushrooms is estimated at more than $ 1.2 billion (Shirota, 1996).

Apart from being used as food and medicine, mushrooms are also utilized for making various articles like hats, hand bags, picture frames, bottle corks, curry combs, ordinary combs, flower pots, as writing material and for dyeing purposes (Bahl, 1984).

MATERIALS AND METHODS

3. MATERIALS AND METHODS

The study on the 'Impact of nutrition education on mushroom consumption' was conducted among the city dwellers in Thiruvananthapuram to create awareness about the benefits of mushroom consumption by popularising standardised recipes and assessing the impact of the imparted knowledge on the consumption of the same.

3.1 Locale of the study

Three resident associations from different localities of Thiruvananthapuram city were selected by simple random sampling. The resident associations selected were Althara resident association at Vellayambalam, Chattambi Swami Nagar resident association at Edappazhanji and Sastri Nagar resident association at Karamana. These selected associations possess the following characteristics.

(i) All the three associations had more than 150 members each.

(ii) The selected associations were functioning for the last five years and have frequent social gatherings.

(iii) Members seemed to be active participants in all activities conducted by the associations.

(iv) Most of the people residing in Sastri Nagar resident associations are vegetarians.

(v) Easy approachability and co-operation of the office bearers of the association

3.2 Selection of samples

(i) Selection of sample (One hundred and fifty respondents)

Raj (1972) observed that in simple random sampling, each unit in the population has the same probability of being selected for the sample. Hence in the present study a total 150 respondents were selected at random from the three resident associations (50 members from each association).

(ii) Selection of sub sample (Seventy five respondents)

After assessing the socio-economic variables and dietary variables like food habits, food preferences, protein intake and knowledge on mushrooms, a sub sample of seventy five respondents who have volunteered were selected from the three resident associations ; twenty five from each, for undergoing the education programme.

3.3 Plan of action

(i) Work plan on sample (One hundred and fifty respondents)

A. Survey to collect base line information on socio-economic variables.

B. Dietary survey to assess dietary variables like food habits, food preferences and protein intake. Food weighment survey was used to assess the protein intake.

C. Knowledge of respondents on mushroom cultivation were also assessed.

(ii) Work plan on sub sample (Seventy five respondents)

A. Implementation of education programme planned through

(a) Conduct of two lecture classes on cultivational, nutritive and therapeutic qualities of mushroom.

(b) Conduct of cooking demonstration of six selected mushroom recipes followed by assessing the acceptance and preference score for recipes.

(c) Conduct of method demonstration in the cultivation technology of mushrooms

(d) Distribution of spawned bed among the trainees to motivate them to grow mushrooms.

B. Assessment of knowledge gain with the use of properly structured check lists before and after the education programme.

C. Rating the extent of adoption among the trainees by a well-structured questionnaire.

(iii) Statistical analysis for interpreting the collected data

3.4 Development of tools

Interview method was used for the collection of data since Gupta (1987) has stated that the information received from an interview schedule was more reliable as the accuracy of the statements could be checked by supplementary questions wherever necessary. A schedule refers to a set of statements and / or questions to be associated by the respondent in a free to free interview and filled in by the interviewee (Chaudhari, 1989).

To elicit information regarding the socio-economic characteristics and dietary pattern of the respondents, oral questionnaire method was used. In the present study, the method suggested by Swaminathan (1993) was followed where in the investigator goes around with a schedule for collecting

information from the respondents regarding family details.

3.4. 1 Socio-economic survey

The socio-economic level of the respondents such as social, economic, religious and the family background in general, have a very distinct part to play in determining the attitudes and food behavioural pattern of the individual (Arora, 1991).

In this study, the schedule developed to elicit information on socio-economic characteristics was formed in such a way to collect details regarding the age, religion, caste, educational status, size of family, family composition, total monthly income of family, employment status, nature of participation in nutrition education classes and exposure to various information sources.

The schedule developed was pre-tested, which is given in Appendix - I.

3.4. 2 Diet survey

According to Swaminathan (1993) diet surveys constitute an essential part of any complete study of nutritional status of individuals or groups, providing essential information on nutrient intake levels, sources of nutrients, food habits and preferences.

In this study, the questionnaire was developed in such a way to collect information on the nutritional adequacy of food consumed with special reference to protein intake ; food habits and food preferences of the respondents with reference to use of mushroom.

(a) Food habits

The questionnaire structured to collect information on food habits was developed in such a way to assess the dietary habits, foods avoided on health reasons, commonly used preparation methods for various food stuffs and details on habit of dining out, habit of buying food from hotels, reasons for excluding favourite foods, mode of use of mushroom, opinion on mushroom consumption and family members who dines out.

The questionnaire structured was pre-tested and finalised which is given in Appendix-II.

(b) Food preferences

Schedule having a five point rating scale was used to assess the food preferences. To find out the food preferences of respondents, they were asked to record their order of preference for each food group recorded in the schedule.

The schedule developed was presented in Appendix-III.

(c) Protein intake

Food weighment survey was used to assess the protein intake. Gore *et al.* (1997) opined that actual food intake was assessed through food weighment method and it gives reasonably accurate values of individual dietary intake. According to Rahman and Rao (1999) the techniques commonly employed for undertaking diet surveys in families comprise of weighment and oral questionnaire (24 hour recall) methods.

Single day weighment survey was used in this study. According to Rao (1975) any single day or two day weighment method would be as efficient a tool as that of seven days.

1. Actual food intake

One-day weighment was done for assessing the actual food intake. During the food weighment survey, all the raw foods used for family cooking were weighed and the total cooked food weight of each preparation was recorded. The food consumed by the individual and items remaining after eating were also weighed to find out the exact amount of food consumed by them. The weight of raw foods consumed by the individual was calculated by the following formula.

$$\text{Weight of raw foods consumed by individual} \text{ or } \text{Raw equivalents of food items used by individual} = \frac{\text{Total quantity of raw ingredients used for each preparation} \times \text{Volume of cooked food consumed by an individual}}{\text{Total volume of cooked food}}$$

2. Protein intake

The protein intake of the foods consumed was calculated using food composition tables(ICMR, 1999).

The quantity of each food item as well as the computed protein intake was then compared with the Recommended Dietary Allowance of foods and nutrients suggested by Indian Council of Medical Research (1999).

The schedule prepared for the weighment survey is given in Appendix-IV.

Plate No. 1 Weighment of food


5 kg.
SEKA
8 10'00

3.4.3 Knowledge on mushroom cultivation

The knowledge of respondents about the technology of mushroom cultivation was also assessed.

3.4.4 Lecture classes

Lecture is an excellent method for presenting information to a large number of persons in a short period of time and is extensively used to present authoritative or technical information, to develop background and appreciation and to integrate ideas (Adivi Reddy, 1976).

In the present study, two lecture classes were planned. The classes were conducted in the selected three colonies located in Thiruvananthapuram city. The topics selected for the classes were on cultivational, nutritional and medicinal significance of mushroom and cultivation technology of mushroom. The lecture class was of two hours duration cum discussion. The education programme was conducted under direct supervision of the chairman. Lecture classes were supplemented with suitable teaching aids like poster and folder. Sadaqath and Channegowda (1987) reported that visual aids increase the effectiveness of lecture. The respondents were requested to disseminate the knowledge gained from the class with their friends and neighbours. Folders were distributed after the class for further reference.

The gist of the lecture and the teaching aids used were depicted in Appendix-V and Appendix-VI respectively.

3.4.5 Cooking demonstration

To motivate the respondents for mushroom consumption, cooking demonstration was conducted for selected 25 members each in all the three

Plate No. 2 Nutrition education programme


NUTRITION EDUCATION PROGRAMME FOR
PROMOTING MUSHROOM CONSUMPTION

resident associations in three consecutive days. Six mushroom recipes standardised by Usha *et al.* (1990) were selected for demonstration from the technical bulletin on 'Mushrooms' published by Kerala Agricultural University. Methods of preparing mushroom soup, mushroom omelette, mushroom cutlet, mushroom tikki, mushroom pakora and mushroom pickle were demonstrated to the respondents. The respondents were also invited to participate in the conduct of cooking demonstrations.

After cooking demonstration pamphlet containing methods of preparation of recipes and details of major nutrients available for each recipe were distributed among the respondents for ready reference.

The pamphlet formulated is appended in Appendix- VII.

3.4.6 Acceptance and Preference Score

The products after demonstration were served to the respondents for tasting and were requested to score the acceptability in terms of quality attributes such as appearance, flavour, colour, taste and texture of products and also to rank the six products demonstrated based on their preference.

(a) Acceptance Score

According to Herrington (1991) sensory quality is one of the criteria for the acceptability of any food product by consumer. Here a five-point scale score card was formulated and the respondents was asked to score the product in terms of appearance, flavour, colour, taste and texture. While tasting, they were requested to drink water in between for the removal of any after taste carried over from sample to sample. The tasting session was held in the afternoon between 3 p.m. and 4 p.m. Since this time was considered as the ideal time for conducting the acceptability studies (Swaminathan, 1975).

Plate No. 3 Cooking demonstration


MME FOR
IPTION

Acceptance score card formulated for six mushroom recipes is given in Appendix-VIII.

(b) Preference score

The preference of the respondents for each mushroom product were rated on a four point scale viz.

(0) Disliked very much

(1) Dislike

(2) Like

(3) Liked very much

Score card for preference test is appended in Appendix- IX

3.4.7 Method demonstration

According to (Waghmare, 1980) method demonstration is a demonstration wherein we show how to do a job step by step and it teaches a new skill or an old practice in a better way. Transfer of technology from lab to land or from the point of its origin to the hands of the actual beneficiary is one of the primary responsibility of all scientific or academic studies. In this study, an attempt on these lines was also undertaken. Technology of mushroom cultivation was demonstrated to selected respondents in Thiruvananthapuram city. They watched the process, listen to the oral explanation and asked questions during or at the close of the demonstration to clear up points about which there was an uncertainty.

In the present study cultivation technology of oyster mushroom was chosen for demonstration. Since oyster mushroom is bigger and brighter with

Plate No. 4 Spawned beds prepared for supply

Plate No. 5 Supplying the spawned bed

a long shelf life, suited for tropical paddy growing areas and they thrive well on temperature ranging between 70^0 and 100^0 F with 65-80 per cent humidity (Pathak, 1986) and also are better in consumer aspects than the generally grown button mushroom as reported by (Sohi,1986). Chadha (1994) reported that oyster mushrooms are easiest and cheapest to grow. A survey conducted in Chandigarh indicated that 75 per cent of the subjects were aware of button mushroom while only five per cent had a chance to come across oyster mushroom. Responses of subjects showed great acceptability towards oyster mushroom due to its taste, texture, aroma and roughage. Hence product promotion and aggressive marketing strategy are however needed to popularise this mushroom (Kaushal and Rawat, 1998).

According to Zadrazil and Schneidereit (1980), polybags are the cheapest technology and hence 'Poly bag method' of oyster mushroom cultivation was demonstrated. The details of the cultivation technology follows.

Materials required : (for one bed preparation)

(1) Polythene Cover- 1 no:

Thickness-150-200 gauge

Width-35 cm

Length-60cm

(2) Spawn - 150g

(3) Straw - 1kg

Methodology

Preparation of Substrate

Fresh and good quality straw is to be used for cultivation. The straw can be made into small round twists and tied up. They are soaked in clean water overnight (12-16 hours) and after soaking has done excess water should be drained off.

Pasteurisation of substrate

This enables to minimise contamination and also help to enhance yield. Boil water in a wide mouthed container and put the wet substrate. Dip the same in boiling water for about 15 to 20 minutes (80-85^{0}C). Floating of straw is to be avoided by keeping some heavy material over it. After pasteurisation spread it over a mesh or clean place to drain the water and allow the straw to cool down to room temperature.

Spawning

At the time of spawning the moisture content of the processed straw is to be 65 to 70 percent. It is advisable to use young spawn for higher yields. More than one-month-old spawn gives only lesser yield.

The spawn is removed from the bottle using a clean rod with a hook at one end. A few holes are punched here and there on polythene bags for facilitating cross ventilation. Usually polythene tubes are cut into required length and one end is properly tied. The substrate is taken to form a layer of about 10 to 15 cm at the bottom of this tube. A thin layer of spawn is spread over this along the circumference. Above this a second layer of straw is taken and the same also in turn spawned. The polythene bag is filled up alternating with spawn and straw, finally the cover is made compact and the top tied.

Spawn Running

The filled up bags can be kept length wise on a flat surface either on a platform or can be arranged on a shelf keeping at a distance of about 15 to 20 cm in a cool dark place. If black or green mould growth is seen during the spawn run, such beds are to be removed from the stack. Spawn run will be optimum at a temperature of 24 to 28 ^{0}C under a relative humidity of 80 to 85 percent. A dark place is more suited. In 15 to 20 days time the substrate will be fully harboured by the white mycelium of the mushroom fungus and the whole mass has been turned into a solid cylindrical Structure. Poly bags are stripped open at this stage.

Cropping

The solid cylindrical mass is to be incubated for fruit body formation. It can be hung or stacked length wise on the shelves of the mushroom house. If there is sufficient moisture, it is not necessary to water them during the first two days. Afterwards water is to be sprinkled on them, so as to keep moist, which can be better done by spraying water using a sprayer, 2 or 3 times a day. The mushroom house is to have an average relative humidity of 80 to 85 percent and temperature 24 to 28^{0}C. The mushroom initials (Sporocarps) appear in 3 to 5 days and the same can be harvested in another two days time. They appear in tiers all along the cylindrical shaped substrate in clumps. They vary in size, shape and colour.

Harvesting

The correct stage for harvesting mushroom is before the upcurving of margin of the pileus and shedding the white spore powder. Harvesting is to

be done carefully by picking the sporocarps without damage to the beds. Flushes will continue to appear for a period of 3 to 5 weeks and they can be harvested at intervals of 8 to 10 days. After this the outer portion of the beds are to be scraped off lightly and after proper watering they are kept aside for few more days for further harvests.

Flip chart prepared for teaching steps in cultivation of oyster mushroom is appended in Appendix- X

3.4.8 Spawned bed supply

Seventy five spawned beds were prepared in two consecutive days. Spawn were bought from the Department of Plant Pathology, College of Agriculture, Vellayani. After spawning, the beds were kept inside the laboratory under dark condition for completing the spawn run. Later the spawn run bags were distributed among the trainees inorder to motivate them to take-up mushroom cultivation as a hobby or enterprise.

3.4.9 Assessment of Knowledge gain

(a) Pre-test

For assessing the knowledge on use of mushroom among the sub sample, a checklist of 20 statements pertaining to mushroom use were prepared. The main purpose of these statements is to test the awareness of the respondents regarding the use of mushroom. The statements are administered to 75 respondents and they were requested to give their reactions to each statement on 'agree' and 'disagree'. 'Agree' and 'disagree' are given respectively the scores '1' and '0'. The total score of a respondent is obtained by summing the weights of individual items responded.

Plate No. 4 Spawned beds prepared for supply

Plate No. 5 Supplying the spawned bed

(b) Post- test

For evaluating the impact of nutrition education programme checklist administered earlier to these respondents to assess their knowledge on mushroom use was used. The maximum score attainable by a respondent through this test would be 20. The difference between pre and post score was taken as the knowledge gain of an individual. The possible range of knowledge gain was between 0 and 20.

The checklist prepared to assess the knowledge gain of respondents were pre-tested and finalised which is given in Appendix- XI

3.4.10 Assessment of Extent of adoption

For assessing the extent of adoption of cultivation and use of mushroom a well structured questionnaire was used after one month (30 days) interval for getting information on their frequency of mushroom consumption, opinion about spawned bed supplied, yield obtained from supplied bed, percentage of adopters of mushroom cultivation, yield difference between supplied beds and self-made beds.

The questionnaire formulated was given in Appendix- XII.

3.4.11 Statistical Analysis

The following statistical techniques were used in the analysis of the data.

(a) Frequency and Percentage

Some of the data are subjected to and interpreted in terms of frequency and percentages.

(b) Mean

The arithmetic mean ($\overline{X}$) is the quotient that results when sum of all items in the series is divided by the number of the items. The formula in terms of symbol is

$$\overline{X} = \frac{\Sigma x}{N} \quad \text{where,}$$

$\overline{X}$ = Mean

Σx = Sum of individual items

N = Number of items

(c) Standard deviation (SD)

The Standard deviation was found out by taking the differences of each items in the series from the arithmetic mean, squaring these differences, summing all the squared differences dividing by the number of items and then extracting the square root. The formula in terms of symbol is

$$SD = \sqrt{\frac{\Sigma x^2}{N}} \quad \text{where,}$$

SD = Standard deviation

Σx^2 = Sum of the squared deviations from the mean

N = Number of items

(d) Simple Correlations were computed to find out the relationship between the selected independent variables and the dependent variable to study the inter relationships and degree of association among the various independent variables.

e) Chi square test was used to find out any difference or discrepancy between the theoretical values and observed values of an experiment.

RESULTS

4. RESULTS

A study was conducted on the 'Impact of nutrition education on mushroom consumption' among the city dwellers in Thiruvananthapuram to create awareness about the benefits of mushroom consumption by popularising standard recipes and to assess the impact of the imparted knowledge on the consumption of the same. The data collected from sample (one hundred and fifty respondents) and sub sample (seventy five respondents) were analysed and the results are presented under the following heads.

4.1 Sample (one hundred and fifty respondents)

A. Socio-economic variables

B. Dietary variables

   i. Food habits

   ii. Food preferences

   iii. Protein intake

C. Knowledge on mushroom cultivation

4.2 Sub Sample (seventy five respondents)

A. Acceptance and preference score of demonstrated mushroom recipes

B. Knowledge gain

C. Extent of Adoption

4.1 Sample (one hundred and fifty respondents)

4.1.A Socio-economic variables

Socio-economic variables of the selected one hundred and fifty respondents with particular reference to Age, Religion and caste, Educational status, Family size, Family composition, Monthly income, Employment status, Participation in nutrition education classes and Exposure to information sources were assessed.

Age wise distribution of respondents is presented in Table 1.

Table 1 Age wise distribution of respondents

Age	Distribution of respondents	
	Number	Percentage
≤ 20	6	4
21 - 30	29	19
31 – 40	44	29
41 – 50	50	34
> 50	21	14
Total	150	100

The data presented in Table 1 reveals that 34 per cent of the respondents belonged to the age-group of 41-50 years, 29 per cent of respondents were in the age group of 31-40 years. This was followed by respondents with age group of 21-30 years who accounted for 19 per cent of the respondents surveyed. About 14 per cent constituted those in age groups above fifty years and four per cent in age group less than or equal to twenty years.

A highly significant and positive correlation was found between age of respondents and education (γ = 0.1774*) and also between age of respondents and

their preference for proteinaceous foods ($\gamma = 0.2054$) as depicted in Appendix – XIII.

Details regarding the religion and caste of families surveyed were presented in Table 2.

Table 2. Religion and caste wise distribution of families

(a) Religion	Distribution of families	
	Number	Percentage
Hindu	136	90.7
Christian	12	8.0
Muslim	2	1.3
Total	150	100
(b) Caste	Distribution of families	
	Number	Percentage
Forward	124	82.7
Backward	19	12.7
Scheduled caste	2	1.3
Scheduled tribe	5	3.3
Total	150	100

As depicted in Table 2, 90.7 per cent of families were Hindus, 8 per cent were Christians and 1.3 per cent were Muslims. Among the families surveyed 82.7 per cent were forward caste, 12.7 per cent were backward caste, 3.3 per cent and 1.3 per cent of families belonged to scheduled tribe and scheduled caste respectively.

Educational status of the respondents were given in Table 3.

Table 3. Distribution of respondents based on their educational status

Educational status	Distribution of respondents	
	Number	Percentage
Below S.S.L.C.	9	6
S.S.L.C.	35	23.3
Pre-degree	34	22.7
Degree	32	21.0
Above degree	40	27.0
Total	150	100

Among 150 respondents 27 per cent were found to have education above degree, an almost equal per cent (i.e., 233per cent and 22.7 per cent) have education up to S.S.L.C. and pre-degree respectively, 21 per cent have education up to degree and 6 per cent were below S.S.L.C.

As depicted in Table 4, significant difference was noticed between education and income (χ^2_4 = 33.2236**) and also between education and preference for proteinaceous food (χ^2_9 = 24.4886**).

Table 4. Distribution of respondents based on their relationship of education with income and preference score for proteinaceous foods

Education	Income				Preference score for proteinaceous foods			
	< 3000	3000 – 6000	6000 – 9000	> 9000	< 14	14-16	16-18.5	>18.5
Below S.S.L.C	2 (1)	4 (3)	3 (2)	0 (0)	3 (2)	1 (1)	2 (1)	3 (2)
S.S.L.C.	9 (6)	19 (13)	7 (5)	0 (0)	13 (9)	13 (9)	7 (5)	2 (1)
Pre-degree	6 (4)	12 (8)	10 (7)	6 (4)	18 (12)	4 (3)	5 (3)	7 (5)
Degree	0 (0)	11 (7)	17 (11)	4 (3)	10 (7)	4 (3)	10 (7)	8 (5)
Above degree	0 (0)	7 (5)	18 (12)	15 (10)	7 (5)	5 (3)	11 (7)	17 (11)
	χ^2_4 = 33.2236**				χ^2_9 = 24.4886**			

N = 150 respondents

**Significant at 1 per cent level of probability (The numbers in parenthesis denotes the percentage of respective numbers)

As indicated in Appendix-XIII a highly positive and significant correlation was found between the education of respondents and their preference for mushroom (γ= 0.3727**).

Table 5. Distribution of families a based on their family size

Family size	Distribution of families	
	Number	Percentage
Small (1-14 members)	124	82.7
Large (> 4 members)	26	17.3
Total	150	100

From Table 5 it is clear that 82.7 per cent of the families had one to four members while 17.3 per cent had more than four members. Majority of families in the present study could be categorised under the small family with one to four members in each family and minority belonged to large family with more than four members.

Family composition assessed by determining age and sex distribution of family members are given in Table 6.

Table 6. Age and sex wise distribution of the members of families surveyed

Sex wise distribution	Age (Years)			
	≤ 18 (Children)		≥ 18 (Adults)	
	Number	Percentage	Number	Percentage
Females	64	54.7	228	55
Males	53	45.3	188	45
Total	117	100	416	100

The age and sex based distribution of the population is presented in Table 6 reveals that out of 150 families surveyed 55 per cent were adult females and 45 per cent were adult males and remaining were child population having 54.7 per cent females and 45.3 per cent males.

A significant difference between number of adults and monthly income of family (X^2 = 10.3209**) was evident from Table 7.

Table 7. Distribution of families based on relationship of adult members with monthly income of family

Number of adults	Monthly income			
	<2999	3000-5999	6000-9999	≥10000
1	1 (1)	4 (3)	4 (3)	0 (0)
2	6 (4)	30 (20)	24 (16)	12 (18)
3	8 (5)	13 (9)	9 (6)	5 (3)
4	2 (1)	5 (3)	7 (5)	6 (4)
5	0 (0)	1 (1)	11 (7)	1 (1)
6	0 (0)	0 (0)	0 (0)	1 (1)
	X^2_2 = 10.3209**			

N = 150 respondents

** Significant at 1 per cent level of probability (The numbers in parenthesis denotes the percentage of respective numbers).

Total monthly income of the families were collected and Table 8 reveals the distribution of families with respect to their total monthly income.

Table 8. Distribution of families based on their monthly income

Monthly income	Distribution of families	
	Number	Percentage
< 3000	17	11
3000 - 6000	54	36
6000 – 9000	54	36
> 9000	25	17
Total	150	100

It was observed from Table 8 that an equal percentage (viz., 36 per cent each) had monthly income ranging from Rs.3000-6000 and 6000-9000. 17 per cent earned monthly income more than Rs. 9000 and 11 per cent have an income less than 3000 rupees.

As depicted in Appendix-XIII a highly significant and positive correlation was observed between monthly income and preference score for mushroom (γ = 0.3973**).

Employment status of the respondents were enquired and the details were depicted in Table 9.

Table 9. Distribution of respondents based on their employment status

Employment status	Distribution of respondents	
	Number	Percentage
Government employee	26	17
Private employee	22	15
Self-employed	16	11
Unemployed	86	57
Total	150	100

Table 9 reveals that out of 150 respondents 57 per cent of respondents were unemployed while 17 per cent were government employees. About 15 per cent had private jobs and 11 per cent were self-employed.

Table 10. Distribution of respondents based on their nature of participation in nutrition education classes

Nature of participation in nutrition education classes	Distribution of respondents	
	Number	Percentage
Participated	122	81
Not participated	28	19
Total	150	100

It was observed from Table10 that majority of respondents (81 percent) were not participated in nutrition education classes while 19 per cent of respondents were participated in nutrition education classes conducted by health workers.

Details of respondents with respect to their exposure to various sources from which respondents gets information on nutritional aspects were enquired and details were given in Table11.

Table 11. Distribution of respondents based on their exposure to information sources

Information sources	Distribution of respondents	
	Number	Percentage
Television	79	52.7
Radio	22	14.7
Newspaper	14	9.3
Magazines	31	20.6
Exhibitions	1	0.7
Relatives	3	2.0
Total	150	100

Table 11 revealed that 52.7 per cent of respondents gets information from television, 20.6 per cent from magazines, 14.7 per cent from radio followed by 9.3 per cent, 2 per cent and 0.7 per cent from newspapers, relatives and exhibitions respectively.

4.1.B Dietary variables

(i) Food Habits

Food habits of respondents were assessed with regard to their dietary habit, foods avoided on health reasons, commonly used preparation methods, habit of dining out, habit of buying food from hotels, reasons for excluding favourite foods, mode of use of mushroom, opinion on mushroom consumption. Family members who used to take food from outside home were also assessed. The results obtained were presented below.

Dietary habits of respondents indicated that majority of respondents were vegetarians i.e., about 110 members (73 per cent). Out of 150 respondents, 37 members (25 per cent) were non-vegetarians and 3 members (2 per cent) were ovo-vegetarians. The details were presented in Table 12.

Table 12. Distribution of respondents based on their cultural dietary habit

Dietary habit of respondents	Distribution of respondents	
	Number	Percentage
Vegetarians	110	73
Non-vegetarians	37	25
Ovo-vegetarians	3	2
Total	150	100

Table 13. Distribution of respondents based on their foods avoided due to health reasons

Name of food stuffs avoided	Health problems	Distribution of respondents	
		Number	Percentage
No foods avoided	No health problems	104	69.3
Tubers and pulses	Flatulence	22	14.7
Sugar&jaggery	Diabetes	9	6.0
Fats and oils	Hypertension	6	4.0
	Coronary heart diseases	9	6.0
Total		150	100

As evident from Table 13, 69.3 per cent of respondents need not avoid any foods due to any health reasons while 14.7 per cent had to avoid tubers and pulses due to flatulence, 6 per cent had to avoid sugar and Jaggery because of diabetes, 4 per cent and 6 per cent of respondents had to exclude fats and oils due to diseases like hyper tension and coronary heart diseases respectively.

Preparation methods most frequently used by families were surveyed and depicted in Table14.

Table 14. Distribution of families based on their commonly used preparation methods

Preparation methods used	Number of families adopting different methods							
	Cereals	Pulses	Green leafy vegetables	Other vegetables	Roots and tubes	Flesh foods	Egg	Milk
Boiling	18 (12)	-	-	-	150 (100)	-	123 (82)	150 (100)
Boiling and straining	132 (88)	-	-	-	-	-	-	-
Steaming	-	27 (18)	-	-	-	89 (60)	-	-
Steaming and seasoning	-	112 (75)	150 (100)	150 (100)	-	-	-	-
Steaming and frying	-	-	-	-	-	41 (27)	-	-
Roasting	-	11 (7)	-	-	-	-	-	-
Frying	-	-	-	-	-	20 (13)	27 (18)	-

(Numbers given in parenthesis denotes the percentage of respective numbers)

From Table14 it was clear that most of the families (88 percent) were using boiling and straining method for cooking cereals, while 12 per cent adopted simple boiling for cereal cooking.

Steaming and seasoning was used by 75 per cent of families for cooking pulses while 18 per cent and 7 per cent of families were using methods like steaming and roasting respectively for preparing pulses. An equal percentage (i.e., 100 percent) of families were also using steaming and seasoning method for cooking green leafy vegetables and other vegetables.

Hundred per cent families were using boiling method for cooking roots and tubers and also for cooking milk.

Sixty per cent of families were adopting steaming method for cooking flesh foods whereas 27 per cent and 13 per cent of families were adopting methods like steaming and frying; and frying for cooking flesh foods respectively.

Boiling was the common method used for cooking eggs by 82 per cent of families while 18 per cent uses frying method for preparing eggs.

Distribution of respondents based on their habit of dining out were assessed and depicted in Table 15.

Table 15. Distribution of respondents based on their frequency of dining outside home

Frequency of dining outside home	Distribution of respondents	
	Number	Percentage
Daily	-	-
Weekly	6	4.0
Monthly	7	4.7
Occasionally	68	45.3
While traveling only	36	24.0
Never	33	22.0
Total	150	100

It was evident from Table 15 that out of 150 respondents about 45.3 per cent takes food outside home only on occasions, 24 per cent dines out only while traveling, 4.7 per cent used to take food outside home monthly and 4 per cent dines out weekly. About 22 per cent of respondents never used to dines outside home. No respondents seemed to take food outside home daily.

Table 16. Distribution of respondents based on their habit of buying food from hotels

Habit of buying food from hotels	Distribution of respondents	
	Number	Percentage
No	107	71.3
Yes	43	28.7
Total	150	100

Table16 revealed that about 71.3 per cent of respondents were not in the habit of buying food from hotels while 28.7 per cent had the habit of buying food from hotels.

Reasons for excluding favourite foods of respondents were surveyed and shown in Table 17.

Table 17. Distribution of respondents based on their reasons for excluding favourite foods

Reasons for excluding favourite foods	Distribution of respondents	
	Number	Percentage
Expensive	50	33
Considering the preference of person who dines with them	8	5
Considering the preference of family members	38	26
Difficulty in cooking	23	15
Lacking other facilities	26	17
Not avoiding any favourite foods	5	4
Total	150	100

From Table 17 it was revealed that about 33 per cent of respondents were excluding their favourite foods as it is too expensive while 26 per cent were excluding their favourite foods as they considers the preference of their family members, 17 percent, 15 per cent and five per cent of respondents were excluding their favourite foods as they lack facilitates, due to difficulty in cooking and as they considers the preference of persons who dines with them respectively. About four per cent of respondents were not avoiding their favourite foods due to any above reasons.

Respondent's mode of use of mushroom were enquired and details were given in Table18.

Table 18. Distribution of respondents based on their mode of use of mushroom

Mode of use of mushroom	Distribution of respondents	
	Number	Percentage
By self-cooking	42	28
Through friends	15	10
From hotels	21	14
Not used	72	48
Total	150	100

Table18 shows that out of 150 respondents, about 48 per cent did not use mushroom, while 28 percent, 10 per cent and 14 per cent used mushrooms by self-cooking, through friends and from hotels respectively.

Opinion of respondents regarding mushroom consumption were surveyed and given in Table19.

Table 19. Distribution of respondents based on their opinion on mushroom consumption

Opinion on mushroom consumption	Distribution of respondents	
	Number	Percentage
Good	63	42
Not good	10	7
Don't have any idea about mushroom consumption	77	51
Total	150	100

It was evident from Table19 that 42 per cent of respondents were ignorant about mushroom consumption while 51 per cent had the opinion that mushroom consumption is good and 7 per cent of respondents were of the opinion that mushroom consumption was not good.

Distribution of families based on their members who used to take food from outside were enquired and details were depicted in Table 20.

Table 20. Distribution of families based on family members taking food from outside

Family members taking food from outside	Distribution of respondents	
	Number	Percentage
Head	50	33
Son	36	24
Daughter	4	3
No members taking food from outside home	60	40
Total	150	100

Table 20 reveals that in about 40 per cent of families, family members were not taking food from outside home while in 33 percent, 24 per cent and 3 per cent of families, head of the family, son and daughter were taking food from outside home respectively.

(ii) Food Preferences

Preference of respondents for various food groups including mushroom were assessed using a five point scale and the details were presented in Table 21.

Table 21. Preference of respondents for various food groups

Food groups	Extremely liked		Liked		Not liked very much		Not at all liked		Not tested	
	Number	Percen-tage	Number	Percen-tage	Number	Perce n-tage	Number	Percen-tage	Number	Percen -tage
Cereals	108	72	40	26.7	2	1.3	-	-	-	-
Pulses	44	29.3	57	38	43	28.7	6	4	-	-
Roots and Tubers	10	6.7	38	25.3	92	61.3	10	6.7	-	-
Green leafy vegetables	108	72	36	24	5	3.3	1	0.7	-	-
Other vegetables	103	68.6	40	26.7	6	4	1	0.7	-	-
Fruits	102	68	37	24.6	10	6.7	1	0.7	-	-
Milk and milk products	96	64	40	26.6	13	8.7	1	0.7	-	-
Meat, fish and egg	32	21.3	9	6	9	6	-	-	100	66.7
Fats and oils	9	6	39	26	58	38.7	44	29.3	-	-
Sugar and jaggery	19	12.7	90	60	27	18	14	9.3	-	-
Nuts and oil seeds	37	24.7	86	57.3	12	8	15	10	-	-
Mushroom	67	44.7	8	5.3	3	2	-	-	72	48

From Table 21 following results were obtained.

Out of 150 respondents about 108 (72 per cent), 40 (26.7 per cent) and 2 (1.3 per cent) respondents extremely liked cereals, liked cereals and not liked cereals very much respectively.

Preference of respondents towards pulses shows that about 57 (38 per cent) respondents liked pulses, 44 (29.3 per cent) extremely liked it, 43 (28.7 per cent) not liked it very much and 6 (4 per cent) not at all liked it.

In the case of roots and tubers about 92 (61.3 per cent) did not like it very much, 38 (25.3 per cent) liked it while an equal percentage 10 (6.7 per cent) each extremely liked and not at all liked roots and tubers.

Preference of respondents for green leafy vegetables showed that 108 (72 per cent) respondents extremely liked leafy vegetables, 36 (24 per cent) liked it, 5 (3.3 per cent) not liked it very much while 1 (0.7 per cent) not at all liked it.

Out of 150 respondents 103 (68.6 per cent) extremely liked vegetables, 40 (26.7 per cent) not liked it very much and not at all liked it respectively.

It was observed from Table 21 that about 102 (68 percent), 37 (24.6 per cent), 10 (6.7 per cent) and 1(0.7 per cent) of respondents extremely liked fruits, liked fruits, not liked fruits very much and not at all liked it respectively.

Preference of respondents towards milk and milk products showed that majority of respondents 96 (64 per cent) extremely liked it, where as 40 (26.6 per cent), 13 (18.7 per cent) and 1(0.7 per cent) liked milk and milk products, not liked it very much and not at all liked it respectively.

With regards to meat, fish and egg 100 (66.7 per cent) of respondents did not even tasted it while 32 (21.3 per cent) extremely liked it. An equal number of respondents 9 (6 per cent) each liked it and not liked flesh foods very much.

From 150 respondents about 58 (38.7 per cent) respondents not liked fats and oil very much, 44 (29.3 per cent) not at all liked it, 39 (26 per cent) liked it and 9 (6 per cent) extremely liked it.

The preference of respondents for sugar and Jaggery revealed that 90 (60 per cent) liked it, 27(18 per cent) not liked it very much, 19(12.7 per cent) extremely liked it and 14 (9.3 per cent) not at all liked it.

Considering the preference for nuts and oil seeds, it was evident that 86 (57.3 per cent) liked it, 37 (24.7 per cent) extremely liked it while 15 (10 per cent) not at all liked it and 12 (8 per cent) not liked it very much.

Preference for mushroom showed that about 72 (48 per cent) did not taste it, 67 (44. 7 per cent) extremely liked it, 8(5.3 per cent) liked it and only 3 (2 per cent) respondents not liked it very much.

Preference score for various food groups among respondents was assessed by assigning scores ranging from 0 to 4 depending on their preference. Based on these scores, preference score for each food group was determined using the formulae suggested by Reaburn *et al.* (1979). The formula was appended in Appendix-XIV.

Based on the preference score obtained by respondents for individual food groups, they were classified to highly preferred ones, medium preferred ones and low preferred ones. Highly preferred foods were those with scores above (mean + standard deviation), medium preferred foods were those with scores between (mean – standard deviation and mean + standard deviation) and low preferred foods were those with score less than (mean-standard deviation). Foods according to the order of preference among the respondents are indicated in Table 22 (a), 22 (b) and 22 (c).

Table 22 (a). Highly preferred foods among respondents (scores above 91.42)

Food groups	Preference score
Cereals	92.68
Green leafy vegetables	91.83

Table 22 (b). Medium preferred foods among respondents (scores between 51.7 and 91.42)

Food groups	Preference score
Pulses	73.15
Roots and tubers	58.00
Other vegetables	90.80
Fruits	89.98
Milk and milk products	88.48
Sugar and jaggery	69.03
Nuts and oil seeds	74.18
Fats and oils	52.18

Table 22 (c). Low preferred foods among respondents (scores below 51.7)

Food groups	Preference score
Meat, fish and egg	28.80
Mushroom	49.68

Highly preferred foods among respondents were found to be cereals and green leafy vegetables. Low preferred foods were identified as meat, fish, eggs and mushroom. Foods like pulses, roots, tubers, other vegetables, fruits, milk and milk products, sugar, Jaggery, nuts, oils seeds, fats and oils were found to be their medium preferred foods.

Table 23. Distribution of respondents based on their preference score for *Proteinaceous foods

Preference score	Distribution of respondents	
	Number	Percentage
Above 18.5 (Highly preferred)	37	24.7
14 – 18.5 (Medium preferred)	62	41.3
Below 14 (Low preferred)	51	34.0
Total	150	100

* Proteinaceous foods includes both rich and good sources of protein like meat, fish, eggs, milk and milk products, nuts, oil seeds, pulses, mushroom and cereals.

According to Gopalan *et al.* (1991) rice contains less protein (7 per cent) than wheat and other cereals, but its quality is better. However, cereals as they are consumed in large amounts daily, they contribute a considerable amount of protein to the daily intake.

It is evident from Table 23 that majority of respondents 62 (41.3 percent) shows medium preference towards proteinaceous foods while 37 (24.7 percent) and 51 (34 percent) shows high and low preference towards proteinaceous foods respectively.

Proteinaceous foods includes both rich and good sources of protein like meat, fish, eggs, milk and milk products, nuts, oilseeds, pulses, mushroom and cereals.

A highly positive and significant association was obtained between preference score for mushroom and preference score for proteinaceous foods ($\gamma = 0.7340^{**}$) as concealed from Appendix-XIII.

The average food preference score obtained by respondents were determined and details are presented in Table 24.

Table 24. Distribution of respondents based on average food preference score

Average food preference score	Distribution of respondents	
	Number	Percentage
< 0.6 (Low preference score)	14.3	10
0.6 – 3.4 (Medium preference score)	74.4	50
> 3.4 (High preference score)	61.3	40
Total	150	100

The range such as low, medium and high preference scores was obtained by calculating standard deviation (σ) and mean ($\overline{X}$). Preference score (x) is said to be low if x is less than $\overline{X}$ - σ ($x < \overline{X} - \sigma$), medium if x is between and $\overline{X}$ - σ and $\overline{X}$ + σ ($x = \overline{X} - \sigma$ to $\overline{X} + \sigma$) and high if x is greater than $\overline{X}$ + σ ($x > \overline{X} + \sigma$).

Table 24 reveals that out of 150 respondents about 74.4 (50 percent) had the average preference scores between 0.6 and 3.4. 61.3 (40 per cent) respondents had preference scores above 3.4 while only 14.3 (10 percent) had scores below 0.6.

(iii) Protein intake

(a) Actual food intake

The actual food intake of respondents were assessed through single day food weighment method. Comparison of diets were made with the RDA suggested by ICMR (1999). The average quantity of foods consumed by respondents obtained from actual food weighment are presented in Table 25.

Table 25. Actual food intake of respondents estimated by weighment method (ICMR-1999)

Food stuffs	Vegetarians				Non-vegetarians			
	Food intake ((g) (mean)	RDA	Variation	Per cent diet adequacy	Food intake ((g) (mean)	RDA	Variation	Per cent diet adequacy
Cereals	265.40	260	-5.40	102.00	268.00	250	-18.00	107.20
Pulses	23.80	60	36.20	39.67	18.00	50	32.00	36.00
Green leafy vegetables	7.36	100	92.64	7.36	33.25	100	66.75	33.25
Other vegetables	41.00	75	34.00	54.67	9.90	75	65.10	13.20
Roots and Tubers	69.45	50	-19.45	138.90	29.00	50	21.00	58.00
Fruits	55.00	60	5.00	91.67	11.87	60	48.13	19.78
Milk	250.00	400	150.00	62.50	191.20	250	58.80	76.48
Fats and oils	20.12	30	9.88	67.00	22.00	35	13.00	62.85
Sugar and jaggery	35.90	30	-5.90	119.67	21.50	30	8.50	71.66
Flesh foods (Meat, fish and egg)	-	-	-	-	43.75	90	46.25	48.60
Ground nut	4.36	50	45.64	8.72	-	30	-	-
Oil seeds	27.90	$	-	-	55.00	$	-	-
Processed products	79.78	$	-	-	135.90	$	-	-
	N = 110				N = 40			

$ - Not available

*N – Number of respondents

As revealed in the table, the intake of cereals was found to be higher than the suggested allowances of ICMR in both vegetarians and non-vegetarians. In the case of vegetarians the intake of roots and tubers and sugar and jaggery was found to be greater while in the case of non-vegetarians only 58 and 71.66 per cent respectively of the RDA were met. Intake of all the other foods were found to be below the RDA in both vegetarians and non-vegetarians. Intake of green leafy vegetables, other vegetables, fruits and milk were found to be 7.36, 54.67, 91.67 and 62.5 per cent

respectively of the RDA in vegetarians and 33.25, 13.2, 19.78 and 76.48 per cent respectively of the RDA in non-vegetarians.

The intake of fats and oils was about 67 and 62.85 per cent of the RDA in vegetarians and non-vegetarians respectively. In the case of vegetarians the intake of groundnut was only about 8.72 per cent of the RDA. While its intake was not observed in non-vegetarians. It was observed that only about 48.6 per cent of RDA was met in relation to the intake of flesh foods in non-vegetarians.

(b) Protein intake

The average protein intake of the respondents are depicted in Table 26. This table depicted that the percentage of RDA met by vegetarians and non-vegetarians with regard to protein were 87 and 104.2 per cent respectively.

Table 26. Protein intake of respondents estimated by weighment method. (ICMR- 1999)

	Protein intake (Mean) (g)	RDA	Variation	Per cent diet adequacy
Vegetarian (N = 110)	43.54	50	6.46	87.0
Non-vegetarian (N = 40)	52.14	50	-2.14	104.2

*N = Number of respondents

4.1.C Knowledge on Mushroom Cultivation

Knowledge of respondents on mushroom cultivation were assessed and are given in Table 27.

Table 27. Distribution of respondents based on their knowledge on mushroom cultivation

Knowledge on mushroom cultivation	Distribution of respondents	
	Number	Percentage
Know	10	6.7
Don't know	140	93.3
Total	150	100

Table 27 conceals that out of 150 respondents about 140 (93.3 per cent) respondents didn't know the technology of mushroom cultivation while 10 (6.7 per cent) know its cultivation technology.

4.2 Sub sample (Seventy five respondents)

4.2.A. Acceptance and preference score of demonstrated mushroom recipes

Six standardised mushroom recipes namely mushroom soup, mushroom omelette, mushroom tikki, mushroom cutlet, mushroom pakora and mushroom pickle were demonstrated to the respondents and the acceptance score interms of organoleptic qualities like appearance, flavour, colour, taste and texture; general or over all acceptability score (pooled scores) and also preference score rated on a four point scale for each recipes were assessed. The results were given in Table 28.

Table 28. Ranking mushroom recipes (Mean scores)

Recipes	Appearance	Flavour	Colour	Texture	General / overall acceptability score (Pooled score)	Recipe preference score
Mushroom soup	247.0	233.0	269.2	254.5	249.3	196.5
Mushroom omelette	177.1	200.4	172.4	195.0	166.2	172.5
Mushroom tikki	263.0	235.0	239.5	236.0	250.0	268.5
Mushroom cutlet	204.0	218.0	188.0	199.0	199.1	235.5
Mushroom pakora	196.0	215.0	200.0	229.3	206.0	229.5
Mushroom pickle	267.0	262.0	284.2	240.0	283.0	250.5
χ^2 (Chi square)	40.31**	11.23**	53.80**	14.03**	40.69**	39.82**
Critical value	41.69					

** Significant at 1 per cent level of probability

From Table 28 it was evident that rank means scores of flavour, colour, taste and texture, over all acceptability and preference of each recipe significantly differs from each other.

(i) Acceptance score

Acceptance score was determined interms of organoleptic qualities like appearance, flavour, colour, taste and texture of mushroom preparations

Appearance

In the case of appearance mushroom pickle was found to be the best followed by mushroom tikki, mushroom soup, mushroom pakora, mushroom cutlet and mushroom omelette.

The mean scores of ranks of appearance when compared with critical value obtained as observed from Table 28 showed that mushroom pickle, mushroom tikki and mushroom soup were not significantly different from each other while mushroom pickle and mushroom cutlet, mushroom pickle and mushroom pakora, mushroom pickle and mushroom omelette shows significant difference between each other. It was also observed that mushroom cutlet, mushroom pakora and mushroom omelette were not showing any significant difference with each other.

Flavour

The scores for flavour shows that mushroom pickle has got highest score followed by mushroom tikki, mushroom soup, mushroom cutlet, mushroom pakora and mushroom omelette.

When means scores of flavour was compared with critical value, it was found that the mean scores between mushroom pickle, mushroom tikki and mushroom soup; mushroom soup, mushroom cutlet, mushroom pakora and mushroom omelette were not significantly different from each other while significant difference were noticed between mushroom pickle and mushroom cutlet, mushroom pickle and mushroom pakora and mushroom pickle and mushroom omelette.

Colour

The highest score for colour was found to mushroom pickle followed by mushroom soup, mushroom tikki, mushroom pakora, mushroom cutlet and mushroom omelette.

The mean scores of ranks of colour when compared with critical value revealed that rank mean scores of mushroom pickle and mushroom soup have no significant difference while rank mean scores of mushroom pickle and mushroom

tikki, mushroom pickle and mushroom pakora, mushroom pickle and cutlet, mushroom pickle and mushroom omelette were significantly different. There were no significant difference noticed between mushroom soup and mushroom tikki, mushroom tikki and pakora and also between mushroom pakora, mushroom cutlet and mushroom omelette. Mean scores of ranks between mushroom soup and mushroom pakora, mushroom soup and mushroom cutlet, mushroom soup and mushroom omelette, mushroom tikki and cutlet and mushroom tikki and mushroom omelette were found to be significantly different.

Taste

The taste of mushroom pickle was seemed to be best followed by mushroom tikki, mushroom cutlet, mushroom pakora, mushroom soup and mushroom omelette.

The mean scores of ranks of taste between mushroom pickle and mushroom soup, mushroom pickle and mushroom omelette; mushroom tikki and mushroom soup, mushroom tikki and mushroom omelette; mushroom cutlet and mushroom omelette, mushroom pakora and mushroom omelette showed significant difference when compared with critical value while rank mean scores between mushroom pickle, mushroom tikki, mushroom cutlet and mushroom pakora; mushroom pakora and soup; mushroom soup and mushroom omelette showed no significant difference when compared to critical value.

Texture

In the case of texture mushroom soup was found to be the best followed by mushroom pickle, mushroom tikki, mushroom pakora, mushroom cutlet and mushroom omelette.

Rank mean scores in the case of texture of recipes showed significant

difference between mushroom soup and mushroom cutlet, mushroom soup and mushroom omelette and mushroom pickle and mushroom omelette while there were no significant difference noticed between mushroom soup, mushroom pickle, mushroom tikki and pakora; mushroom pickle and mushroom cutlet; mushroom tikki, mushroom cutlet and mushroom omelette and also between mushroom pakora, mushroom cutlet and mushroom omelette when compared to critical value.

General / over all acceptability

The over all acceptability scores / pooled scores of recipes (ie, pooled up scores of different quality attributes such as appearance, flavour, colour, taste and texture of each mushroom recipe) depicted that highest mean score was for mushroom pickle followed by mushroom tikki, mushroom soup, mushroom pakora, mushroom cutlet and mushroom omelette.

In comparison to critical value the rank mean scores between mushroom pickle and mushroom pakora, mushroom pickle and mushroom cutlet; mushroom pickle and mushroom omelette; mushroom tikki and mushroom pakora; mushroom tikki and mushroom cutlet, mushroom tikki and mushroom omelette, mushroom soup and mushroom pakora; mushroom soup and mushroom cutlet; mushroom soup and mushroom omelette revealed significant difference where as mushroom pickle, mushroom tikki and mushroom soup, mushroom pakora, mushroom cutlet and mushroom omelette were not showing any significant difference.

(ii) Preference Score

Among six recipes mushroom tikki was seemed to be highly preferred followed by mushroom pickle, mushroom cutlet, mushroom pakora, mushroom soup and mushroom omelette.

While considering the rank means scores of recipe preference score which was compared with the critical value, it was observed that scores between mushroom tikki, mushroom pickle, mushroom cutlet and mushroom pakora; mushroom cutlet and mushroom soup; mushroom pakora and mushroom soup; mushroom soup and mushroom omelette were not significantly different. The scores between mushroom tikki and mushroom soup, mushroom tikki and mushroom omelette; mushroom pickle and mushroom soup; mushroom pickle and mushroom omelette; mushroom cutlet and mushroom omelette; mushroom pakora and mushroom omelette were significantly different.

4.2.B Knowledge gain

Knowledge gain of respondents were assessed by using a check-list of 20 knowledge items on mushroom use before and after the education programme. Each question was given a unit score for one correct answer and zero for wrong answer. The difference between pre and post score was taken as knowledge gain of an individual. The possible range of knowledge gain was between 0 and 20.

(i) Pre-knowledge score

Table 29. Distribution of respondents based on their pre-knowledge score

Pre-knowledge score	Distribution of respondents	
	Number	Percentage
< 7.73 (Low)	14	18.6
7.73 – 15.33 (Medium)	47	62.8
> 15.33 (High)	14	18.6
Total	75	100

Low, medium and high knowledge scores were assessed by calculating standard deviation (σ) and mean ($\overline{X}$), knowledge score (x) is said to be low if x is less than $\overline{X}$ - σ ($x < \overline{X} - \sigma$), medium if x is between $\overline{X}$ - σ and $\overline{X}$ + σ ($x = \overline{X} - \sigma$ to $\overline{X} + \sigma$) and high if x is greater than $\overline{X}$ + σ ($x > \overline{X} + \sigma$).

It was evident form Table 29 that out of 75 respondents an equal number of respondents each viz., 14 (18.6 per cent) respondents were scored both low and high while 47 (62.8 per cent) respondents were medium scorers.

(ii) Post-knowledge score

The results of post-knowledge score as viewed from Table 30 showed that each respondent scored greater than 15.33, thus 100 per cent of respondents scored high marks (i.e., >15.33).

Table 30. Distribution of respondents based on their post-knowledge score

Post-knowledge score	Distribution of respondents	
	Number	Percentage
< 7.73 (Low)	-	-
7.73 – 15.33 (Medium)	-	-
> 15.33 (High)	75	100
Total	75	100

4.2.C Extent of adoption

Adoption of both consumption and cultivation aspects of mushroom after one month (30 days) of education programme were assessed by rating the frequency of mushroom consumption, opinion on spawned bed supply, yield from supplied bed,

raising of mushroom and yield difference between supplied spawned bed and self-made beds.

Frequency of mushroom consumption after education programme were assessed and results obtained are given in Table 31.

Table 31. Distribution of respondents based on frequency of mushroom consumption

Frequency of mushroom consumption	Distribution of respondents	
	Number	Percentage
On special occasion	14	18.7
Once in a month	21	28.0
Once in a week	26	34.6
Twice in a week	14	18.7
Not consuming mushrooms	-	-
Total	75	100

Table 31 depicts that out of 75 respondents about 26 (34.6 per cent) respondents consumes mushroom once in a week while 21 (28 per cent) consumes mushroom once in a month. An equal percentage each viz., 14 (18.7 per cent) of respondents consumes mushroom on special occasion and twice in a week.

Opinion of respondents on spawned bed supply were assessed and results are given in Table 32.

Table 32. Distribution of respondents based on their opinion about spawned bed supply

Opinion about spawned bed supply	Distribution of respondents	
	Number	Percentage
Good	38	51
Bad	-	-
Encouraging	13	17
Less work	24	32
Total	75	100

Table 32 shows that 51 per cent of respondents had the opinion that spawned bed supply method was good, 32 per cent opined that there was only less work in growing mushrooms from a supplied spawned bed while 17 per cent considered it as encouraging.

Yield obtained from spawned bed supplied were enquired and are given in Table 33.

Table 33. Distribution of respondents based on yield obtained from supplied bed

Yield (g)	Distribution of respondents	
	Number	Percentage
< 582.45 (Low)	14	19
582.45 – 833.14 (Medium)	52	69
> 833.14 (High)	9	12
Total	75	100

Low, medium and high yield were assessed by calculating standard deviation (σ) and mean ($\overline{X}$). Yield (x) is said to be low if x is less than $\overline{X} - \sigma$ ($x < \overline{X} - \sigma$), medium if x is between $\overline{X} - \sigma$ and $\overline{X} + \sigma$ ($x = \overline{X} - \sigma$ to $\overline{X} + \sigma$) and high if x is greater than $\overline{X} + \sigma$ ($x > \overline{X} + \sigma$).

It was evident from Table 33 that about 69 per cent of respondents got medium yield, 19 per cent got low yield and 12 per cent has got high yield.

Respondents who have purchased spawn and raised mushroom after education programme were inferred and details were depicted in Table 34.

Table 34. Distribution of respondents based on buying of mushroom spawn and raising of mushroom

(a) Purchased spawn	Distribution of respondents	
	Number	Percentage
Purchased	70	93
Not purchased	5	7
Total	75	100
(b) Raised mushroom	Distribution of respondents	
	Number	Percentage
Raised	69	92
Not raised	8	8
Total	75	100

Table 34 depicted that about 93 per cent and 92 per cent of respondents purchased spawn and raised mushroom respectively while 7 per cent and 8 per cent of respondents did not purchase spawn and raised mushroom from it respectively.

Difference in yield of mushroom obtained between supplied spawned beds and self made beds were assessed and results are depicted in Table 35.

Table 35. Distribution of respondents based on yield difference obtained between supplied spawned beds and self-made beds

Yield difference between supplied spawned beds and self made beds	Distribution of respondents	
	Number	Percentage
No difference	7	9.4
More yield from supplied spawned beds	67	89.3
More yield in self-made beds	1	1.3
Total	75	100

Table 35 reveals that about 89.3 per cent of respondents got more yield from supplied spawned bed while 1.3 per cent got more yield from self-made beds. About 9.4 per cent of respondents did not notice any difference in yield between beds supplied and self-made beds.

DISCUSSION

5. DISCUSSION

The salient findings of the study 'Impact of nutrition education on mushroom consumption' based on sample (one hundred and fifty respondents) and sub sample (seventy five respondents) are discussed under following heads.

5.1 Sample (one hundred and fifty respondents)

A . Socio- economic variables

B. Dietary variables

(i) Food Habits

(ii) Food Preferences

(iii) Protein intake.

C. Knowledge on mushroom cultivation

5.2 Sub sample (Seventy five respondents)

A. Acceptance and preference score of demonstrated mushroom recipes.

B. Knowledge gain

C. Extent of Adoption

5. 1. Sample (one hundred and fifty respondents)

5.1.A Socio-economic variables

Socio-economic factors have a definite bearing on the dietary habits of the people and there by on their dietary intake and nutritional status (Juna, 1999). Derby (1976) reported that among the various factors affecting the nutritional

status of an individual, diet with its close association with socio-economic factors emerge as an important force of influence. There is an increasing awareness of the relationship between malnutrition and socio economic factors. According to Nanba and O'Keefe (1985) poor socio-economic conditions are the root cause of most of the malnutrition problems. Devadas and Eswaran (1986) had opined that food habits of the people depended on availability of food, which inturn was influenced by climate, socio-economic conditions and cultural environment. According to Ghosh (1989) social factors like religion, occupation, economic status, education, beliefs and culture had important bearing on health. To assess the socio-economic status, details pertaining to the type of family, family size, monthly income and caste are to be ascertained (Srishi, 1985)

Cole (1981) reported that an understanding of behaviour science is basic for selecting teaching methods as extension deals first with people and then with subject matter. In the present study socio-economic variables were assessed to formulate proper teaching aids for the implementation of appropriate nutrition education.

1. Age

In the present study, 34 percentage of the respondents surveyed, belonged to the age group between 41-50 years. This is in accordance to the observation made by Roy (1966) where he stated that the effectiveness of lecture, group discussion and bulletin was influenced by the age of respondents. He also found that age affected the learning capacity of the respondents. Respondents above 35 years of age had a high learning capacity. It has been observed by

Arora (1991) reported that caste is an unique institution of the Indian society. Hence caste system of 150 families were analysed and it was observed that majority of families belonged to forward caste. Similar findings can be seen in results of survey conducted by Lisa (1996).

According to Khader and Padmavathi (1991) consumption of mushroom is not yet popularised in local community where people are so religious minded and hesitant to use mushroom as food in their daily life and that is why in this study religion and caste of families are taken into consideration so that such false notions can be eliminated through nutrition education.

3. Educational status

The level of education of respondents were recorded in this study. Since it can be related to awareness pertaining to health care. In this study it was observed that the present generation was better educated than the older generation. It was also observed that majority (27 per cent) of respondents had education above degree. So, as the education increases their preference for proteinaceous foods and mushroom also increased. Significant difference was noted between education and preference for proteinaceous foods. A highly positive significant association was found between the education of respondent and preference for mushroom.

Similar observation was reported by Huffman *et al.* (1985) that educational status and literacy rate have been proved to be powerful determinants of nutritional status as it may influence the awareness about importance of good nutrition, which can affect food choice.

According to Park and Park (1991) those who are well educated will be placed in higher positions, drawing a good salary, which will increase the purchasing power of family. In this study education of respondents and their income seemed to have significant difference. As the education increases there is an increase in income level also.

Sujatha and Annamalai (1998) observed that better the education greater would be the knowledge gain and adoption. This finding is in agreement with Venkatakrishnan (1991), Joseph *et al.* (1991) and Kumar *et al.* (1994). Supporting to the above findings, in the present study also majority of respondents were with education above degree and hence, there seemed to be greater knowledge gain and extent of adoption regarding mushroom cultivation and consumption.

4. Family Size

Family size is an important social factor that is reported to influence nutritional status and hence distribution of families according to family size were analysed.

The present study reveals that small sized families (1-4 members) were found to be more popular in this community. According to Park and Park (1991) the average family size in India is four. Predominance of nuclear type families among families residing in Thiruvananthapuram has been reported by Sadasivan *et al.* (1980), Suja (1989) and Lovely (1996).

This reveals the recent social trend universally observed, where there is failing of joint family system brought in by the social processes such as urbanisation which has ushered in the spread of nuclear family system, where the husband, wife and their children reside under one- roof. The small family norm might also be due to higher female literacy and consequent exposure to information through mass media. The other factors contributing to reduction in house hold size can be emigration of male adults in search of employment and also fall in birth rate, which are two characteristics of modern Kerala. This small family norm is of great social significance, since it has a direct influence on the percapita availability of income, as well as food . These in turn would have a direct and favourable impact on the nutritional status of families.

5. Family composition

It has been observed from present study that female population predominates males. This follows the general sex ratio of Kerala or Thiruvananthapuram district which according to census figures there are more number of females compared to males (Manorama Year Book, 1999). This is a secular trend in Kerala as a whole. Similar findings were observed in surveys of Gincy (1987) and Karuna (1993).

As there are more adult females, they all might help in cooking. So the group selected were proper one to have nutrition education so that they can contribute much to health.

It may also be noted that the child population is low when compared to adults. This reflects the changing demographic profile in India in general. Park

and Park (1991) has reported that the demographic profile of India is fast changing and is characterised by adult population forming 60 per cent and young population forming 40 per cent. A similar trend was reported by the Kerala Statistical Institute (1992). In their survey, where they observed a decrease in the percentage of population in the younger age group (0-14) and an increase in the percentage of population in the older age group of 60 and above in Kerala. Reports of surveys done by Laisamma (1992) and Lisa (1996) were also supportive to this aspect.

The present study reveals that there is a significant difference between number of adults in the families and monthly income of the family. As number of adults in the family increases there is an increase in monthly income also.

6. Monthly Income

The economic status directly or indirectly influences the purchasing power and standard of living. Arora (1991) suggests that household income should be taken into consideration because it is the family income which really determines the family's status and the socio-economic strata of the society to which they belong.

The present study indicates that majority of families (72 per cent) belongs to middle income group. A highly significant and positive correlation is observed between monthly income and preference score for mushroom. This might be because as mushroom is an expensive item, its intake is highly subject to income variation. In this study as the respondents mainly consist of middle income group; they need to acquire knowledge about mushroom cultivation so that they

can produce their own mushroom and can consume them thus can avoid protein deficiency.

The income can also influence the knowledge gain. Vishnoi and Bose (1961) reported that income has influence on the gain in knowledge by the respondents. Somasundaram and Singh (1978) found significant correlation between knowledge gain and income in the case of adaptors. Hundred percent knowledge gain of respondents was observed in the present study and one reason might be majority of them belonged to middle income group.

7. Employment status

Occupational status of the respondents were selected because wide variations were observed in the selected respondents. Dandekar and Rath (1971) had reported that due to unemployment and under employment atleast 30.00 per cent of the population in India were living below the poverty line.

Though majority of the respondents in the present study had education above degree, the percentage of unemployed respondents (57 per cent) were more. Rampant unemployment among the educated was also evident from the fact that 27 percent of the respondents possessed postgraduate degrees. This might be due to lack of job opportunities and also majority of respondents were housewives. For these reasons it was obvious that these respondents were most suitable candidates who could be motivated to undertake mushroom cultivation as an avenue for self-employment. Pillai and Bhaskaran (1991) in their findings

of the study - Mushroom cultivation, a self employment avenue for rural youth – reported that most of the respondents had general education with out any technical know-how and this would naturally lead to insecurity in their life amidst unemployment problem and according to them that may be one reason why the youth preferred to have mushroom cultivation as their self employment enterprise

Housewives who were not job oriented could improve both their and their family's nutritional status by cultivation and consumption of mushroom.

8. Participation in nutrition education classes

It was inferred from the present study that most of the respondents (81 per cent) had not participated in any nutrition education classes. This might be due to lack of time as most of them were housewives. Hence they could not be abreast with the latest development in the field of nutrition, which inturn can have adverse effects in their dietary habits. In this study, it is encouraging to note that the group selected could be real beneficiaries.

9. Exposure to information sources

Exposure to mass media is assessed by determining their familiarity with different medias which are most popular in the state (Gincy, 1987). Siddaramiah and Rajanna (1984) and Chandrakandan (1980) opined that a communicable fact should be disseminated in such a way that it will motivate people to direct action. In their view, continuous exposure to various tools of communication is the key for successful motivational and action led flow of information. Sripal

(1978) established a positive relationship between knowledge gain and mass media exposure. Selvaraj and Knight John (1985) reported that mass media participation has no significant influence in the gain in knowledge.

According to Furhan and Gunter (1990) majority of adolescents were in the habit of watching television programmes daily. The finding in the present study also supports this. In this study about 52.7 percent of respondents gets information from television. Communication through mass media like television has got advantages over other media because of its mass coverage (Philip *et al.* 1998)

5.1.B. Dietary variables

(i) Food Habits

Food is the major vehicle for affecting improved nutrition of people and hence assessment of food consumption and food habits of the people should form an integral part of the evaluation of any nutrition intervention programme (Chavez and Ruth, 1984).

1. Dietary habit

Dietary habits of the people depended on the availability of food, which was observed to be influenced by the climate, socio-economic, cultural variables, environment, religion, superstitions and ignorance (Devadas and Eswaran, 1986).

Stephanie (1984) opined that in South India only about 28.00 per cent of the total population is completely vegetarian and veganism is virtually unknown. But the finding of present study doesn't support that as it was evident that

majority of respondents (73 percent) were vegetarians and only about 2 per cent were ovo-vegetarians, while remaining were non-vegetarians. This might be because of two factors. One is the ethical or religious belief. The second factor is income, because meat and fish are expensive items of food (Achaya, 1995). He also reported that upper income groups are vegetarians through belief, lower ones through income scarcity. In this study majority belonged to middle and upper income groups. Though many of the respondents were vegetarians, their family members were not seemed to be pure vegetarians.

According to Dwyer (1996) different philosophical and religious groups have advocated vegetarian diets for philosophical as well as health reasons. In his view, in Eastern countries Jainism, Buddhism, Hinduism, Zoroastrianism and sects in other Eastern religions have stressed vegetarianism. The present study indicated that most of the respondents were Hindus and belonged to forward caste. Another reason for avoiding non-vegetarian diet was due to health reasons. Some of the respondents had to reduce the fat intake because of various health problems like atherosclerosis, obesity, hypertension, diabetes, and coronary heart diseases. Again as majority of respondents belonged to middle-aged group, they were more prone to those diseases. These might be the reasons because most of them restricts to vegetarian diets.

2. Foods avoided on health reasons

In the present study, it is interesting to note that majority of the respondents (69.3 per cent) were not avoiding any food items on account of any health reasons. This might be because most of them were well educated. Similar

observations were reported by Carlo *et al.* (1987) that better educated people experienced substantially lower risks of diabetes, hypertension and heart diseases etc.

Though majority were free from any disease condition, few respondents (30.7 per cent) were found to have diseases like flatulence (14.7 per cent), diabetes (6 per cent) hyper tension (4 per cent) and coronary heart diseases (6 per cent). They avoided foods like tubers, pulses, fats, oils, sugar and jaggery as evident from table 13.

According to Kurade *et al.* (1998) mushrooms, on account of its richness in dietary fibre, proteins, low calorific value and absence of cholesterol, find application in diet therapies treating obesity, diabetes and coronary heart diseases. Hence mushroom was a good alternative for respondents who had health problems.

3. Commonly used preparation methods

It is evident from the present study that boiling was the commonly adopted method by the families for cooking milk, egg, roots and tubers. While boiling and straining was commonly practiced (88 per cent) for cooking cereals. In the case of pulses, green leafy vegetables and other vegetables most of the families stuck to steaming and seasoning while 60 per cent of families practiced steaming method for flesh foods. These findings was similar to that of Laisamma (1992) and Suja (1989)

It is inferred from the present study that majority used the above methods as it was habitual, some considers their preference for family members and for easy cooking while only a few concerns about nutrient loss.

4. Habit of dining out

The present study reveals that while 45.3 per cent of subjects used to take food outside home only on certain occasions, only 32.7 per cent had the habit of dining out and remaining didn't dine out. This trend was also observed by Leena (1990). This indicates that most respondents preferred home made foods and as majority were housewives they lack time to go and dine out.

5. Habit of buying food from hotels.

Majority of respondents seemed to avoid buying food from hotels there by loosing their chance to taste novel recipes.

6. Reasons for excluding favourite foods

Vast majority of respondents cited unaffordability as a reason in excluding their favourite foods there by limiting their family expenditure. Quiogue (1970) found that lower the income greater was the percentage spent on food. In present study majority belonged to middle income group, so they were sacrificing their favourite foods for limiting their family budget. The same trend was observed by Leena (1990) where she reported that though majority of families had income above Rs. 2000, only 35 per cent of their income were spent on food.

Apart from these facts, all of them showed much willingness to try out new recipes, there by, it was assured that they made ideal participants for this study.

7. Mode of use of mushroom

It was seen that about 48 per cent have not yet chanced upon any mushroom savouries whereas 52 per cent of respondents have tried out mushroom cuisines at hotels (14 per cent), at friend's (10 per cent) and the rest (28 per cent) have tried them out at home. This shows that mushroom is surely gaining importance among our population.

8. Opinion on mushroom consumption

Despite of the fact that majority of the respondents had no idea about consumptional value of mushroom, 42 per cent considered it fit for health while seven per cent where of the opinion that it was unfit.

The reasons given by them was that all mushrooms were poisonous and are non-vegetarian item. Similar findings were quoted by Wright *et al.* (1988) and Benjamin and Anuradha (1991).

Wright *et al.* (1988) had opined that though the cultivated mushrooms are apparently non-toxic , majority of people have the apprehension that mushrooms being basically fungi may have some toxic components that may show cumulative effects on regular consumption.

According to Benjamin and Anuradha (1991) reasons given by non-consumers for avoiding mushroom were mainly cost, taste, caste / religion, false

believes and lack of knowledge. Some avoided it on particular days as it was considered as a non-vegetarian item.

9. Family members taking food from outside

Among the families surveyed majority (40 per cent) were not observed to be taking food outside home. In most families (33 per cent) head of the family is taking food out side home followed by son and daughter. This might be because of their job and school schedules respectively. It is interesting to note that even in this modern era where most people like to take fast foods outside home, majority of respondents in this study preferred home –made foods.

(ii) Food Preferences

According to Eggert (1984) food preference are formed as a result of the complex interaction of many factors in an individual's environment. These preferences play a critical role in influencing food choices and consumption. Bull (1988) opined that adolescent's food preference and food selection were influenced by social and external pressures.

Food preferences of the adolescents were assessed. Results indicated that a vast majority of respondents extremely liked cereals. Mony (1993) enquired the adolescent's preferences for various preparations in his survey among agricultural labourers in Thiruvananthapuram city and cereal preparations were found to be the favourite item for respondents.

A higher percentage (38 per cent) of respondents recorded their 'likeness' towards pulses while only 29.3 per cent showed 'extreme likeness' towards it. In the case of

roots and tubers, most of the respondents did not like it very much. The percentage of respondents who extremely liked pulses, and roots and tubers were low and the reason found was that they wee suffering from flatulence. According to Achaya (1995) the gas forming nature of most pulses is a drawback. Beatrice (1999) in her finding reported that adolescents medially preferred pulses.

With regard to vegetables, green leafy vegetables, fruits, milk and milk products, majority showed 'extreme likeness'.

Riya (1994) reported that vegetables and fruits were moderately preferred food in households. Krishna Kumari (1983) found that intake of fruits by adolescents were negligible. In contrary to the above findings, in the present study, extreme likeness towards vegetables and fruits showed that now a days people are consuming more vegetables and fruits and are health conscious. Musgrave *et al.* (1981) reported that milk was found to be the most popular drink.

As majority of the respondents were vegetarians, a higher percentage does not seem to taste meat, fish and egg and also mushroom. According to Khader and Padmavathi (1991) consumption of mushroom is not yet popularised in local community.

NNMB (1989) reported that Kerala diets are found to be deficit in fats and oils. Similar pattern was observed in present study also where majority did not like fats and oils very much.

Sugar, jaggery, nuts and oils seeds were liked by majority of respondents. Robson *et al.* (1991) found that adolescents preferred sweet preparations such as cake, puddings and biscuits.

From the food preference score it was found that highly preferred foods of respondents were found to be cereals and green leafy vegetables, while low preferred foods were meat, fish, egg and mushroom. Foods like pulses, roots and tubers vegetables, fruits, milk and milk products, fats and oils, sugar and jaggery, nuts and oil seeds were identified to be their medium preferred foods .

Distribution of respondents according to their preference score for proteinaceous foods like meat, fish and egg, milk and milk products, nuts and oilseeds, mushroom, pulses and cereals indicated that most of the respondents (41.3 per cent) had medium preference for these foods while only (24.7 per cent) scored highest preference score.

Association between preference score for mushroom and protein rich foods showed that there is positive and significant correlation between each i.e., as the preference for protein rich foods increases there is also an increase in preference score for mushroom.

Assessment of average food preference score of respondents showed that a higher percentage of respondents scored medium preference for all foods. Similar trend can be observed in findings of Mony (1993).

The deep-rooted food habits inhabited by the families might have influenced their preferences.

(iii) Protein intake

(a) Actual food intake

Among different methods of diet surveys weighing of raw and cooked food is the most reliable one (Begum,1995). The actual food intake of respondents were assessed

through single day food weighment method. Results indicated that the intake of cereals were higher than RDA in both vegetarians and non-vegetarians, while the intake of roots and tubers and sugar and jaggery were seemed to be higher only in the case of vegetarians . According to Johnson *et al.* (1994) the daily diet in most of the women comprised of energy rich food articles like cereals, sugar and fats and oils. In the present study intake of fats and oils were lower than RDA. Kerala diets are found to be deficit in fats and oils (NNMB, 1989).

According to NIN (1993) 96 per cent of the population consumes an inadequate level of pulses as compared to cereals. Similar trend was observed in this study also. Surveys conducted by Food and Nutrition Board (1989) reported that only 50g of flesh foods were consumed daily by middle-income group of Thiruvananthapuram district. In present study also only about 44 g of flesh foods were consumed daily when compared to 90g of flesh foods as suggested by ICMR (1999). The intake of all the other foods stuffs like green leafy vegetables, other vegetables, fruits, milk, nuts and oil seeds were also seemed to be lower than suggested RDA. This is in accordance with the findings of Juna (1999).

(b) Protein intake

Proteins are one of the most important nutrient required by the body and should be supplied in adequate amounts in the diet is an important measure of adequacy and quality of a diet (Gopalan *et al.*, 1991). Hence the protein intake was estimated. Results showed that the vegetarians (N = 110) were deficit in protein intake when compared to protein adequate non-vegetarians. In this study a vast majority of respondents were vegetarians and it was observed that only about 87 per cent of protein were met when

compared to RDA by ICMR (1999). Dwyer (1996) said that diets that are predominantly based on plant foods are generally moderate in calories and proteins. He also reported that plant proteins are rarely complete in themselves.

According to Dorothy *et al.* (1980) the main disadvantage of vegetarian diet is that it may lack sufficient amount of essential amino acids as they are limited in various plant foods. Probably prolonged consumption of such diets have resulted in deficient protein intake of respondents. Anjula and Kanwal (2000) reported that insufficient consumption of proteins results in the weakness of muscles and also stunted growth.

Excessive heat treatment particularly dry heat treatment affects the quality of vegetable protein by making some of the essential amino acids like lysine and methionine unavailable (Gopalan *et al.*, 1991). While heat treatment (boiling or deep frying) had only little effect on nutrients of mushrooms. Mushrooms are superior in protein content to all the vegetables and fruits (Hema, 1995). All essential amino acids are present in mushrooms and are rich in lysine and tryptophan (Rai, 1995).

Proteins are hard to just digest. Moreover undigested proteins rot and produce sulphurous gases which poison the blood-stream (Anjula and Kanwal, 2000). Ereifj and AL-Raddad (1999) reported that mushrooms are relatively high in digestible proteins among vegetable foods. Their proteins have 60 to 70 percentage digestibility (Kurade *et al.*, 1998). Hence supplementary value of mushroom protein in vegetarian diet is of considerable significance (Zakhary, 1990). Mushroom has been recognisd by FAO (1977) as food contributing to the protein nutrition of the countries depending largely on cereals. On account of

being cereal based, Indian diet suffers from inadequate protein content. Mushroom protein has been universally accepted to be superior to vegetable proteins and as good as animal protein. Mushrooms are there fore, recognisd as non-conventional source of protein, which can bridge the protein quality gap in the Indian diet (Kurade *et al.*,1998).

5.1.C. Knowledge on mushroom cultivation

The assessment of respondents about the knowledge on mushroom cultivation indicates that majority of respondents (93.3 per cent) were ignorant about its cultivation. Delmas (1978) and Manachre (1980) suggested that the cultivation and domestication of higher fungi should be undertaken and highlighted. It can be grown under different climatic conditions and on agricultural and industrial wastes. Suharban (1987) opined that growing of mushrooms can go a long way in the efficient utilisation of agricultural wastes. The spent substrate after mushroom cultivation can also be used as an animal and poultry feed or as a soil conditioner. As it is completely free from pesticide residues and risk due to its consumption is eliminated.

Among various training programmes of Tamil Nadu Agricultural University, the training on mushroom cultivation receives overwhelming response from the people because it is a viable enterprise that could be started as an on- farm activity/non farm activity/ self–employment activity by both rural and urban people in places where the ecological conditions are favourable (Murugesan *et al.*, 1998). According to Ranganathan and Somasundaram (1998) mushroom production is one of such activities which can easily be taken

especially by unemployed rural youth which provides substantial income. For example if it is continuously cultivated in an area of 5-10 cents, the net profit might be ten times more than that of continuous cropping of vegetables in one acre. Lakshmanan and Dharmalingam (1996) reported that a net profit of Rs.5000/ month on an investment of Rs.10,000 can be realised through oyster mushroom cultivation.

Successful cultivation of mushrooms on a commercial basis calls for an exposure of the future growers to mastery of technology so that it will provide avenue for a profitable self-employment (Rahiman and Nehru, 1983). According to Jayarajan (1990) growing edible mushroom is gaining momentum in recent years and with adequate financial assistance and market support, it could be developed into a sound agro-based industry providing employment opportunities particularly for the women folk.

In the present study, most respondents were unemployed housewives, and were not aware of mushroom cultivation technology. Their leisure time can be properly utilised by producing mushroom both on nutritious and profit basis. This necessitates the training for mushroom cultivation.

5.2 Sub Sample (seventy five respondents)

5.2.A. Acceptance and preference score of demonstrated mushroom recipes

(i) Acceptance score

Acceptability of demonstrated mushroom recipes were assessed in terms of organoleptic qualities like appearance, flavour, colour, taste and texture. Organoleptic

qualities play an important role in evaluating the quality of food products. Quality of a food is a combination of attributes that determines the degree of acceptability of the product. For an average consumer, the concept of food quality consists in those related to the sensory characterisitcs which may be classified in accordance with the human senses of perception as appearance, kinesthetics (texture), odour and taste (Setty, 1989). When the quality of food is assessed by means of human sensory organs, the evaluation is said to be sensory analysis. Sensory evaluation can be used to predict the acceptance of a food item (Jellinick, 1986 ;Clement and Kubena, 1989 and Mc Dermott, 1992). Rajalakshmi (1993) described sensory analysis as a scientific discipline used to evoke, measure, analyse and interpret reaction to these characteristic on food and materials as perceived by the sense of sight, smell, taste, touch and hearing. Quality parameters such as appearance, colour, flavour, texture and taste are assessed by means of human sensory organs.

According to Mc Larson (1984) the criteria included in food quality system are general acceptance, taste, appearance, texture and aroma of food. In the present study quality parameters such as appearance, flavour, colour, taste, texture and general / overall acceptability were assessed by respondents.

Appearance

The first impression about a food is usually visual and plays a major part in our willingness to accept it. As the preference to appearance is one of the major factor leading to the increasing demands of the product, it is very essential to keep the product quite attractive (Christen,1985). Appearance is a composite of all information about the product and its environment which reaches the eye(Birch *et al.*,1988)

The appearance of mushroom recipes were assessed by the respondents and highest mean score was for pickle and lowest was for omelette.

The highest score for mushroom pickle might be due to the attractive appearance of mushrooms at button stage that was visible in the pickle. In the case of omelette and other recipes like tikki, cutlet and pakora, mushrooms were stuffed inside and cannot be identified as mushroom cuisines.

Mean scores for appearance of six recipes when compared with the critical value showed that the scores obtained for 'pickle, tikki and soup' were not significantly different. Lowest scores similar to omelette was obtained for cutlet and pakora indicating that mean scores of 'omelette, cutlet and pakora' were not significantly different.

Flavour

Flavour is an important factor which enriches the consumer's preference to a particular food (Ranganna, 1984). Flavour is the unique character of odour and taste. A change can be attributed to alternation in chemical composition. According to Birch *et al.* (1988) flavour is the mingled but specific experience of sensation produced by a material taken in the mouth perceived principally by the senses of basic smell and by other cutaneous sensations in mouth.

Results indicated that among various mushroom recipes the highest and lowest mean scores were obtained for mushroom pickle and omelette respectively. Generally, the characteristic flavour of eggs were not liked by most people. In the case of mushroom omelette, flavour of egg predominates and that was the reason for its lowest score, whereas in mushroom pickle the subtle flavour of mushrooms were predominating

which was liked by all. The preparations like tikki, cutlet and pakora were having almost same flavour as they were all fried items.

Significant difference was not observed between mean scores of the ranks of 'pickle, tikki and soup' and also between tikki, soup, cutlet, pakora and omelette, when compared with critical value. The scores of tikki and soup were in between the highest rank mean score of pickle as well as lowest score of omelette. So the scores of both tikki and soup could be considered not so high as pickle and not so low as omelette. While cutlet and pakora could be considered as having lowest rank mean scores like omelette.

Colour

Colour is the most important character by which quality of food is judged. If the colour is unattractive, a potential consumer may not be impressed by the major attributes. Clydesdale (1989) reported that colour affected the perception of other sensory characteristics such as taste and flavour. According to the report from Central Food Technology Research Institute (1979-80) the aesthetic, safety, sensory characteristics and acceptability of food are affected by colour. The joint FAO and WHO expert committee on food additives recognised that colour has an effect on food choice (Huguetle, 1991). Jellinick (1986) reported that the first impression of food is usually visual and major part of our willingness to accept a food depends upon its colour.

Results of present study indicated that the rank mean scores were highest for pickle and lowest for omelette. It was inferred from respondents' attitude that majority liked the translucent nature of pickle as it was prepared in vinegar. The colours of other preparations like tikki, pakora and cutlet (golden brown), soup

(creamy white) and omelette (yellow) were common and was not that much accepted.

Preparations like 'soup'; 'pakora and cutlet' could be ranked as having highest and lowest scores respectively as significant difference were not noticed between mean scores of ranks of 'pickle and soup' and also between 'pakora, cutlet and omelette', when they were compared with critical value.

Taste

Taste is not only a sensory response to soluble materials but also aesthetic appreciation of the mouth. According to Rolls *et al.* (1981) in the various quality attribute tests, the first preference goes to taste followed by appearance, texture and colour.

In the case of taste the highest rank mean score was for pickle and lowest was for omelette. The sour taste of pickle was very much accepted by respondents as common pickles were too hot. Even though majority of respondents belonged to vegetarian category, the meaty and sour taste of mushrooms were liked by everyone. The taste of mushrooms were not dominating in other preparations like tikki, cutlet, pakora, soup and omelette and that might be the reason for their lower scores.

Comparison of rank mean scores of taste with critical value obtained showed that there is no significant difference between scores of 'pickle, tikki, cutlet and pakora' and 'omelette and soup'. This in turn indicates that scores of tikki,

cutlet and pakora could be ranged as highest as pickle while the scores of soup as lowest as omelette.

Texture

Texture is a percentage resulting from interaction between food and its consumer (Jack *et al.*, 1995). It constitute a physical property of food stuffs apprehended by the eye, the skin and muscle sense located in the mouth.

In the present study, soup has got the highest rank mean score. This is due to its smooth texture.

On considering the comparison between rank mean scores for texture and critical value, it was identified that the scores of pickle, tikki, pakora and cutlet were between the highest score of soup and lowest score of omelette.

General acceptance / over all acceptability

The over all acceptability depends on the concentration or amount of the particular components, nutritional and other hidden attributes of a food and its palatability or sensory quality. Indian Food Industry (1998) reported that the quality is the main criteria on which the acceptability of any product depends. Here, the over all acceptability scores were determined by pooling up the scores obtained for different quality attributes (appearance, flavour colour, taste and texture) of each mushroom recipe.

The pooled score showed that highest rank mean score was for pickle followed by tikki, soup, pakora, cutlet and omelette. Comparison of these pooled scores with critical value indicated that there is no significant difference between

pickle, tikki and soup and between pakora, cutlet and omelette. Hence, it could be assessed that tikki and soup has got almost highest scores as pickle while pakora and cutlet has lowest scores as omelette.

(ii) Preference Score

Acceptability of a product could be assessed by conducting preference test on a large number of consumers (Watts *et al.*, 1989)

It was assumed from the recipe preference score that highest preference was for mushroom tikki followed by pickle, cutlet, pakora, soup and omelette. Keralites are generally fond of cereal based preparations and as mushroom tikki is a combination of bread and mushroom, it was highly preferred by majority of respondents. Lowest score for mushroom omelette was mainly due to its characteristic flavour and taste of egg predominates the mushrooms rolled inside. Again most of respondents considered it as a common item of consumption.

Comparison of rank mean scores for preference with critical value showed that there was no significant difference between highest scores of tikki with pickle, cutlet and pakora and also between lowest score of omelette with soup.

5.2.B. Knowledge gain

(i) Pre-knowledge score

Pre-knowledge score obtained from respondents about mushroom use indicated that majority of respondents (62.8 per cent) belonged to medium level and did not have a clear concept about mushroom use. This in turn necessitates the need for nutrition education regarding mushroom consumption. To implement

appropriate nutrition education, proper teaching aids were formulated after assessing the pre-knowledge score. Cole (1981) reported that teaching methods should be selected carefully and specifically and should emanate from a knowledge base that addresses all facts of the learning situation.

(ii) Post–knowledge score

Post–knowledge score obtained after pre-test showed hundred percent knowledge gain. The difference in the knowledge score of respondents between pre-test and immediate post-test was quantified as knowledge gain. Singh (1995) reported that there was significant difference in gain in knowledge of the tribal women exposed to nutrition education training. All education efforts aim at learning which can be recalled and transformed to new situation (Biradar and Sundaraswamy, 1998). According to Usha *et al.* (1980) nutrition education imparted through the specially prepared nutrition education primer for adult education improved their learning skills and awareness of the nutritional facts of the learner.

Extension studies have shown that the more teaching methods used, the higher the percentage of people changing their practices (Cole, 1981). In present study, the teaching aids used were lecture, discussion, pamphlet, folder, poster flip chart and method demonstration. Rani and Malaviya (1986) studied about the effectiveness of media mix systems such as flip chart, leaflet, and line charts along with method demonstration. The effectiveness was studied in terms of retention of knowledge. It was indicated that all the three media-mix systems have been substantially effective in transmitting technical know-how. Somewhat

sufficient knowledge retention was observed in almost 100 per cent rural women. According to Mukta and Annamma (1998) a combination of media such as posters, flip books, booklets, charts, flags, lectures and individual contacts helped the rural mothers to grasp information and change their attitude towards favourable side.

Sadaqath and Channegowda (1987) and Kaur and Roy (1986) reported that visuals aids increase the effectiveness of lecture. Among the visual aids flip chart and specimens are important. The increase in the knowledge level was more in the case of pamphlet + lecture + discussion than in lecture alone (Biradar and Sundaraswamy, 1998). A study conducted by Harriman (1990) on 82 men and 101 expectant women concurred with the notion that parents preferred readily assessable sources like pamphlets, books, news letters and televisions to obtain child rearing information.

It is evident from the result that knowledge gain is substantial due to education programme. Age and education of respondents also seemed to influence the knowledge gain. Santhoshkumar (1990) observed that there was an increasing response to education programmes as the age advanced up to 45 years. In this study majority of respondents belonged to age group between 41-50 years.

A study on the effectiveness of visuals in teaching shows that the respondents of age group up to 35 years with higher education were found to have more knowledge gain, knowledge retention, skill acquisition and symbolic adoption (Philip *et al.*, 1999). Most of the respondents in this study had

education above degree and this in turn would be a reason for their best knowledge gain.

Assistance to the women groups has been found to be relatively more productive and repayment performance was also better (Rajakutty, 1997). It is evident from the present study that all respondents were females and showed more productive knowledge score after education programme.

5.2.C. Extent of Adoption

The knowledge gained just after the exposure to the media is no doubt important, but what is more important is the amount of knowledge retained after a lapse of time after the exposure to the media (Biradar and Sundaraswamy,1998). Ramnath (1980), Neelma (1996) and Neelma *et al.* (1998) reported a highly positive significant variation in adoption of child health care practices due to maternal education . A work conducted by Rajammal *et al.* ($1982_{(b)}$) revealed that rural women adopted desirable health practices as a result of their exposure to the education programmes.

1. Frequency of mushroom consumption

Results revealed that majority of respondents were consuming mushroom once in a week as a common vegetable. It was interesting to note that after education programme, there was not even a single respondent who haven't tasted mushroom at least once. This inturn indicates the perfect impact of nutrition education on the respondents

2. Opinion on spawned bed supply

Distribution of respondents based on their opinion on spawned bed supply showed that about 51 per cent of respondents had good opinion on spawned bed supply. The positive attitude of respondents towards spawned bed supply revealed their motivation to take mushroom cultivation as a hobby.

3. Yield from supplied bed

It is evident from the results that about 69 per cent got medium yield i.e., between 582.45 to 833.14 g of mushrooms from spawned bed supplied. This best results in yield inturn encouraged the participants to purchase spawn and raise the mushroom. On harvest of each bed a minimum of ½ kg mushroom is obtained as per Priya (2000).

4 Raising of mushroom

It was observed from the present study that about 93 per cent of respondents were motivated to purchase spawn while 92 per cent were succeeded in raising mushroom. From these results it could be assumed that out of 75 respondents about 70 (93 per cent) respondents adopted mushroom cultivation as a hobby.

Murugesan *et al.* (1998) reported that among the various training programmes of TNAU, the training on mushroom cultivation receives an over-whelming response from the people as it could be started as a self employment activity by both rural and urban people. Results of present study also showed similarity towards finding of Kumar *et al.* (1994) and Murugesan *et al.* (1998) where majority

of respondents gained medium to high level of knowledge about mushroom cultivation due to training.

The knowledge gain in present study might be attributed to the fact that most of the respondents were voluntary participants with an urge/enthusiasm to know about mushroom cultivation and consumption. Besides this as a vast majority of them were house wives and were middle aged, they have plenty of leisure time and were interested to utilise the leisure time effectively.

Another reason for their knowledge gain and adoption of mushroom cultivation might be that they were all city dwellers as Sujatha and Annamalai (1998) reported that people who were cosmopolite in nature would have higher adoption.

As majority of respondents were middle aged and had education above degree their adoption might be increased as observed in findings of Joseph *et al.* (1991) where they reported that elder people and matriculates (included both graduates and post graduates) were more keen to take mushroom cultivation as a subsidiary occupation.

With regard to the reasons inferred from respondents for opting mushroom cultivation, most respondents opined that the technology is simple and cost of investment is less while reasons given by non-adopters were the non-availability of spawn in the market. Similar trend was also observed in findings of Pillai and Bhaskaran (1991) in their study on mushroom cultivation among rural youth. Another motivational factor given by most respondents for adopting mushroom cultivation was that they could grow mushroom for self-consumption. Similar

findings was observed in the study on impact of training on cultivation of mushrooms to unemployed youth in Kerala by Rahiman *et al.* (1991).

5. Yield difference between supplied spawned bed and self –made beds

Majority (89.3 per cent) seemed to have obtained more yield from spawned bed supplied than self made beds. This reveals that failure rate is low in the case of supplied spawned beds. Reasons for slightly less yield in self-made beds indicated by respondents were due to lack of quality spawn and problem of fungal attack. Respondents also revealed their desire to buy 'spawned beds' if available in market, so that there will be less work and less chance for fungal attack as in the case of self–made beds.

The present investigation offers scope for the distribution of spawned bed for promoting mushroom growing as well as consumption. Mushroom cultivation training centres may make arrangements to distribute spawned bed in addition to spawn for promoting mushroom production and consumption.

SUMMARY

6. SUMMARY

The present study to assess the 'Impact of nutrition education on mushroom consumption', threw light on the socio-economic characteristics, dietary variables and knowledge on mushroom cultivation of one hundred and fifty dwellers (50 members each from three resident associations namely Althara resident association at Vellayambalam, Chattambi Swami Nagar resident association at Edappazhanji and Sastri Nagar resident association at Karamana) residing in Thiruvananthapuram city.

Acceptance and preference scores for six demonstrated mushroom recipes, knowledge gain after education programme and extent of adoption after one month of education programme were determined in sub sample of seventy five dwellers (25 each selected from the samples of three resident associations mentioned above).

Results of the survey showed that all the respondents were women and majority belonged to the age group of 41-50 years with sound education. But most of them were unemployed and had not participated in any nutrition education classes.

Respondents surveyed were mainly Hindus and belonged to forward caste. Majority of families were nuclear type having one to four members. In these families higher concentration of adult population and female population were observed.

Most of the families had monthly income between 3000-9000 rupees and belonged to middle class families.

A greater percentage of respondents were vegetarians and are enjoying good health while a few percentage had to reduce the intake of tubers, pulses, fats, oils, sugar and jaggery due to diseases like flatulence, hypertension, coronary heart diseases and diabetes.

Though vast majority of respondents are not in the habit of buying food from hotels they all liked to try new foods. Many of them were excluding their favourite foods as it is expensive.

It was observed that out of 150 respondents, about 52 percent had used mushroom through various sources while 48 percent had not yet tasted mushroom. Though most of the respondents had no idea on mushroom consumption, about 42 percent had good opinion on mushroom consumption.

The respondents surveyed seemed to have high preference towards food groups like cereals and leafy vegetables while low preference was observed towards meat, fish, egg and mushroom. This may be due to the vegetarian habit of respondents. Food groups like pulses, roots and tubers, vegetables, fruits, milk and milk products, sugar and jaggery, nuts and oil seeds and fats and oils were preferred moderately by the respondents.

Mean food intake assessed by weighment method among 150 respondents revealed that their diets did not meet RDA for all foods except cereals, root and tubers and sugar and jaggery.

Assessment of mean protein intake revealed that majority of respondents were protein deficit.

Considering the knowledge on mushroom cultivation, most of the respondents were ignore about the technology of mushroom cultivation.

Six mushroom recipes namely mushroom soup, mushroom omelette, mushroom cutlet, mushroom tikki, mushroom pakora and mushroom pickle were demonstrated and nutritional adequacy of each recipes with reference to raw ingredients used were calculated using nutritive value table recommended by ICMR (1999). Appearance, flavour, colour, taste, texture and preference of each recipe were assessed by the respondents. The statistical analysis revealed that regarding organoleptic qualities of demonstrated mushroom recipes, mushroom pickle was the highly accepted one while mushroom omelette was the least accepted product.

In the preference tests, mushroom tikki was rated maximum and mushroom omelette minimum. None of the mushroom recipes were ranked too low in mean scores. This revealed that almost all mushroom recipes were liked by the respondents.

Two education classes were conducted to make the respondents aware of the cultivational, nutritional and therapeutic values of mushroom. Lecture was the main teaching method used aided with poster, flip chart, method demonstration, pamphlet, folder and discussion. Assessment of pre-knowledge score of respondents showed that majority of respondents had medium level of knowledge about use of mushroom while a negligible

percentage had high knowledge about mushroom use. Hundred percent of respondents scored high after the education programme which was evident from post-knowledge score. This inturn reveals the effectiveness of nutrition education classes conducted.

Extent of adoption of practices taught during nutrition education classes were assessed after one month interval. It was observed that there was not a single respondent who did not use mushroom at least on special occasions. Majority seemed to consume mushrooms weekly as an ordinary vegetable. In sum, there has developed a pattern of mushroom consumption in all the three selected resident association limits.

Most of the respondents had good opinion towards the 'spawned bed supply' method as it was highly successful. The findings have revealed that majority got medium yield ranging from 582.45 to 833.14 g of mushroom per supplied bed. It is encouraging to note that out of 75 respondents, 70 respondents (93 per cent) purchased spawn and succeeded in raising mushroom. Though they got moderate yield from self-made mushroom beds; they were of the opinion that they got much more yield from supplied beds than self-made ones. It is obvious that the respondents are ready to buy spawned beds if available in market as it provides with less work and more yield, which inturn enhances the mushroom consumption.

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APPENDICES

APPENDIX – I

KERALA AGRICULTURAL UNIVERSITY
Department of Home Science, Vellayani

Name of investigator : Cicil Mary John

Impact of nutrition education on mushroom consumption

Schedule to collect socio-economic characteristics of respondents

1. Serial No :

2. Name of the respondent :

3. Full Address :

4. Age of the respondent :

5. Religion :

6. Caste :

7. Educational status of the respondent :

8. Family size :

9. Number of adults in the family : Male ☐ Female ☐

10. Number of children in the family : Male ☐ Female ☐

11. Estimated monthly income of family :

12. Employment status of the respondent :

13. Nature of participation of respondent in nutrition education classes :

14. Exposure of respondents to various information sources :

APPENDIX – II

KERALA AGRICULTURAL UNIVERSITY
Department of Home Science, Vellayani

Impact of nutrition education on mushroom consumption

Schedule to collect food habits of respondents

1. Dietary habit of the respondents :
2. Foods avoided on health reasons :
3. Frequently used preparation methods :
4. Habit of dining out :
5. Habit of buying food from hotels :
6. Reasons for excluding favourite foods :
7. Mode of use of mushroom :
8. Opinion on mushroom consumption :
9. Details of family members who dines out :

APPENDIX – III

KERALA AGRICULTURAL UNIVERSITY
Department of Home Science, Vellayani

Impact of nutrition education on mushroom consumption

Schedule to collect food preferences of respondents

Food groups	Extremely liked	Liked	Not liked very much	Not at all liked	Not tasted
Cereals					
Pulses					
Roots and tubers					
Green leafy vegetables					
Other vegetables					
Fruits					
Milk and milk products					
Milk, fish and egg					
Fats and oils					
Sugar and jaggery					
Nuts and oil seeds					
Mushroom					

APPENDIX – IV

KERALA AGRICULTURAL UNIVERSITY
Department of Home Science, Vellayani

Family and individual food consumption survey – Food weighment method

Name of investigator : Cicil Mary John
Serial No. :
Name of subject :
Address :
Age of subject :
Date :

Food consumption

Name of the meal	Menu	Weight of total raw ingredients used by family (g)	Weight of total cooked food consumed by family (g)	Amount of cooked food consumed by individual (g)	Raw equivalents used by individual (g)
Breakfast Lunch Tea-time Dinner Others					

APPENDIX – V

KERALA AGRICULTURAL UNIVERSITY
Department of Home Science, Vellayani

Gist of lecture on cultivational, nutritive and medicinal values of mushroom

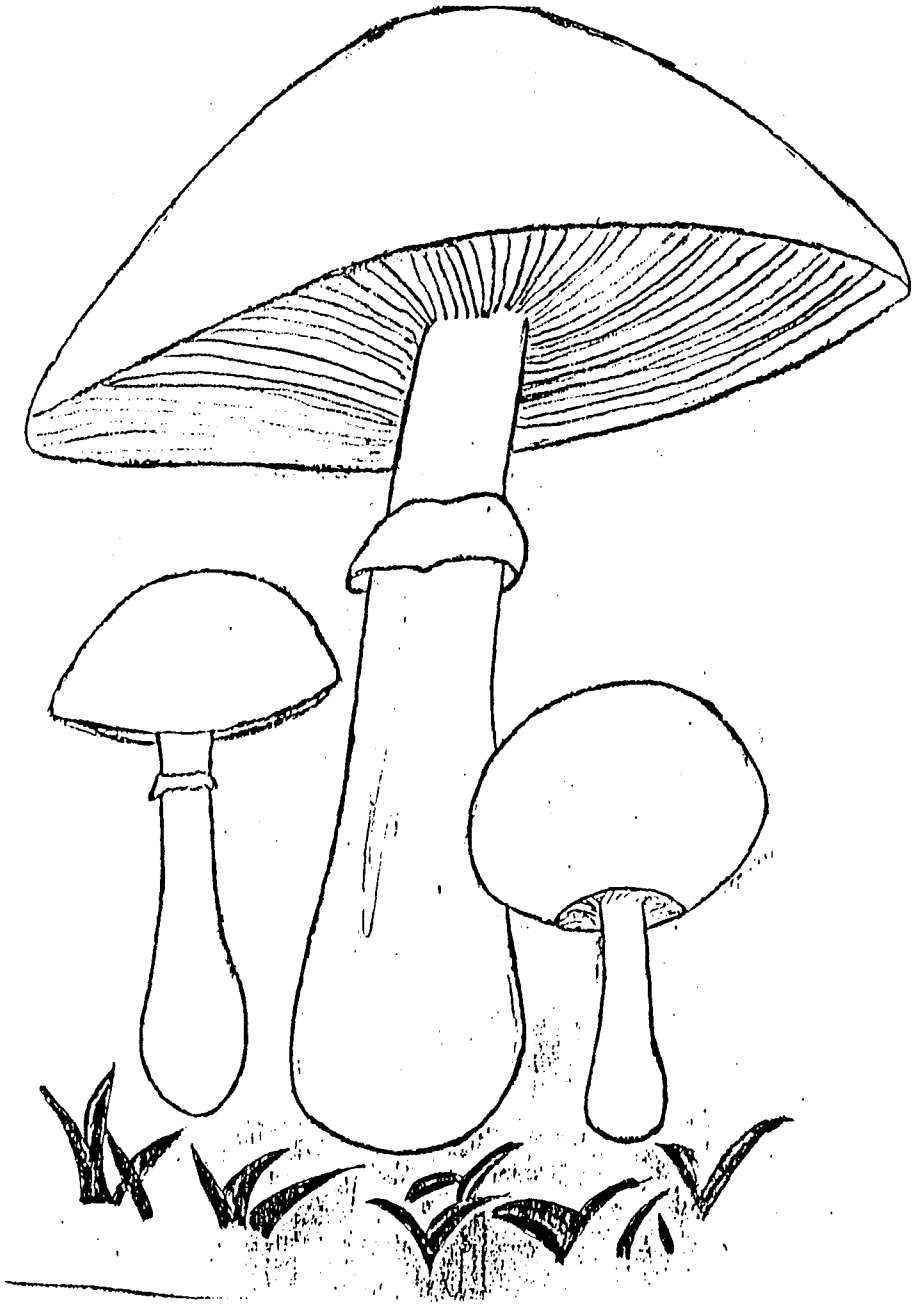
- Interesting myths regarding mushroom consumption
- Poisonous mushrooms and its identification
- Cultivational value of mushrooms
- Nutritive value of mushrooms
    - Various nutrients present in mushrooms
    - Their quantity and functions in human body
- Medicinal value of mushrooms
    - Mushrooms used as medicines
    - Diseases that can be cured by using mushrooms
    - Preparations of some home medicines using mushrooms
- Few techniques for mushroom preservation

APPENDIX – VI

Teaching aids used in education programme

(a) Poster

MUSHROOM – VEGETABLE FOR FUTURE



Cholesterol free and protein rich

APPENDIX – VIII

Evaluation card for composite scoring test

Name of resident association : Serial No. :

Name of Subject : Address :

Date :

Name of Products : (1) Mushroom soup (2) Mushroom omelette (3) Mushroom tikki (4) Mushroom cutlet (5) Mushroom pakoras (6) Mushroom pickle

Assign scores for each sample for various characteristics

Quality attributes	Maximum score	Code number of samples					
		1	2	3	4	5	6
Appearance							
Flavour							
Colour							
Taste							
Texture / consistency							

Note : Excellent (5) Very good (4) Good (3) Satisfactory (2) Poor (1)

APPENDIX – IX

Score card for recipe preference test

Name of resident association :
Name of subject :

Serial No. :
Address :
Date :

Name of Products : (1) Mushroom soup (2) Mushroom omelette (3) Mushroom tikki (4) Mushroom cutlet (5) Mushroom pakoras (6) Mushroom pickle

Code number of samples	Liked very much (3)	Liked (2)	Disliked (1)	Disliked very much (0)
1				
2				
3				
4				
5				
6				

APPENDIX – X

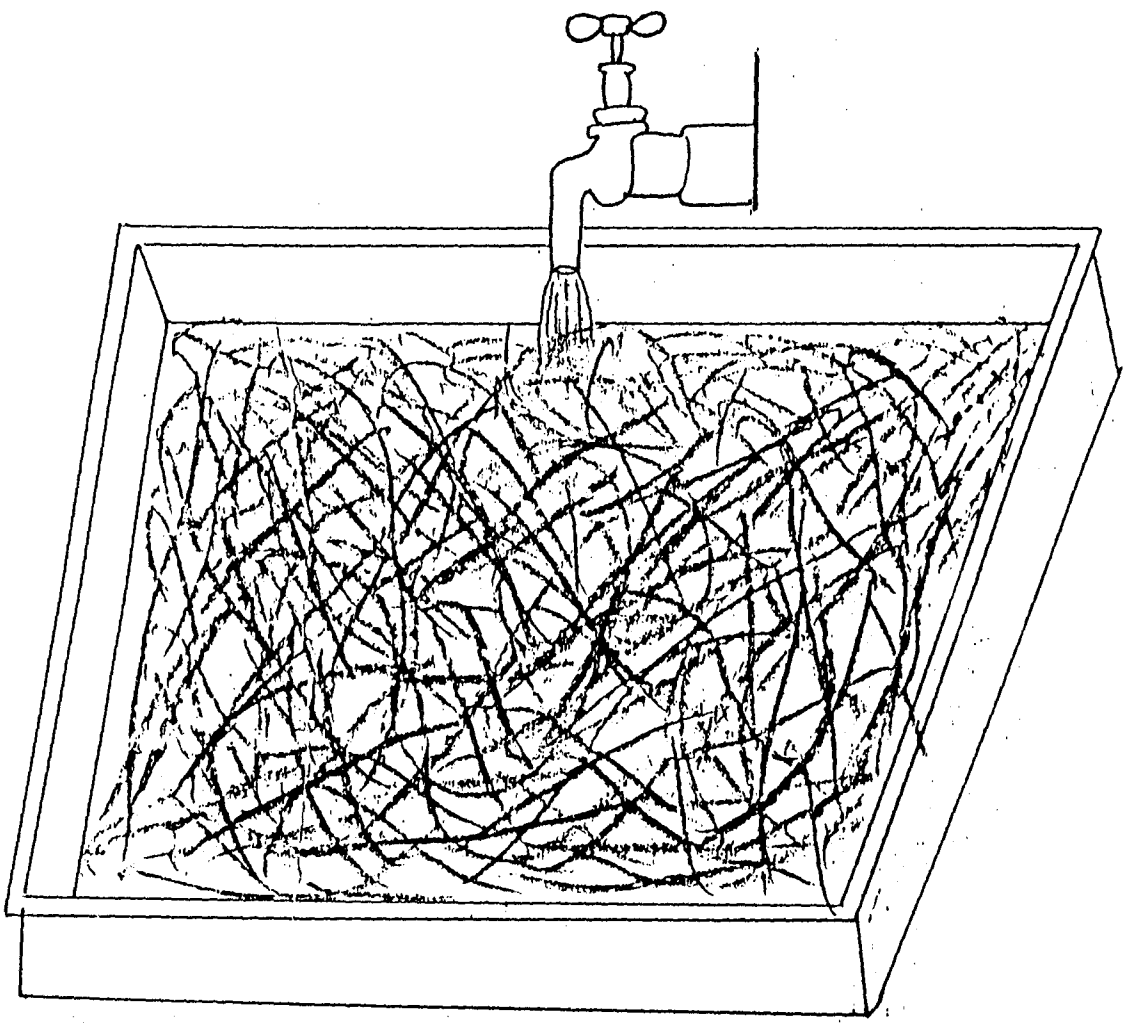
FLIP CHART

STEPS IN THE CULTIVATION OF OYSTER MUSHROOM

(POLY BAG METHOD)

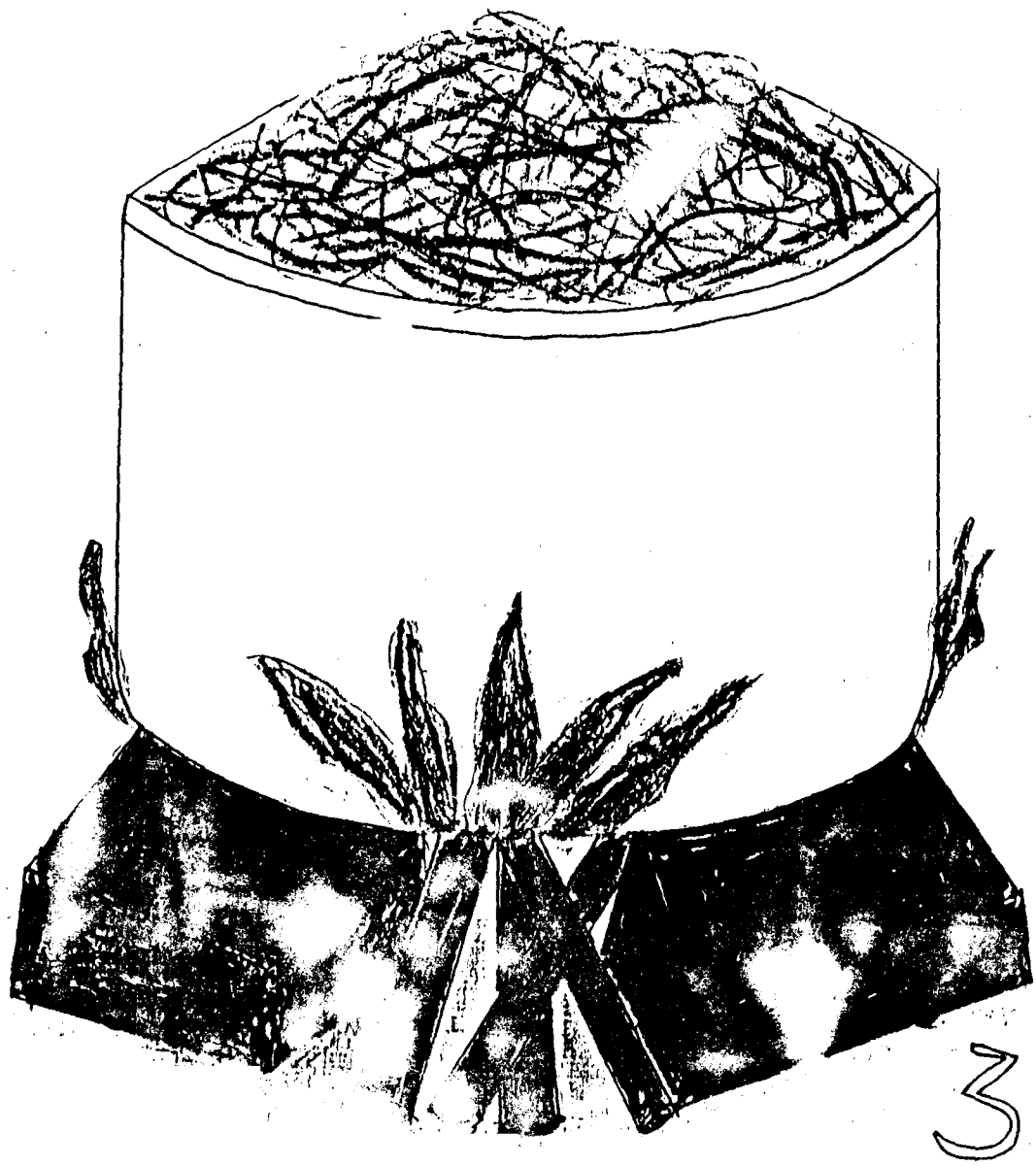
1. Straw made into cushions

2. Soaking overnight

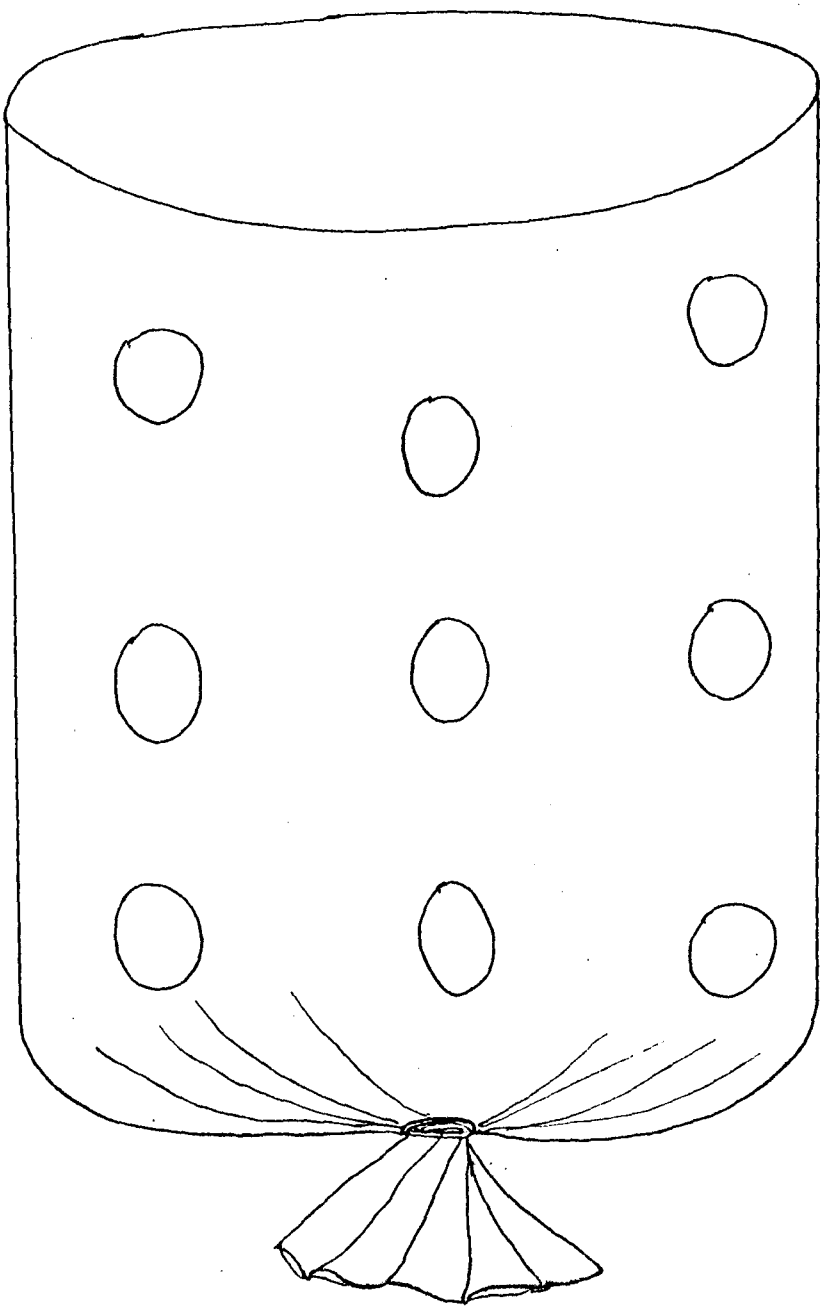


2

3. Boiling the straw

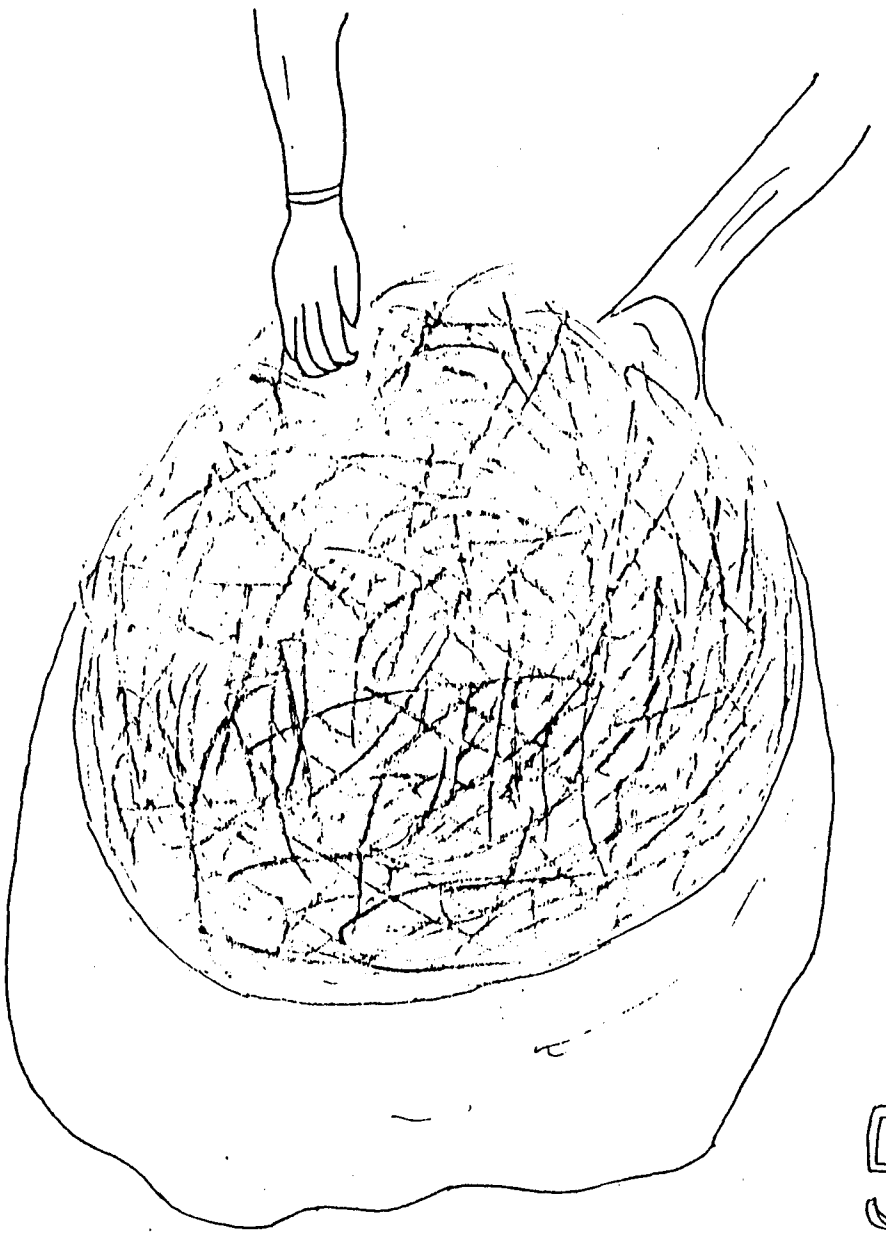


4. Poly bag with holes



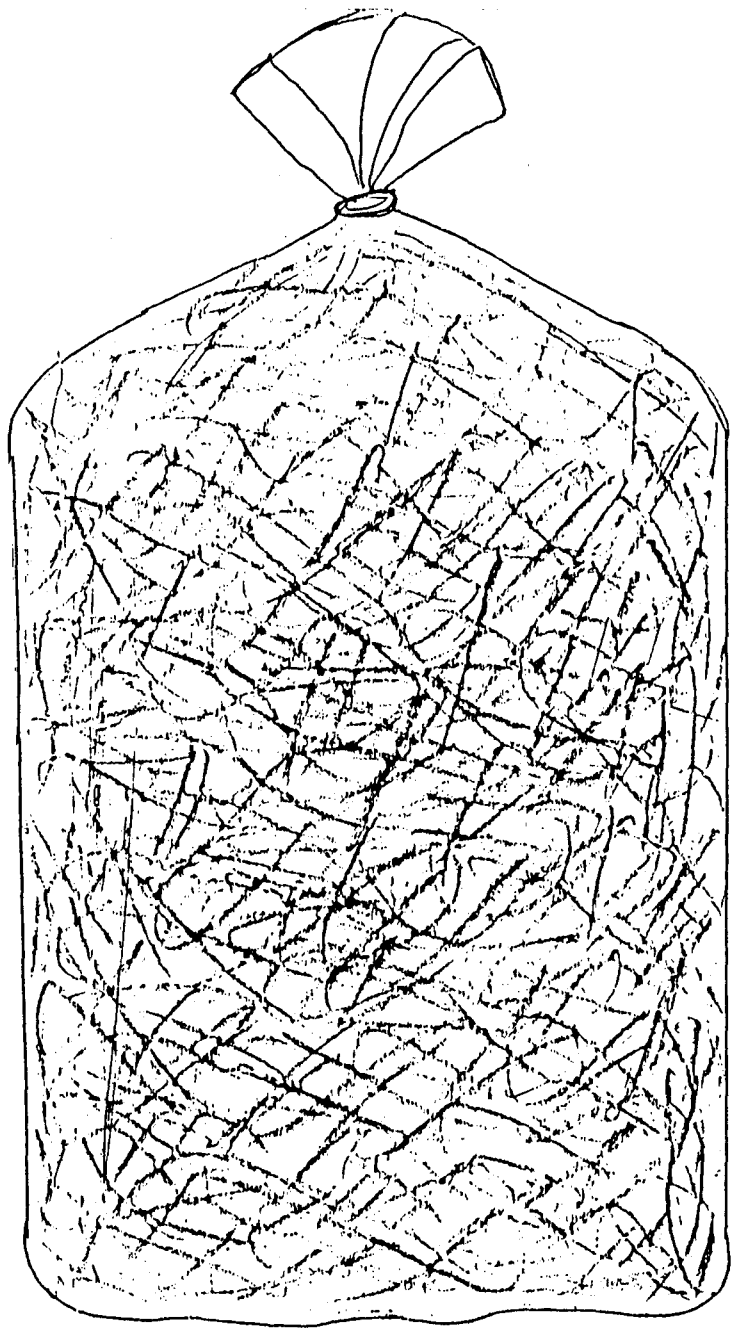
4

5. Filling poly bag by layers



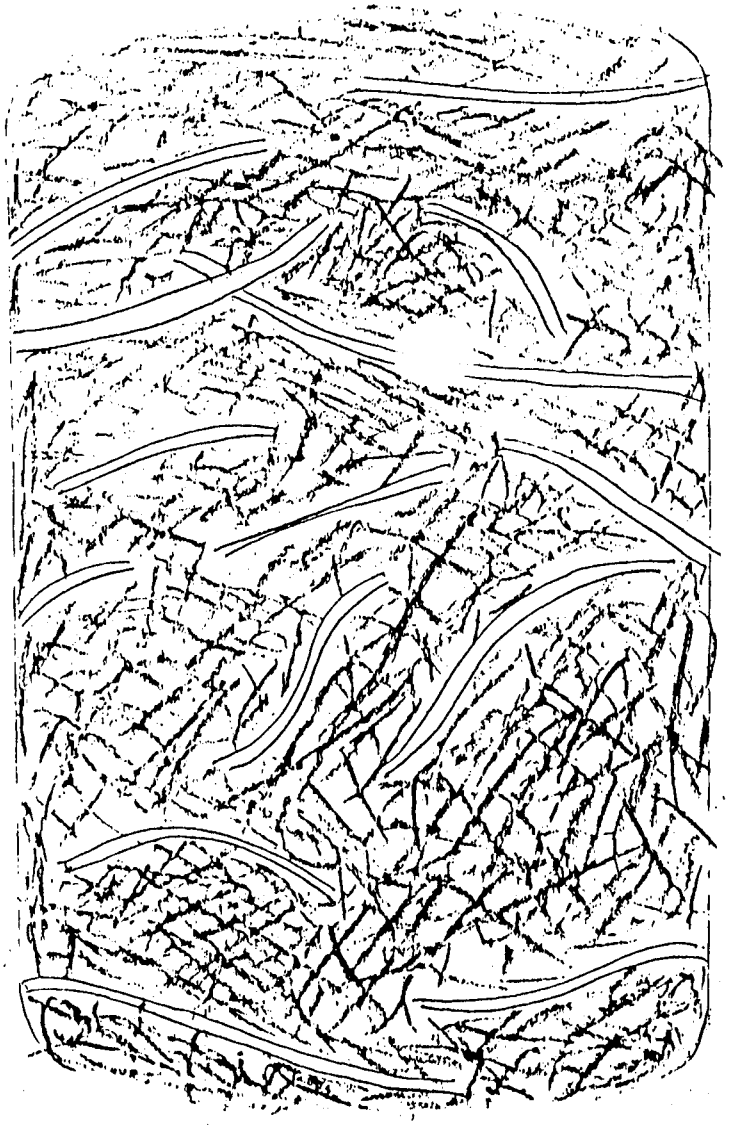
5

6. Filled up poly bag



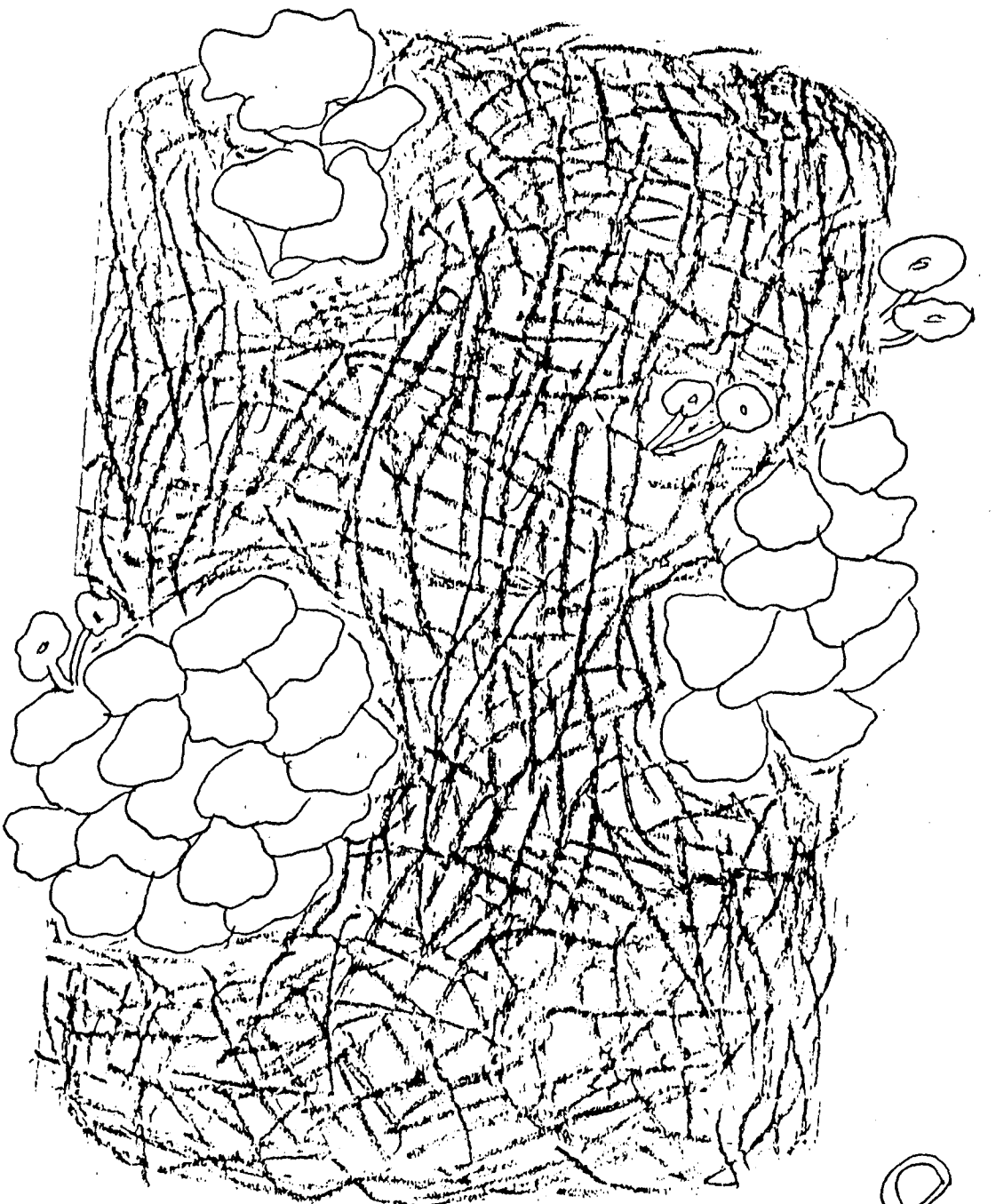
6

7. Spawn run



7

8. Harvesting stage



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APPENDIX – XI

KERALA AGRICULTURAL UNIVERSITY
Department of Home Science, Vellayani

Name of investigator : Cicil Mary John

Name of subject :

Impact of nutrition education on mushroom consumption

Checklist to assess the knowledge gain of respondents

1.	Mushroom is a vegetable	Agree/ disagree
2.	Some species of mushrooms are poisonous	:
3.	Mushroom is a tasty food stuff	:
4.	Mushroom – cereal combination could be used for obtaining good protein quality	:
5.	Edible mushrooms have both nutritive and medicinal values	:
6.	It is good to include mushrooms in diets of obese people	:
7.	Mushroom protein lies between vegetable and meat	:
8.	Mushroom is a food stuff suited to vegetarians	:
9.	Mushroom contains less amount of fat	:
10.	Mushrooms have lots of vitamins and minerals	:
11.	Diseases like peptic ulcer, diabetes and hypertension could be reduced by consuming mushrooms	:
12.	Nutritive value of our diets could be increased by including mushrooms	:

13.	Mushrooms are expensive	Agree/disagree
14.	It is easy to cultivate mushroom for domestic use	:
15.	Mushrooms could be prepared easily	:
16.	Mushrooms can be consumed by all irrespective of age group	:
17.	Mushroom as a food item has got high demand in sophisticated societies	:
18.	Harvested mushrooms cannot be kept more than 24 hours at room temperature	:
19.	Pickled mushrooms has got long shelf life	:
20.	Dried mushrooms could be kept in an air-tight tin for a long period	:

APPENDIX – XII

KERALA AGRICULTURAL UNIVERSITY
Department of Home Science, Vellayani

Name of investigator : Cicil Mary John

Name of subject :

Impact of nutrition education on mushroom consumption

Schedule to assess the extent of adoption among respondents

1. Frequency of mushroom consumption :

2. Opinion about spawned bed supply :

3. Yield obtained from supplied bed :

4. a) Did you purchase spawn after the education programme :

   b) Could you raise mushroom from the spawn purchased :

5. Yield difference noticed between supplied beds and self-made beds :

APPENDIX – XIII

Correlation coefficients of some important personal characteristics with their personal food preference

Variables	Age (X_1)	Education (X_2)	Monthly income (X_3)	Preference score for proteinaceous foods (X_4)	Preference score for mushroom (X_5)
Age (X_1)	1.0000**				
Education (X_2)	0.1774*	1.0000**			
Monthly income (X_3)	0.0285^{NS}	0.5060 ^{NS}	1.0000**		
Preference score for proteinaceous foods (X_4)	0.2054*	0.2793 ^{NS}	0.3891 ^{NS}	1.0000**	
Preference score for mushroom (X_5)	0.1314^{NS}	0.3727**	0.3973**	0.7340**	1.0000**

N = 150 respondents
** Significant at 1 per cent level of probability
* Significant at 5 per cent level of probability
NS – Non significant

APPENDIX – XIV

Formulae for calculating preference score for each food group

$$\text{Score} = \frac{R_1 S_1 + R_2 S_2 + \text{----------} + R_n S_n}{n}$$

S_n = Scale of rating
R_n = Percentage of respondents selecting a rating
n = Maximum scale rating

APPENDIX - XV

Statistical parameters of some important variables

Variables	Mean	Standard error	Coefficient of variation
Age (X_1)	39.2	1	27
Education (X_2)	3.4	0.1	37.3
Monthly income (X_3)	6000	241	49.2
Preference score for proteinaceous foods (X_4)	16.2	0.3	20.2
Preference score for mushroom (X_5)	2	0.2	101
*N = 150			

* Number of respondents

APPENDIX – XVI

Statistical parameters of some important variables

Variables	Mean	Standard error	Coefficient of variation
Yield (X_6)	708	14.5	18
Frequency of mushroom use (X_7)	4	0.1	28.2
Pre-knowledge score (X_8)	12	0.4	33
*N = 75			

* Number of respondents

IMPACT OF NUTRITION EDUCATION ON MUSHROOM CONSUMPTION

By

CICIL MARY JOHN

ABSTRACT OF THE THESIS
SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT
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adult members and female members. Monthly income of most families ranged between Rs. 3000 to 9000.

A vast majority of respondents were vegetarians without much health problems while a few percentage had to reduce the intake of tubers, pulses, fats, oils, sugar, and jaggery due to diseases like flatulence, hypertension, coronary heart diseases and diabetes.

Though a higher concentration of respondents avoid their favourite foods due to high cost, they all liked to try new cuisines.

Majority had no idea about consumptional values of mushrooms. While 42 per cent had good opinion on mushroom consumption. Out of 150 respondents 48 percent had never tasted mushroom.

Highly preferred food groups among respondents were found to be cereals and leafy vegetables while meat, fish, egg and mushrooms were least preferred as majority were vegetarians. All other food groups were moderately preferred by them.

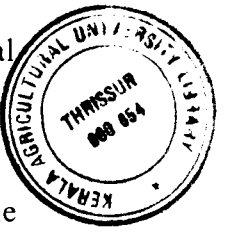
Assessment of the respondent's mean food intake by weighment method showed that the diets of respondents did not meet RDA for all foods except cereals, roots and tubers and sugar and jaggery. Mean protein intake assessed revealed that most respondents were deficient in protein than suggested by ICMR (1999).

It was also observed from the present study that majority of respondents did not know the technical know-how of mushroom cultivation.

Standardised recipes of six mushroom products like mushroom soup, mushroom omelette, mushroom cutlet, mushroom tikki, mushroom pakora and

mushroom pickle were demonstrated and acceptance and preference score for these recipes were assessed by the respondents. In the case of acceptance scores with regard to organoleptic qualities, mushroom pickle was scored highly acceptable and mushroom omelette was the least accepted one. Considering the preference of respondents, mushroom tikki was extremely liked while mushroom omelette was scored minimum preference.

Two lecture classes on cultivational, nutritional and therapeutic values of mushroom were conducted by using appropriate visual aids like poster, flip chart, pamphlet and folder. Cooking demonstration on the preparation of mushroom recipes and method demonstration on the technology of mushroom cultivation were also carried out. Pre-test conducted on the respondents about the use of mushroom showed that majority of respondents had moderate knowledge about mushroom use. Assessment of post-knowledge score of respondents after the education programme showed that hundred per cent of respondents reached the maximum score which inturn indicates the ideal impact of education classes on the respondents.



Assessment of extent of adoption after one month of education programme revealed that majority of respondents were consuming mushroom weekly. With regard to the spawned bed supplied, majority considered it as highly motivating and got medium yield (582.45 to 835.14 g of mushroom) from the bed. It is rather surprising to note that about 93 per cent of respondents purchased spawn after their first trial during the education programme and succeeded in growing mushroom. All the respondents showed great desire for buying spawned beds if available as it provides with less work and more yield than self-made beds; thereby increasing the consumption of mushrooms.