FARMING AMONG THE ATTAPPADY TRIBES OF KERALA: A LIVELIHOOD ANALYSIS

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by

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2020

DECLARATION

I, hereby declare that this thesis entitled **"FARMING AMONG THE ATTAPPADY TRIBES OF KERALA: A LIVELIHOOD ANALYSIS"** is a bonafide record of research work done by me during the course of research and the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.
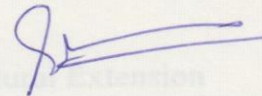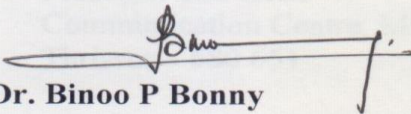
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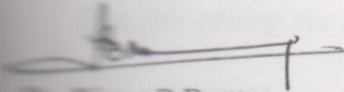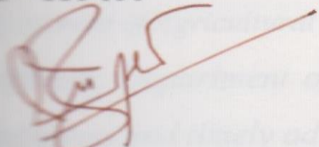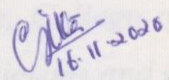**ICAR-IIHRMHESSARAGHATTA   LAKE**

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Sachana, P. C

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INTRODUCTION

1. INTRODUCTION

Tribes in India are generally endowed with skills and resources of distinctive life styles, cultures and languages. Popularly known as *Adivasis* (the original inhabitants), the tribal people are docile, modest, and hardworking ethnic communities. Most of these tribal groups are economically poor, physically fraught and culturally inaccessible. They lived as homogenous groups in clearly distinguishable but isolated, remote forest and hilly areas. Moreover, being unorganised with little education they often found it difficult to relate themselves to the various socio-economic issues in the right perspective. It has been observed that the lack of social and economic infrastructural facilities made their integration with the rest of the population difficult. The geographical separation also excluded and deprived them of the benefits of development and technological advances. In fact, they continued as the most vulnerable section of the population and were often exploited under the capitalistic developmental approaches in recent years. However, constitutional safeguards and concerted efforts of government programmes and policies over the years have been attempting to effect enduring changes in the tribal development perspectives.

Tribes in India

The word tribe has its etymological base in the Latin word *tribes,* which mean *a social group*. Article 366 (25) of Indian Constitution described Scheduled Tribes (ST) as such tribes or tribal communities who are included under Article 342 of the Constitution that entitled them for national legislation that acknowledge their status (GOI, 2017). Accordingly Indian tribes have been characterised as the indigenous social groups in primitive stage of development that share a common ancestry inhabiting remote inaccessible terrains and forest lands of the country. This enabled special provisions to safeguard tribal communities from the acute social, educational and economic deprivations on account of the geographical and cultural isolation. As per the 2011 census tribes accounted for 8.6 per cent of the total Indian population with pan Indian presence among most of the States and

Union Territories. Recent reports showed that more than 550 tribes have been recognised as Scheduled Tribes in India.

Kerala, the southernmost state of India, bordered with mountainous terrains and tropical forests has been home to many indigenous tribes. In the state, the highest population of Scheduled Tribes (ST) is concentrated in the districts of Wayanad (31.24 %), Idukki (11.51 %), Palakkad (10.10 %) and Kasargod (10.08 %) as per the reports of GOI (2011). Among them, Attappady region of Palakkad district which form one of the 43 tribal blocks in the country is known as the tribal nuclei of Kerala. This is mostly attributed to the presence of three major tribal communities' *viz. Irulas, Mudugas and Kurumbas* who inhabit the forest regions of Attappady.

There have been many recent reports from the region that suggest threat to agriculture and forests, the traditional livelihood base of the tribal communities. In fact, the vagaries of climate change and wild animal menace have eroded the soils causing productivity loss and depletion of forest resources. Therefore, sustaining crop production and productivity without damaging the resources and environment are posing great challenge to the tribal farming in the area. This threat to the livelihood of the tribal community which depended on agriculture and forest, have even forced them into bonded and migrant labour (Patidar *et al*. 2018). Moreover, there have been recurring reports of hunger deaths, malnutrition and infant mortality from the region, often viewed as manifestations of unsustainable livelihood base. These indicated that despite the state's remarkable achievements in the social sector, often celebrated as *Kerala Model of Development,* much remain to be desired with respect to its tribal development. It was perceived that the development fell short to encompass tribal communities and addressing their livelihood concerns. Majority of the tribes in Kerala who continue to depend on agriculture are struggling to compete with the current situational threats from increased diversion of forest land for development purposes.

Livelihood security

Recent years have witnessed the emergence of livelihood approach that focus on community assets and resources as an important development tool to improve the conditions of marginal communities. The approach is based on the analyses of how the assets and resources of a community are utilized in a sustainable manner to ensure livelihood security. Livelihoods are defined as the processes through which people obtain the necessities of life and as such the concept is highly contextual. Hence, what constituted the necessities of life varied from society to society though, food, clothing and shelter formed the central theme in all contexts.

Since early 1990's, the right to life and livelihood of tribal people has remained a fundamental concern of all development initiatives in Attappady region. In fact, the tribal livelihood issues of the region mostly addressed the tribal rights on land and forest, their primary livelihood resource base. However, the environment deterioration, climate vagaries, deforestation and issues related to rehabilitation of tribes have adversely affected their habitats and in turn the food diversity. Thus, the malnutrition prevalent among the Attappady tribal population could be attributed to many co-related factors emerging from these that have aggravated household poverty, food insecurity, and maternal nutrition during and before pregnancy as reported by UNICEF (2015). Moreover, many food aid programs that were principally aimed to supplement tribal diets have replaced them with diets predominantly of starchy staples with little or no animal products, fresh fruits and vegetables. These changed dietary patterns are reflected in the health parameters like increased occurrence of diseases like sickle cell anaemia and incidences of increased infant mortality reported among the Attappady tribal communities (Feroze and Aravindan, 2001). In past decades the area was well known for agriculture especially millet cultivation. But owing to the changed dietary patterns and the falling profits and productivity, they have mostly abandoned agriculture and turned to work as migrant wage labourers in the neighbouring areas. This resulted in the decline in cultivated area as well as production in the region.

Both the central and the state governments have tried to ensure livelihood security of the tribal communities through various policies and programs. However, the proportion of investment to benefit of these schemes have been evaluated to be very low and most of them failed in the last mile reach (Tripathy, 2018). This is mostly attributed to the economic and social backwardness of the tribal communities inhabiting the remote inaccessible regions and the mismatch between the development perspectives of policy makers and the tribes. Mostly tagged as backward limited attempts have been made to understand the traditional agricultural systems and practices of tribal communities in the right perspective. In this context, it was assumed to be imperative to know the impact of state interventions on the livelihood base of tribal people and the manner in which the tribal communities have articulated their collective concerns for their livelihood promotion and protection. This warranted for exclusive studies that brought out the basic profile of tribal life and livelihood which are limited.

In this backdrop the present study was pursued using livelihood analysis as a tool to assess the livelihood security of tribal communities. It followed the premise that a livelihood is sustainable when it can cope with and recover from stresses and shocks, maintain and improve its capabilities and assets while not undermining the natural resource base (Chambers and Conway, 1992). It also helped to understand how the tribal livelihood activities were related to farming and its correlation with food security. Formulation of policy recommendations based on the results will help to improve agricultural vocation and farming practices among the tribal farmers. Thus it would help to alleviate poverty and problems of food security among the tribes. Hence the study on the livelihood analysis of Attappady tribes was taken up with the following specific objectives:

Objectives of the study

❑ To analyse the livelihood status of tribal people with special reference to farming

❑ To delineate the factors influencing the selection of farming techniques and strategies among tribal farmers

❑ To assess the food security status of tribal people and identify the extent of contribution of farming in the dietary requirement of tribal people

❑ To formulate policy recommendations to improve the status of agricultural vocation among the tribal farmers

Scope of the study

Present study tries to use livelihood analysis as a tool to assess the livelihood security of tribal communities. It followed the premise that a livelihood was sustainable when it could cope with and recover from stresses and shocks, maintain and improve its capabilities and assets while not undermining the natural resource base. It enabled to understand how the livelihood activities were related to farming culture and its relationship with food security. Formulation of policy recommendations in order to improve agricultural vocation and farming practices among the tribal farmers helped to alleviate poverty and problems of food security among the tribal people. Moreover, the quantitative dimension could facilitate the process of evolving more definite conclusions from the study. This enabled to analyze the nature and magnitude of the trends that emerged from the results of the study which could be used to better understand the micro level impact of secure livelihood.

Limitations

Being a student investigator, the researcher faced many restrictions to access data from the remote tribal villages. Most of the tribal hamlets were found scattered throughout Attappady. Many of them were not accessible by motorised vehicle as they were located on top of the hills and had to be reached on foot. Language was another constraint. The tribal language varied from the native Malayalam and Tamil dialects and they also had their own colloquial languages. The time factor, which is crucial for any study, was another limitation. Since respondents were less exposed to non-tribes, they showed hesitance to share the information they knew. Therefore help of local interpreters were used and data was constrained to that extent. However, all possible precautions were taken to avoid bias and make the study as objective as possible.

Presentation of the study

      The report of the study is presented in five chapters. The first chapter has conceptual introduction, objectives of the study, scope and limitations. In the second chapter the relevant review of literature on which the study is based are presented. The material and methods which have bearing on measurement of variables, with statistical procedures used are presented in the third chapter. The fourth chapter contains results and discussion based on obtained results. Finally, the fifth chapter have the summary and conclusion of the thesis followed by bibliography. At the end abstract and appendices of the study are given.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

The chapter aimed at developing a theoretical framework on the concepts related to *Farming among the Attappadi tribes of Kerala: A livelihood analysis*. This has been developed on the basis of definitions, ideas and concepts derived from various researchers over the years. Each topic presented in the chapter is associated with the available research findings either directly or indirectly related to the present study. This helped to give a proper orientation to the study and also helped to place the problem on a theoretical perspective. This also assisted in evaluating the research results by comparing them with the related effort of others who worked in the area.

The review on literature related to the study has been presented under the following sub-heads:

2.1 Concept of tribe

2.2 Tribal agriculture

2.3 Livelihood analysis

2.4 Tribal life

2.5 Tribes of Attappady

2.6 Food security

2.7 Tribal food security

2.8 Dietary diversity

2.9 Tribal malnutrition and health

2.10 Theoretical framework of the study

2.1 CONCEPT OF TRIBE

A group of people using a common language for communication, following uniform rules of social organization and working together for common purpose is termed as tribe. Generally, they are a gathered group of people sharing social values, common dialect, territory and culture (Dubey, 1977).

According to Verma (1996) tribe forms a group of people using a common language for communication, following uniform rules for social organization and working together for common purposes such as trade, agriculture or welfare.

Nathan and Kekar (2004) reported that in India, indigenous people are the poorest and the most marginalized, oppressed, and deprived people who occupied the bottom strata of society. They are popularly known as the tribal people or the tribal.

2.2 TRIBAL AGRICULTURE

Tribal agriculture is based on indigenous knowledge systems and are mostly dominated by food crops like cereals, millets and pulses. These agriculture systems are known under different names such as *Jhum* culture (North Eastern states), *Utera* and *Benvar* (Madhya Pradesh), *Panchakrishi* (Kerala) etc. in different parts of the country. All these tribal agricultural systems shared the key attributes of subsistence based labour intensive dry farming with static cropping pattern. They also shared the common features of working in harmony with nature with positive linkages to high level of agro-biodiversity that help in meeting the food and nutrition needs of the people dependent on it Narayanaswamy (2006).

Detailed evaluations of these systems by different researchers have revealed them to share resilient and risk minimizing characteristics that ensured minimum returns even under the most adverse conditions. Hence these eco-friendly, zero fossil fuel indigenous systems have gained great significance in the present context of climate change and erratic weather. However, many adaptations causing structural and functional transformation of these systems are also reported from these regions in response to environmental and developmental pressures in recent years.

Sankar and Muraleedharan (1990) reported on the transformation in farming practices witnessed in Attappady area in recent years. According to them a mix of traditional shifting cultivation and modern protected cultivation coexist in the region.

Narayanaswamy (2006) reported that the main occupation of tribals in Tamil Nadu such as *Kurumbas*, *Irulas*, *Todas*, *Kotas*, *Mullakurumbas* and *Panias* was agriculture and they practiced intensive farming.

The tribal communities of Kerala were practicing slash and burn cultivation as indicated by Suresh (2010). *Malavettuvan* and *Malekudiya* tribes of Kasaragod district, *Mullukuruman*, *Kurichyan* and Wayanad *Kadar* tribes of Wayanad district, *Kurumbar* tribe of Attappady region in Palakkad district and *Muthuvan* tribe of Idukki district were some among them who practiced slash and burn cultivation.

The agricultural practices of *Kurichia* tribe in Kerala were analyzed by Suma (2014) who reported that fragmentation of land and decrease in productivity was common in the joint management system of farms and lands followed by them.

Jalaja and Kala, (2015) in their study of Attappady farming sector found that most of the tribal farmers in the region were small-scale farmers who cultivated grains, paddy and vegetables. Majority of these farmers were illiterates and as such had no access to agricultural information on availability of seeds of improved varieties, pest disease management practices etc.

During the period 2001-2011 a kind of metamorphosis was discerned in Attappady regarding the cropping pattern. The combination of three crops of spices, tubers and fruits were switched to a combination of four, comprising of vegetables, fruits, spices and tubers. Mulching and micro irrigation facilities were integrated in their farming practices by a small group of farmers in that area, by seeking assistance from the Department of Agriculture (Premakumar *et al.,* 2015).

About 80 per cent of tribal population across India are agriculturists for whom gathering, hunting, fishing and minor forest product collection formed the major economic activities. Farming sector of tribes was considered as unproductive because of lack of knowledge on scientific practices in agriculture, monocropping, lack of irrigation facilities, indebtedness, uneconomic holdings, lack of mechanization or use of primitive implements (Sanal and Atheeque, 2018).

Sridhar and Kanti (2018) elucidated that the farming practices of tribal people were mostly organic which could be a positive component that could be utilized for the economic benefit of the system.

Majority of the tribal population in Adilabad district in Telangana state were illiterates with nuclear family system. Most of them were farmers and agricultural labourers who practiced monocropping system and were found to be incompetent in improved agricultural practices (Lakshmi and Paul, 2019).

Parida, (2020) revealed that the tribals in high terrains of Odisha cultivated crops like paddy, turmeric etc. using traditional agricultural practices, which was the main reason for lesser yield when compared to nontribal producers. But their traditional agricultural practices helped in maintaining soil fertility with quality produce but failed to meet the increased demand for agricultural produce for the increasing population.

Tribes of Attappady depended on indigenous knowledge based farming practices gained through oral traditions over generations for their livelihood. Their access to land facilitated them to cultivate traditional crops such as millets, pulses, cereals and oilseeds in sufficient quantities that ensured nutritional and food security (Sachana and Bonny, 2020).

2.3 LIVELIHOOD ANALYSIS

According to Chambers and Conway (1991) livelihood analyses covered multiple activities like stability, crises and coping, relative income, expenditure, credit and debt of a household.

According to Ramakrishnan (1993), sustainable livelihoods for the weaker and vulnerable sections of the society could be ensured only with the sustainable development. He opined that, efficient utilization of resources with equity and social justice which implied strong community participation.

DFID (2000) explained that the livelihood comprised of the capabilities, assets and activities in a system required for a means of living. Accordingly a livelihood was considered sustainable when it could deal with and recuperate from shocks and stresses and sustain or develop its competences and resources both at present and in future without depleting the natural resource base.

The modern technologies and development will directly affect and destroy the normal living and sustainability of tribal life and hence all the technologies and innovations developed by scientists should be initially tested and analysed in their places and the economic, social and ecological impacts should be studied (Rajendralal, 2005).

FAO (2008) reported that livelihood is closely linked to socio-economic status, a term used to reflect an individual's access to resources such as food, potable water, health facilities, educational opportunities, and housing. Generally, five categories of assets were identified to be contributing to livelihoods and they include human, physical, social, financial and natural assets.

In the study conducted by Chandran (2012), the housing conditions of the tribal population were analysed for the period 2001 to 2011 and was found that there was remarkable progress in the housing and basic amenities such as access to safe drinking water, electricity etc.

2.4 TRIBAL LIFE

According to Gadgil (1991) most of the tribal communities were aware of the value of conserving biological resources and had devised effective methods to conserve them.

Mahapatra (1991) stated that the indigenous people had not benefited from the developmental projects, while mainstream societies had prospered at their expense, pushing them further deeper into the poverty trap.

The tribal people of Kerala were highly indebted to money lenders as they were not able to make both ends meet with what they earned (Indira, 1993). She has also noted that the measure of indebtedness among Irulas of Nakkupathy in Attappady was the result of such worst exploitations by money lenders on these tribal people.

Sharma (1994) found that the low return in agriculture was the result of low production that was not sufficient for commercialization. The tribes were not aware of the technology changes and invention in different fields of production. They followed primitive methods and used indigenous implements of cultivations. These ultimately resulted in the poor economic status of Indian tribes.

Jha (1995) categorised tribes based on their economic stages of development as forest hunting type, the hill cultivation type, the plain agricultural type, the simple artisan type, the pastoral and cattle herder type, the folk artist type, the agricultural and non-agricultural, the skilled white-collar job and traders type.

Tribes were forced to work as agricultural labourers as a result of several policies of the state and intervention of outsiders which caused land alienation process (Bijoy and Raman, 2003). The authors also opined that the land alienation process worsened the socio - economic situations of the tribes in Kerala.

Chacko (2005) ascertained that the tribal people were viewed as an anachronism or viewed with inquisitive interest in almost all developing and developed societies. Marginalized by the creation of the boundaries of the nation state initially, these indigenous people were further hedged in by colonialism and, then, by the mediocre or patronizing modern state. He concluded that social pressures of technology, market economy and state policy, made significant changes in the way of life of tribal communities over the past decades.

Generally, tribes in Kerala did not stick to any one particular occupation. They usually changed their occupation from one to another depending upon the

availability of jobs, climatic conditions and variation in seasons as reported by Mercy (2005).

Haseena (2007) found that the health condition of tribal women in Attappady depicted a very dangerous picture with the Primary Health Centers (PHC) without sufficient medical facilities and medicine. The conditions of the sub centers are also very pathetic. Whether deliveries take place at the home or in hospital, the tribal mothers are not healthy enough to deliver healthy babies. Almost all of them are horribly anemic. Most of them suffer from deficiency too. It is dangerous for a pregnant woman to have a hemoglobin count below ten. But most tribal women have only six or seven counts. Eclampsia (high blood pressure and seizures) is very common among the tribal women as compared to other women.

Aerthayil (2008) reported that globalization has brought about tremendous economic changes in India and had a negative impact on tribals in Kerala, the most backward and marginalized sections in the state. It had tremendous effect on their livelihood, including employment and the availability of essential commodities, and on the socio-cultural life, including their cultural and religious practices.

The GOI (2008) in its 'Kerala Development Report' stated that rural poverty among adivasis in Kerala was more than two and half times that of the rural population of Kerala in general. Adivasis constituted only around one per cent of the state's population and nearly one fourth of them lived below the official poverty line. The actual incidence of poverty among them could be even higher, which indicated the various dimensions of social inequalities prevalent in the state.

Shincy (2012) in her study on livelihood analysis of Irula tribe of Attappady reported that 54 per cent of tribespeople were deprived with respect to the nutritional security.

According to Vidya (2016) in her study on tribes of Thrissur district found out that dietary habits of the families were non vegetarians and majority of the families had a three meal pattern and cooked food once in a day. The diet of the

families was based on cereals and pulses. The consumption of green leafy vegetables was found occasional in 26.67 per cent of the families and also milk and fruits were consumed rarely by the families.

2.5 TRIBES OF ATTAPPADY

The inhabitants of Attappady include tribals and non-tribals. Most of the non tribals are migrants from Tamil Nadu residing in the Eastern low lying areas of Attappady and the western region consisted of residents from other parts of Kerala. As such the tribal inhabitants of Attappady could not be considered as aboriginal as reported by Nair (1988).

Kurumbas, tribal group were less exposed to the invasive population of Attappady and they were the least affected in terms of cultural erosion (Kunhaman 1989).

The majority among the tribal population of Attappady were *Irulas*, who were the inhabitants of plains and lower elevations (Padmanabhan and Sujana 2008).

According to Shincy (2012) Attappady region remain emblazoned with dynamic, lively and conflicting socio-cultural traits. This was the results of migrants from the plains of East and West who got settled in Attappady area displacing many of the tribes from their original habitats. This subsequently made the tribes a minority with population less than half of the total in the area and was dominated by *Irula, Muduga* and *Kurumba* communities.

Alex *et. al.* (2016) stated that during the lean seasons the *Mudugas* and *Irulas* mostly depended on public distribution system and private shops for food. At the same time *Kurumbas* depended on leaves, tubers and other consumables available in the forest for their basic need of food.

Manikandan (2016) reported drastic changes in the livelihood aspects and strategies of tribes of Attappady over the years. He enlisted British colonialism,

settlers from Kerala and Tamil Nadu, landlords, developmental schemes, forest laws, deforestation and market economy as some of the influential factors for the changes. As reported by him *Irulas* and *Mudugas* were the most affected group.

2.6 FOOD SECURITY

Food security represented a broad concept that evolved in the global context of food crisis from the mid-1970s. It has been assumed to be of importance to recognise the different dimensions of food security in a holistic manner in order to address the problem comprehensively. Hence an attempt to elucidate the evolution of the concept over the years.

2.6.1 Evolving definition of food security

The gradual theoretical evolution of food security is evident in the following definition my various global agencies and researchers who worked in the area as listed below.

World Food Conference (1974) gave one of the pioneering definition of food security as the availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuation in production and prices.

According to FAO (1983) food security was about ensuring that all people at all times had both physical and economic access to the basic food stuff that they needed.

According to USAID (1992) all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life.

Maxwell and Frankenberger (1992) explained food security as the secured access at all times to sufficient food for a healthy life.

FAO (1996) stated that the food security existed when all people at all times had access to sufficient, safe and nutritious food that met their dietary needs and food preferences for an active and healthy life.

According to FAO (2009) food security existed when all people at all times have physical, social, and economic access to sufficient, safe and nutritious food that met their dietary needs and food preferences for an active and healthy life.

2.7 TRIBAL FOOD SECURITY

In an investigation led among Aadi tribal villages of Pasighat regions, East Siang area of Arunachal Pradesh in India, it was observed that the tribes conserved numerous indigenous assortments of grains (for the most part paddy and millet crops), vegetables, spices, pulses and oil seeds under shifting agriculture practice. There were about 74 indigenous varieties of these crops, which were protected, conserved and produced provincially under the system. The study also observed that proficiency of ladies in identification and domestication of plant cultivars under shifting agriculture was more helpful than men to ensure food security through crop diversification under the rainfed conditions (Singh, 2003).

According to Verma and Paul, (2016) the forest assets significantly supported all occupations and means of livelihood among the tribal groups in Jharkhand. Forest development integrated with agri-horticultural and industrial advancement could possibly upgrade job security, decrease destitution and improve food security for the tribal communities. This could also contribute to livelihood improvements in the area for the ignorant, less resource endowed, landless tribal groups in the area.

2.8 DIETARY DIVERSITY

Krebs-Smith *et al.* (1986) tried and compared three different types of dietary diversity measuring procedures which included 1) an overall variety score (simple count of food items), 2) a variety score among major food groups (6 food groups), 3a) a variety score within major food groups, counting distinct foods and 3b) a

variety score within major food groups, counting minor food groups. All dietary measures were based on a 3-day recall period.

WHO (1996) stated that lack of dietary diversity was a particularly severe problem among poor populations from the developing countries because their diets were predominantly based on starchy staples and may contained little or no animal products and few fresh fruits and vegetables. Plant-based diets were low in a number of micronutrients, and the micronutrients they comprised were most probably in the form that was not easily absorbed.

Lowik *et al.* (1999) reported that dietary diversity could be measured by summing the number of foods or food groups consumed over a reference period.

Hooshmand and Udipi (2013) studied about dietary diversity scores, and found that they were increasingly popular as they correlated well with nutrient adequacy and anthropometric indices of children.

Ruel and Alderman (2013) stated that the concept of nutrition sensitive agriculture assumed the agricultural production practices to have the potential to positively affect the underlying determinants of nutrition.

According to Nithya (2014) poverty was acute among the tribes in the state of Kerala where majority of the families had only one meal a day and amongst them half were engaged as agricultural labourers.

Vidya (2016) in her study about tribal families of Thrissur district, reported that majority of the families had a three-meal pattern and cooked food once in a day. The diet of the families was mostly based on cereals and pulses.

Nalinam (2016) in her study conducted in Wayanad, Palakkad and Idukki found that there existed vide disparities among average calorie intake of male and female tribes in the three districts. Due to the peculiarity of their food consumption both genders did not get the required calories. But intensity of lowest calorie consumption was highest for female members of the tribes compared to their male

counterpart. Female members of *Kattunaikyan* community reported lowest average calorie consumption and highest calorie consumption was reported among the females in *Kurichyar* tribes.

2.9 TRIBAL MALNUTRITION AND HEALTH

Nabhan (1989) opined that the failure of federal programs to include or support the continued use of traditional foods had contributed to native Americans' reliance on less healthy foods and culturally inappropriate patterns of consumption.

Amirthaveni and Barikor (2002) reported nutrition and health formed the vital conducive factors for human resource development in countries like India.

Large sections of Indian population suffered from varying degrees of protein energy deficiency (Gopalan, 2002).

Undernourishment continued to be a dominant public health problem and was a cause of considerable extent of child deaths in every year especially in developing countries like India (Black et al., 2003).

Chopra and Makol (2004) found that the common illnesses seen among children in the tribal community of Bastar district of Madhya Pradesh were anemia, malnutrition, diarrheal disease and skin infections. They attributed the situation to the lack of infrastructure, inaccessibility to health institutions and affordability prevalent among the tribes.

The high prevalence of malnutrition in tribal children was closely related with poor feeding practices. Poor feeding practices included delayed initiation of breastfeeding, low duration of exclusive breast feeding and improper weaning practices which contributed to malnourishment in tribal preschool children (Chakrabarty *et. al*., 2006).

Victora (2008) reported that under nutrition in children resulted in life-long consequences, including increased risk of disease, poor cognitive development,

lower school performance and high risk of death in childhood. It also reduced productivity; and increased the risk of chronic diseases in adulthood.

WHO (2008) reported that the emphasis in public health must shift from individual-level interventions that aimed to modify people's behaviors to societal-level interventions that ameliorated their everyday socioeconomic conditions in the study on social determinants of health.

Malnutrition was not only influenced by the food intake but also by access to health services, care for child and pregnant mother and hygiene practices (UNICEF, 2009).

Braveman and Gottlieb (2014) and Marmot *et. al.* (2008) proved from their respective studies that the socioeconomic resources such as wealth, income, and employment were termed as the social determinants of health. Health inequalities were set forth by these fundamental factors. In a manner they influenced the everyday conditions, experiences, and exposures that influenced health situations.

Findings of Nelson and Fritzell (2014) supported that the health of socio-economically unprivileged groups was protected by social assistance programs and also aided in mitigating the extent of socioeconomic health inequalities.

2.10 THEORETICAL FRAMEWORK OF THE STUDY

Based on the literature reviewed a venn diagram depicting the theoretical linkages among the various selected variables was worked out and is presented as Fig. 1.
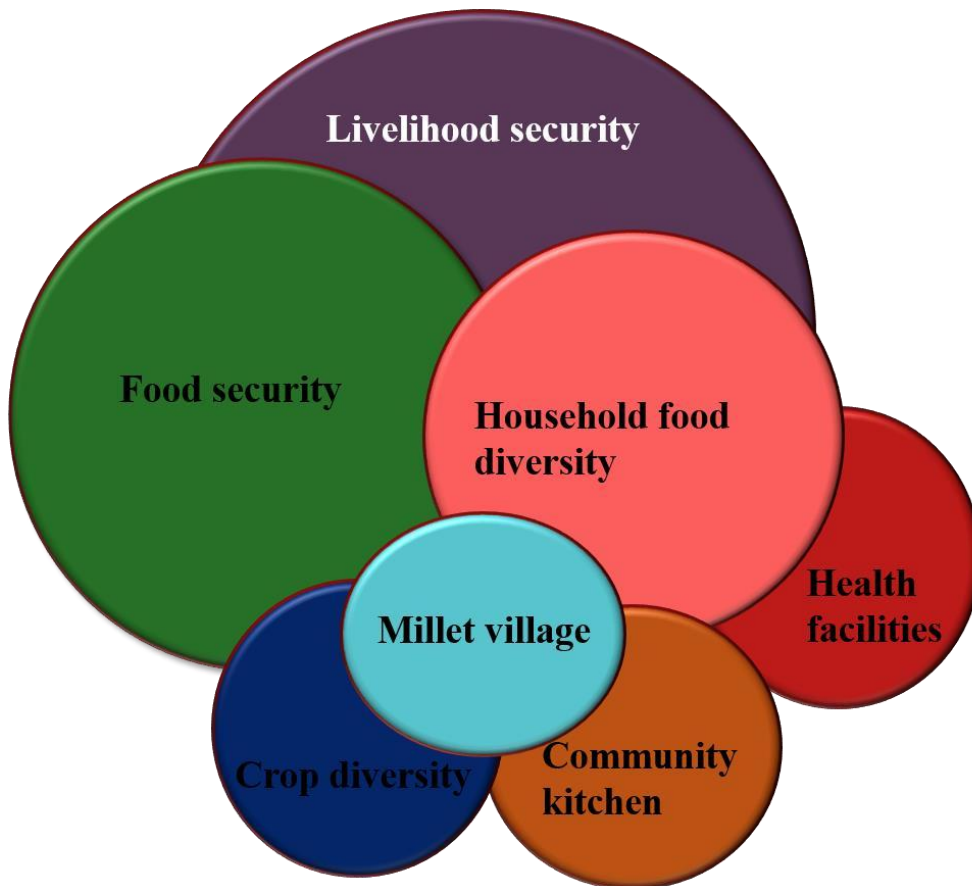
Fig. 1 Conceptual diagram based on theoretical framework of the study

METHODOLOGY

3. METHODOLOGY

The chapter describes the research methods and procedures followed in the present study. The related aspects are detailed under the following subheads in the chapter.

3.1 Research design

3.2 Locale of the study

3.3 Selection of the sample

3.4 Methods used for data collection

3.5 Factors influencing the selection of farming techniques and strategies

3.6 Household dietary diversity of Attappady tribes

3.7 Food security status of the Attappady tribes

3.8 Livelihood security analysis of the Attappady tribes

3.9 Statistical analysis

3.1 RESEARCH DESIGN

Hoffer and Bygrave (1992) defined research design as a basic plan for collecting the experimental data necessary to validate or disprove the basic underlying theories or conceptual models that are investigated.

The present study followed *Ex-post facto* design. It is a research design in which the investigators attempt to trace an effect that has already occurred to its probable causes. It is also a systematic empirical enquiry in which the scientist does not have direct control over the independent variables (Singh, 2006).

3.2 STUDY LOCALE

The study was piloted in Palakkad district, which was purposefully selected because it is one of the districts having highest concentration of tribal settlements in Kerala. Moreover, widespread ecological degradation has been reported to be

adversely affecting the livelihood security of people, especially the tribal women and child population in the area.

3.2.1 Brief description of Palakkad district

Palakkad formed the biggest district in Kerala adjoined on north by Malappuram district, on the south by Thrissur district, on the west by Thrissur and Malappuram districts and east by Coimbatore district of Tamil Nadu. The district lay between 10º21' and 11º14' North latitude and 76º02' and 76º54' East longitude. The Western Ghats bordered the region and the 32 km long gap (Palakkad gap) in the mountains asserted a dominant influence on the climate of the region.

There are 163 revenue villages, 4 municipalities, 13 blocks and five taluks in the Palakkad district. Local self-governments (LSG) administered the development activities at the district panchayat, 13 block panchayats and 91 grama panchayats of the district. Though traditionally entitled as the *granary of Kerala* due to the presence of vast paddy lands, the current extent of urbanization has been reported as 13.6 per cent. The population of the district is 28,10,892 which constituted 8.42% of the total state population (GOI, 2011). 11.5 per cent of the total Kerala state area is constituted by the overall area of the Palakkad district that is 4,480 sq.km. Forests covered 1,360 sq.km of the total land area.

3.2.2 Selection of Panchayats

The Scheduled Tribe (ST) population of Kerala was reported at 4,84,839 which formed 1.45 per cent of the total population of the state (Census, 2011). Highest concentration of Scheduled Tribes is seen in Wayanad district (31.24 per cent) followed by Idukki (11.51 per cent), Palakkad (10.10 per cent) and Kasaragod (10.08 per cent). These four districts together account for 62.93 per cent of Scheduled Tribes in the state.

Attappady which formed one of the 43 tribal development blocks in India, located in Palakkad district formed the study area. It is one of the prominent forest regions of Kerala, which is situated in the north eastern part of Palakkad district

Plate 1. Visiting the 'Millet village' plots

(Fig. 2). The Attappady valley is a southward extension of the Gudalur plateau of the Nilgiris hills in the Western Ghats. It is at an average elevation of 800-1000 meters above the mean sea level and the highest point is the *Malleeswaran* peak. The Bhavani and the Siruvani rivers flow south in the region and join outside the limits of Kerala. It is inhabited by three tribal communities viz. *Irulas, Mudugas and Kurumbas.* As per 2011 census report the predominant of them is the *Irula* community (84 per cent) followed in number by the *Muduga* (10 per cent) and the *Kurumba* (6 per cent) communities respectively.

Irulas: The most populous among the three tribal communities in Attappady region, *Irulas* are distributed among 106 hamlets in the eastern part comprising Agali, Pudur and Sholayur panchayats. Like all other tribal hamlets, the *Irula* hamlets are also built in such a way that they command a view of the *Malleeswaran* peak. The term *Irula* meant dark or black which either referred to the dark jungles in which they reside or to the darkness of their skin. They traditionally practiced shifting cultivation on the forested uplands, dry land farming with ploughing and wet land paddy cultivation. They are considered expert collectors of honey from the beehives. They form the most acculturative group with maximum interaction with outsiders. The literacy rate recorded an increase from 11.75% in 1981 to 57.63% in 2018. This increase also got reflected in the rise of the proportion of those taking tertiary occupations under public departments. Although *Irulas* were considered to be the most inferior among the three tribes studied, they recorded impressive literacy rates, particularly the female literacy, and sex ratios. They were patriarchal community and followed monogamy as a norm. Though polygyny was approved at times, polyandry was strictly forbidden. *Irulas* were non-vegetarians who relished on meats of sheep, goat, field rats, fowls, deer and pig. However, the flesh of buffalos or cattle was not used by them.

According to the prevalent social norms of *Irulas, Kurumba* was considered as a superior community but *Muduga* was treated equal. But this was not reciprocated by the *Muduga* as they considered the *Irula* as inferior to them. This is

reflected in inter community marriages permitted between Kurumba and *Muduga* but not with the *Irula*.

***Kurumba*:** Etymologically, *Kurumba* means one who rear sheep and demographically they constituted the smallest group of the three communities. They lived in two geographically separated segments, the one who inhabited Attappady region was called *Palu Kurumbas* and those inhabiting the Nilgiris was called the *Alu Kurumbas*. They were semi-nomadic and Anavayi, is considered as their original settlement. They also followed a unique system of shifting cultivation described as *dig and scratch* method. According to the method they would dig just enough to plant the seeds or the seedlings and was considered a way of conserving the natural soil base. They also depended on the roots and tubers collected throughout the year. Herding, wage labour, and marketing were the popular vocations among them and in many ways, they were more like hunter-gatherers than agriculturists who used half of what they collected for consumption and exchanged the rest under Barter system. Thus, they were often termed as a settled foraging society who followed patrilineal norms. Though polyandry is forbidden, polygyny is considered as a status symbol. Tradition of herbal medicine for curing of diseases is well established in the community and is often linked to magical and religious practices. It is also observed that the use of modern medicine has gained popularity in the community and they showed a favourable attitude towards family planning programmes.

***Muduga*:** They are tribes settled around the *Malleeswaran* peak in Attappady. The population of *Muduga* living in Attappady region is only 10 per cent of the total tribal population (Census, 2011). They are regarded as the earliest immigrants and consider themselves equal to *Kurumba* with whom they inter-marry. Socially they discriminate *Irula* as inferior to them and do not indulge in matrilineal or any social relation with them. They were once shifting cultivators and have now become largely landless.

Agali, Pudur and Sholayur are the three grama panchayats in Attappady tribal development block and it spreads over six revenue villages such as Agali,
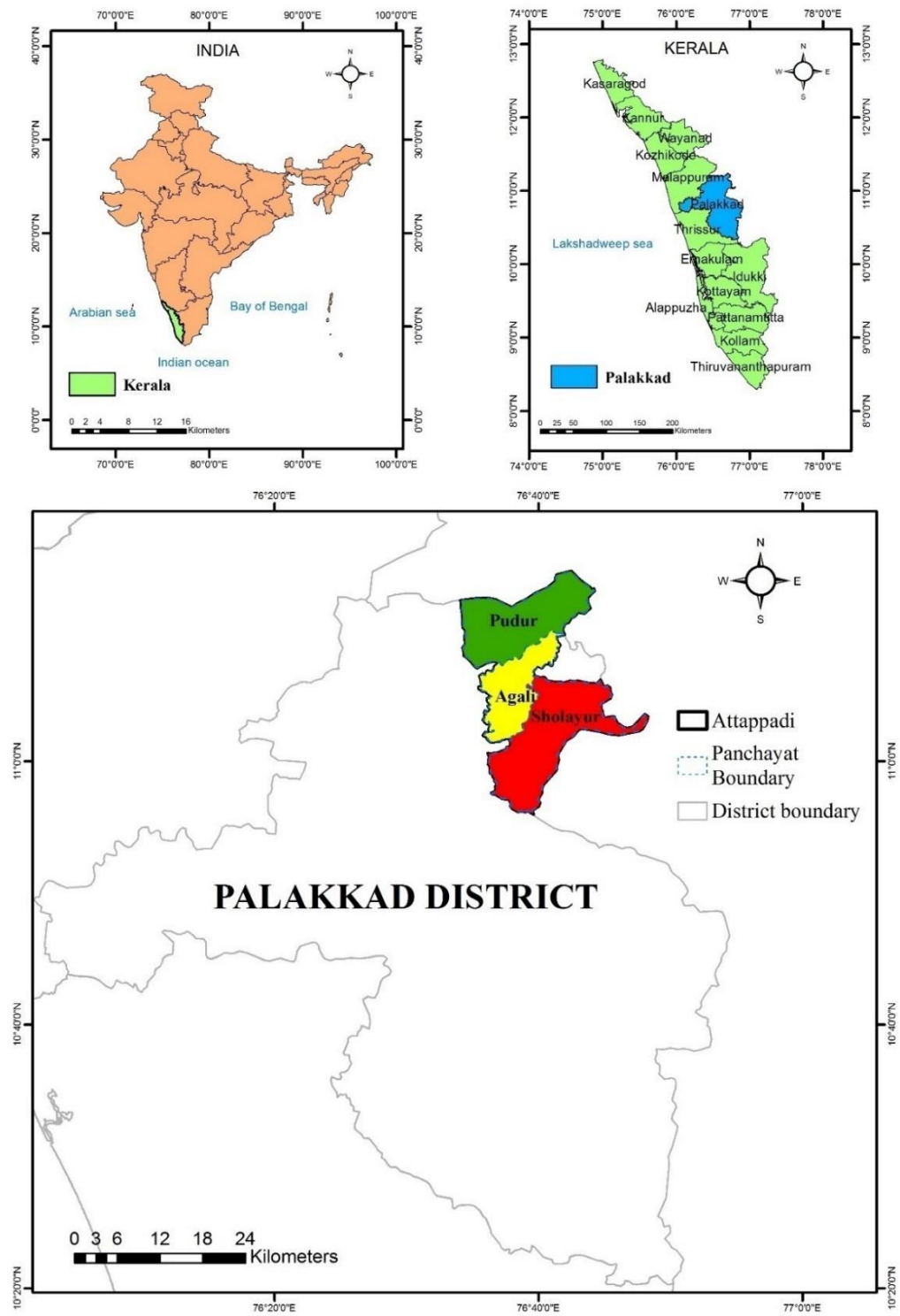
Fig. 2. Map of Palakkad showing the study panchayats

Kallamala, Pudur, Padavayal, Sholayur and Kottathara. The population of Attappady comprised of both tribal and non-tribal population. The non-tribal population termed as *vanthavasis*, largely consisted of settlers from the states of Tamil Nadu and Kerala. They constituted 55 per cent of the population, and the Scheduled Tribe (ST) and Scheduled Caste (SC) comprised 45 per cent. The tribal people of Attappady resided in small nuclear villages called *ooru*. On an average, 50 houses constructed in rows, close to one another and formed each *ooru*. The *Irulas* formed the major tribal group among the tribes and lived in 144 hamlets in the region.

3.3 SAMPLE SELECTION

The three panchayats of the Attappady tribal developmental block namely Attappady I (Agali panchayat), Attappady II (Pudur panchayat) and Attappady III (Sholayur panchayat) were selected for the study as shown in Fig. 3. One hundred tribal families were randomly selected from each of the three panchayaths. Thus, a total of 300 tribal families formed the sample size for the study (Fig. 3).
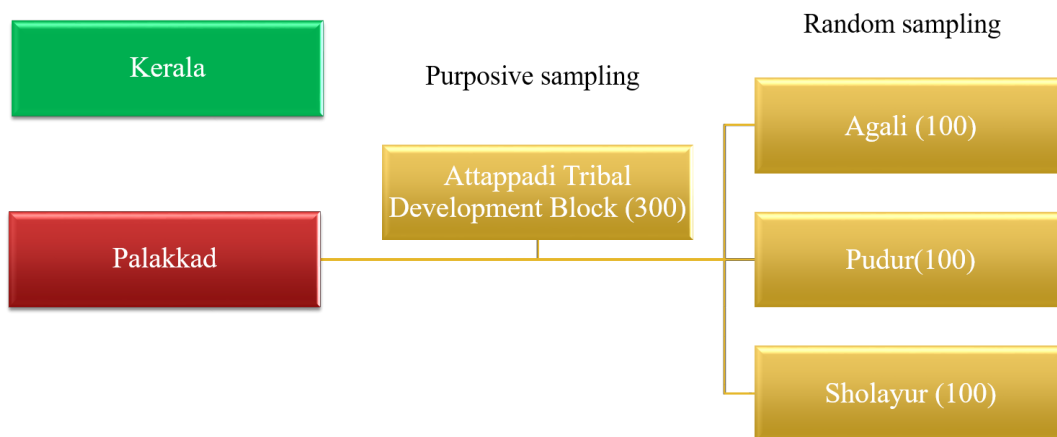
Fig. 3. Flow diagram showing the selection of sample for the study

3.4 METHODS USED FOR DATA COLLECTION

Personal interview method was used in the primary data collection for which a structured schedule developed for the purpose of the study was used. It included

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adopted or developed instruments for the measurement of all variables selected in the study and is given as Appendix-I. The questionnaire was prepared in a conversational manner and transliterated to required schedule at the same time. Tribal respondents were interviewed in their own places and a bond was created. The unclear responses were cleared at the same time to avoid chaos in future. Local interpreters were used to establish the needed connect with the respondents.

3.5 FACTORS INFLUENCING THE SELECTION OF FARMING TECHNIQUES AND STRATEGIES

Delineation of the factors influencing the selection of farming techniques and strategies among tribal farmers were made based on a set of statements selected through literature review and expert rating. Pretesting of selected statements was done in a non-sampling area among 30 randomly selected respondents. In order to determine the relative position of the farmer's scores, the response to each statement in the module was coded either in affirmative or negative (1 or 0) and the total was computed. Selected statements were given for judges rating and 23 statements which were rated by more than fifty per cent judges were selected for the measurement tool. The set of questions given in the main survey questionnaire was pooled into a single overall measurement scale so as to have a continuous, linear scale measured in a single numerical value ranging from 0 to 23. The content validity method through judges rating was used to determine the questionnaire validity. The reliability of the instrument was measured using Cronbach's Alpha statistics and was found to be 0.92 which showed high reliability acceptable enough to be used in data collection. The used 23 statements are given in Appendix-II.

Analysis of data: Data collected was analysed using factor analysis to delineate the factors that influenced the tribal farmers in their selection of farming and adaptation strategies. Analyses were conducted using SPSS software for Windows version 9.2. It helped to reduce the dimensionality of the dataset down to fewer unobserved variables. Descriptive Statistics that were used in the work were the mean, standard deviation, frequency and percentages in evaluating profiles of respondents.

3.6 HOUSEHOLD DIETARY DIVERSITY OF ATTAPPADY TRIBES OF KERALA

The Household Dietary Diversity Score (HDDS) released in 2006 as part of the FANTA II Project (Food and Nutrition Technical Assistance) and was used to measure the tribal household dietary diversity in the study. It is a population-level indicator meant to provide an indication of household economic access to food (Kennedy *et al.*, 2011). Household dietary diversity is conceptualized for the study as the number of food groups consumed by a household over a given reference period, and as such formed an important indicator of food security. Quantity of food items consumed by respondent households recorded based on a 24-hour recall period was used in the analysis in an interval of three days for three times. A more diversified household diet is correlated with caloric and protein adequacy, percentage of protein from animal sources (high quality protein), and household income (Swindale & Bilinsky, 2006). The amount of cooked food consumed by the respondent was then converted to its raw equivalents. The nutritive value of the foods consumed was then calculated using the food composition tables suggested by Gopalan *et al.* (2010) and compared with the RDA of nutrients suggested for sedentary working female and heavy working male.

Each food group is assigned a score of 1 (if consumed) or 0 (if not consumed). The household score ranged from 0 to 12 and was equal to the total number of food groups consumed by the household as detailed below. The list of 12 food groups used in the study is presented in Table 1.

HDDS= Sum (A+B+C+D+E+F+G+H+I+J+K+L)

The average household dietary diversity score for the population of study can be calculated as follows:

Sum (HDDS)
Total number of households surveyed

Table 1. List of food groups used in HDDS

A. Cereals	G. Fruits
B. Pulses/legumes/nuts	H. Vegetables including green leafy vegetables
C. Milk and milk products	I. Root and tubers
D. Meat, poultry	J. Oil/fats
E. Eggs	K. Sugar/honey
F. Fish and seafood	L. Miscellaneous

In addition to the HDDS, another indicator, percent of households that consume Vitamin-A rich vegetables, fruits, meat or milk was also calculated to quantify the proportion of households that are consuming these specific foods. This was calculated using the following procedure.

Households that consume vitamin A rich vegetables, fruits, meat, egg or milk = (No of households with C/D/E/F/G/H) / Total number of households surveyed.

The data collection was based on dietary diversity questionnaire that represented a swift, user-friendly and easily administered low-cost assessment tool. Expanded questionnaire is used for the best outcome and the Food Frequency Questionnaires (FFQs) used in the study is given as Appendix –III.

Analysis of the data

Tabulation of the HDDS has been done with the aid of a computer spreadsheets. HDDS variables are calculated for each household and the value of this variable ranged from 0 to 12.

Items that required household resources to obtain such as condiments, sugar and sugary foods, and beverages, were also included in the score. When the individual scores reflected the nutritional quality of the diet, the Household Dietary Diversity Score (HDDS) indicated the economic ability of a household to access variety of foods. In order to better reflect a quality diet, the number of different food groups consumed was calculated, rather than the number of different foods

consumed. Thus, the HDDS has been designed to reflect household dietary diversity, on average, among all members.

The nutrient intake based on age, sex and activity was compared with Recommended Dietary Allowances (RDA) suggested by ICMR (2010). The percentage of RDA met was computed to find out the adequacy of nutrient intake.

3.6.1 Household dietary pattern of tribes of Attappady Tribal Developmental Block

A diet survey conducted to assess the dietary pattern of Attappady tribes among the selected respondents as 30 each from *ooru* where there was community kitchen functioning and the other control set drawn from where there was no community kitchen. The pre-tested schedule used is presented in Appendix IV. The frequency of consumption of different food items by the respondents was assessed by recording the use of different foods using a frequency scale *viz.,* daily, thrice a week, twice a week, monthly twice, monthly once, occasionally/never. The scale suggested by Raeburn *et al*. (1979) was used for calculating the percent of food use frequency and the formula used is as given below.

Percentage of total score = *(R1S1 + R2S2 + • • • + RnSn)/n*

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

Rn = percentage of respondents selecting a rating

n = maximum scale rating

Analysis of the data

Scoring procedure was followed to quantify the frequency of use of food items. The daily used food items were given a score 30, those food items used four times in a week were given a score of 16, thrice a week were given a score 12, twice a week as 8, once a week as 4, monthly twice as 2, monthly once as 1 and those that were used occasionally/never were given zero score. Mean scores were calculated for each food group. The mean percent score was calculated by dividing the mean score on the maximum score of 30 and multiplied by 100. The foods that scored

above 90 per cent were grouped as daily used foods while those foods that scored below 15 per cent were classified as least frequently used foods. Frequently used foods were those items which scored between 75- 89 per cent and the less frequently used foods were those which got scores ranging between 15 -74 per cent.

3.6.2 Crop Diversity Index of the Attappady Tribal Developmental Block

Crop diversity is a facet of biodiversity significant for food security. FAO (2002) stated that the decline of biodiversity has to be considered as one of the most serious present day environmental concern. While crop diversification will be a practical solution in reducing the risks associated with food insecurity, the efforts done to increase the crop diversity in the deprived regions were comparatively less. The low income from agricultural production and prevalent nutrition insecurity were the major challenges associated with low crop diversity. In order to enumerate the crop diversity status of Attappady tribal development block Simpson Diversity Index (SI) was used. In order to quantify the biodiversity of a habitat, it takes into count the number of species alive and the richness of each species. Richness and evenness are the two main factors taken into account for measuring diversity. The measurement details of SI is given below.

Simpson Index: It is the most suitable index for measuring diversification of crops in a particular geographical region and is calculated by the following equation.

Simpson Index (SI) $= 1 - \Sigma Pi^2$

Where, $Pi = Ai / \Sigma Ai$

Simpson's Diversity Index is a measure of diversity where Pi denoted the proportion of the *i*th activity in acreage. If SI is near zero, it indicated that the zone or region is near to the specialization in growing of a particular crop and if it is close to one, then the zone is fully diversified in terms of crops.

3.7 FOOD SECURITY STATUS OF THE ATTAPPADY TRIBES

The following steps have been adopted for the development of a scale to measure food security of tribal people:

- Identification and operationalization of different dimensions
- Item selection and scrutiny of items
- Validity measures
- Reliability analysis
- Analysis of the data

3.7.1   Identification and operationalization of different dimensions

The FAO (2009) definition implied four core axioms for measurement i.e. *scale axiom* (must address both individuals and groups at various scales of aggregation), the *time axiom* (assess stability, both predictable and unpredictable variation), the *access axiom* (poverty, institutions, infrastructure) and the *outcomes axiom* (that nutrition and health ultimately achieved). The theoretical analysis also provided four dimensions of food security that included availability, access, utilization and stability. So, these dimensions were enlisted for inclusion in the scale *viz.* food availability, accessibility, utilization and stability faced by the tribal people. Each of these dimensions were operationalized as follows.

Food availability: Food availability was operationalized as a situation where all people had necessary quantities of food available on an unswerving basis.

Food accessibility: Food accessibility was measured in terms of physical, social, and economic access to food. It was operationalized as the affordability and allocation of food, as well as whether the respondent had sufficient income to buy food at existing prices or had adequate land and further assets to cultivate his own foodstuff. There were two distinct types of access to food viz. direct access and economic access. Direct access involved the capacity of a household to produce its own food using human and material resources and economic access involved the

purchase of food from outside sources by the household using its economic resources.

Food utilization: It denoted the outcome of food in terms of nutrition and health ultimately achieved by the individual from its food consumption. Food utilization was operationalized in terms of the metabolism of food by individuals. Access to healthcare was another determinant of food utilization, since the health of individuals was an indirect measure of how the food was metabolized.

Food stability: Food stability was operationalized for the study as the ability to obtain sufficient food over time, given both predictable and unpredictable variation.

3.7.2. Item selection and scrutiny of items

The food security core module questionnaire covered a full range of severity of food security observed under current condition for the families with children. In order to determine the relative position of the family's scores, the response to each question in the food security core module was coded as either affirmative or negative (1 or 0) and the total was computed. The set of food security questions included in the core survey module was combined into a single overall measure called food security scale so as to have a continuous, linear scale which measured the degree of food security experienced by a family in terms of a single numerical value ranging from 0 to 28. The food security core module questionnaire is given as Appendix V.

3.7.3. Validity analysis of scale

The competence of the tool to measure the food security of tribal people was confirmed by establishing the content validity. All the parameters of food security were comprised in the index with the help of expert discussions and literature review.

3.7.4. Reliability analysis of scale

Reliability of a scale ensured the stability, dependability, consistency and accuracy of measurement by the instrument (Kerlinger, 1978). The reliability of the index was established through coefficient alpha (Cronbach, 1951). Reliability

statistics of the scale was found using Cronbach's Alpha that recorded a score of 0.89 then, the high consistency of the instrument was ensured.

3.7.5. Food security Index

In order to calculate food security index (FSI), primarily each component score was added and used in the following equation

$$\text{FSI} = \sum_{i=1}^{4} FS c \quad /$$

Where $\sum_{i=1}^{4} FSc$ is the sum of components of food security

n = total number of components

3.8 LIVELIHOOD SECURITY ANALYSISOF THE ATTAPPADY TRIBES

A livelihood is a means of securing the necessities of life and was operationally defined as including the competence, wherewithal, (both material and social assets) and all required living activities. Competence meant to include everything that a person could achieve with his/her economic, social, and personal characteristics with aset of alternative beings and doings. Wherewithal comprised several components and some of which represented the economic factors like capital, and claims and access to resources.

According to FAO (2009), generally, there were five categories of assets identified as contributing to livelihoods such as human assets, social assets, natural assets, physical assets and financial assets. People drew from these set of capital assets that served as a basis for their livelihoods.

A sustainable livelihood is established when it can cope with and recuperate from pressures and shocks and uphold or improve its capabilities and assets both in the present and in the future, while not undermining the natural resource base. Sustainable Livelihood Framework by FAO (2008) was used for conducting livelihood analysis in the study. Asset pentagon was used for analyzing the availability and access of people to various capital dimensions *viz.* human, social, natural, physical and financial assets (Fig.4). The asset pentagon lies at the core of the livelihood's framework 'within' the vulnerability context. The vulnerability

context referred to the seasonality, trends, and shocks that affect people's livelihoods and it is a complex array of influences having direct or indirect impact.
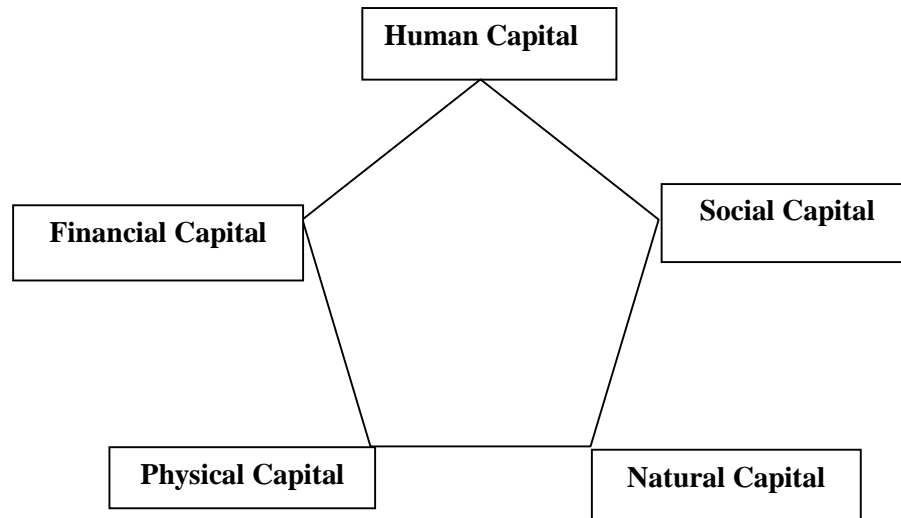
Fig. 4 Livelihood asset pentagon (FAO, 2008)

The shape of the pentagon could be used to show schematically the variations in availability and access of people to various assets *viz.* human assets, social assets, natural assets, physical assets and financial assets. The idea has been conceptualized with the central point of the pentagon, at which the lines met, representing zero access to assets while the outer perimeter represented the maximum access to assets. So, pentagons of different shapes will apply to different situations and these pentagons change over time. So, the asset pentagon needs to be considered as a dynamic and diagrammatic presentation of the assets of a social group. On this basis, pentagons of different shapes could be drawn for different communities or different social groups within the same communities. In order to assess the livelihood capital status of tribes in the study area and for plotting the pentagon, a measurement procedure was developed. Livelihood capital comprising five component capitals as was given in the Sustainable Livelihood Framework and its component parameters were measured using scoring procedure developed for the study following Shincy (2012). The component parameters were selected on the basis of consultation with experts and review of literature. The component parameters selected for the study are presented in Table 2.
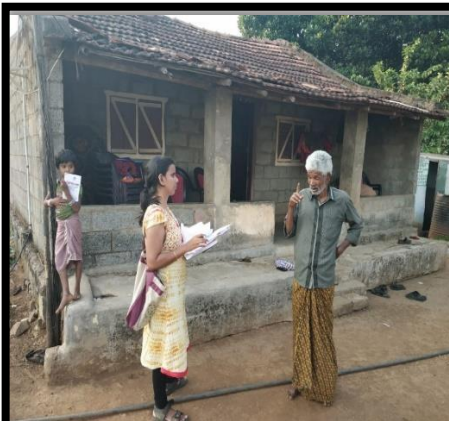
Plate 2. Establishing rapport with farmers in their field

Table 2. List of parameters used in the measurement of asset pentagon

Measured capital	Parameters selected
1. Human capital	
	1 Formal education
	2 Informal education
	3 Mass media exposure
	4 Social participation
	5 Contact with extension agency
	6 Leadership quality
	7 Innovativeness
	8 Addictive health behaviour
	9 Healthcare seeking behaviour
	10 Anthropometric measurements
2. Social capital	
	1 Relationship with family members
	2 Relationship with others
	3 Activities in public space
	4 Concerns towards the weaker sections
	5 Interdependence and networking
3. Natural capital	
	1 Land owned
	2 Utilisation of Natural resources to fulfil livelihood requirements
	3 Common property resources
4. Physical capital	
	1 Type of house
	2 Nature of house based on ownership
	3 Livestock possession
	4 Material possession
	5 Distance travelled in fetching firewood
	6 Access to safe drinking water
	7 Sanitation facilities
	8 Electricity connectivity
5. Financial capital	
	1 Income per month
	2 Expenditure patterns
	3 Indebtedness
	4 Borrowing patterns

3.8.1 Human capital

Human capital has been operationally defined as all the assistances needed to pursue different livelihood strategies and achieve their livelihood objectives. It includes the skills, knowledge, skilled labour and good health that together enable people to achieve the same.

3.8.1.1 Formal education

It is operationalised as the level of educational qualification achieved by the respondent at the time of study. Scale adopted by Shincy (2012) was utilized in the present study and the scoring pattern is given in appendix I.

3.8.1.2 Informal education

Informal education has been operationalized as educational interventions exterior to the formal system of education. A scoring procedure was developed for the measurement of informal education. It was calculated by counting the number of informal educational activities respondent was undergone till date. A scoring was based on the participation (2) and non-participation (1) by the respondent. Then sum of all activities were found out to get the overall score of a respondent as depicted in appendix I.

3.8.1.3 Mass media exposure

Mass media exposure is operationalised as how often the respondent was exposed to various mass media sources. The scale used by Prasidha (2006) was used with necessary modifications for the study. The score of a respondent was taken as the sum of overall scores of the items given in appendix I. The possible score ranged from 6-18.

3.8.1.4 Social participation

Social participation referred to the type and content of participation tribes people followed in various social activities. It was measured using the scale followed by Sachana (2015) given in Appendix I.

3.8.1.5 Contact with extension agency

Contact with extension agency represented the extent of contact the tribes people had with different extension agencies. The response was measured using the scoring procedure indicated in Table 3. Sum of each category was calculated to obtain the overall score. Maximum score was 3 and minimum score 1. Scale was adopted for the present study from Anoop (2013).

Table 3. Parameters used to measure contact with extension agency

Sl. No:	Category of personnel	Frequency of contact		
		Regularly (3)	Occasionally (2)	Never (1)
1	NGO Extension functionaries			
2	Agricultural officer/ Assistant			
5	Health workers			

3.8.1.6 Leadership quality

Leadership quality referred to the capacity of the tribes to inspire and influence others to join in the achievement of a common goal. The procedure followed by Meera (2001) was used to measure the same with slight modification. The five statements of the scale weighted on a three point continuum and the total score ranged between 5 and 15 (Appendix I).

3.8.1.7 Innovativeness

Innovativeness was conceptualized for the study as the curiosity and interest of the tribes to pursue advanced technologies as well as new techniques suitable for their daily living. The scale developed by Seema (1997) to study innovativeness was used here. The five statements of the scale was measured on a five point continuum and the maximum score was 25 and minimum score was five (Appendix I).

3.8.1.8 Addictive health behavior

Addictive health behavior referred to the degree to which a respondent was addicted to the habits of smoking, consumption of alcohol, drugs etc. The scale was

adopted from Shincy (2012) with slight modification to suit the study (Table 4). How often the respondent was using the addictive were measured and the maximum obtainable score was 12 and minimum was three.

Table 4. Parameters used in the measurement of addictive health behaviour

Sl. No.	Addictive habit	Frequency		
		Regularly (3)	**Occasionally (2)**	**Never (1)**
1	Smoking			
2	Use of alcohol			
4	Betel chewing			

3.8.1.9. Healthcare seeking behavior

The variable was operationally defined as the healthcare actions followed by the tribal respondents for promoting optimal wellness, recovery, and rehabilitation as followed by in the study. The possible scores of the selected items ranged from 1 to 2 as given in appendix I.

3.8.1.10 Anthropometric measurements

Anthropometry referred to the measurement of health parameters of human individual. Body Mass Index (BMI) was used in the study and was defined as the individual's body weight measured in divided by the square of his or her height measured in.

Procedure adopted for anthropometric measurements

Weight for age: A portable weighing balance was used for measuring the weight of the individuals. The accuracy of the machine ensured periodically. The respondent was asked to stand on the platform of the machine, without touching anything and looking straight ahead. Three times each reading was taken to ensure correctness of the measurement.

Plate 3. Institutional visits

Height for age: The anthropometric rod designed by the National Institute of Nutrition was used to determine height of respondents. A place where the floor was even and not rough was selected to place the rod perpendicularly. The respondent was asked to stand as back of the head touching the rod. The ruler was held on the top of the head in the centre, crushing the hair at right angle to the scale and the height read off from the lower edge of the ruler to the nearest 0.5 cm. Each reading was repeated three times to ensure correctness of the measurement.

Interpretation of scores: BMI score less than 16.0 was indicative of chronic energy deficiency-grade III severe category, 16-17 score showed chronic energy deficiency-grade II moderate, BMI of 17.0 to 18.5 suggested that the person had chronic energy deficiency-grade I mild. BMI values of 18.5 to 20 indicated low weight normal, a value from 20 to 23 suggested normal weight category, whereas BMI scores above 23 and 25 suggested that the person falls in overweight and obesity category respectively (WHO, 2000).

3.8.2 Social capital

Social capital referred to the the effective functioning of the social groups and resources upon which people be contingent in chase of their livelihood objectives. These were established through more formalised groups, social networks and connections, relationships of trust, mutuality and exchanges over years.

Social capital was calculated by measuring five component parameters *viz.* relationships with members within the family, relationship with others, activities in public space, concern towards the weaker sections and interdependence. All these parameters explained the interpersonal relationship status of the individual within a social system.

3.8.2.1 Relationship with family members

The scale used by Shincy (2012) for her study was adopted and it measures and the kind of mutual relationships the members had inside the family. The sum of

overall scores of the items calculated to get the individual respondent score. The scoring was as given in appendix I and the scores ranged from 4-12.

3.8.2.2 Relationship with other members in society

The relationship with others (members in society) were measured quantitatively using the scale adopted by Shincy (2012). The quality and kind of the relationship maintained by the individual with the neighbours, peer groups and relatives were studied. The sum of overall scores of the items was taken as individual score of the respondent. The scores were assigned as shown in appendix I. The possible score ranged from 3-9.

3.8.2.3 Activities in public space

Activities in public space referred to the degree of participation of the tribes by identifying the main activities in the settlement and it was measured by the frequency of participation (Appendix I). Over all sum of scores of the items was taken to get the individual score. The scale was adapted from Shincy (2012).

3.8.2.4 Concern towards the weaker sections

The variable referred to the extent of concern expressed by the respondents towards the weaker sections of the society and was measured on a five point continuum (Appendix I). The maximum obtainable score range was 3-15.

3.8.2.5 Interdependence

Interdependence is operationally defined as the relationship and contact maintained by the individuals mutually in a social system for their better co-existence. The tribal interdependence and networking among the society was studied and the scores were ranged from 3-15 (Appendix I).

3.8.3 Natural capital

Natural capital referred to the stock of natural resources from which flow of resources and services that benefits people and economy are derived. It was operationalized to include landholding, utilisation of natural resources to fulfil livelihood requirements and common property resources as follows.

3.8.3.1 Landholding

Landholding referred to the extent to which the respondent possess sufficient land with right and control over it so as to utilize its resources for a secure living. This was measured by directly asking the respondents to indicate the total land possessed by him / her and was recorded in cents. It included both owned and leased in land in possession of a respondent.

3.8.3.2 Utilisation of natural resources to fulfil livelihood requirements

The extent of utilization and requirement of natural resources by the tribal people were found out using the scale given in appendix I Iindividual score of each of these requirements were added up to get the final score for the respondent.

3.8.3.3 Common property resources

Common property resource referred to the commonly owned natural resources utilized by all the members of the society. Mostly they were non-renewable in nature and the two dimensions *viz.* access and quality in which it was measured using the scale are given below.

1. Access

Unlimited/ unrestricted	2
Highly restricted	1

2. Quality

Currently in good condition	3
Depleting	2
Almost depleted	1

In order to get individual common property resource score the scores by a respondent on the above two dimensions were multiplied against each item for all the resources given in the scale. The maximum possible score obtained was 36 and

minimum was 6. List of parameters used in the measurement of common property resources are given in appendix I.

3.8.4 Physical capital

Physical capital referred to the tangible as well as man-made resources and the basic infrastructure and which is used to meet their daily livelihoods. According to Getachew (1995) farm inputs contribute positively and increase productivity is applied properly to agricultural activities. Thus, the contributions of these farm inputs to crop production also have a positive effect towards household food security. Type of house, ownership status, livestock possession, material possession, access to drinking water was identified as the important dimensions of its measurement as detailed below.

3.8.4.1 Type of house

Type of house is measured based on the type of material used and condition of the house. The scale of measurement used adopted with slight modifications used by Shincy (2012) .The scores were assigned as detailed in appendix I.

3.8.4.2 House ownership status

To know about the ownership status of their house, whether it was built by them or they got it from any government scheme direct questions were asked. For own house a score of 2 was given and for the other 1 was given.

3.8.4.3 Livestock possession

The total number of animals as well as poultry owned by each respondent was measured. Separate weightages were given to each group based on judges rating and which is given in table 5. The scale was adopted from Shincy (2012) and was used with slight modification.

Table 5. Items used in the measurement of livestock possession

Type of animal	Score
Bullock (one)	2
Milch cow (one)	2.5
Goat (one)	1.5
Piggery (one)	1.5
Duckers (upto 25 nos.)	1
Poultry Duckers (upto 25 nos.)	1

3.8.4.4 Material possession

Material possession was defined as the physical gadgets or machineries used for productive as well as non-productive activities possessed by the respondent. The scale used by Shincy (2012) adopted with slight modifications. Separate weightages were provided to each material based on judges rating and which is presented in table 6.

3.8.4.5 Distance travelled in fetching firewood

Distance travelled by the respondent for collecting firewood from forest for their livelihood needs like preparation of food was measured by asking straight questions and to and fro distance is recorded.

3.8.4.6 Access to safe drinking water

Access to safe drinking water could be defined as the distance an individual needed to walk from home to get unpolluted drinking water for daily use. A scale developed by NSSO (2002) was used with slight modification. The scale is given in Table 7.

Table 6. Parameters used in the measurement of material possession

Sl. No.	Materials possessed	Score	Number in possession
1	Country/ Iron plough	2.5	
2	Levelling board	2.5	
3	Thresher	5.5	
4	Farm cart	5	
5	Pump set	6	
6	Knapsack sprayer	4	
7	Power sprayer	4	
8	Tractor/ Power tiller	7	
9	Radio/ Transistor	3.5	
10	Bicycle	3	
11	Motor cycle/ Scooter	6.5	
12	Sewing machine	4.5	
13	Table	1.5	
14	Chair	0.5	
15	Cot	1	
16	Shelf	2	

Table 7. Parameters used to measure access to safe drinking water

Distance from home to the water source	Score
House premises	6
Upto 500m	5
500m-1Km	4
1-2Km	3
2-4Km	2
>4km	1

3.8.4.7 Sanitation facility

Sanitation facility of the household is measured by asking whether they had toilet facility in their compound. Scores were recorded as two for those who possess and one for not possessing toilet facility in their household.

3.8.4.8 Eelectricity connectivity

Electrical connectivity of the household is measured by directly asking whether they had electrical connection in their house. Scores were recorded as two for those who possess and one for not possessing electrical connectivity.

3.8.5 Financial capital

Financial capital could be referred as the resources like money, credit and other forms of funding that is utilized by the public for creating wealth to achieve their livelihood.

3.8.5.1 Monthly income

Monthly income can be referred as total incomes of the household for a month including the income through all the sources. This was recorded by directly asking the respondent.

3.8.5.2 Expenditure pattern

The total amount spent on food, non-food consumptive items, travelling, recreation etc. were recorded to study the expenditure pattern. By taking the sum of all the individual expenses as given in Table 8 total monthly expenditure for the family was calculated.

3.8.5.3 Indebtedness

The total debt respondent owed in terms of money at the time of survey to various money lending sources is referred to as the indebtedness. It was recorded by directly asking questions to the respondent.

Table 8. List of parameters used in the measurement of expenditure pattern

Items	Total expenses per month
Food	
Cloth	
Electricity	
Medical expenses	
Education	
Religion/ Social function	
Taxes	
Alcohol	
Recreation	
Travelling expenses	
News paper/ Magazine	
Fuel	
Mobile phone charges	
Others	

3.8.5.4 Borrowing pattern

The borrowing pattern can be operationalized as the source from which the respondent borrows money whenever he needs to meet his livelihood requirement. It could be recorded by directly asking the respondents to indicate their source of borrowing by putting a tick (√) mark in the given column (Table 9).

3.8.6 Measurement of livelihood capital index

Livelihood capital is expressed as livelihood capital index which will be the derivative of five component capital indexes *viz*. Social capital, Human capital, Natural capital, Physical capital and Financial capital. The procedures for computing each component capital are detailed as follows.

Table 9. Parameters used in the measurement of borrowing pattern

Sl. No:	Source of borrowing	Put a tick(√) mark in the appropriate column
1	From non- institutional sources for daily expenses	
2	From non-institutional sources for productive purposes	
3	From non-institutional sources for consumption purposes	
4	From non-institutional sources when contingency occurs	
5	From income generation activity group	
6	Only from institutional sources	

3.8.6.1 Human capital

Human capital is a measure of the skills, education, capacity and attributes of labour which influence their productive capacity and earning potential (Pettinger, 2019)

Table 10. List of parameters used in the measurement of human capital index

Variable Code	Component parameters	Score range
YA1	Formal education	1-17
YA2	Informal education	13-26
YA3	Mass media exposure	6-18
YA4	Social participation	5-40
YA5	Contact with extension agency	3-9
YA6	Leadership quality	5-25
YA7	Innovativeness	5-25
YA8	Addictive health behaviour	3-9
YA9	Healthcare seeking behavior	2-4
YA10	Anthropometric measurements	

Variables YA1 to YA10 were standardized in the following form:

$$y_i' = \frac{y_{i\max} - y_i}{y_{i\max} - y_{i\min}}$$

where, y_i = observation for the ith human capital variable $I = 1, 2, \dots, 10$

$y_{i\max}$ = maximum value that the variable y_i can attain, which is given in the Table 24

$y_{i\min}$ = minimum value that the variable y_i can attain, which is given in the Table 24

By definition, y_i' ε [0, 1]; that is, y_i' ranges from 0 to 1, both inclusive.

The Body Mass Index (BMI), YA10- Human capital variable, which was measured in the unit Kg/ m^2 was defined as the ratio of body weight (in Kg) of the individual to the square of his/her height (in m).

The Body Mass Index (YA10) was standardized using the formula:

$$y_i' = 10 - \frac{y_i - y_{inorm}}{y_{i\max} - y_{i\min}} x10, \text{ if } y_i > 18.5$$
$$= 10 - \frac{y_{inorm} - y_i}{y_{i\max} - y_{i\min}} x10, \text{ if otherwise.}$$

where y_{inorm} is the normal value for the BMI of an adult (18.5 Kg/m^2).

Human capital index $y' = 100 - [y_{10}.\sum_{i=1}^{9} y_i]$

The social capital, natural capital and physical capital variables were standardized using the same formula used for Human capital variables YA1 to YA9

3.8.6.2 Social capital

The five variables in the social capital component were standardized (Table 11) and then the social capital was calculated as the sum of the scores of the social capital variables.

Table 11. List of parameters used in the measurement of social capital index

Variable Code	Component parameters	Score range
YB1	Relationship with family members	4-12
YB2	Relationship with others	3-9
YB3	Activities in public space	15-45
YB4	Concerns towards the weaker sections	4-20
YB5	Interdependence and networking	5-15

Social Capital Index, $y^{'} = 100 - [\frac{1}{5}\sum_{i=1}^{5} y_i^{'} x 100]$

3.8.6.3 Natural capital

Natural capital referred as the natural resource stocks from which asset flows and services beneficial for livelihoods were derived.

Table 12. Parameters used in the measurement of natural capital index

Variable Code	Component parameters	Score range
YC1	Land owned	Area
YC2	Utilisation of Natural resources to fulfil livelihood requirements	5-15
YC3	Common property resources	6-36

Natural Capital Index, $y^{'} = 100 - [\frac{1}{3}\sum_{i=1}^{3} y_i^{'} x 100]$

3.8.6.4 Physical capital

Physical capital refers to the all the tangible items possessed by the household which directly or indirectly related to factors of production to meet their livelihood requirements. The seven parameters in the physical capital component

were statndardised and then the physical capital was calculated as the sum of the satandardised scores of the physical capital variables.

Table 13. Parameters used in the measurement of natural capital index

Variable Code	Component parameters	Score range
YD1	Type of house	1-6
YD2	Nature of house based on ownership	1-2
YD3	Sharing of house	1-2
YD4	Livestock possession	No.
YD5	Material possession	9-27
YD6	Access to safe drinking water	1-6
YD7	Toilet facilities	1-2
YD8	Electricity connectivity	1-2

Physical Capital Index, $y' = 100 - [\frac{1}{8}\sum_{i=1}^{8} y_i' x 100]$

By definition, these indices y' viz., human capital, social capital, natural capital and physical capital, ranges 0 – 100.

3.8.6.5 Financial capital

Financial capital refers to the purchasing power or medium that represents saved up financial wealth, usually in the form of currency, which is used for their livelihood (Curtiss, 2012). Family income, total debt he/ she was liable to pay (as on the survey date) and the source of credit he availed (institutional, or others) were the three variables used for estimating financial capital of a household. It could be abstracted as his ability to earn money above a minimum income so that he could meet the essential needs of his family and lead a decent living. In the present study, the poverty line of a rural person as fixed by the government agencies was considered as the standard income level. Thus, the poverty line fixed for 2015, deflated (using consumer price index) to the 2010 prices was computed at Rs.910 per standard person as the minimum income required by the family (V_{min}).

The due amount a family liable to pay per month for the debt was taken as the interest incurred to the family on account of the debt. It was computed using the given formula,

V_d = Interest per month for the debt he incurred at the rate of 20%, if the credit source was non institutional and 10%, otherwise.

Standardized income of the respondent was taken as financial capital(Y) and which was calculated using the given formula:

$$\text{Financial capital, } y' = \frac{y - y_d}{y_{min}} x100$$

$$\text{Financial capital index} = [\frac{1}{3} \sum_{i=1}^{3} y_i' x100]$$

Index on livelihood capital was computed as a proportion of the sum total of the five indices calculated and was found to be one-fifth of the total. Accordingly, index on livelihood capital ranged between 0 and 100.

3.9 STATISTICAL ANALYSIS

The data collected from the respondents were scored, tabulated and analysed using suitable statistical methods. Keeping in view the objectives of the study and amenability, the data were subjected to different statistical tools. Brief descriptions of the tools used are given below.

1. **Mean:** To make suitable comparisons of different variables the mean scores were used wherever necessary.

2. **Percentage analysis:** Percentage was used to make simple, easy comparison wherever necessary.

3. **Factor analysis:** The technique of factor analysis is used when a systematic interdependence exists among a set of variables under consideration and the investigator is intents to find out related factors more fundamental or latent, which

created this commonality. This analysis helps in resolving multidimensional variables into relatively few groups called factors and the factors thus derived are qualified to be treated as new variables. It helps to reduce the dimensionality of the dataset down to fewer unobserved variables. The major steps involved are given below:

A. Preparation of correlation matrix of the items

Detailing the inter-relationship between the variables under consideration was a prerequisite for carrying out factor analysis. While selecting the variables for analysis care should be given to select only those variables that were significantly related to each other by large correlation coefficients.

B. Factor extraction

Among the methods available for factor extraction, *viz*. centroid method, the principal components method and maximum likelihood method, the principal component analysis being the most extensively used and simple to derive, was used for the study (Kothari, 1985).

In this method, the linear combinations were arranged in the descending order of their ability to explain the total variance with the first linear combination accounting for the maximum variance in the sample and so on. This results in the conversion of a set of related variables to a set of independent factors or components. The proportion of total variance of a variable accounted for by 'common factor' was termed the communality (h2) and the rest of the variance left unexplained by the common factor was explained by the 'unique factor' specific to that particular variable. Grouping of a set of related variables under one factor was made possible through the process of extraction of factors.

The factor loadings are given by the coefficients under each of the factors. Only those factors sufficient enough to explain the data and loaded significantly on it were selected through factor analysis. The standardized regression coefficient in the multiple regression equation where the factors were independent and the variables dependent ones were also given by the factor loadings. The percent of variance accounted by a factor could be explained with the help of factor extraction

depended on the Eigen value. The selected factors must have an Eigen value more than one.

C. Factor rotation

In the initial matrix, distinguishing the principal factors from the less important ones was difficult as the factors and the variables were intertwined. The initial factor matrix was transformed by rotation, into one that was easier to interpret. The commonalities and the percentage of total variance explained were not changed by rotation of the factors. But there were changes in the percentage variance explained by the retained factors.

Any of the following methods viz. Quartimax, Varimax and Equimax could be employed for factor rotation. The variables were simplified by the quatrimax type of rotation while the number of factors needed to explain the given data were minimized by varimax type of rotation. The Equimax was a compromise between the other two. The Varimax rotation was used as the main goal of factor analysis was to sort out the given data on a minimum set of factors.

D. Interpreting the rotated factor

According to Jambu (1991) significant factors should obtain a factor loading more than 0.33. But for the interpretation of factor analysis results, the highest factor loadings were considered. For validating the scale and in analysis of data in factors affecting sustainability this method was used.

4. Multiple linear regression: It was used to predict the outcome of a response variable from several explanatory variables. To model the linear relationship between the explanatory (independent) variables and response (dependent) variables multiple linear regression was used in the study.

5. Friedman test: When the dependent variable being measured was ordinal Friedman test was used to test for differences among groups. This test was also used for continuous data that violated the assumptions necessary to run the one-way ANOVA with repeated measures.

6. Kruskal-Wallis test: It was used to test for rank-based nonparametric test that can be used to determine if there are statistically significant differences between two or more groups of an independent variable on a continuous or ordinal dependent variable.

7. t test: To measure the significant differences between different parameters t test was used.

RESULTS AND DISCUSSION

4. RESULTS AND DISCUSSION

The chapter depicts the findings of the study in line with the objectives set forth. The results based on the analysis of data along with appropriate discussions are presented under the following subheads.

4.1   Comparative analysis of socio-economic profile of the Attappady tribes

4.2   Factors influencing the selection of farming techniques and strategies

4.3   Household dietary diversity of Attappady tribes of Kerala

4.4   Food security status of the Attappady tribes

4.5   Livelihood security analysis of the Attappady tribes

4.6   Policy recommendations to improve agricultural vocation of the tribes

4.1   COMPARATIVE ANALYSIS OF SOCIO-ECONOMIC PROFILE OF ATTAPPADY TRIBES

Socio economic variables served as indicators of quality of life attributes as well as opportunities and privileges afforded to people within a society. Socio economic status of *Irula*, *Muduga*, and *Kurumba* the three main tribes in Attappady region spread in Agali, Puthur and Sholayur Grama Panchayats assessed and compared based on the primary data collected in the study is presented. The socio-economic variables selected were categorized as personal characteristics and availability of infrastructural facilities.

4.1.1 Personal variables

Variables selected under personal attributes in the study were formal education, social participation, contact with extension agency, leadership quality, innovativeness, monthly family expenditure and informal social networks. The results are presented and interpreted with suitable supporting references under the following sub heads

4.1.1.1. Formal education

Results presented in Table 14 revealed one of the most important fact about tribal people that 39 per cent of the tribes were illiterate and only 11 per cent of them had high school education. When the panchayat wise analysis was considered, Agali panchayat had minimum number of illiterates at 22 per cent compared to Pudur and Sholayur panchayats with illiteracy rates recorded at 48 and 47 per cent respectively. Information from the table also indicated that in Agali 12 per cent of them could read only, 34 per cent obtained primary school and 21 per cent had gone for high school education and above. The Pudur panchayat where the illiteracy rates was the highest (48%) also recorded the most backward educational scenario among the tribal panchayats studied. The results showed that 27 per cent and 16 per cent of the tribes in the panchayat could read only and read and write respectively and only five per cent obtained primary education and there was only four per cent who had high school education and above. In the Sholayur panchayat, the situation was not much different and 47 per cent were illiterate, 21 per cent and 14 per cent could read only and read and write respectively, 8 per cent obtained primary education and there was 10 per cent with high school education and above.

Table 14. Distribution of tribes according to their educational qualification

n=300

Sl. No	Category	Agali	Pudur	Sholayur	Total	
		%	%	%	Frequency	%
1	Illiterate	22	48	47	117	39
2	Can read only	12	27	21	60	20
3	Can read and write	11	16	14	41	14
4	Primary school	34	5	8	47	16
5	Middle school	0	0	0	0	0
6	High school and above	21	4	10	35	11
	Total	**100**	**100**	**100**	**300**	**100**

The results thus highlighted the inadequacy of educational development interventions that was implemented at the Attappady tribal area. It could be observed that despite concerted efforts by the government, there has been no substantial change in the educational status of this most deprived section of the state. Even though free education was offered students were not willing to join the tribal educational institutions as distance and other barriers persisted. Thus it could be concluded that the educational program and facilities designed for their welfare, seldom attracted them or could not conscientize and motivate them regarding the importance of education in their life. The findings reiterated the results of many earlier researches which highlighted education as one of the most critical variables as of Sachana (2015). Her study on livelihood issues of tribal women found that, 80 per cent of the tribal women were illiterate, 1 per cent had obtained primary education, 13 per cent, five per cent and two per cent respondents obtained education at middle school, higher secondary and collegiate level respectively. Similar observations which indicate dismal education status among the tribal population of Attapadi tribes were also found in the studies of Rashid (2019). Therefore, it was inferred that poor education was one of the cardinal reasons for the backwardness of the tribes and emphasized the need of promotion of education among the tribal children. An educational system more sensitive to tribal culture, languages and livelihood systems is recommended for better results.

4.1.1.2. Social participation

The results given in Table 15 revealed that social participation of the tribes of Attappady area was low. The table results indicated that 73 per cent of the tribes were having a low level of social participation with scores that ranged 8-24. In the panchayat wise analysis, it could be observed that in the case of Pudur, 91 per cent and at Sholayur 50 per cent of them had low level of social participation. However, Agali panchayat had the highest 55 per cent in the category of high social participation and only 45 per cent were in the low social participation group.

Table 15. Distribution of tribes according to their social participation

Sl. No	Category	Score range	Agali %	Pudur %	Sholayur %	Total Frequency	Total %
1	Below median	8-24	45	91	82	218	73
2	Above median	24-40	55	9	18	82	27
	Total		100	100	100	300	100
N=300; Median= 24; Range= 8 – 40							

The low level of social participation could be related to the innate cultural traits of skepticism along with the lack of initiative and motivation among the tribes. This was found aggravated by domination of non-tribal settlers in the region. They introduced new lifestyles in the society which the tribes found difficult to cope up with leading to their social exclusion and discrimination. This has resulted in severe inequalities against the tribal people in the society.

However, public funded developmental activities under MGNREGA, Kudumbasree Mission and Japanese aided eco-restoration program called Attappady Hill Area Development Society (AHADS) have brought significant changes in their attitude to development. This is quite evident from the finding of relatively higher social participation scores for the tribal people of Agali panchayat where activities of MGNREGA, AHADS and Kudumbasree were more prominent compared to the other two more remote panchayats. Agali panchayat had the AHADS office located in it and also had the geographical advantage of sharing borders with the developed areas of Mannarkkad which are reflected in the higher social participation. The results were in conformity with the findings of Suresh (2001)

4.1.1.3. Contact with extension agency

A perusal of the results presented in Table 16 depicts that contact with extension agency of the tribespeople of Attappady area was observed to be very low. This could be related as a continuation of their lower level of social participation. As they were introvert by nature and the exclusion they were confronting in the society attributed to this situation. They were very much reluctant to seek help from anyone other than their own people. Moreover, it could also be attributed to the years of exclusion faced by them in the sectors of employment, education, agriculture etc. On the contrary, inadequacy of extension contact because of the extension functionaries working in the tribal areas are not trained properly to work with tribal population and to formulate appropriate interventions; they apply the same extension approaches for all categories of farmers would also have a role.

Table 16. Distribution of Attappady tribes based on their contact with extension agency

Sl. No.	Category	Score range	Panchayat wise distribution (%)			Total	
			Agali	Pudur	Sholayur	Frequency	%
1	Below median	6-9	72	81	82	235	78.33
2	Above median	9-12	28	19	18	65	21.67
	Total		100	100	100	300	100
n=300; Median= 9 Range = 6-12							

4.1.1.4. Leadership quality

Results from Table 17 brought to light the fact that leadership quality of tribes in Attappady tribal development area was low with around 67 per cent having low scores between 5 and 10. In the comparison of the panchayat wise analysis, it was found that Pudur and Sholayur also followed similar trends of low leadership quality scores with 89 per cent and 82 per cent respectively falling under the low

score category. But a considerable 69 per cent of the tribes in Agali panchayath recorded high levels of   leadership quality scores. This was in line with high social participation scores recorded from Agali compared to the other two panchayats.

Table 17. Distribution of tribes according to their leadership quality

Sl. No	Category	Score range	Agali	Pudur	Sholayur	Total	
			%	%	%	Frequency	%
1	Below median	5-10	31	89	82	202	67.33
2	Above median	5-15	69	11	18	98	32.67
	Total		**100**	**100**	**100**	**300**	**100**
N=300, Median=10; Range= 5-15							

In fact, the ability to lead a group or team to achieve certain goals formed an important prerequisite for personality development which in turn lead to social development. The developmental activities organized by different public and social sector agencies were mostly concentrated in Agali region of Attappady block due to locational and cultural advantages. It was inferred that the participation in the programs of these agencies should have enabled them to acquire leadership abilities which had direct and indirect implications in improving their life.

4.1.1.5. Innovativeness

Findings presented in Table 18 revealed that the attribute of innovativeness of Attappady tribes showed low score for majority (79 per cent) of the respondents. Being ethnic indigenous groups, they had their own traditional methods in every field like agriculture, small trades, construction activities etc. They mostly followed these unique tribal ways of life were religious practices of worshiping nature and land laws that give collective rights to communities assumed great significance. In such contexts innovative ways that deviated from accepted norms were not accepted

or considered desirable as evident from the results. Similar results were reported by Bashir *et al*., (2015).

Table 18. Distribution of tribes of Attappady according to their innovativeness

Sl. No.	Category	Score range	Panchayat wise distribution (%)			Total	
			Agali	Pudur	Sholayur	Frequency	%
1	Below median	5-10	67	86	85	238	79.33
2	Above median	10-15	33	14	15	62	20.67
	Total		**100**	**100**	**100**	**300**	**100**
N=300; Median= 10 Range =5-15							

4.1.1.6. Monthly family expenditure

The average family monthly expenditure of tribes in Agali, Pudur and Sholayur panchayats are given as Table 19. The results indicated that 74 per cent of the tribal families in the area had average monthly expenditure below Rs. 4000 which was categorized as low income groups. The highest monthly expenditure group was of nine percent who incurred a monthly family expenditure of more than Rs. 6000. In the panchayat wise analysis it could be seen that to a very large extent the tribal families followed a common pattern of monthly family expenditure in all the three panchayats. However, Agali panchayat with its geographical advantage and presence of many external development agencies had the highest (24 per cent) proportion of tribal families who recorded monthly average expenditure above Rs 6000.

The poor economic status of the tribes has bearing on the structural and functional changes in the land ownership status that alienated them from the traditional agricultural vocation. Depletion of natural water sources, soil, lack of

irrigation facilities and recurring wild animal menace to the agriculture crops turned farming unsustainable in the region.

Table 19. Distribution of Attappady tribes based on their monthly family expenditure (N=300)

Sl. No.	Monthly Expenditure (Rs)	Category	Agali %	Pudur %	Sholayur %	Total Frequency	Total %
1	<2000	Very low income	14	31	16	61	21
2	2000-4000	Low income	32	61	66	159	53
3	4000-6000	Moderate low income	30	4	18	52	17
4	> 6000	Moderate income	24	4	0	28	9
	Total		100	100	100	300	100

This made the tribal people depend on wage earning labour jobs for their livelihood. This is also indicative from the higher economic status of the tribes in the Agali panchayat where more jobs are available compared to more conservative and less accessible Pudur and Sholayur panchayats. Similar trends in household expenditure were earlier reported by Alex *et al.* (2016).

4.1.1.7. Informal social networks

A perusal of table 20 showed the results of informal social network among the tribes of Attappady tribal development area. It is evident from the table that majority (67 per cent) has low informal social network scores between 04 and 08. This also followed the same pattern of social participation, innovativeness and contact to extension agency. However, when the panchayat wise scores were analyzed, it was observed that 89 per cent of the tribes in Pudur panchayat and 82 per cent of the Sholayur panchayat had low level of informal social network scores.

Table 20. Distribution of Attappady tribes based on informal social networks

Sl. No.	Category	Score range	Panchayat wise distribution (%)			Total	
			Agali	Pudur	Sholayur	Frequency	%
1	Below median	4-8	31	89	82	202	67
2	Above median	8-12	69	11	18	98	33
	Total		100	100	100	300	100
n=300; Median= 8 Range =4-12							

However, in Agali Panchayat 69 per cent of the tribes had higher level of informal networks among the community evidenced by scores between 8 and 12. The results find confirmation in the culture of *Mudugas* and *Kurumbas* who dominated the Purdur and Sholayur panchayats. They preferred to remain as far removed as possible from the civilized people from the plains unlike *Irulas* who formed the dominant population of Agali Panchayat. Studies of Jalaja and Kala (2015) was reported to support the present findings.

4.1.2. Availability of infrastructure facilities

Infrastructural development in the area was assessed in terms of selected variables such as availability of electric power, type of house owned, sanitation facility, distance to drinking water access and landholding status. The results along with interpretation and support research evidences are presented under the following subheads.

4.1.2.1. Availability of electric power

Results from the Table 21 clearly suggested that among the total respondents 91 per cent had electricity in their houses. While analyzing each panchayat separately, it was observed that in the Agali panchayat 91 per cent of the respondents had electricity; in Pudur and Sholayur panchayat 88 per cent and 95 per cent respectively of the respondents had power connectivity. Similar results were found by Sachana (2015) in her study on livelihood issues of tribal women. She

found that 58 per cent of the total tribal women surveyed had electricity in their houses. This could be viewed as a significant achievement of the government developmental projects implemented in the area during the past few decades.

Table 21. Distribution of Attappady tribal houses based on availability of electric power

Sl. No	Category	Panchayat wise distribution (%)			Total	
		Agali	Pudur	Sholayur	Frequency	%
1	Houses without electricity	9	12	5	26	9
2	Houses with electricity	91	88	95	274	91
	Total	**100**	**100**	**100**	**300**	**100**

4.1.2.2. Sanitation facility

The results in Table 22 provided a representative picture of the effect of mainstream society and prominent development concerns on Attappady tribal lives. In conventional practices the tribal knowledge as well as sanitation consciousness was comparatively low and they were following open defecation system in forest lands. However, the results in the table defied the convention and indicated that among the total respondents 91 per cent had toilet facility in their houses. According to the findings, only 9 per cent of the tribes still depended on open forest lands for their primary needs. The trend was uniform as reported from Agali, Pudur and Sholayur panchayats which had 91, 88 and 95 per cent houses respectively with exclusive household toilet facilities. Sachana (2015) found that among the tribal women of Attappady tribal block, only 27 per cents had toilet facility in their houses. Therefore, the results indicated significant deviation in the sanitation facilities in the area during the past few years. The present findings could be recognized as the results of continuous efforts by state and central government during the past years to popularize sanitation and good health practices and facilities among the tribes.

Table 22. Distribution of Attappady tribes according to the availability of sanitation facility (n=300)

Sl. No	Category	Panchayat wise distribution (%)			Total	
		Agali	Pudur	Sholayur	Frequency	%
1	Houses without toilets	9	12	5	26	9
2	Houses with toilets	91	88	95	274	91
	Total	**100**	**100**	**100**	**300**	**100**

4.1.2.3. Type of house owned

A strong and secure shelter is one of the important requirements for any human life. Results presented in Table 23 provided a clear picture of the types of houses owned by the tribes in Attappady tribal development block. According to the results in the table, the number of thatched houses in tribal hamlets has shown a decreasing trend with only 15 per cent of households under the category. This decreasing trend of thatched houses which were the conventional dwelling habitats could be viewed as an indicator of livelihood promotion by government programs mostly under AHADS. Most of the houses were either constructed by the government or under the governments' financial assistance in various schemes for the tribal community. According to the present findings majority of the tribes of Agali panchayat (55 per cent) and 81 percent of all the three panchayats had small concrete houses. This achievement could be attributed to the housing scheme implemented by AHADS which had constructed concrete houses in most of the tribal hamlets as reported by Paul (2013).

4.1.2.4. Access to drinking water

Results presented in Table 24 revealed that there was no much difference in the case of access to drinking water between the three panchayats studied. In both Agali and Sholayur panchayats 84 per cent of the tribes had access to drinking water

within their home premises. As per the results in the table there were 11 per cent who had access to drinking water within 500 m distance from their households and less than one per cent of the respondents had to travel upto 1km distance to fetch water. However, it was important to recognize that the maximum distance in which water was available was 1-2 km that too depended by less than 4 per cent of the tribal groups. In the case of Pudur panchayat 75 per cent of the total respondents were having access to safe drinking water within their home premises itself and for 19 per cent within 500 m distance. The maximum distance that was travelled by 5 per cent of the tribes to get drinking water in the panchayat was 2km. In Sholayur panchayat also 14 per cent and 2 per cent of the respondents were having accessibility within 500 m and 1-2 km respectively.

The results reassured the success of Jalanidhi project in bringing safe drinking water to the Attappady tribal block. Still there do exist a minority who belonged to deep inner forest and the hilly ranges who face inadequacy of safe drinking water in reachable distances.

Table 23. Distribution of Attappady tribes based on the type of house owned

Sl. No	Category of houses	Panchayat wise distribution (%)			Total	
		Agali	Pudur	Sholayur	Frequency	%
1	Mud walled thatched	11	19	14	44	15
2	Brick or laterite walled thatched	22	46	47	115	38
3	Brick or laterite walled tiled	12	27	21	60	20
4	Concrete house (small)	55	8	18	81	27
	Total	**100**	**100**	**100**	**300**	**100**

Table 24. Distribution of Attappady tribes based on their access to drinking water (n=300)

Sl. No	Distance to access of drinking water	Panchayat wise distribution (%)			Total	
		Agali	Pudur	Sholayur	Frequency	%
1	1-2 km	4	5	2	11	3.67
2	500 m-1 km	1	1	0	2	0.66
3	Upto 500 m	11	19	14	44	14.67
4	Within the home premises	84	75	84	243	81.00
	Total	100	100	100	300	100

4.1.2.5. Landholding status

Land holding status held critical importance in tribal studies as land alienation was one of the major challenges faced by the tribes not only in Attappady but world over. This was reflected in the results of Pudur and Sholayur panachayats (Table 25) where 73 per cent of tribes had landholdings of marginal size less than 1.00 ha. However, average distribution of landholding among 62.0 % of tribes in Agali panchayats was of small holding category that ranged between 1.00 and 2.00 ha. The results confirmed the practice of shared management of common property land among the tribes popular as *Panchakkadu* (4 acres/family) for carrying out agriculture (Alex *et al.,* 2016). However, it could be inferred from the results that cultural exchanges with settlers and other external agents had influenced the tribal perspectives of land ownership.

Table 25. Distribution of Attappady tribes according landholding status

(n=300)

Sl. No	Land area owned (ha)	Panchayat wise distribution (%)			Total	
		Agali	Pudur	Sholayur	Frequency	%
1	< 1.00 ha	38.00	73.00	73.00	184	61.33
2	1.00 -2.00 ha	62.00	27.00	27.00	116	38.67
	Total	100	100	100	300	100

4.2. FACTORS INFLUENCING TRIBAL FARMING TECHNIQUES AND STRATEGIES

Traditionally tribal population of Attappady followed shifting cultivation which involved strategies to cultivate different crops in predetermined areas (Suresh, 2001). These included approaches that assumed great significance in enhancing the capacity of land to rejuvenate natural vegetation and water resources. However, land alienation and degradation of natural resources due to erratic weather, habitat loss and wild animal menace have influenced tribal farming and fueled the transformation of the tribes from agriculturists to wage labourers. These changing trends in vocation and the factors that influenced the farming practices in the region are discussed.

4.2.2 Major occupations of Attappady tribes

Traditionally tribal communities in Attappady depended on agriculture based on indigenous knowledge gained through oral tradition and practice over generations for their livelihood. The prevalence of community ownership of land had the advantage of providing access to required land for cultivation. This enabled them to grow their traditional crops in sufficient quantities that ensured their food and nutritional security over the years. Major traditional crops cultivated included millets, pulses and oilseeds such as *makka cholam* or maize (*Zea mays*), ragi or finger millet (*Eleusine coracana*), *chama* or little millet (*Panicum miliaceum*), *thuvara* or red gram (*Cajanus cajan)*, groundnut (*Arachis hypogeae*) and castor (*Ricinus communis*). However, large scale alienation of tribal land in Attappady happened between 1950 and 1980 as reported by Suresh, 2001. It was aggravated by the introduction of the government policy of granting individual ownership of land under the Government of Kerala Land Assignment Act 1960 (Sachana, 2015). Lack of awareness and ineptitude in handling individual property among the tribes was exploited by outside settlers leading to their loss of rights on land. The settlers took over the fertile lands especially in the plains and displaced the tribes to hilly areas with low fertility. *Irulas* and *Mudugas* were the worst affected compared to *Kurumbas* who occupied the reserve forests areas and the remote inaccessible

forests lands (Suresh, 2001) According to Sankar and Muraleedharan (1990) farming in Attappady area in recent years have transformed into a mix of traditional practices like shifting cultivation and modern agricultural methods like protected cultivation. This lead to deforestation and unsustainable agricultural practices, which had its dent in the tribal agro-ecosystem which causes unpredictable rains, dried rivers and degraded soils. This endangered agriculture as the mainstay of the majority of the tribal population forcing them to abandon the cultivation of traditional food crops. This had significant impact on nutritional security and health in the region resulting in wide spread anemia and other diseases.

Majority who left agriculture turned out to be migrant laborers in plantations and construction sites in Karnataka due to limited job opportunities in the area. Some depended on the collection and sale of non-timber forest products (NTFP) such as lac, honey, medicinal plants etc. Those few who continued in agriculture shifted to new crops due to falling yields, recurring pest and diseases and inefficient practices. Premakumar *et al.* (2015) reported a transition in cropping pattern in the region from a three crop combination of fruits, spices and tuber to four crop combinations of fruits, spices, vegetables and tuber during the period 2001-2011. Presently minor groups have even integrated some of the modern techniques of agriculture like micro irrigation, mulching etc. with the assistance of the ITDP and Department of Agriculture. Details of crops grown along with the season of cultivation collected in field survey of the study area are presented as Table 26. Majority of tribal farms still depend on traditional indigenous practices such as the use of traditional seeds, hand weeding, inter-cultural operations using traditional tools etc. The traditionally conserved seeds are shared by farmers within the community. Conventionally seeds like cowpea are coated with clay and are conserved in air tight wooden as well as clay bottle like structures. This practice was popular among the tribal communities as it conserved the seeds for one to two seasons. Traditional seeds of millets such as finger millet, pearl millet and sorghum grown by the tribes showed high climate resilience and were found ideal in environments prone to drought and extreme heat. Another significant finding was

that majority of tribal farmers viewed agriculture not just as an economic activity but a process of co-existence with nature. Therefore, growing food without harming nature, the soil and the ecosystem guided their production practices rather than economics of yield and profit.

Table 26. Major crops cultivated in Attappady tribal belt during 2019-20

Sl. No.	Crop	Area (ha)			Season
		Agali	Pudur	Sholayur	
1	Banana	1514	30	750	Oct-Nov to Aug-Sept
2	Vegetables	34	30	60	Aug-Oct, Nov-Jan
3	Ragi	75	75	65	May to August, Sept to Dec
4	Bajra	20	20	10	May to August, Sept to Dec
5	Sorghum	20	20	15	May to August, Sept to Dec
6	*Thina*	20	20	20	May to August, Sept to Dec
7	Red gram	35	35	52	May to August, Sept to Dec
8	Cow pea	20	20	30	May to August, Sept to Dec
9	Groundnut	40	40	60	May to August, Sept to Dec
10	Mustard	2	6	8	May to August, Sept to Dec

(Source: Basic data compiled from local Agricultural Extension Offices, 2019)

Geographical remoteness of the area ramified into exclusion from social agencies, educational institutions, business activities and information supply sources. The tribal communities lived in scattered and isolated areas that lacked infrastructural and social amenities (electricity, portable water, good roads, hospitals and schools). Moreover there was reported mismatch between available technologies and real-life needs especially in agriculture. The available high-yielding cultivars did not suit their requirements, in terms of crop duration and grain quality needed for their food products. Climate vagaries in the form of irregular monsoon resulting in long dry spells and drought-like situations during early kharif (summer cropping) season and, untimely rain has become regular phenomenon. This has made the area conducive for the spread of many crop diseases and pests. Another constraint reported was the damage caused to the agricultural self-reliance

due to the spread of monoculture crops and plantations under development schemes implemented. These schemes failed to understand the value of diversity and conservation strategies followed in tribal farming and have caused serious harm to the tribal communities of the area.

4.2.3 Factors influencing tribal farming

Five factors were delineated using factor analysis that are independent of each other and are presented in Table 41. Each factor was derived from a weighted linear combination of agricultural variables that accounted for the largest total variation in the data. The factors extracted are given in the descending order of importance with respect to the proportion of the variance accounted by each factor. These five factors extracted together explained a total variance of 92.51 per cent which implied high significance of the selected variables. The results of the rotated factor matrix for the statements are presented in Table 27. Though the general criterion of meaningful selection was factor loading score of 0.30 to 0.40, the study used a factor loading score of ≥ 0.5 to identify the most highly correlated variables in each factor as indicated by Tabachnick and Fidell (2001). In addition, the eigenvalue for each factor extracted with values >1 which indicated that the factor explained more of the variance than could be accounted for by any one variable was selected. Thus, number of factors in the model was determined based on the criteria that at least two variables with a loading score of ≥ 0.5 in a factor; factors must have an eigen value >1.0; and each factor must account for at least 1% of the total variance. Every variable in each factor had a factor loading score that represented the correlations between each of the variables included in each factor, similar to Pearson's correlation coefficients. The scree plot test which depicts the factors on the x axis and the corresponding eigen values on the y axis was used to extract the five determining factors (Fig. 5). The test drops factors after the break of inflexion.

The results in Table 28 showed that the Factor 1 comprised of eight items with factor loadings ranging from 0.69 to 0.96. Factor 2 comprised of six items with factor loadings ranging from 0.69 to 0.95. Factor 3 had six items with factor loadings ranging from 0.74 to 0.84. Factor 4 comprised of two items with factor

loadings ranging from 0.85 to 0.80 and Factor 5 had one item with factor loading 0.96. Based on the variable components under each factor labelling of factor was taken up as given in Table 28. Agricultural technology & input services, policy, knowledge & information support, infrastructure, weather & technological constraints, farm management and market orientation and access to extension services were the delineated factors. For the tribal farmers the most important factor needed to continue their farming as livelihood is the availability of agricultural inputs like seeds, fertilizers and plant protection materials. As they had very poor facilities for transportation as well as for the purchase of agri-input services, their major concern for this would naturally be high. Tribes being ethnic communities with comparatively low innovativeness, specific targeted policies or schemes should be implemented to keep them in track. The very clear example for this is the success of the Millet Village program which was implemented in the area to promote and sustain the cultivation of certain millet crops. It was well accepted and with the advantage of assured seeds, inputs and information under the scheme it revived the generations old millet cultivation in the area. Moreover, the nature and the terrain of the land has undergone changes as a result of continuous happening of natural calamities and weather changes which need special package programs. It was these constraints that compelled many of the traditional farming families to leave agriculture as their means of livelihood. Therefore, any intervention in promoting agriculture in the region needs to be rooted in needs and regional requirements of the real farmers of Attappady area.

Table 27. Factor analysis statistics related to the factors influencing tribal farming

Factors	Eigenvalue	Variance (%)	Cumulative variance (%)
1	10.016	43.55	43.55
2	5.750	24.99	68.54
3	2.976	12.94	81.48
4	1.492	6.49	87.97
5	1.044	4.54	92.51
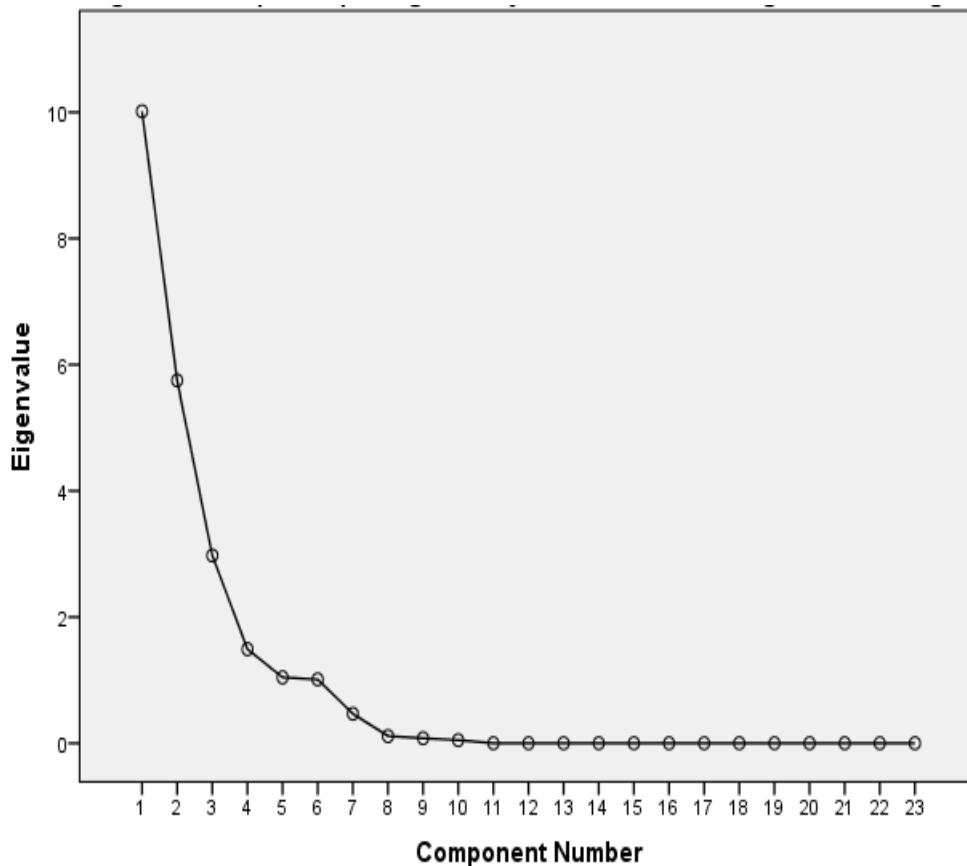
Fig 5. Scree plot depicting the major factors influencing tribal farming

4.3 HOUSEHOLD DIETARY DIVERSITY OF ATTAPPADY TRIBES OF KERALA

Household dietary diversity (HDDS) variables were calculated for each household and the value of this variable ranged from 0 to 12. Household resources required to obtain items such as condiments, sugar and sugary foods, and beverages were also included in the score. When the individual scores reflected the nutritional quality of the diet, the Household Dietary Diversity Score (HDDS) indicated the economic ability of a household to access variety of foods. In order to better reflect a quality diet, the number of different food groups consumed was calculated, rather than the number of different foods consumed. Thus, the HDDS has been designed to reflect household dietary diversity, on average, among all members.

Table 28. Factors influencing tribal farming in Attappady region of Kerala

Factor	Variables	Factor label	Factor Loadings
1	Access to institutional credit	Agricultural technology and other input service access	0.71
	Support from input dealers, Agri-business companies, Agri-clinics and Agri-business firms		0.81
	Adequacy and timely availability of agri-inputs		0.71
	Complexity of available technology		0.76
	Market demand for cultivated crops		0.87
	Adequacy of availability of market infrastructure		0.87
	Benefits availed from government and policies		0.96
	Suitability of existing cropping pattern		0.96
2	Farm mechanization	Policy, knowledge and information support	0.95
	Access to research and extension services		0.95
	Real time market information		0.91
	Cost effectiveness of mechanization		0.88
	Government policy support		0.88
	Knowledge on crop management?		0.71
3	Irrigation facilities	Infrastructure, weather and technological constraints	0.85
	Availability of electricity		0.83
	Innovative technologies for the cropping system		0.82
	Presence of organized marketing system		0.81
	Economic and technical viability of practices		0.77
	Suitability of weather		0.74
4	Awareness on marketing location	Farm management & market orientation	0.86
	Adequate labours to manage farm		0.81
5	Do you have extension access to get the technologies?	Extension service access	0.96

Table 29. Household Dietary Diversity Score (HDDS) of Attappady tribes

(n=300)

Parameters measured	HDDS item scores recorded			
	5	**6**	**7**	**8**
Frequency of households with the score	82	20	177	21
Proportion of households (%)	27	07	59	07
Sum of HDDS	1937			
Household that consumes Vitamin A rich vegetable, fruits, milk or meat (%)	59			

It can be observed from the results of Table 29 that the dietary habits of 59 per cent Attappady tribes had a reasonable amount of diversity with starchy staples, eggs, fruits and vegetables. However, their diet had the inherent deficiency of vitamin A with only 59 per cent of the population having it in the diet. This had serious effect on health in the form of prevalent night blindness, fatigue etc. Moreover, there were around 27 per cent of the tribal population whose diversity of food consumption was low with an average score of 5 that indicated a predominant dependence on cereals and vegetables which could only meet their energy and nutrient requirements. Evidently, the consumption of fruits, milk and non-vegetarian food items was much lower in the group.

Although good nutrition remained a prerequisite for a healthy and active life for all, the average HDSS score of 6.45 in Attappady tribal area indicated lack of dietary diversity. This was mostly the result of the low intake of meat, poultry, fish, and fruits prevalent in the area. Many earlier studies indicated that household food security was directly linked with household dietary energy and socio-economic position (Hoddinot and Yohannes, 2002; Hatloy *et al*., 2000). Therefore, the most rational, sustainable and long-term solution to the problem of malnutrition was

ensuring availability, accessibility and consumption of adequate amounts of diverse food sources.

Table 30. Household food security sources of Attappady tribes (N=300)

Sl. No.	Food sources	Frequency	Per cent
1	Own production, gathering, hunting, fishing	71	23.67
2	Purchased sources	89	29.67
3	Food aid through community kitchen	140	46.67

The results on the extent of dependence on various food sources for household diet by the tribes are presented in Table 30. The results suggested that majority (46.67 per cent) of the tribal population were dependent on food aid programs sponsored by different public and non-government voluntary agencies. In fact, the various food aid programs functioning in the area were aimed at ensuring dietary diversity and food security and the major food aid programs operational in the area were the Public Distribution System (PDS) and Community Kitchen. It has been observed that the Community Kitchen was the most accessed sources for food by the majority (46.67%) of tribes. In fact, the Community Kitchen program was started in the backdrop of the high rate of infant mortality and malnutrition deaths in 2013-2014 among tribal communities of Kerala by the Social Justice Department. However, later it was handed over to Kudumbashree Mission and was run by them since then. Though Community Kitchen was initiated as the nutritional programme to address malnourishment among children, at present it primarily catered to pregnant women, lactating mothers, adolescent girls, senior citizens and other impoverished members also. Menu served at the kitchen included white boiled rice, ragi powder, variety of pulses like green gram (*Vigna radiata*), horse gram (*Macrotyloma uniflorum*) and chick pea (*Cicer arietinum*). This was well accepted because it represented the revival of traditional *Ooraduppu* (Hamlet Hearth) which involved the practice of sharing food and having meals together that had been

prevalent among the tribes. Therefore, it could be concluded that introduction of Community Kitchen could revive and enhance the solidarity and unity in the tribal hamlets.

Presently the Community Kitchen was self-managed by the tribal women's neighborhood groups (NHG) where the NHGs purchased the provisions from the *Maveli* store (Fair price shop of Supplyco) on a monthly basis. Firewood for cooking would be either bought or collected by the NHG depending on the local requirements. Maintenance of hygiene in the kitchen was also the responsibility of the NHG for which a hygiene protocol developed for the purpose was in place. Vessels and utensils were provided for cooking and storing water under the scheme. The stock registers were maintained by the secretary of the NHG with the support of the animator. Earlier one meal a day was served during the evenings for the community. However, of late the food was being provided in the morning, afternoon and evening mostly to pregnant and lactating mothers. The community kitchen also had started using the vegetables grown by the community and had been extended to provide food to school going children in the mornings and evenings. *Avil* (rice flakes), broken wheat *uppuma*, rice gruel, green gram and *idli* were served as morning breakfast. The *Ooru* samithi executive committee, the animator and the project management unit of Kudumbashree Mission were responsible for monitoring the management of the project.

Moreover, the Community Kitchen also helped directly in the reduction of anemic problem, increase in the weight of infants and enhanced the health status of pregnant women. Indirect influence included improvement in women empowerment, traditional agricultural activities and overall self-confidence and social commitment among the tribes.

The results of Table 44 also indicated that despite these functional interventions, 23.67 per cent of tribes continued to rely on their indigenous food sources from farming, gathering, hunting and fishing. These traditional sources included rich food diversity consisting of wild unconventional forest products, cultivated grains and hunted animal and fish products used for subsistence (Singh

and Arora, 1978). However, these sources were influenced by vagaries of nature and availability varied from extreme deprivation in lean season to high levels of intakes of several foods during post-harvest period. Geographical isolation, primitive agricultural practices, socio-cultural taboos, lack of formal education, poor infrastructure facilities, improper health seeking behavior and poverty lead to the development of various morbidities and under nutrition. Thus, the socio-economic conditions like agricultural pattern and occupation which showed high diversity among the tribal groups were found to be determined by the ecosystem they lived. Thus they were observed to bear high influence on the health and nutritional status.

Three Nutritional Rehabilitation Centres (NRCs) were operational in the region and also a hospital facility to take care of anomalies during pregnancy and post-delivery complications function under this. These efforts were in addition to various services provided by the Health Department, Social Justice Department and Local Self Government Department. There were two allopathic outpatient (OP) clinics functioning in the region. All these led to significant reduction in infant deaths in Attappady which was reduced from 31 in 2013, to 12 in 2018 as per the records of Primary Health Center sources. In fact, even the deaths reported in 2019 from the region was found to be related to congenital anomalies and not to malnutrition per se. In Attappady, financial assistance was distributed to all tribal patients, pregnant ladies and mothers of newborn infants under tribal welfare schemes. In addition special assistance was given to sickle cell anemia patients in the region as reported by ITDP (2018).

4.3.1 Comparison of dietary pattern of Attappady tribes

Tribal communities had relatively more vulnerability to food and nutrition insecurity compared to their rural counterparts. In fact, the consumption pattern of tribes varied according to the hamlet (*ooru*) to which he/she belonged. Their daily activities as well as access to resources played a major role in determining the

quantity of food consumed by each individual in the family. A comparative analysis of dietary pattern of men and women taken up in the study are discussed.

4.3.1.1. Comparison of dietary nutrient intake among the Attappady tribal men

A perusal of Table 31 gave the overall picture of the dietary nutrient intake pattern of male tribal members of Attappady tribal development block. The results indicated a significant difference in the mean nutrient intake among the tribal men who lived in hamlets (*ooru*) with and without Community Kitchen (CK). An independent t-test conducted for each nutrient, showed a significant difference at $p < 0.05$, on all nutritional parameters except ascorbic acid. The comparison of nutrient uptake by the tribal men with Recommended Dietary Allowances (RDA) is also furnished as Fig. 6.

Also, a comparison of Recommended Dietary Allowances (RDA) with dietary nutrient intake of Attappady tribal men in areas with and without Community Kitchen (CK) is presented in Table 32. It was observed from the table that there existed a significant difference between the RDA and diets of tribal men in both areas with and without Community Kitchen. The significant result could be seen from the result in the case of protein that is 56.78 g was made available to tribal men than the ooru without CK of 38.05. The major source for protein includes pulses and it was supplied in regular interval in the sufficient quantities. However, the quantitative difference was comparatively lower in areas with CK and could infer that their nutrient requirement was not fully met by the present level of food consumption.

Table 31. Comparison of dietary nutrient intake of Attappady tribes (Male) in areas with and without Community Kitchen (CK) (n=60)

Dietary nutrients(RDA)	*Ooru* with CK		*Ooru* without CK		t value
	Mean nutrient intake/day	Standard Error	Mean nutrient intake/day	Standard Error	
Energy (kcal)	1966.63	35.85	1156.29	34.86	16.20**
Protein (g)	56.78	1.27	38.05	1.08	15.99**
Ca (mg)	342.21	9.37	162.16	8.12	14.52**
Fe (mg)	21.67	0.34	12.19	0.35	19.43**
Beta carotene (ug)	1366.20	71.72	390.94	54.91	10.80**
Riboflavin (mg)	1.03	0.02	0.52	0.02	18.09**
Ascorbic acid (mg)	11.40	3.41	25.08	6.12	-1.95*

** - significant at 5% significance level, * - significant at 10% significance level

Table 32. Comparison of Recommended Dietary Allowances (RDA) with dietary nutrient intake of Attappady tribes (Men) (n=60)

Dietary nutrients	RDA	*Ooru* with CK		*Ooru* without CK	
		Mean nutrient value	t value	Mean nutrient value	t value
Energy (kcal)	3490	1966.63	7.63**	1156.29	12.02**
Protein (g)	60	56.78	-0.68*	38.05	3.64**
Ca (mg)	600	342.21	4.94**	162.16	9.68**
Fe (mg)	17	21.67	-2.44**	12.19	2.49**
Beta carotene (ug)	4800	1366.20	8.60**	390.94	14.42**
Riboflavin (mg)	2.1	1.03	8.70**	0.52	15.79**
Ascorbic acid (mg)	40	11.4	1.51*	25.08	0.44*

** - significant at 5% significance level, * - significant at 10% significance level
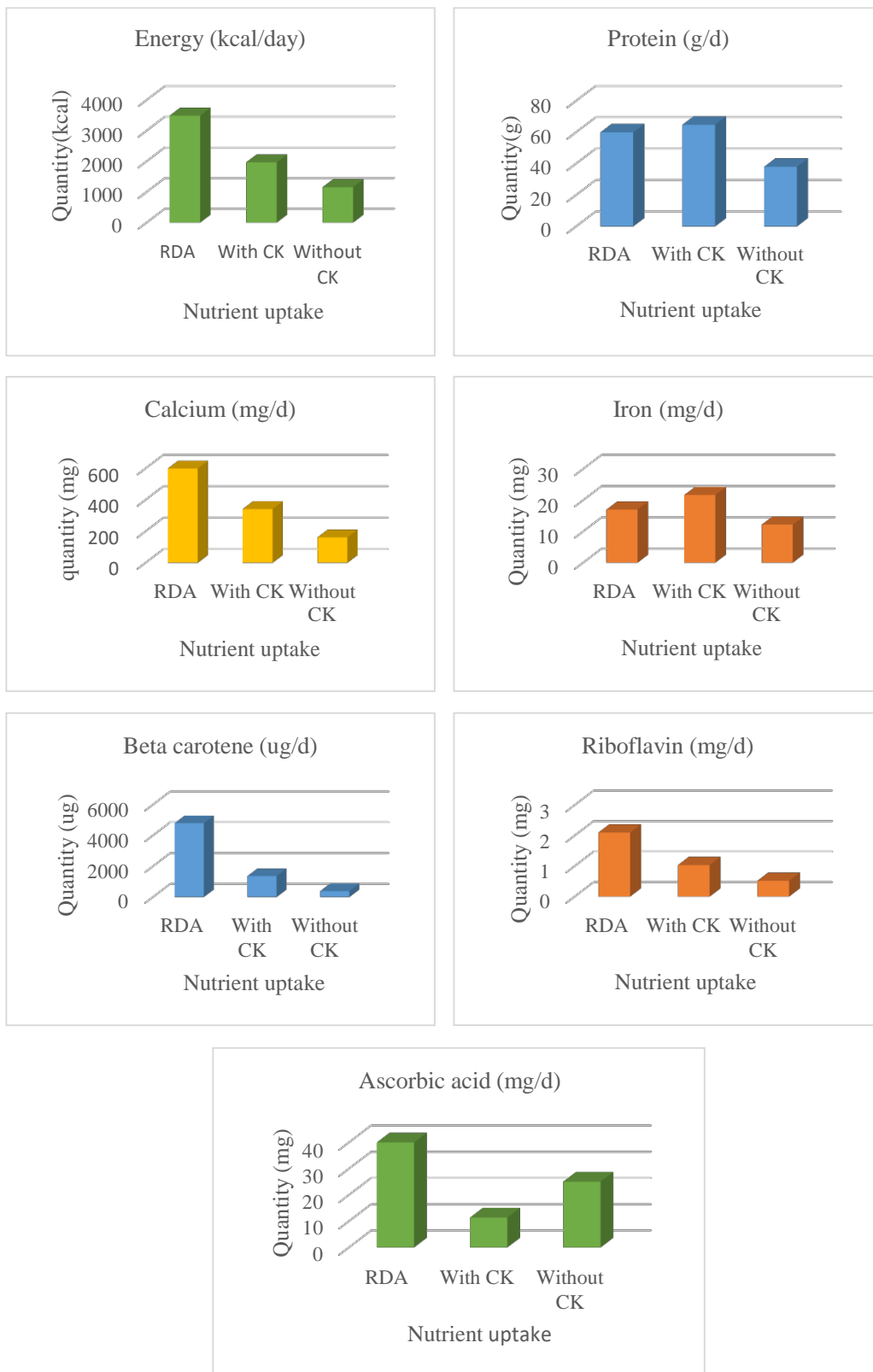
Fig. 6. Comparison of RDA with dietary nutrient intake of Attappady tribes (Men)

4.3.1.2. Comparison of dietary nutrient availability among the Attappady tribal women

A perusal of Table 33 gave the overall picture of the consumption pattern of tribal women of Attappady tribal development block. There existed a significant difference in nutrient intake among the women who lived in hamlets (*ooru*) with and without CK. An independent t-test conducted for each nutrient showed the pattern to be significant at $p < 0.05$, for all nutrient except ascorbic acid which was significant at $p < 0.10$. Thus, it could be inferred that nutrient intake through food was a critical component in the health of tribal women as suggested by Sanjoy (2011). He had reported that anaemia lowered resistance to fatigue, affected working capacity under conditions of stress and increased susceptibility to other diseases.

Table 33. Comparison of dietary nutrient availability of Attappady tribes (Women) in terms of food aid through community kitchen (CK) (n=60)

Dietary nutrients	Ooru with CK		Ooru without CK		t value
	Mean nutrient value	**Standard Error**	**Mean nutrient value**	**Standard Error**	
Energy (kcal)	1167.29	23.27	783.06	139.07	11.16**
Protein (g)	41.58	0.82	26.40	0.82	13.07**
Ca (mg)	263.68	6.25	129.65	6.04	15.42**
Fe (mg)	13.09	0.33	8.25	0.30	10.95**
Beta carotene (ug)	1473.9	65.747	527.97	63.77	10.33**
Riboflavin (mg)	0.71	0.01	0.40	0.08	14.98**
Ascorbic acid (mg)	19.38	3.15	6.84	6.84	2.54*

** - significant at 5% significance level, * - significant at 10% significance level

Results on comparison of RDA with dietary nutrient intake among respondents is included as Table 34. It could be observed that there existed significant improvement in the nutrient intake of individuals due to the presence of CK. The higher nutrient availability recorded in areas where CK was present clearly substantiated its importance in these tribal hamlets (*ooru*). However, the results were also indicative that the present level of dietary inputs distributed through (CK) could not fully meet the recommended nutrient requirements and need to be revised accordingly. This was evident from the results which showed significant difference in the dietary nutrient availability and RDA both in hamlets with and without CK. The results endorsed the finding of Nelson and Fritzell (2014) which reported that social assistance programs offered an important means of protecting the health of socio economically disadvantaged groups and mitigating the extent of socioeconomic health inequalities. Several other studies have also reported deficient intake of calories and protein among tribal populations relative to the Indian RDA, which supported the present findings (Rao *et al*., 1994; Yadav and Singh, 1999; Agte *et al.,* 2005; Mittal and Srivastava, 2006). The results on comparison of nutrient uptake by the tribal women with RDA is also depicted as Fig. 7.

Table 34. Comparison of Recommended Dietary Allowances (RDA) with dietary nutrient availability of Attappady tribal women (n=60)

Dietary nutrients	RDA	*Ooru* with CK		*Ooru* without CK	
		Mean nutrient value	t value	Mean nutrient value	t value
Energy (kcal/d)	2230	1167.29	8.20**	783.06	10.24**
Protein (g/d)	55	41.58	2.93**	26.40	6.26**
Ca (mg/d)	600	263.68	9.66**	129.65	13.99**
Fe (mg/d)	21	13.09	4.35**	8.25	7.70**
Beta carotene (ug/d)	4800	1473.90	9.09**	527.97	12.03**
Riboflavin (mg/d)	1.3	0.71	7.88**	0.40	10.74**
Ascorbic acid (mg/d)	40	19.38	1.18*	6.84	1.56*

** - significant at 5% significance level, * - significant at 10% significance level
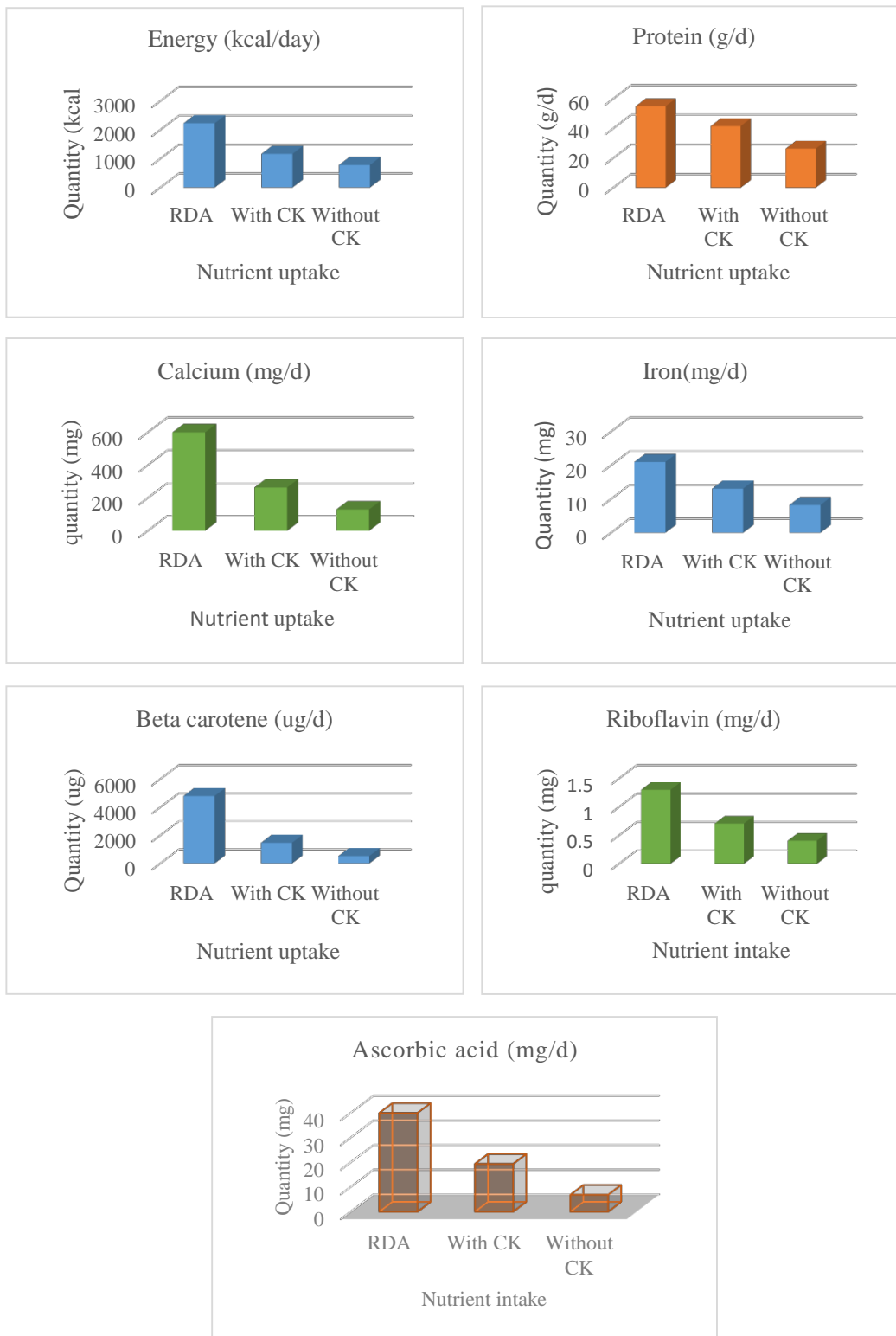
Fig 7. Comparison of RDA with dietary nutrient intake of Attappady tribes (Women)

4.3.1.3. Health of tribes based on Body Mass Index (BMI)

Body Mass Index (BMI) was observed to be closely related to an individual's food consumption pattern (Shetty and James, 1994). A perusal of Table 35 showed the physical health of the tribes in terms of BMI (Body Mass Index) based on ICMR indicator scores with the base year 2014. It could be observed from the results that only 13 per cent of the tribes suffered from severe category of grade III chronic energy deficiency. Majority of 74.3 per cent of the tribes were in the mild category of grade I chronic energy deficiency followed by 6 per cent in grade II moderate chronic energy deficiency category. The study also revealed that obesity and overweight were not problems among these tribeseople. However, none of the respondents from any of the selected panchayats in the study qualified to be in the normal body weight category which suggested for revisiting the current nutrient and food policies implemented. World Health Organization suggested that one of the main strategies to improve BMI and nutrient intake was to increase the dietary diversity at the household level (WHO, 2006).

Table 35. Distribution of tribal women on health indicators based on Body Mass Index (BMI) (n=300)

Sl. No.	Health indicators	Score Range	Agali	Pudur	Sholayur	Total	
			%	%	%	Frequency	%
1	Chronic energy deficiency-grade III severe	<16	1	17	21	39	13.00
2	Chronic energy deficiency-grade II moderate	16.0 - 17.0	4	11	3	18	6.00
3	Chronic energy deficiency-grade I mild	17.0 - 18.5	87	69	67	223	74.30
4	Low weight-normal	18.5-20.0	8	3	9	20	6.70
5	Normal	20.0-23.0	0	0	0	0	0
6	Overweight	>23	0	0	0	0	0
7	Obesity	>25	0	0	0	0	0
	Total	-	**100**	**100**	**100**	**300**	**100**

In the panchayat wise analysis also, similar trend was observed with respect to the prevalence of grade I chronic energy deficiency among tribal women in all

the selected areas of study (Table 49). There were 87 %, 69 % and 67 % of respondents identified with grade I chronic energy deficiency in the panchayats of Agali, Pudur and Sholayur respectively. In Agali, only one per cent of the tribes suffered from severe grade III chronic energy deficiency and in Pudur and Sholayur the respective per cent under the category were 17 and 21. The results also indicated moderate grade II chronic energy deficiency among 4.0%, 11% and 30.0% of respondents from Agali, Pudur and Sholayur panchayats in that order.

The results in the table also depicted 8.0%, 3.0% and 9.0% respectively from Agali, Pudur and Sholayur panchayats in low weight-normal category of body weights. The poor performance of tribal women on health indicators was reflected in the high maternal mortality rate reported among these tribes. Maternal malnutrition was quite common among the tribal women especially those who had closely spaced multiple pregnancies. They were also found to follow unhygienic and primitive practices for parturition. These women did not follow any specific nutritious diet during pregnancy from its inception to termination. Tribal diet which was depended on Community Kitchen was found to be grossly deficient in calcium, vitamin A, vitamin C, riboflavin and animal protein which aggravated the health issues. The results were in conformity of Nagda (2004) who reported prevalence of anemia in more than 80% among tribal children.

4.3.1.4 Household dietary pattern of tribes of Attappady Tribal development Block

Results from Table 36 indicated that among the major food groups only cereals and pulses figured in the daily consuming food groups and vegetables were recorded as frequently used food group. However, fish, meat, egg where least frequently used and milk, coffee/tea, homemade snacks and condiments and spices belonged to less frequently used food groups. It could be observed from the table results that there existed significant improvement in the nutrient intake of individuals due to the presence of Community Kitchen. The higher nutrient

availability recorded in areas where Community Kitchen clearly substantiated its importance in these tribal hamlets (*ooru*).

Table 36. Comparison of dietary pattern of Attappady tribes in terms of food aid through community kitchen (n=60)

Sl. No.	Food groups	With CK	Dietary pattern	Without CK	Dietary pattern
1	Cereals	100	Daily	100	Daily
2	Pulses	100	Daily	100	Daily
3	Vegetables	53.33	Frequently used	36.88	Frequently used
4	Meat	2.22	Least frequently used	8	Least frequently used
5	Fish	0.44	Least frequently used	1.48	Least frequently used
6	Egg	13.33	Least frequently used	7.55	Least frequently used
7	Fruits	14.66	Least frequently used	6.22	Least frequently used
8	Milk&milk products	27.33	Less frequently used	14	Less frequently used
9	Coffee/tea	16.66	Less frequently used	23.33	Less frequently used
10	Home made snacks	17.77	Less frequently used	15.55	Less frequently used
11	Condiments &spices	17.33	Less frequently used	12.88	Less frequently used

A comparison of the dietary pattern of Attappady tribes in terms of food aid through community kitchen was elucidated using t test and the results are depicted as Table 37. The results from the table revealed that there existed a significant difference between the dietary pattern followed by the tribes who belonged to *ooru* with and without Community Kitchen especially in the case of consumption of vegetables, fish, egg and meat.

Table 37. Statistical comparison of dietary pattern of Attappady tribes in terms of food aid through community kitchen (CK) (n=60)

Food groups	With CK		Without CK		t value
	Mean	Std error	Mean	Std error	
Vegetables	16.00	0.00	11.07	0.63	7.87**
Meat	0.67	0.28	2.4	0.57	-2.73**
Fish	0.13	0.06	0.97	0.18	-4.46**
Egg	4.0	0	2.27	0.63	2.77**
Fruits	4.4	0.67	1.93	0.43	3.07**
Milk&milk products	8.2	2.29	4.2	1.70	1.40**
Coffee/tea	5.0	2.08	7.0	2.36	-0.64
Home made snacks	5.33	0.80	4.47	0.82	0.58
Condiments &spices	5.2	1.84	3.87	1.32	0.58

** - significant at 5% significance level, * - significant at 10% significance level

4.3.2 Determinants of Household Dietary Diversity Score

This section explored the determinants of Household Dietary Diversity Score (HDDS) among the sampled households using a regression framework. Quantity of food items consumed by respondent households recorded based on a 24-hour recall period was used in the analysis in an interval of three days for three times. The socio-economic as well as demographic variables such as family size, utilization of natural resources, access to common property resources, access to safe drinking water, formal education, informal education, mass media exposure, social participation, monthly expenditure and Body Mass Index (BMI) were also included in the determinant analysis. Accordingly, a multiple linear regression model with double-log transformation was fitted, taking HDDS as the dependent variable. The model was estimated to tackle the underlying heteroscedasticity problem. Overall fit of the model was significant at the 1 % level with an R^2 value of 0.52 (Table 38).

It implied that 52 per cent of the determinants of HDDS were explained by the selected variables. Landholding of the household was significant and positive in determining the dietary basket whereas, utilization of natural resources, informal education and Body Mass Index were found significant and held negative relation with HDDS.

Table 38. Determinants of household dietary diversity in Attappady tribal development block (n=300)

Dependent variable – Log (HDDS)		
Determinants	**Coefficient**	**Standard error**
Constant	9.30	1.40
Sympson Index	-0.69	0.90
Land owned	0.61	0.45
Utilization of natural resources (UNR)	-2.18	1.62*
Common property resources (CPR)	1.17	1.22
Healthcare seeking behaviour	-2.32	0.53**
Formal education	0.21	1.02
Informal education	-1.77	1.04*
Mass media exposure	1.83	0.99*
Family Size	-0.23	1.36
Livelihood Capital Index	-2.14	0.88**
No. of observations	60.0	-
F value	5.93	-
R^2	0.55	-

**significant at 5% significance level, *significant at 10% level

The results in Table 52 which indicated significant but negative relationship between utilization of natural resources and HDDS could be explained in terms of the high natural resource depletion in the area. This led to reduced dependence on natural resources for livelihood by the tribes who had diversified to wage labour

and other livelihood vocations during the past many decades. However, the depletion of available resources was being continued unabated under extreme climatic vagaries and exploitation by the human activities especially of the non-tribal settlers. There was only a minority, especially the tribal women, who depended on forest fruits, lac and honey that yielded frugal returns as reflected in the results. Another interesting finding from the table was the significant but negative correlation of informal education with HDDS at 10% level of significance. This could possibly be related to the negative influences of tribal mystic beliefs and rituals deep rooted in their culture which had influenced their dietary habits also. Moreover, the concept of good health care practices and preventive and curative aspects of dietary nutrition is yet to gain popularity as explained by Bhowmik (2003).

4.3.3. Crop diversity in Attappady tribal block

Food and Agriculture Organization had reported biodiversity loss as one of the most serious environmental concerns of present era (FAO, 2002a). Crop diversity formed an important component of biodiversity which assumed great importance in food security. Crop diversification has been considered a viable option in reducing the risks associated with food insecurity. However, the efforts in the deprived regions to enhance crop diversity were comparatively less due to low income from agricultural production, nutrition insecurity, environmental degradation and other related challenges. Hence an analysis of crop diversity was undertaken and the results of Simpson Diversity Index used to measure crop diversity status of Attappady tribal development block is presented in Table 39.

Table 39. Crop diversity index of households of Attappady tribal area (n=60)

Simpson Diversity Index	Frequency	Per cent	Category
0.21-0.40	1	1.7	Low
0.41-0.60	8	13.3	Medium
0.61-0.80	41	68.3	High
0.81-1.0	10	16.7	Very high
Total	**60**	**100**	

Based on the observations of results in Table 53 it could be seen that there were only 1.7 per cent and 13.3 per cent of the households in the category of low and medium crop diversity scores respectively. Majority of 68.3 and 16.7 per cent of the households respectively belonged to categories with high and very high crop diversity indices. This could find support in the unique relationship the tribal groups traditionally shared with nature. They followed land laws that gave collective rights to communities and had unique religious practices of worshiping nature that protected biodiversity. This could ensure food security with access to adequate food crops in households at all times of the year. Even though these were disrupted as a consequence of economic, climatic and environmental shocks due to multiple factors, a resurgence was witnessed in recent years as a result of the agro-biodiversity mainstreaming project implemented by Kudumbashree Mission. It involved tribes trained as Master Farmers to revive traditional and sustainable farming practices called *panchakrishi* (promoted integrated production of pulses, tubers, millets, and vegetables) as reflected in the high crop diversity indices (Jain, 2020). Similarly, Makate *et al*. (2016) held that smallholder farmers' investment in crop diversification would help them cushion the problem of food insecurity and increase yields.

4.4. FOOD SECURITY OF ATTAPPADY TRIBES

The implications of food security on poverty and human development posed pervasive challenges in tribal belts of the country. Hence the study focussed on the measurement of food security and the factors influencing it in the selected tribal areas, the results of which are detailed under.

4.4.1. Status of food security among Attappady tribes

An analysis of the food security status of Attappady tribes measured using Food Security Index (FSI) based on the parameters of availability, accessibility, utilization and stability are given as Table 40 and Fig.8. A perusal of the table results indicated the food security status of Attappady tribes. It was observed from the results that majority of the tribes were in very low and medium categories of food security. When eight per cent of the tribes recorded very low food security (FSI 0.01-0.20), another 46.7 per cent of the tribes, belonged to low food security status with FSI values between 0.21 and 0.40. However, there were 33.3 and 12 per cent of them respectively in medium and very high food security categories. It was quite evident from the results that the majority of tribal people were facing problem with food security. Therefore, implementation of policies for supplementing food and nutritional requirements for these vulnerable tribal groups need urgent attention.

Though the Public Distribution System (PDS) and Community Kitchen attempted to ensure at least one complete meal a day for children below six years, adolescents, pregnant and lactating women and those above the age of 60 years, results indicated much more was desired in terms of food security. A great learning from these programs was that they needed to be footed more in tribal food habits and culture to get better reach and success. This warranted that along with the adequacy of quantity, nutritional and food habits of the tribes need to be integrated into food security programs to reach the desired goals. In this along with conventional milk, fruits and vegetables, food neutraceuticals and fortified foods could be introduced to enhance nutrition and health of the tribes, which were important in the philosophy of food security.

Table 40. Status of food security of Attappady tribes of Kerala (N=300)

Food Security Index	Frequency	Per cent	Category
0.01-0.20	24	8.0	Very low
0.21-0.40	140	46.7	Low
0.41-0.60	100	33.3	Medium
0.61-0.80	0	-	High
0.81-1.0	36	12.0	Very high
Total	**300**	**100**	
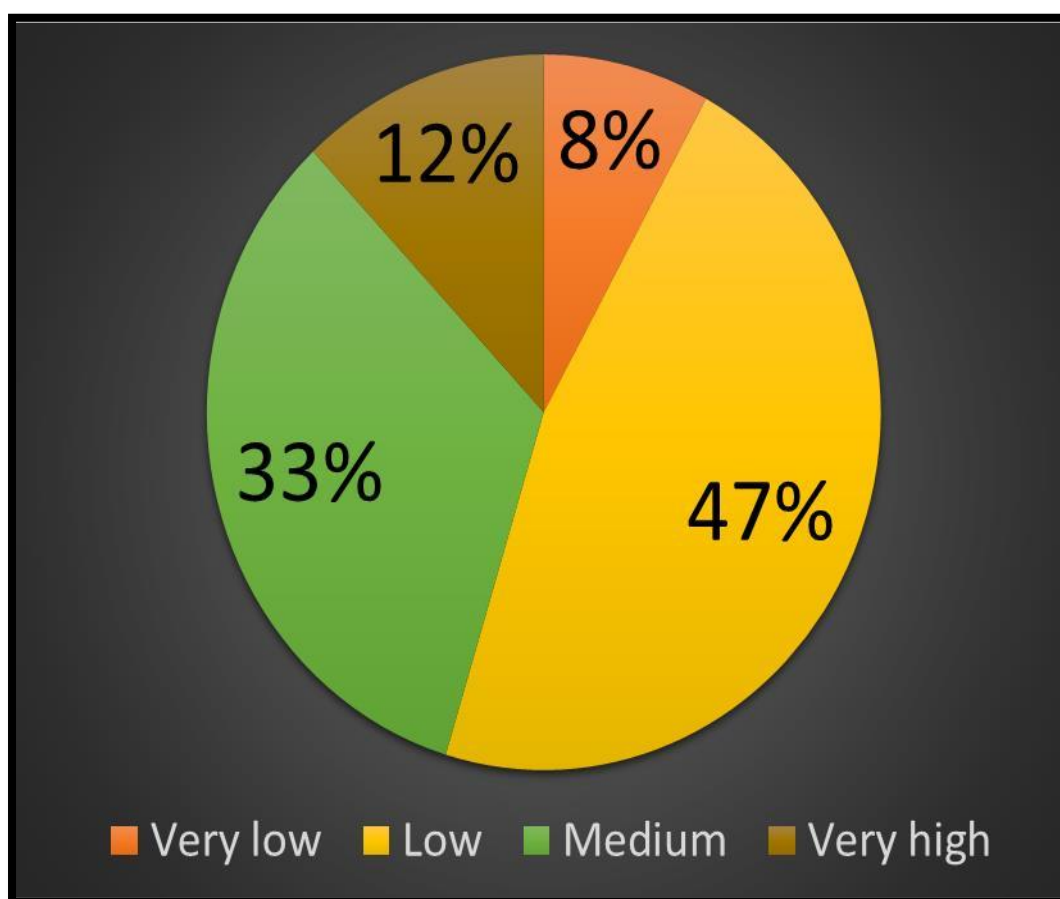
Fig. 8. Food security Index (FSI) of Attappady tribes of Kerala

4.4.2. Components of Food Security Index (FSI)

Conventionally availability, accessibility, utilization and stability were considered to be the four components of food security. In order to revalidate these components in the food security of the Attappady tribal region Friedman test was conducted and the results are given in Table 41. The results in the table indicated significant relation among the variables studied with the p value less than 0.05. Among the variables tested, accessibility had the highest mean rank of 2.82, followed by availability with 2.51. Stability and utilization had mean rank scores of 2.42 and 2.25 respectively. The results were in line with the findings of Sahu *et al*., 2017 in their study of household food security of high hill tribal community of Nagaland.

Table 41. Friedman test statistics for food security index

Test statistics		Parameters	Mean Rank
N	300	Availability	2.51
Chi-Square	35.76	Accessibility	2.82
df	3	Utilization	2.25
Asymp. Sig.	.000	Stability	2.42

4.4. 3. Factors affecting food security of Attappady tribes

In order to bring out distinctly the underlying dimensions of food security status of tribal people, the FSI scores were subjected to factor analysis. The factor statistics presented in Table 42 indicated that there was only one factor extracted which explained a total variance of 65.24 per cent. The factor scree plot depicting the results are also shown as Fig. 9 in which the number of components were plotted against the eigenvalue. Components which had eigenvalue more than 1.0; and that accounted for at least one per cent of the total variance was selected as the determining factors. Moreover, the extracted factor had four components of food security viz. availability, accessibility, utilization and stability. High factor loadings

(h^2) of the four items ranged from 0.69 to 0.91 on each of these components validating the prevalent theoretical proposition of food security. It conclusively proved that food security in the Attappady region also had the same factors as proposed by theory. The results also implied high significance for the dimensions stability (0.91) and utilization (0.85) as indicated by relatively higher scores in the overall food security of the tribal area.
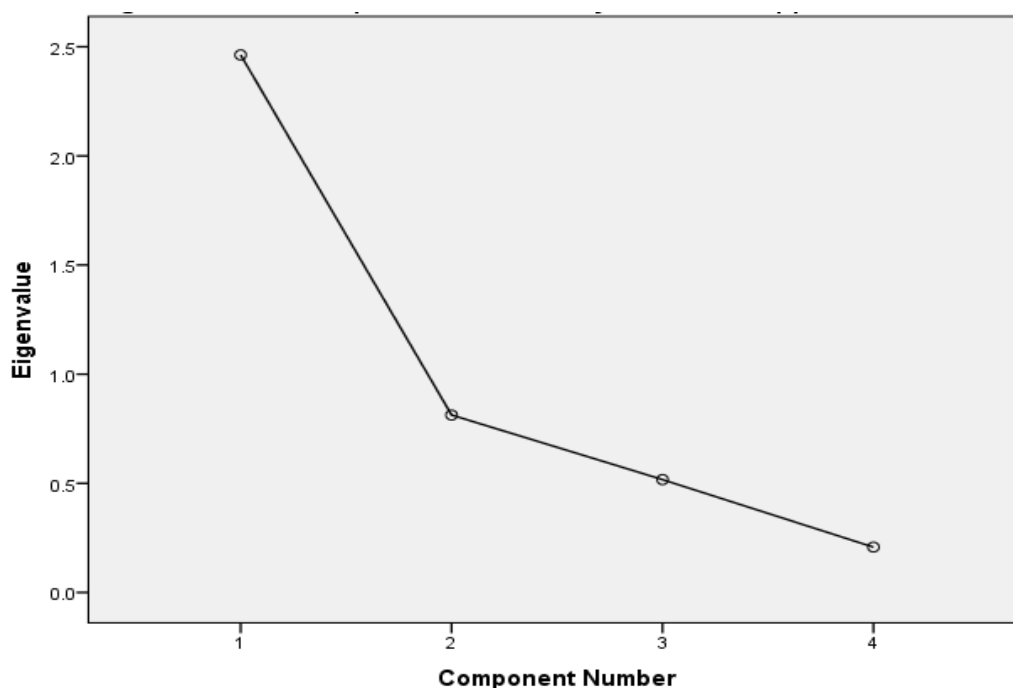
Fig. 9 Factor scree plot of food security index of Attappadi tribes

Table 42. Factor statistics of the food security of Attappady tribes of Kerala

Factor	Eigenvalue	Variance (%)	Cumulative variance (%)	Components of factor extracted	Factor loadings (h^2)
1	2.61	65.24	65.24	Availability	0.69
				Accessibility	0.77
				Utilization	0.85
				Stability	0.91

4.5 LIVELIHOOD SECURITY ANALYSIS OF THE ATTAPPADY TRIBES

An analysis of the livelihood security of the Attappady tribes was taken up using the Livelihood Security Index (LSI). It was based on a holistic conceptualisation that captured the complexities of livelihoods shaped by numerous factors that ranged from local trends to international issues adapted from DFID (1999). Accordingly, present study conceptualised it to include factors like household assets, production strategies, priorities and goals at micro-level, and the policies, institutions and processes that affect livelihoods at macro-level as well. Moreover, it was assessed as a participatory process that focused on the needs and priorities of the affected population. The household analysis of livelihood security was based on the measurement of livelihood assets (natural, physical, financial, human, and social); levels of household production; levels of income and consumption, and the ability of households to diversify their income and consumption sources to mitigate the effects of any risks, especially during disasters.

Panchayath wise livelihood analysis was conducted using the measure Livelihood Security Index (LSI) following the procedure of FAO (2008) and the results obtained are discussed below.

4.5.1. Livelihood Security Indices (LSI) of tribes of Agali panchayath

Livelihood security assessment was based on the five core assets viz. natural, social, human, physical and financial capital and were illustrated as pentagon asset graphs. The results are given as Table 43 and Fig. 10.

A perusal of Table 43 that gave the measure of livelihood status of tribes of Agali panchayath on the selected dimensions and also the overall score indicated low Financial Capital Index (FCI) scores of 35.91 for the region. It could also be observed that except on FCI, on all other dimensions, the panchayat had moderate scores. However, it could also be infered that the low FCI scores had the potential to off set the moderate scores on all the other four dimensions and the overall

livelihood security balance of the area. This was evident from the skewed livelihood asset pentagon graph depicted as Fig. 10.

Table 43. Livelihood security of the tribes of Agali panchayath (n = 100)

Sl. No.	Dimensions of livelihood security	Measurement Index	Index score
1	Financial Capital (FC)	FCI	35.91
2	Natural Capital (NC)	NCI	66.35
3	Physical Capital (PC)	PCI	65.00
4	Social Capital (SC)	SCI	59.52
5	Human Capital (HC)	HCI	62.27
6	**Overall Livelihood Security (LS)**	**LSI**	**57.81**
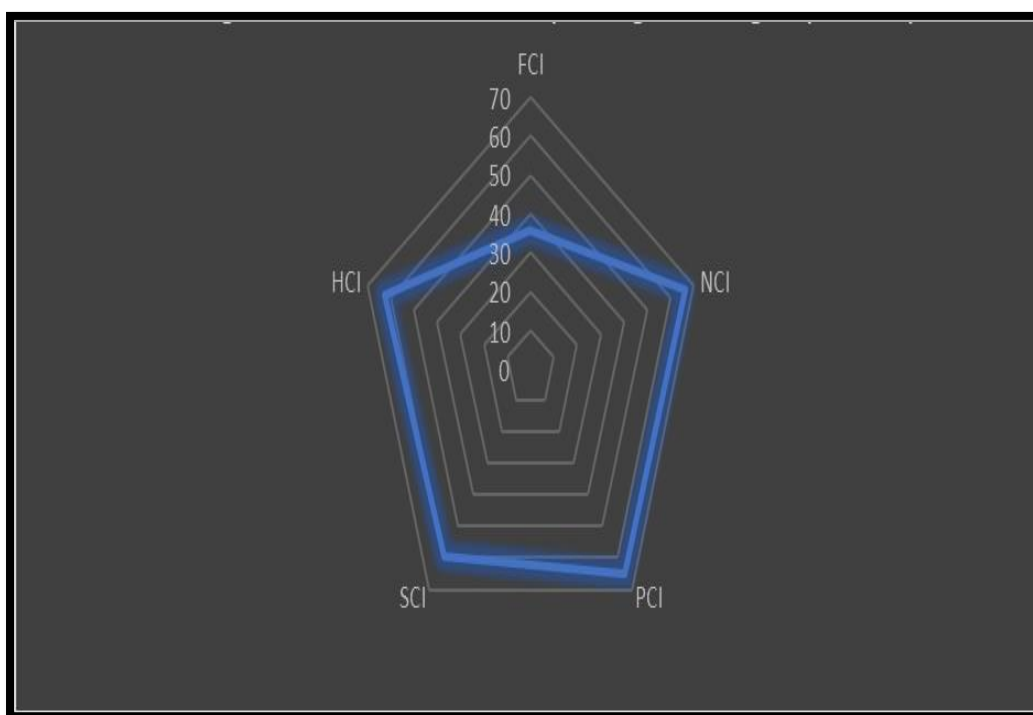
Fig 10. Livelihood asset pentagon of Agali panchayat

The results indicated that the area had reasonably good values on Social Capital Index (SCI) of 59.52, Human Capital Index (HCI)of 62.27, Physical Capital Index (PCI)of 65.00 and Natural Capital Index(NCI) of 66.35. However, the overall Livelihood Security Index for the panchayat was at 57.81 and the results called for concerted efforts to improve the income generation opportunities for the tribes in the area.

In fact, the results reflected the activities of Attappady Hill Area Development Society (AHADS), which successfully implemented many tribal empowerment and eco-restoration projects in the panchayat with financial aid of the Japan International Cooperation Agency. Evaluation study of the program by Iqbal *et al* (2013) reported that many economic activities under the project had become non-functional since 2010 due to relapse of the funds. Also, research results of Paul (2013) indicated that, *Irulas*, the major tribes group residing in the Agali panchayat, had more job opportunities than *Mudugas* and *Kurumbas* under Mahatma Gandhi National Rural Employment Guarantee Program (MGNREGP). However, in recent years there was lack of work under MGNREGP which had pushed the tribes in the area to unemployment and poverty. These findings substantiate the low FCI scores of Agali panchayat in the present study.

Most of the tribal development programs implemented by government agencies were focused on the vulnerabilities related to human health, education, housing, roads and other infrastructure of the area. These interventions mostly benefitted Agali panchayath due to its demographic and geographic advantages. This area was dominated by *Irulas* who constituted 84 per cent (Census, 2011) of the total tribal population in the Attappady area. Moreover, they were culturally and geographically better adapted to external interventions compared to *Mudugas* and *Kurumbas* who were only a minority in the area. This influence was quite evident in the pentagon graph which showed a balanced distribution of five dimensions of the livelihood analysis.

4.5.2. Factors affecting livelihood security of the tribes of Agali panchayat

In order to have a better understanding of the LSI, factor analysis which could delineate the latent factors that influenced the livelihood security was deployed. The results of factor analysis presented as Table 44 revealed the presence of seven influential factors that were independent of each other. Each factor was derived from a weighted linear combination of variables that accounted for the largest total variation in the data. The factors extracted were given in the descending order of importance with respect to the proportion of the variance accounted by each factor. The seven factors extracted together explained a total variance of 91.99 per cent which implied high significance of the selected variables in the overall livelihood security of the area.

Table 44. Factor statistics of the livelihood security of the tribes of Agali panchayat (n=100)

Factors	Eigen value	Variance (%)	Cumulative variance (%)
1	13.75	47.42	47.42
2	4.19	14.45	61.88
3	2.84	9.81	71.69
4	2.07	7.15	78.84
5	1.49	5.12	83.96
6	1.28	4.41	88.36
7	1.05	3.63	91.99

The scree plot test which depicted the factors on the x axis and the corresponding Eigen values on the y axis was used to extract the five major determining components (Fig 11). The test showed the graph to flatten off after the break of inflexion. Hence the first five factors that showed high variation were selected as the major determining factors and the factors 6 and 7 as minor factors.

The major factors together explained 83.96 per cent of total variance and the minor factors could explain 8.03 per cent as per the results from Table 44.

The eigen value for each factor extracted had values more than one which indicated that the factor explained more of the variance than could be accounted for by any one included variable. Thus, number of factors in the model was determined based on the criteria that at least two variables with a loading score of ≥0.5 were present in a factor. Accordingly the selected factors had an eigen value greater than one and each factor accounted for at least 1% of the total variance. Every item in each factor had a factor loading score that represented the correlations between each of the variables included in the factor. Only those items that had loadings greater than 0.3 were included for the description of the extracted component.

Fig 11. Factor scree plot of livelihood analysis of Agali panchayat

The results of the rotated factor matrix for the items are presented in Table 45. It showed that the Factor 1 comprised of thirteen items with factor loadings ranging from 0.626 to 0.975. Similarly Factor 2 comprised of six items with factor loadings ranging from 0.682 to 0.964 and Factor 3 had two items with factor loadings of 0.666 and 0.958. With respect to the factors 4 and 5, each had two items and the factor loading scores of items under Factor 4 was 0.709 and 0.839 and Factor 5 items showed equal factor loading scores of 0.97 each. Factors six and seven also comprised of two items each with factor loadings 0.68, 0.76 and 0.67, 0.82 respectively. The relatively high values of factor loadings for items of all factors in Table 59 are indicative of the high relevance of these factors in the overall livelihood security of Agali panchayat.

Based on the items loaded under each of the delineated factors, appropriate naming was done and is featured as major and minor factors in Fig. 12. Accordingly, the major factors that had intrinsic relationship with the livelihood security of the area were identified as community networking and interdependence, access and ownership of productive resources, social capital resources, nutrition and health, and infrastructural facilities. The community networking and interdependence factor alone could explain almost half of the total variance (47.42%) which is indicative of the prevalent tribal norms of community living and its influence on livelihood security. The minor factors were named as basic amenities and economic status.

4.5.3. Livelihood Security Indices (LSI) of tribes of Pudur panchayat

Livelihood security of Pudur panchayat was assessed based on the core assets of natural, social, human, physical and financial capital. Livelihood security index and pentagon asset graphs were used in the analysis and the results are discussed.

Table 45. Factor loadings of items in livelihood security index (LSI) of Agali panchayath (n=100)

Factor No.	Items	Items extracted under factors	Factor loading
Factor 1	1	Informal get together	0.98
	2	Leadership quality	0.96
	3	Interdependence and networking	0.94
	4	Expenditure pattern	0.93
	5	Innovativeness	0.91
	6	Livestock possession	0.87
	7	Concern towards weaker section	0.85
	8	Contact with extension agency	0.83
	9	Media exposure	0.82
	10	Type of house	0.77
	11	Informal network	0.75
	12	Relationship with others	0.75
	13	Common property resources	0.63
Factor 2	1	Material possession	0.96
	2	Addictive health behavior	0.93
	3	Borrowing pattern	0.76
	4	Health seeking behaviour	0.75
	5	Utilization of natural resources	0.68
	6	Land ownership	0.63
Factor 3	1	Social participation	0.67
	2	Formal education	0.96
Factor 4	1	Informal education	0.71
	2	Body Mass Index	0.84
Factor 5	1	Sanitation facility	0.97
	2	Electricity	0.97
Factor 6	1	Access to drinking water	0.76
	2	Ownership of the house	0.68
Factor 7	1	Ownership of the house shared	0.82
	2	Monthly income	0.67
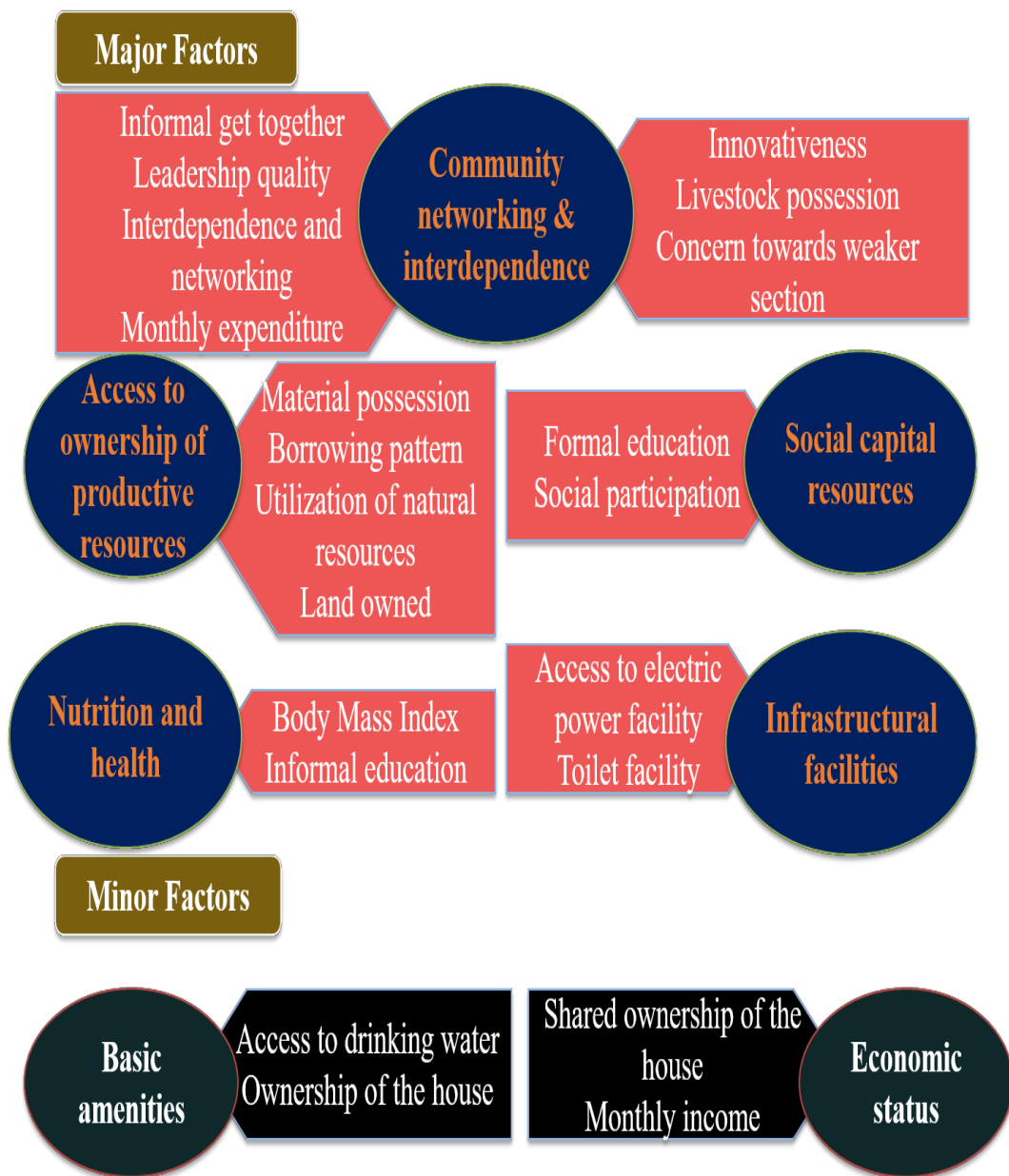
Fig.12. Diagrammatic representation of factors affecting livelihood security of tribes in Agali panchayat

Table 46. Livelihood security measures of the tribes of Pudur panchayath

<div align="right">(n =100)</div>

Sl. No.	Dimensions of livelihood security	Measurement Index	Index score
1	Financial Capital (FC)	FCI	47.00
2	Natural Capital (NC)	NCI	50.96
3	Physical Capital (PC)	PCI	57.75
4	Social Capital (SC)	SCI	16.88
5	Human Capital (HC)	HCI	45.14
6	**Overall Livelihood Security (LS)**	**LSI**	**43.55**

An examination of Table 46 illustrated that the livelihood status of tribes of Pudur panchayath on the selected core dimensions indicated comparitively low scores on all the selected dimensions with lowest scores for social capital (16.88). The low social capital score contridicted the tribal norms of community living and reflected alienation in the region. It is an indication of the lack of education, health and other facilities that enrich social capital which needs redressal. It could also be observed that on all other dimensions also, the panchayat recorded only very moderate scores. This is evident from the highly skewed livelihood asset pentagon graph depicted as Fig. 13. The results indicated that the area also had very moderate scores on Financial Capital Index (FCI) of 47.00, Human Capital Index (HCI) of 45.14, Physical Capital Index (PCI)of 57.75 and Natural Capital Index(NCI) of 50.96. The overall Livelihood Security Index (LSI) for the panchayat was only 43.55.

4.5.4. Factors affecting livelihood security of the tribes of Pudur panchayat

Factor analysis delineated five factors that affected the livelihood security of the tribes of Pudur panchayat and the results are presented in Table 61. It was observed that these factors had significant influence on the livelihood security of the region and are independent of each other.
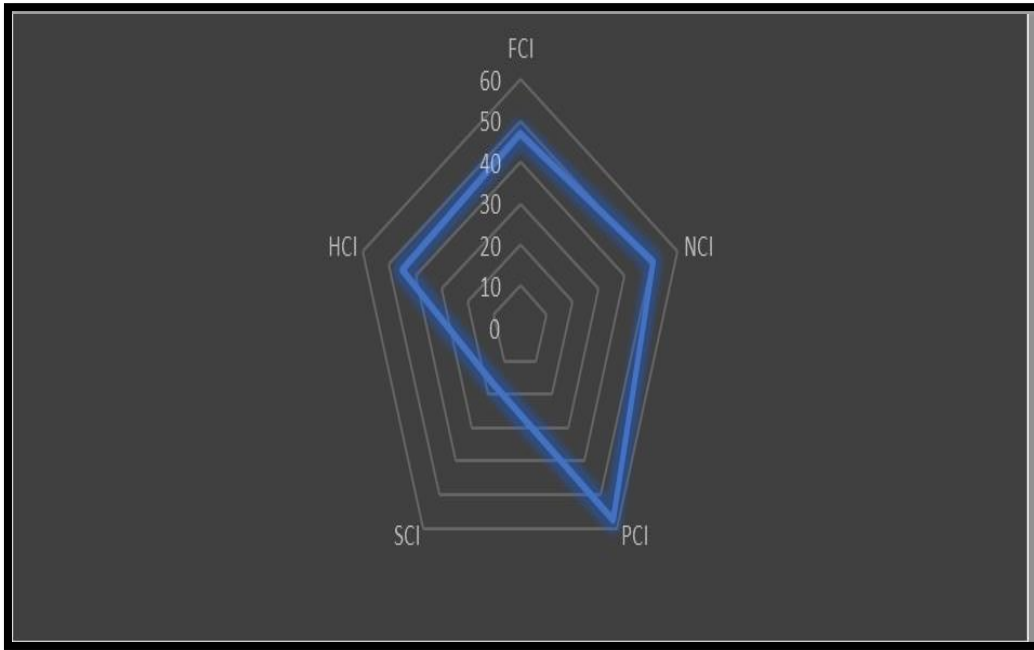
Fig 13. Livelihood asset pentagon of Pudur panchayat

Each factor was derived from a weighted linear combination of variables that accounted for the largest total variation in the data. The factors extracted were given in the descending order of importance with respect to the proportion of the variance accounted by each factor. These five factors together explained a total variance of 85.82 per cent which implied high significance of the selected variables in the livelihood security of the panchayat.

Table 47. Factor statistics of the livelihood security of the tribes of Pudur panchayat

(n=100)

Factors	Eigen value	Variance (%)	Cumulative variance (%)
1	12.36	42.63	42.63
2	6.62	22.83	65.46
3	2.62	9.04	74.50
4	1.98	6.84	81.34
5	1.30	4.48	85.82

Scree plot which depict the delineated factors on the x axis and the corresponding Eigen values on the y axis was used to extract the major determining factors (Fig. 14). The extracted graph flattened off after the break of inflexion and the four factors before the point were selected as the major determining factors and the factor 5 beyond the point as a minor factor. The major factors together explained 81.34 per cent of total variance and the minor factor could explain 4.48 per cent of total variance (Table 47).

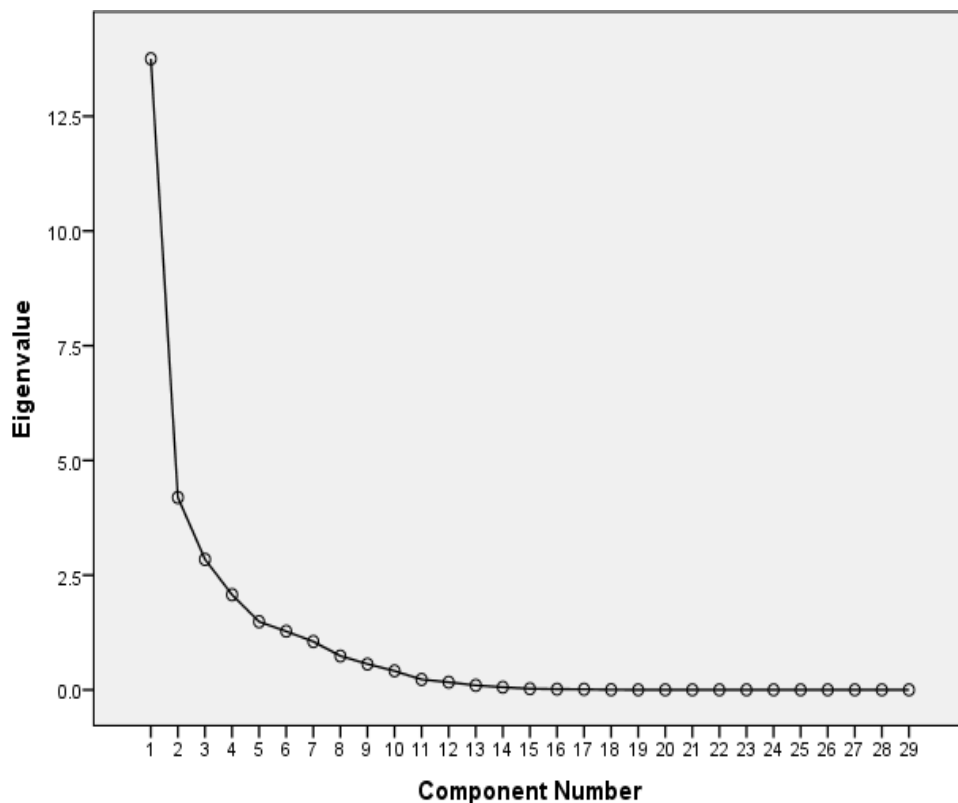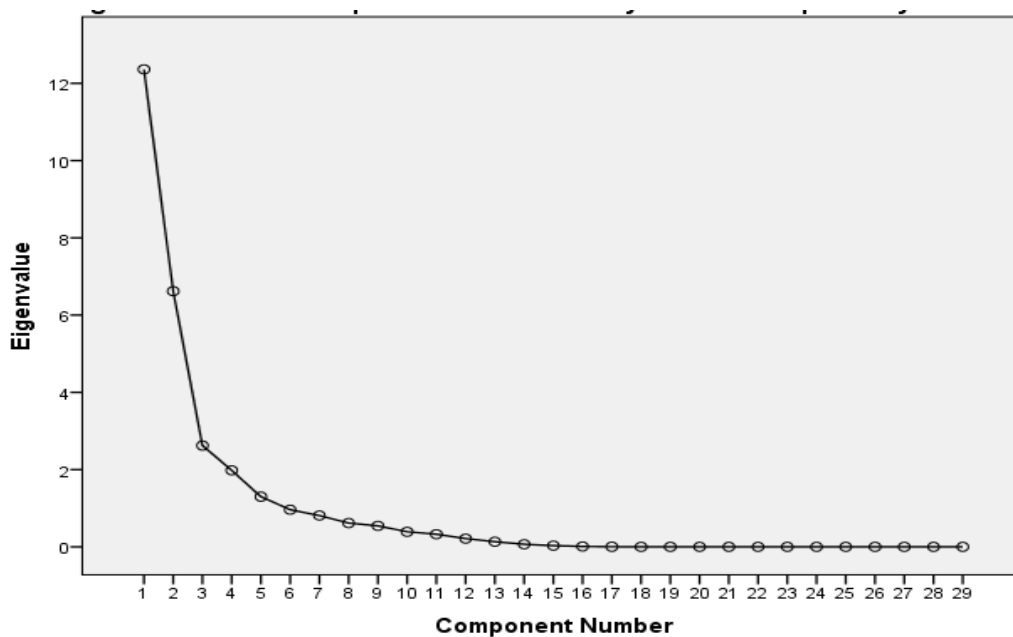**Fig 14. Factor scree plot of livelihood analysis of Pudur panchayath**

The results of the rotated factor matrix for the items covered under each factor have been presented in Table 48. The results showed that the Factor 1 comprised of twelve items with factor loadings ranging from 0.53 to 0.96. It also showed that Factor 2 had nine items with factor loadings that ranged from 0.46 to 0.95 whereas Factor 3 had only three items with factor loadings ranging from 0.76 to 0.85. The factor loadings for Factors 4 and 5 which comprised of two items each were 0.93, 0.0.76 to 0.85. The uniformly high values of factor loadings indicated the significance of these variables in the delineated factors and the overall livelihood security of the panchayat.

Table 48. Rotated factor loadings on items of livelihood security index (LSI) of Pudur panchayat (n=100)

Factor no.	Item no.	Factors	Factor loading
Factor 1	1	Contact with extension agency	0.96
	2	Informal network	0.95
	3	Relationship with others	0.95
	4	Media exposure	0.92
	5	Informal education	0.88
	6	Social participation	0.87
	7	Interdependence and networking	0.80
	8	Concern towards weaker section	0.77
	9	Leadership quality	0.75
	10	Informal get together	0.75
	11	Addictive health behaviour	0.64
	12	Body Mass Index	0.53
Factor 2	1	Utilization of natural resources	0.95
	2	Material possession	0.93
	3	Common property resources	0.91
	4	Borrowing pattern	0.78
	5	Land	0.77
	6	Ownership of the house	0.73
	7	Health seeking behaviour	0.73
	8	Expenditure pattern	0.67
	9	Monthly income	0.46
Factor 3	1	Livestock possession	0.85
	2	Innovativeness	0.79
	3	Formal education	0.76
Factor 4	1	Electricity	0.99
	2	Sanitation facility	0.99
Factor 5	1	Ownership of the house shared	0.85
	2	Access to drinking water	0.76

Based on the items loaded under each factor, appropriate nomenclature was assigned and is depicted as major and minor factors in Fig. 15. Accordingly, the major factors that had close relationship with the livelihood security of the area were identified as community networking and interdependence, access and entitlement of productive resources, social capital assets, access to sanitation and electricity, and basic amenities. The community networking and social dependence factor alone could explain a total variance of 42.63% which was indicative of the prevalent tribal norms of community living and its influence on livelihood security.

4.5.5. Livelihood Security Index (LSI) of tribes of Sholayur panchayat

Livelihood Security Index (LSI) based on factor analysis and pentagon asset graphs were used to assess the livelihood security of Sholayur panchayat and the results are discussed. Livelihood security measures of Sholayur panchayat on the core assets of natural, social, human, physical and financial capital are presented in Table 49. An illustration of the results as livelihood asset pentagon can be viewed in Fig.15.

Table 49. Livelihood security measures of the tribes of Sholayur panchayath

(n =100)

Sl. No.	Dimensions of livelihood security	Measurement Index	Index score
1	Financial Capital (FC)	FCI	40.57
2	Natural Capital (NC)	NCI	52.95
3	Physical Capital (PC)	PCI	62.93
4	Social Capital (SC)	SCI	21.63
5	Human Capital (HC)	HCI	48.45
6	**Overall Livelihood Security (LS)**	**LSI**	**45.31**

A perusal of Table 63 indicated very low Social Capital Index (SCI) of 21.63, Financial Capital Index (FCI) of 40.57, Human Capital Index (HCI) of 48.45, Physical Capital Index (PCI) of 62.93 and Natural Capital Index (NCI) of 52.95. The overall Livelihood Security Index (LSI) for the area was 45.31.
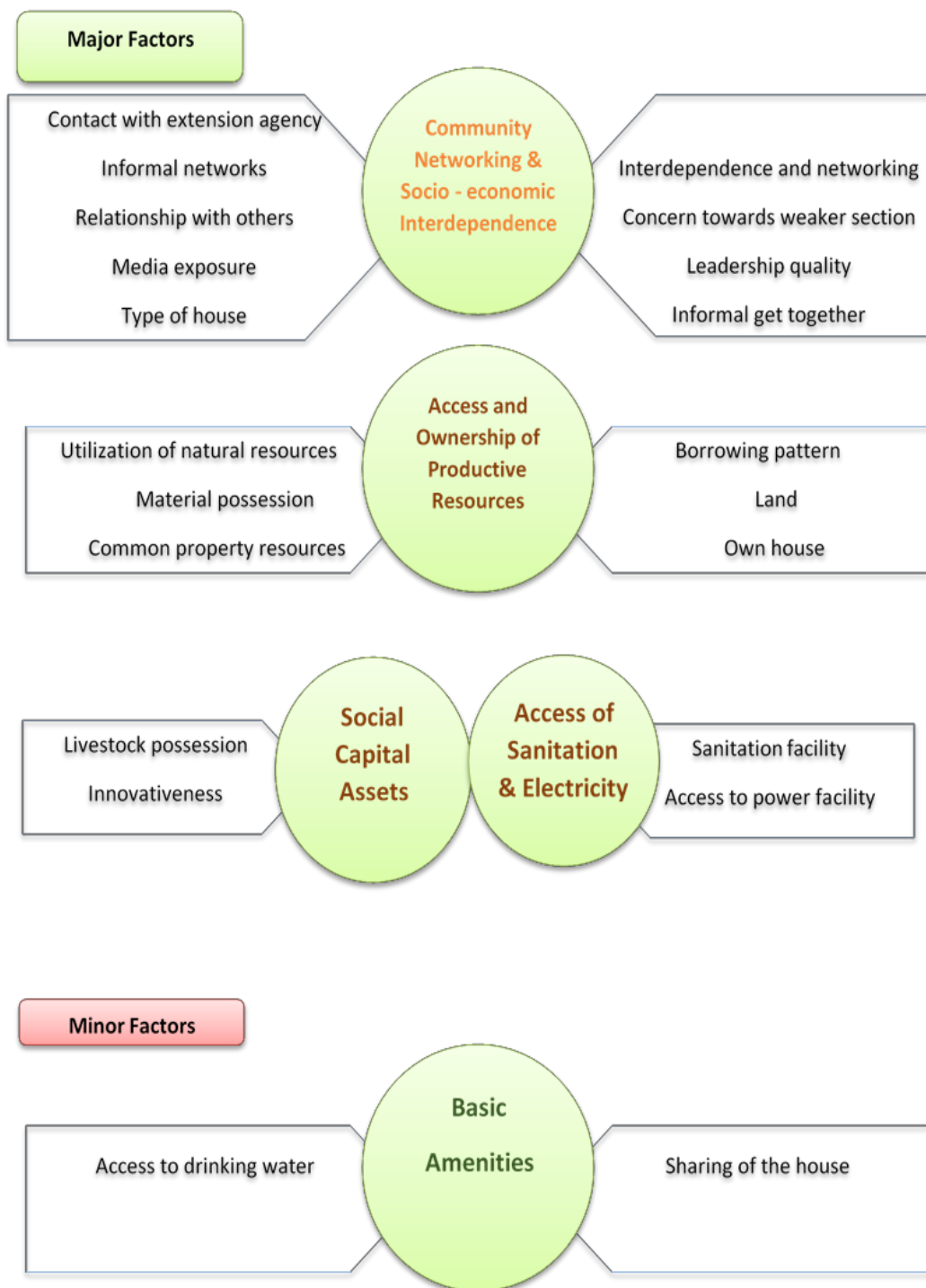
Fig. 15. Diagrammatic representation of factors affecting livelihood security of tribes in Pudur panchayat

The only dimension on which the area had reasonably high score was on the physical Capital. This could be explained in terms of the efforts of Attappady Hill Development project which constructed around 2000 houses for tribes in the area. The high deviation in the SCI was evident from the highly skewed livelihood asset pentagon graph depicted as Fig.16. The pentagon has almost turned into a quadrangle due to the deviant low scores of SCI. The results warranted immediate interventions in building the social capital assets so that the traditional tribal norms of community living and social interdependence are intact. The very low scores of social and financial capitals directly as well as indirectly proved the under development of the community. The outcomes would be present manifested in the health and social dimensions of the population. According to Nalinam (2016) the dominant disease group includes respiratory infection, diarrheal disorders, skin infections, malnutrition, and anemia. Degenerative diseases like diabetes, hypertension, and heart diseases have also begun to surface among tribes in Kerala and the results seemed to suggest that incidence of morbidity is not declining among them.
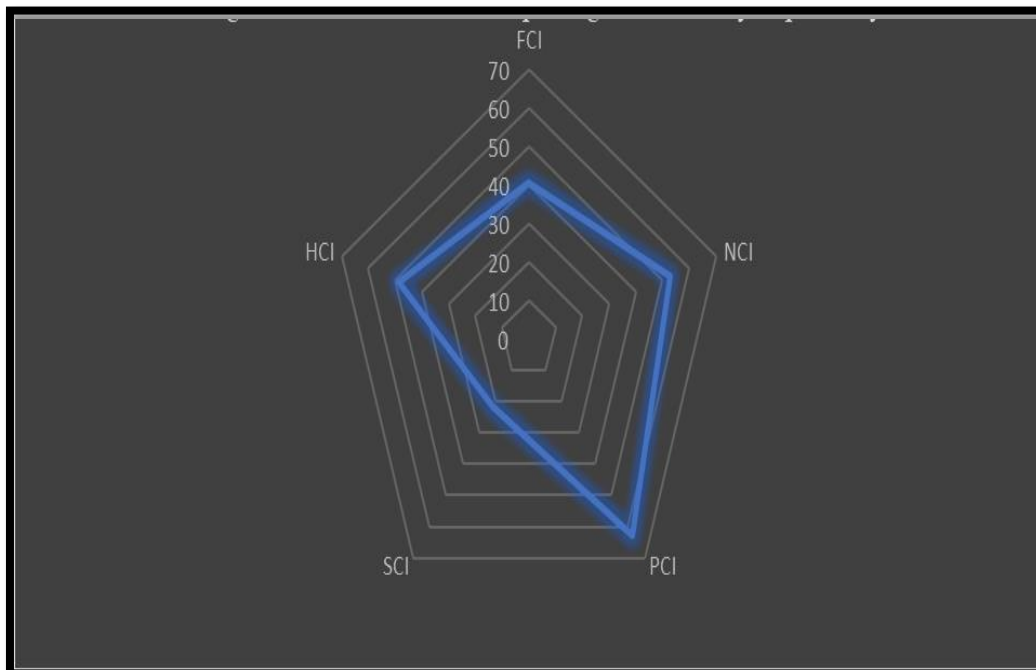
Fig 16. Livelihood asset pentagon of Sholayur panchayat

4.5.6. Factors affecting Livelihood Security of the tribes of Sholayur panchayat

Five factors were delineated using factor analysis that are independent of each other and are presented in Table 50. Each factor was derived from a weighted linear combination of variables that accounted for the largest total variation in the data. The factors extracted are given in the descending order of importance with respect to the proportion of the variance accounted by each factor. These five factors extracted together explained a total variance of 90.31 per cent which implied high significance of the selected variables.

Table 50. Factor statistics of the livelihood security of the tribes of Sholayur panchayat (n=100)

Factors	Eigen value	Variance (%)	Cumulative variance (%)
1	14.15	48.78	48.78
2	6.62	22.84	71.62
3	2.42	8.33	79.95
4	1.89	6.50	86.45
5	1.12	3.86	90.31

The results of the rotated factor matrix for the items are presented in Table 65. The results in the table showed that the Factor 1 comprised of seventeen items with factor loadings ranging from 0.48 to 0.99. However, the Factor 2 had only five items with factor loadings ranging from 0.73 to 0.90 and Factor 3 four items with factor loadings ranging from 0.68 to 0.89. The factor loadings of the two items featured in Factor 4 were 0.99 each and of the single item under Factor 5 was 0.72. Factor loadings represented the correlations between each of the items and the high scores indicated close association between the items under each of the delineated factors.

Scree plot technique was used in the classification of the delineated factors into major and minor categories. The factors were plotted on the x axis and the corresponding Eigen values on the y axis as presented in Fig. 17. The extracted graph flattened off after the break of inflexion and the three factors before the point were selected as the major determining factors and the factors 4 and 5 beyond the point of inflexion as the minor factors. The major factors together explained 79.95 per cent of total variance and the minor factors explained 10.36 per cent (Table 51).
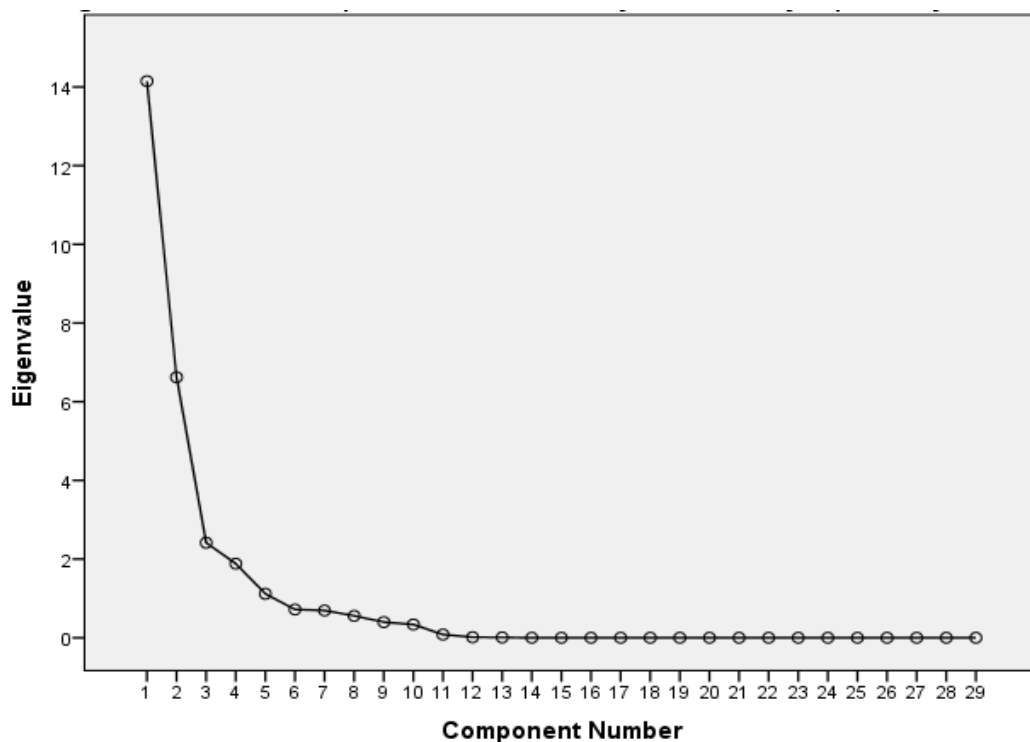
Fig 17. Factor scree plot of livelihood analysis of Sholayur panchayath

The results of the rotated factor matrix for the items covered under each delineated factor for Sholayur panchayat has been given as Table 65. The findings showed that the Factor 1 comprised of 17 items with factor loadings ranging from 0.48 to 0.99. It was also evident from the results that Factor 2 had only five items with factor loadings of range 0.73 to 0.90 and Factor 3 had four items with factor loadings ranging from 0.68 to 0.89. The factor loadings for minor factors 4 and 5 which comprised of two and one item respectively had the scores 0.99 each for

Factor 4 and 0.72 for Factor 5. The uniformly high values of factor loadings indicated the significance of these variables in the delineated factors and the overall livelihood security of the panchayat.

Table 51. **Rotated factor loadings of items in the Livelihood Security Index (LSI) of Sholayur panchayath** (n=100)

Factor No.	Sl. No.	Factors	Factor loading
Factor 1	1	Interdependence and networking	0.99
	2	Informal get together	0.99
	3	Leadership quality	0.99
	4	Concern towards weaker section	0.98
	5	Relationship with others	0.95
	6	Informal network	0.95
	7	Contact with extension agency	0.94
	8	Formal education	0.92
	9	Social participation	0.89
	10	Innovativeness	0.89
	11	Informal education	0.89
	12	Type of house	0.86
	13	Livestock possession	0.84
	14	Media exposure	0.84
	15	Expenditure pattern	0.79
	16	Monthly income	0.48
	17	Addictive health behaviour	0.68
Factor 2	1	Borrowing pattern	0.90
	2	Material possession	0.85
	3	Land ownership	0.74
	4	Body Mass Index	0.73
	5	Health seeking behaviour	0.73
Factor 3	1	Ownership of the house	0.89
	2	Access to drinking water	0.70
	3	Utilization of natural resources	0.69
	4	Common property resources	0.68
Factor 4	1	Electricity	0.99
	2	Sanitation facility	0.99
Factor 5	1	Ownership of the house shared	0.72

Names were assigned to both major and minor factors delineated based on the items loaded under each factor, and is portrayed as Fig. 18. Accordingly, the three major factors that featured in the livelihood security of the area were identified as community networks and socio-economic interdependence, access and ownership of capital resources, and shared access and ownership of natural resources and basic amenities. The minor factors were identified to be access to electricity and sanitation and community living. It could be inferred from the results that community networks and socio-economic interdependence alone could explain almost half of the total variance (48.78 %) and the major factors together explained 79.95 per cent of total variance (Table 64). The minor factors accorded for 10.36 per cent of the total variance of 90.31 per cent. The results were also indicative of the prevalent tribal norms of community living and its influence on livelihood security

4.5.7. Comparative analysis on dimensions of livelihood security

In order to understand the distribution of different indices among three panchayath Kruskal-Wallis test was done and the results are given in Table 52 and Fig. 19. In the case of financial and physical capital index there was significant difference between Agali and Sholayur as well as between Pudur and Sholayur panchayats. However, there was no much difference between Agali and Pudur on these parameters of livelihood. When the natural, social and human capital indices were compared, it could be observed that Pudur and Sholayur were on par whereas Agali and Pudur and Agali and Sholayur differed significantly on these dimensions of livelihood.

Major Factors

Interdependence and networking
Informal get together
Concern towards weaker section
Informal networks
Relationship with others
Leadership quality
Contact with extension agency
Formal education

Community Networking & Socio - economic Interdependence

Innovativeness
Social participation
Informal education
Type of house
Livestock possession
Media exposure
Monthly expenditure
Health seeking behavior

Access & Ownership of Capital Resources

Material possession
Borrowing pattern
Land ownership

Shared access & Ownership of Natural Resources & Basic Amenities

Utilization of natural resource
Common property resources
Ownership of the house
Access to drinking water

Minor Factors

Access to Electricity and Sanitation

Access to power facility
Sanitation facility

Community living

Shared ownership of the house

Fig. 18. Diagrammatic representation of factor affecting livelihood security in Sholayur panchayat
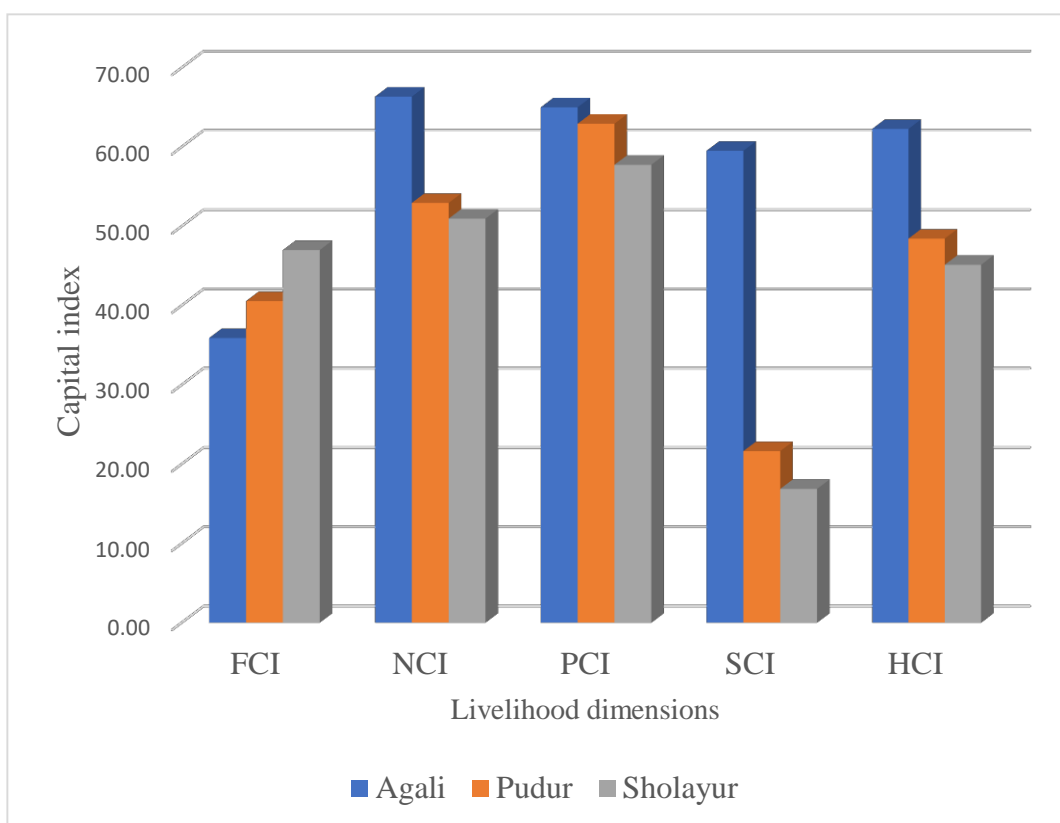
Fig. 19. Comparison of selected panchayats on dimensions of livelihood security

Table 52. Comparison of selected panchayats on dimensions of livelihood security (n=300)

Name of Panchayat	Livelihood security dimensions*				
	FCI	NCI	PCI	SCI	HCI
Agali	35.91[a]	66.35[a]	65.00[a]	59.52[a]	62.27[a]
Pudur	40.57[a]	52.95[b]	62.93[a]	21.64[b]	48.45[b]
Sholayur	47.00[b]	50.96[b]	57.75[b]	16.88[b]	45.14[b]

*FCI= Financial Capital Index, NCI=Natural Capital Index, PCI= Physical Capital Index, SCI=Social capital Index, HCI= Human Capital Index

4.5.8. Livelihood Security Indices (LSI) of tribes of Attappady Tribal Development Block

Livelihood security of Attappady Tribal Development Block was assessed based on the core assets of natural, social, human, physical and financial capital. Livelihood Security Index (Table 53) and pentagon asset graphs (Fig. 20) were used in the analysis and the results are discussed.

Table 53. Distribution of livelihood indices of tribes of Attappady Tribal Development Block (n=300)

Sl. No.	Dimensions of livelihood security	Measurement Index	Index score
1	Financial Capital (FC)	FCI	41.16
2	Natural Capital (NC)	NCI	56.75
3	Physical Capital (PC)	PCI	61.89
4	Social Capital (SC)	SCI	32.68
5	Human Capital (HC)	HCI	51.95
	Overall Livelihood Security (LS)	LCI	48.89
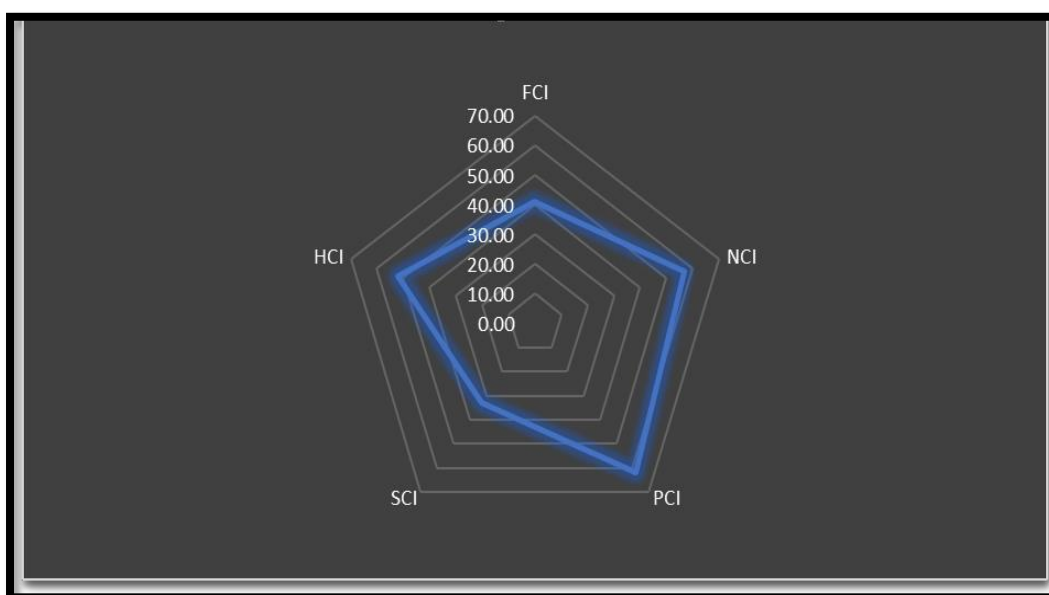
Fig 20. Livelihood asset pentagon of Attappady Tribal Development Block

An examination of table 67 that depicted the livelihood status of tribes of Attappady Tribal Development Block on the selected core dimensions indicated comparitively low scores on all the selected dimensions with lowest scores for social capital (32.68). The low social capital scores contridicted the tribal norms of community living and reflected alienation in the region. It gave an indication of the lack of education, health and other facilities that enriched social capital and needed redressal. This was also evident from the highly skewed livelihood asset pentagon graph depicted as Fig.19. The results indicated that the area also had very modest scores on Financial Capital Index (FCI) of 41.16, Human Capital Index (HCI) of 51.95, Physical Capital Index (PCI)of 61.89 and Natural Capital Index(NCI) of 56.75. The overall Livelihood Security Index (LSI) for the block was only 48.89. The results called for concerted efforts to improve the livelihood security of the area especially in improving the social capital assets in the area.

From the livelihood asset pentagon diagram (Fig. 20), it could be observed that the tribes in Attappady area had very low scores on social capital and financial capital indices. This was indicative of the various forms of social discrimination and economic exploitation faced by them from the settlers and the non-tribes in the region. Majority of tribes especially in Agali panchayats had lost their lands to the settlers and were displaced to barren hilly tracts. This land alienation threatened their livelihoods and made them wage labourers in the fields of settlers and plantations. The results find conformity in the findings of Rajasenan and Nikitha, (2013) who reported land alienation as the major problem that adversely affected livelihood status of tribes in Wayanad, Idukki and Palakkad districts of which the worst affected was Palakkad.

4.5.8. Factors affecting Livelihood Security of the tribes of Attappady Tribal Block

Six factors were delineated using factor analysis that were independent of each other and are presented in Table 54. The factors extracted are given in the descending order of importance with respect to the proportion of the variance accounted by each factor. These six factors extracted together explained a total

variance of 86.15 per cent which implied high significance of the selected variables. Scree plot used in the classification of the delineated factors into major and minor categories is given as Fig. 21.

Table 54. Factor statistics of the livelihood security of the tribes of Attappady Tribal Block (N=300)

Factor	Eigenvalue	Variance (%)	Cumulative variance (%)
1	12.99	44.83	44.83
2	5.29	18.25	63.08
3	2.19	7.57	70.66
4	1.87	6.46	77.12
5	1.52	5.25	82.38
6	1.09	3.77	86.15

The results of the rotated factor matrix for the statements are presented in Table 55. The results in the table showed that the Factor 1 comprised of thirteen items with factor loadings ranging from 0.80 to 0.98. Factor 2 comprised of five items with factor loadings ranging from 0.66 to 0.89. Factor 3 had three items with factor loadings ranging from 0.66 to 0.87. Factor 4 comprised of two items with factor loadings ranging from 0.59 to 0.73. Factor 5 had two items with factor loading 0.99 and Factor 6 comprised of three items with factor loadings ranging from 0.53 to 0.63.

Appropriate nomenclatures were assigned to both major and minor factors delineated based on the items loaded under each factor, and is portrayed as Fig. 22. Accordingly, the three major factors that featured in the livelihood security of the area were identified as community networking and economic resources, economic capital and access and entitlements to basic amenities. The minor factors were identified to be health, electricity and sanitation and social capital.
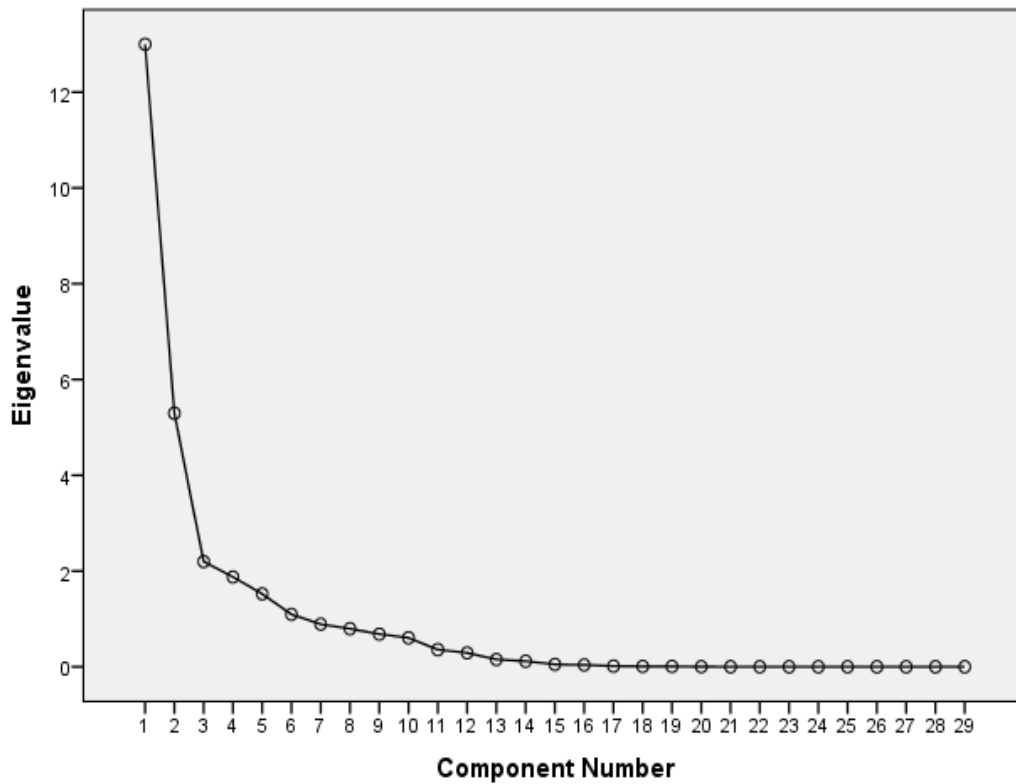
Fig 21. Factor scree plot of livelihood analysis of Attappady Block

Braveman (2014) and Marmot *et al.* (2008) confirmed that socio-economic resources such as wealth, income, and employment referred to as the social determinants of health, were the fundamental causes of health and related inequalities persistent in the tribal communities. They were termed fundamental as they influenced the everyday conditions, experiences, and exposures causing inequities in the society. Community-based programs that shared tribal norms should be promoted to play a key role until health services, education, income, and communications have improved to the point that maternal and child mortality has fallen substantially and malnutrition was reduced.

Table 55. Rotated factor loadings of items in livelihood security index (LSI) of Attappady Tribal Block (n=300)

Factor No.	Sl. No.	Factors	Factor loading (h^2)
Factor 1	1	Informal get together	0.98
	2	Leadership quality	0.98
	3	Interdependence and networking	0.97
	4	Concern towards weaker section	0.94
	5	Contact with extension agency	0.93
	6	Relationship with others	0.90
	7	Informal network	0.90
	8	Social participation	0.86
	9	Media exposure	0.86
	10	Innovativeness	0.85
	11	Livestock possession	0.83
	12	Type of house	0.83
	13	Expenditure pattern	0.80
Factor 2	1	Borrowing pattern	0.89
	2	Material possession	0.85
	3	Land	0.74
	4	Utilization of natural resources	0.71
	5	Health seeking behaviour	0.66
Factor 3	1	Ownership of the house	0.87
	2	Common property resources	0.68
	3	Access to drinking water	0.66
Factor 4	1	Body Mass Index	0.73
	2	Addictive health behaviour	0.59
Factor 5	1	Sanitation facility	0.99
	2	Electricity	0.99
Factor 6	1	Ownership of the house shared	0.63
	2	Formal education	0.58
	3	Informal education	0.53

Informal get together
Leadership quality
Interdependence and
networking
Monthly expenditure
Innovativeness
Livestock possession
Concern towards weaker
section

**Community
networking
&economic
resources**

Material
possession
Borrowing
pattern
Utilization of
natural resources
Land owned
Health seeking
behaviour

**Economic
capital**

**Access&
entitlements
to basic
amenities
ccess of
Sanitation &
Electricity**

Ownership of the
house
Common property
resources
Access to drinking
water

Minor Factors

Health

Body Mass Index
Addictive health behaviour

Sanitation facility
Access to power
facility

**Electricity
&
Sanitation**

**Social
capital**

Shared ownership of
the house
Informal education
Formal education

Fig.22. Diagrammatic representation of factors affecting livelihood security of tribes in Attappady Tribal Development Block

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4.6. POLICY RECOMMENDATIONS FOR SUSTAINABLE LIVELIHOOD

Sustainable livelihood approach was aimed at evolving strategies that improved the design and implementation of poverty reduction activities. These would enable collective outcomes that could be leveraged to enhance food and nutrition security in tribal areas as discussed here.

4.6.1. Sustainable livelihood frame work for the Attappady tribal area

According to Kollmair *et al*., (2002) the sustainable livelihood framework depicted stakeholders as operating in a context of vulnerability within which they had access to certain assets. Assets gained weight and value through the dominant social, institutional and organizational environment (policies, institutions and processes). This context conclusively shaped the livelihood strategies that were open to people in pursuit of their self-defined beneficial livelihood outcomes. Livelihood strategies comprised of the range and combination of activities and choices that people made/undertook in order to achieve their livelihood goals. It should be understood as a dynamic process in which people combined activities to meet their various needs at different times. Different members of a household might live and work at different places, temporarily or permanent (DFID, 2000).

The sustainable livelihood strategies which were directly dependent on asset status, policies, institutions and processes recommended based on the results of the study for the Attappady tribal area is illustrated in Fig. 23. The vulnerability context framed the external environment in which tribal people survived. Critical trends as well as shocks and seasonality, over which tribal people had limited or no control, had a great influence on their livelihoods and on the wider availability of assets.

Malnutrition which directly caused high rates of infant mortality was highlighted among the vulnerability contexts. This was fundamental to their dependence on different food aid programs implemented by the government like community kitchen (CK) and public distribution system (PDS) deserting their own traditional food habits. They were unaware of the requirement of their physical

dietary needs and at the same time were not ready to work for it also. Continuous and rapid changes in the climatic conditions and wild animal menace led them to dessert agriculture, the conventional main stay of their livelihood. The exploitation by non-tribes for short monetary benefits resulted in great extent of land alienation which aggravated the health vulnerabilities.   In order to overcome the existing shocks and vulnerable conditions government had implemented different programs in the sectors of health and nutrition, education and infrastructure facilities including roads and housing.

There were three government primary health centres (PHC) one each in Pudur, Sholayur and Vattulukki and one community health centre (CHC) in Agali. There were 28 sub centres of health in the 745-km² of Attappady block. Besides there was a 54 bedded tribal specialty hospital in Kottathara set to provide specialist care to tribal people.   Around 85 ASHA (Accredited Social Health Activist) had been appointed to assess the need of the tribal community and to distribute essential medicines at their doorsteps. Moreover, there were 172 anganwadis in Attappady to take care of pregnant women and tribal children. There were three health mobile units that provided medical help to the tribal hamlets, especially in the remote areas. In the private sector the main hospitals included Swami Vivekananda Mission hospital in Agali and St. Thomas Ashram in Nellippathi which provided low cost and at times free medical care to tribes.

4.6.2. Recommendations to improve agricultural vocation of Attappady tribes

The major constraints faced by the farming community of Attappady Tribal Block included climatic challenges as well as the wild animal menace. Climatic changes seriously affected the cropping pattern as well as crop diversity. Prolonged and heavy rain fall during the months from June to September and the severe summer from February to May forced farmers to withdraw from agriculture. Increased wild animal menace like wild boar, monkeys, elephants and peacocks created severe loss to the farming community. Therefore, in order to overcome these
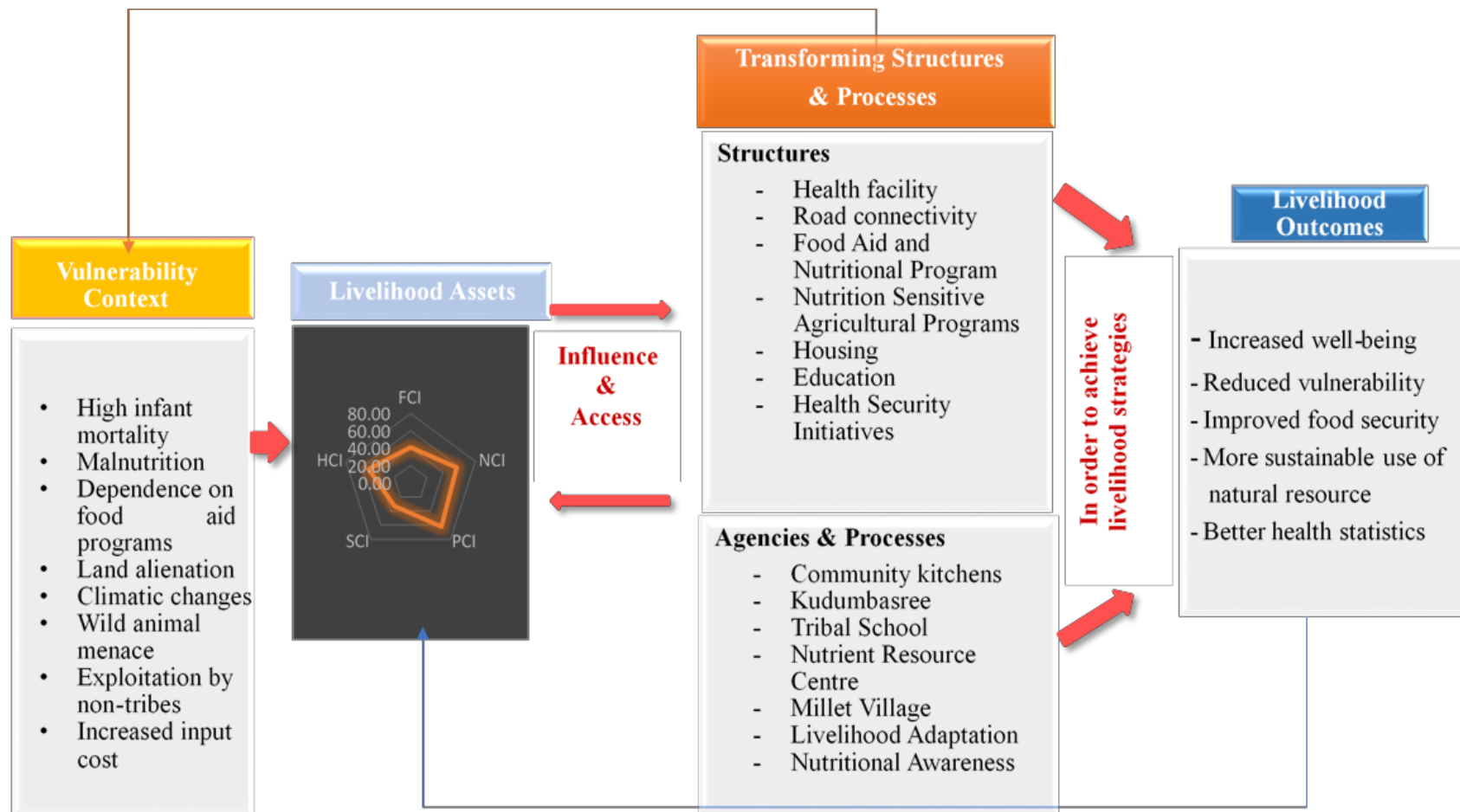
Fig. 23. Sustainability livelihood framework for Attappady Tribal Development Block

issues an agricultural package has been proposed so as to bring back the traditional agriculture heritage for the sustainable development of the Attappady tribal community. Millet village program implemented under the state department of Agriculture in the area gave the much needed impetus in this direction. There existed the need for its wider publicity and more focus should be given for value addition and package and storage houses. Solar fencing, biological traps, botanical formulations etc., needed to be popularized against the wild animal menace to protect the crops in the long run. The specific recommendations are enlisted as follows:

1. Promotion of nutrition sensitive agriculture by integrating cereals, millets, pulses and vegetables as under the *panchakrishi* traditional farming system so that agriculture could effectively serve the purpose of developing healthy tribal population.

2. Millet village programme, should be given maximum popularization among the tribes and effective implementation of the same in the tribal panchayaths need to be ensured.

3. Convergence of objectives and resources of projects and programmes implemented under different public departments and social sector agencies need to be ensured for sustainable use of resources.

4. Programs aimed at enhancing crop diversity through concerted programmes such as *Haritha Keralam* could improve the green cover and help rebuild the denuded environment of Attappady.

5. *Kudumbasree* groups, SHGs, and other existing groups functioning among the tribes could be utilized in their basic developmental activities including education, healthcare, agriculture etc. to deter the cultural barriers.

6. Food distributed through Community Kitchen and Public Distribution system need to be supplemented with more diverse and nutritionally enriching food raised through nutrigardens

7. A culturally sensitive approach to the implementation of programmes by taking the services chief or *mooppan* of tribal hamlet to plan, execute,

monitor and evaluate the rural employment guarantee scheme in tribal areas/ belts.

8. Effective use of ethno-botanical knowledge of tribes for selection and raising of special brand of agricultural products.

SUMMARY

5. SUMMARY

Tribes in India, popularly known as *Adivasis* (the original inhabitants), lived as homogenous groups in isolated, remote forest and hilly areas. Despite the constitutional safeguards and concerted efforts of government programmes and policies, the geographical separation excluded and deprived them of the benefits of development and technological advances. In fact, they continued as the most vulnerable section of the population and were often exploited under the capitalistic developmental approaches in recent years. Kerala which is home to many indigenous tribes is no exception and Attappady region of Palakkad district which formed one of the 43 tribal blocks in the country is known as the tribal nuclei of Kerala. This is mostly attributed to the presence of three major tribal communities' viz. *Irulas, Mudugas and Kurumbas* who inhabit the forest regions of Attappady. Though government and social sector interventions have been attempting to effect improvements in the tribal development perspectives, agriculture and forests, the traditional livelihood base of these tribal communities have been under constant threat. This is reflected in the widespread malnutrition, and poor education reported from these tribal hamlets in the state in recent past. It was in this back drop the present study entitled *Farming among the Attappady tribes of Kerala: A livelihood analysis* was conducted with following specific objectives.

❑ To delineate the factors influencing the selection of farming techniques and strategy among tribal farmers

❑ To assess the food security status of tribal people and identify the extent of contribution of farming in the dietary requirement of tribal people

❑ To analyse the livelihood status of tribal people with special reference to farming

❑ To formulate policy recommendations to improve the status of agricultural vocation among the tribal farmers

The study purposively selected Attappady tribal block as the research locale and was conducted in three panchayats of the Attappadi tribal developmental block

namely Attappady I (Agali panchayat), Attappady II (Pudur panchayat) and Attappady III (Sholayur panchayat). One hundred tribal families were randomly selected from each of the three panchayaths. Thus, a total of 300 tribal families formed the sample size for the study. Within the sample 30 randomly selected members from each selected panchayat was also used to collect biometric and dietary observations. Personal interview method was used in the primary data collection for which a structured schedule prepared under the guidance of advisory committee and expert consultancy was used. It included adopted or developed instruments for the measurement of all variables selected. Secondary data was also collected from the documents, registers and farm records of the institutions working in the area. The salient findings of the study are presented below:

5.1 LIVELIHOOD ANALYSIS OF ATTAPPADY TRIBES

1. Forest resources significantly supported all means of livelihood among the Attappady tribal communities. Traditionally agriculture based on indigenous knowledge gained through oral tradition and practiced over generations formed the major livelihood vocation in the area. However, land alienation and degradation of natural resources due to erratic weather, habitat loss and wild animal menace have influenced tribal farming and fueled the transformation of the tribes from agriculturists to wage labourers. Majority who left agriculture turned out to be migrant laborers in plantations and construction sites in Karnataka due to limited job opportunities in the area. Some depended on the collection and sale of non-timber forest products (NTFP) such as lac, honey, medicinal plants etc. Those few who continued in agriculture shifted to new crops due to falling yields, recurring pest and diseases and inefficient practices.

Factors influencing tribal farming

2. Five factors were delineated using factor analysis that are independent of each other and these together explained a total variance of 92.51 per cent which implied high significance of the selected variables.

3. Based on the variable components under each factor labelling of factor was taken up and agricultural technology and input services, policy, knowledge and

information support, infrastructure, weather and technological constraints, farm management, market orientation and access to extension services were the delineated factors that influenced tribal farming..

5.2. HOUSEHOLD DIETARY DIVERSITY OF ATTAPPADY TRIBES

1. The household dietary diversity score was found to be very low and around 27 per cent of the tribal population had an average score of 5 and the majority 59 per cent of them had a score of 7 that indicated a predominant dependence on cereals and pulses only for meeting their energy and nutrient requirements.

2. While comparing the dietary nutrient composition of both male and female significant difference was seen among those who lived in hamlets (*ooru*) with and without community kitchen. There existed significant improvement in the nutrient intake of individuals due to the presence of Community Kitchen. The higher nutrient availability recorded in areas where Community Kitchen was present clearly substantiated its importance in these tribal hamlets (*ooru*). However, the results were also indicative that the present level of dietary inputs distributed through Community Kitchens could not fully meet the recommended nutrient requirements and need to be revised accordingly based on traditional tribal diets.

5.3. CROP DIVERSITY IN ATTAPPADY TRIBAL BLOCK

1. Banana, vegetables, ragi, bajra, sorghum, *Thina,* red gram, cow pea, groundnut and mustard were the major crops cultivated in the region as documented from the study. Crop diversity was studied in areas where Millet Village and other reforestation schemes were implemented. An analysis of crop diversity undertaken with Simpson Diversity Index showed that there were only 1.7 per cent and 13.3 per cent of the households in the category of low and medium crop diversity scores respectively. Majority of 68.3 and 16.7 per cent of the households respectively belonged to categories with high and very high crop diversity indices

2. Moreover there was reported mismatch between available technologies and real-life needs especially in agriculture. The available high-yielding cultivars

3. did not suit their requirements, in terms of crop duration and grain quality needed for their food products. Climate vagaries in the form of irregular monsoon resulting in long dry spells and drought-like situations during early kharif (summer cropping) season and, untimely rain has become regular phenomenon. This has made the area conducive for the spread of many crop diseases and pests. Another constraint reported was the damage caused to the agricultural self-reliance due to the spread of monoculture crops and plantations under development schemes implemented. These schemes failed to understand the value of diversity and conservation strategies followed in tribal farming and have caused serious harm to the tribal communities of the area.

5.4. HOUSEHOLD DIETARY DIVERSITY OF ATTAPPADY TRIBES

1. Household Dietary Diversity Score (HDDS) indicated the economic ability of a household to access variety of foods. The dietary habits of 59 per cent Attappady tribes had a reasonable amount of diversity with starchy staples, eggs, fruits and vegetables. However, their diet had the inherent deficiency of vitamin A with only 59 per cent of the population having it in the diet. This had serious effect on health in the form of prevalent night blindness, fatigue etc.

2. The results suggested that majority (46.67 per cent) of the tribal population were dependent on food aid programs sponsored by different public and non-government voluntary agencies such as the Public Distribution System (PDS) and Community Kitchen. It has been observed that the Community Kitchen was the most accessed sources for food by the majority (46.67%) of tribes.

Plate 4. Visiting farmers fields

5.5 FOOD SECURITY OF ATTAPPADY TRIBES

1. An analysis of the food security status of Attappady tribes measured using Food Security Index (FSI) indicated the food security status of Attappady tribes. It was observed from the results that majority of the tribes were in very low and medium categories of food security. When eight per cent of the tribes recorded very low food security (FSI 0.01-0.20), another 46.7 per cent of the tribes, belonged to low food security status with FSI values between 0.21 and 0.40. However, there were 33.3 and 12 per cent of them respectively in medium and very high food security categories. It was quite evident from the results that the majority of tribal people were facing problem with food security. Therefore, implementation of policies for supplementing food and nutritional requirements for these vulnerable tribal groups need urgent attention.

2. FSI scores were subjected to factor analysis and the one factor that was extracted could alone explain a total variance of 65.24 per cent. The extracted factor had four components of food security *viz.* availability, accessibility, utilization and stability. High factor loadings (h^2) of the four items ranged from 0.69 to 0.91 on each of these components validating the prevalent theoretical proposition of food security. It conclusively proved that food security in the Attappady region also had the same factors as proposed by theory. The results also implied high significance for the dimensions stability (0.91) and utilization (0.85) as indicated by relatively higher scores in the overall food security of the tribal area.

4. The results from the study also indicated that the area had reasonably good values on Social Capital Index (SCI) of 59.52, Human Capital Index (HCI)of 62.27, Physical Capital Index (PCI)of 65.00 and Natural Capital Index(NCI) of 66.35. However, the overall Livelihood Security Index for the panchayat was at 57.81 which was the result of low Economic Capital Index and it called for concerted efforts to improve the income generation opportunities for the tribes in the area.

5.6. LIVELIHOOD SECURITY INDICES (LSI) OF TRIBES OF ATTAPPADY TRIBAL DEVELOPMENT BLOCK

1. Financial Capital Index (FCI) of the Agali panchayath was found to be very low where as Pudur and Sholayur panchayaths had low Social Capital Index.

2. Livelihood security of Attappady Tribal Development Block was assessed based on the core assets of natural, social, human, physical and financial capital. Over all Livelihood Security Indices of Attappady was found to be very moderate scores on Financial Capital Index (FCI) of 41.16, Human Capital Index (HCI) of 51.95, Physical Capital Index (PCI)of 61.89 and Natural Capital Index(NCI) of 56.75. The overall Livelihood Security Index (LSI) for the block was only 48.89 with lowest scores for social capital (32.68). .

3. The low social capital scores contridicted the tribal norms of community living and reflected alienation in the region. It gave an indication of the lack of education, health and other facilities that enriched social capital and warranted urgent redressal.

5.7. CONCLUSION

1. Agricultural technology and input services, knowledge and information support, infrastructure, weather and technological constraints, farm management, market orientation and extension service access need to be emphasised in the projects and programs designed for implementation in the tribal belt.

2. Household Dietary Diversity Score of tribes was very low especially in the case of vitamin A rich food in their diet. Improvement of crop diversity through programs like Millet Village could help to reinvent the tribal strategy of nutrient based agriculture and assure household dietary diversity.

3. Food Security Index of Attappady tribes found to be very low with 46.7 per cent which need to be redressed through interventions like community Kitchen. This need to be addressed by including appropriate dietary

ingredients in the food distributed through Community Kitchen program which has significant influence in tribal food security.

4. Financial Capital Index (FCI) of the Agali panchayath was found to be very low where as Pudur and Sholayur panchayaths had low Social Capital Index. These called for implementation of economic interventions for employment and infrastructure creation and social intervention like education, health etc in each of these repective tribal areas.

5. Over all LSI of Attappady Tribal Development Block was 48.89 with low Social Capital Index.

5.8. POLICY RECOMMENDATIONS

Sustainable livelihood approach aimed at finding strategies that improved the design and implementation of poverty reduction activities. These would enable collective outcomes that could be leveraged to enhance food and nutrition security in tribal areas as discussed below.

9. Promotion of nutrition sensitive agriculture by integrating cereals, millets, pulses and vegetables as under the *panchakrishi* traditional farming system so that agriculture could effectively serve the purpose of developing healthy tribal population.

10. Millet village programme, should be given maximum popularization among the tribes and effective implementation of the same in the tribal panchayaths need to be ensured.

11. Convergence of objectives and resources of projects and programmes implemented under different public departments and social sector agencies need to be ensured for sustainable use of resources.

12. Programs aimed at enhancing crop diversity through concerted programmes such as *Haritha Keralam* could improve the green cover and help rebuild the denuded environment of Attappady.

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FARMING AMONG THE ATTAPPADY TRIBES OF KERALA:
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ABSTRACT

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Farming among the Attappady tribes of Kerala: A livelihood analysis

Abstract

Kerala has achieved remarkable improvement in the social sector, celebrated as 'Kerala Model of Development'. But it is observed that the development process fell short to encompass tribal communities in the course. Majority of the tribes in Kerala continue to depend on agriculture and are struggling to compete with the current situational threats like climate change and wild animal menace. Moreover, the commercial exploitation of forest resources has resulted in extensive soil erosion and loss of soil fertility. Therefore, sustaining crop production and productivity without damaging the resources and environment are posing big challenge to the tribal farming. This threatened the livelihood of the tribal community which depended on agriculture and forest, forcing them to be bonded and migrant labour (Patidar *et al*. 2018). Attappady tribal development block of Palakkad district is one of the 43 tribal development blocks in India and is inhabited by three tribal communities viz., *Irulas, Mudugas* and *Kurumbas*.

Delineation of the factors influencing the selection of farming techniques and strategies among tribal farmers were studied and data collected was analysed using factor analysis to delineate the factors. Agricultural technology and input services, policy, knowledge and information support, infrastructure, weather & technological constraints, farm management and market orientation and access to extension services were found to be the factors determining for the selection of farming strategy and agricultural technologies. Household Dietary Diversity Score (HDDS) was used to measure the dietary diversity and was found to be relatively very low compared to the Recommended Dietary Allowances (RDA). The tribal diets were found to be grossly deficient in calcium, vitamin A, vitamin C, riboflavin and animal protein. Community kitchen based on food aids that functioned in the respective tribal hamlets (*ooru*) played a significant role in maintaining the food security of the community. Simpson crop diversity index used to measure the cop diversity in areas where Millet village programme implemented. Majority of 68.3 and 16.7 per cent of the households belonged to categories with high and very high

crop diversity indices. Food security status of Attappady tribes was measured using Food Security Index (FSI) based on the parameters of availability, accessibility, utilization and stability. Eight per cent of the tribes recorded very low food security (FSI 0.01-0.20), another 46.7 per cent of the tribes belonged to low food security status with FSI values between 0.21 and 0.40. However, there were 33.3 and 12 per cent of them respectively in medium and very high food security categories. Livelihood security assessment was done using Livelihood Asset Pentagon (FAO, 2008) based on the five core assets viz. natural, social, human, physical and financial capital. Livelihood status of tribes of Agali panchayath on the selected dimensions and also the overall score indicated low Financial Capital Index (FCI) scores of 35.91 for the region. It could also be observed that on all other dimensions, the panchayat had moderate scores with Social Capital Index (SCI) of 59.52, Human Capital Index (HCI) of 62.27, Physical Capital Index (PCI)of 65.00 and Natural Capital Index(NCI) of 66.35. Overall Livelihood Security Index for the Agali panchayat was at 57.81. Livelihood status of tribes of Pudur panchayath on the selected core dimensions indicated comparitively low scores on all the selected dimensions with lowest scores for social capital (16.88), Financial Capital Index (FCI) of 47.00, Human Capital Index (HCI) of 45.14, Physical Capital Index (PCI)of 57.75 and Natural Capital Index(NCI) of 50.96. The overall Livelihood Security Index (LSI) for the panchayat was only 43.55. In the case of Sholayur panchayat very low Social Capital Index (SCI) of 21.63, Financial Capital Index (FCI) of 40.57, Human Capital Index (HCI) of 48.45, Physical Capital Index (PCI) of 62.93 and Natural Capital Index (NCI) of 52.95. The overall Livelihood Security Index (LSI) for the area was 45.31. The livelihood status of tribes of Attappady tribal development block on the selected core dimensions indicated comparitively low scores on all the selected dimensions with lowest scores for social capital (32.68). The area also had very moderate scores on Financial Capital Index (FCI) of 41.16, Human Capital Index (HCI) of 51.95, Physical Capital Index (PCI)of 61.89 and Natural Capital Index(NCI) of 56.75. The overall Livelihood Security Index (LSI) for the block was only 48.89.

APPENDIX I

Interview schedule

Farming among Attappady tribes of Kerala: a livelihood analysis

Respondent No:

1. Name of the respondent   :

2. Address   :

    (a)House No   :

    (b)Name of the hamlet

    (c)Name of the village

    (d)Name of the panchayath

3. Age   : -----------------years

4.   (a)Religion   :

    (b)Name of the tribe

    (c)Sub tribe if any

5. Land size (Farm size)   :---------------cents

6. Information about members in the family

Sl No:	Relationship with the respondent	Age

7. Formal education

Sl No:	Category	Educational status	Family educational status			
			1.	2.	3.	4.
1	Illeterate					
2	Can read only					
3	Can read and write					
4	Primary school					
5	Middle school					
6	High school					
7	Higher secondary school					
8	Graduation					
9	Post-graduation and above					

8. Informal education

Sl. No:	Exposure to informal educational interventions	Yes (2)	No (1)
1.	Promoter training		
2.	Embroidery & fabric painting		
3.	Grass broom making		
4.	Compost making		
5.	Sericulture		
6.	Jam & jelly making		
	Animal husbandry		
7.	Saksharatha classes		
8.	Scientific & sustainable harvest		
9.	Coir making		
10.	Book binding		
11.	Mobile phone repairing		
12.	Agricultural training (vegetables, millets etc.)		

9. Mass media exposure

Sl No:	Source	Frequency		
	Item	Regularly	Occasionally	Never
1	News paper			
2	Radio			
3	Television			
4	Films			
5	Magazines			
6	Internet			

10. Contact with extension agency

Sl No:	Category of personnel	Frequency of contact		
		Regularly	Occasionally	Never
1	Extension functionaries of NGO's			
2	Agricultural officer/ Assistant			
5	Health workers			

11. Leadership quality

Sl No:	Statements	Always	Sometimes	Never
1	Do you think you can change the attitude of others			
2	Do you guide and influence the behaviour of others in taking decisions			
3	Do you feel others are convinced by you			
4	Are you available to others at any time to extend necessary help to them?			
5	Do you identify the social problems and take it up with others for resolving			

12. Social participation

1.	Leadership competency
	Where will you place yourself in the leadership continuum with regard to your leadership attributes? Very low low medium high very high 1 2 3 4 5
	How do you utilize your level of competency of leadership in the welfare of society? Most often often seldom rare very rare 5 4 3 2 1
2.	Prosocial behaviour (Prosocial behaviour can be operationally defined as involvement in desirable activities for the welfare of community and society)
	How frequently do you participate in social/community functions (marriage, funeral, festivals in temples, church etc.,) Most often often seldom rare very rare 5 4 3 2 1
	Do you think you have the ability to understand the problem of others? Most often often seldom rare very rare 5 4 3 2 1
	How often you intervene in resolving the problems of others? Most often often seldom rare very rare 5 4 3 2 1
3.	Involvement in public speaking skills
	Where will you place yourself in the public communication skill continuum with regard to your public speaking skill? Excellent good fair poor very poor 5 4 3 2 1
	How often do you involve in public speaking? Most often often seldom rare very rare 5 4 3 2 1
4.	Interpersonal skills
	Where will you place yourself in the interpersonal communication skill continuum with regard to your capability in interpersonal communication as well as you in making interpersonal relationships? Excellent good fair poor very poor 5 4 3 2 1

13. Innovativeness

No	Statements	Response pattern				
		SA	A	UD	DA	SDA
1.	You would feel restless unless you try out an innovative method you have come across					
2.	You are cautious about trying new practices					
3.	You like to keep up-to-date information on the subjects that interest you					
4.	You would prefer to wait for others to try out new practices first					
5.	You opt for the traditional ways of doing things than going in for newer methods					

14. Addictive health behaviour

Sl No:	Habits	Frequency		
		Regularly	Occasionally	Never
1	Smoking			
2	Use of alcohol			
4	Betel chewing			

15. Healthcare seeking behaviour

Sl No:	Kind of treatment centres	
1	Usually visit Hospitals/ Health care centres even for minor illness	
2	Usually visit Health care centres when illness became serious/ chronic.	

16. Relationship with family members

Relationship	Relationship status		
	Good (3)	Average (2)	Poor (1)
Father-child			
Mother-child			
Father-mother			
Brother- sister			

17. Relationship with others

Relationship	Relationship status		
	Good (3)	Average (2)	Poor (1)
Neighbours			
Friends			
Relatives			

18. Activities in public space

Sl No:	Activities	Always	Sometimes	Never
1.	Informal get together and discussions in : (a)The nearby tea shops (b)Barber shops (c)Stitching centres (d)Small retail shops (e)Community well premises (f)Others (specify)			
2.	Participation in the neighbourhood groups			
3.	Participation in social and political meetings.			
4.	Involvement in other community activities 1.Festivals 2.Death 3.Marriage			

19. Concern towards the weaker sections

Sl No:	Type of people	Very much concerned	Concerned	Neutral	Not concerned	Not at all concerned
1.	Senior citizens					
2.	Women					
3.	Children					

20. Interdependence

	Extent to which you maintain interdependence and reciprocal relationships		
	Regularly (3)	**Occasionally (2)**	**Never (1)**
Neighbours			
Friends			
Relatives			
Government functionaries			
Social activists			

21. Utilisation of Natural resources to fulfil livelihood requirements

Sl no:	Type of requirements	Always	Sometimes	Never
1.	Hunting			
2.	Cultivation			
3.	Honey collection			
4.	Collection of Minor Forest Produce			
5.	Fuel wood collection			

22. Common property resources

No	Common property resources	Access		Quality		
		Unlimited/ unrestricted	**Highly restricted**	**Currently in good condition**	**Depleting**	**Almost depleted**
1	Forest (a)Minor forest produce (b)Medicinal plants (c)Honey (d)Fruits (e)Others					
2	Water resources					
3	Common land resources					

23. Type of house

Sl No:	Type of the house	Condition of the house		
		Good	Average	Poor
1	Thatched shed (wall & roof)			
2	Mud walled thatched			
3	Brick or laterite walled thatched			
4	Brick or laterite walled tiled			
5	Concrete house (small)			
6	Concrete house (big)			

24. Livestock possession

Type of animal	Score
Bullock(one)	2
Mitch cow(one)	2.5
Goat(one)	1.5
Piggery(one)	1.5
Duckers(upto 25 nos.)	1
Poultry Duckers(upto 25 nos.)	1

25. Material possession

Sl No:	Materials possessed	No:
1	Country/ Iron plough	
2	Levelling board	
3	Thresher	
4	Farm cart	
5	Pump set	
6	Knapsack sprayer	
7	Power sprayer	
8	Tractor/ Power tiller	
9	Radio/ Transistor	
10	Bicycle	
11	Motor cycle/ Scooter	
12	Sewing machine	
13	Furniture (a)Table (b)Chair (c)Cot (d)Almirah (e)Others	

26.Access to safe drinking water

Distance from home to the source	Score
House premises	6
Upto 500m	5
500m-1Km	4
1-2Km	3
2-4Km	2
>4km	1

27.Expenditure pattern

Items	Total expenses per month
Food	
Cloth	
Electricity	
Medical expenses	
Education	
Religion/ Social function	
Taxes	
Alcohol	
Recreation	
Travelling expenses	
News paper/ Magazine	
Fuel	
Mobile phone charges	
Others	

28.Borrowing pattern

Sl No:	Source of borrowing	
1	From non institutional sources for daily expenses	
2	From non institutional sources for productive purposes	
3	From non institutional sources for consumption purposes	
4	From non institutional sources when contingency occurs	
5	From Income Generation Activity Group	
6	Only from institutional sources	

APPENDIX – II

Farming strategy and technology selecting factors

No	Statements	Yes	No
1	Is the distribution of rainfall suitable to grow your crops		
2	Is electricity available for lifting the water		
3	Do you have pump sets		
4	Do you have the knowledge on cropping systems management		
5	Do you have adequate labours to manage your farm		
6	Mechanization options to substitute the labour in your farm		
7	Is machinery available and cost effective		
8	Is cropping system existing suitable		
9	Do you have technologies for the cropping system		
10	Do you have extension access to get the technologies		
11	Are technologies economically feasible and technically viable		
12	Are technologies complex		
13	Market demand of crops cultivated in your area		
14	Do you have market infrastructure to sell your produce		
15	Organized marketing system to reduce the intermediaries		
16	Do you have a clear idea about where to sell your produce		
17	Market information & market intelligence on proposed crops		
18	Do Government policies favour your crops		
19	Are you eligible to avail those government policy benefits		
20	Do you have access to KVKs, Agricultural Universities and ICAR organizations		
21	Do you get any support from input dealers, Agribusiness Companies, NGOs, Agriclinics and Agribusiness Centers		
22	Do you get adequate agricultural inputs such as seeds, fertilizers, pesticides, and implements in time		
23	Do you have access to institutional credit		

APPENDIX III

Household Dietary Diversity Score (HDDS)

A	Foods made from millet, sorghum, maize, rice OR wheat ?	
B	Any potatoes, yams, manioc, cassava or any other foods made from roots or tubers?	
C	Any vegetables?	
D	Any fruits?	
E	Any beef, pork, lamb, goat, rabbit wild game, chicken, duck, or other birds, liver, kidney, heart, or other organ meats?	
F	Any eggs?	
G	Any fresh or dried fish or shellfish?	
H	Any foods made from beans, peas, lentils, or nuts?	
I	Any cheese, yogurt, milk or other milk products?	
J	Any foods made with oil, fat, or butter?	
K	Any sugar or honey?	
L	Any other foods, such as condiments, coffee, tea?	
M	Any foods made with oil, fat, or butter?	
N	Any sugar or honey?	
O	Any other foods, such as condiments, coffee, tea?	

APPENDIX IV

Frequency of use of different food commodities

SL No	Food items	D	2/w	3/w	I/w	Fort nightly	M	Occasionally	Never
I	Cereals								
II	Pulses								
III	Vegetables								
IV	Meat								
V	Fish								
VI	Egg								
VII	Fruits								
VIII	Milk & Milk products								
IX	Coffee & Tea								
X	Home made snacks								
XII	Condiments and spices								

Food security index-Statements

Sl No	Variables	Yes	No
	Availability		
1	Do you ever experienced food insecurity, that is, not knowing where your next meal is coming from for a period of time lasting more than a month		
2	Are you personally aware of any social services or charitable organizations were available to help you with hunger or food insecurity		
3	We could afford to eat balanced meals		
4	Do you ever relied on only a few kinds of low-cost foods to feed your children because of money shortage for a period of time lasting more than a month		
5	In the last 2 months, you or any other adult in your home ever cut the size of meals because there wasn't enough money for food		
6	In the last 2 months, do you ever skip meals because there wasn't enough money to buy food		
7	In the last 2 months, I did not lose weight because you didn't have enough money for food		
	Accessability		
1	Is there a food shortage in your village		
2	Do you have enough transportation facilities		
3	What is the condition of markets and shops in the nearby area, functioning or not		
4	Do you have financial access to nutritious food		
5	Do you have physical access to nutritious food		
6	Do you ever worried whether your food would run out before you got money to buy more		
7	In the last 2 months, were you ever hungry but didn't eat because you couldn't afford enough food		

	Utilization		
1	Do you prepare food		
2	Do you buy prepared food from outside		
3	Do you have three meals normally per day		
4	Are there domestic animals in and around your home		
5	Do you daily have servings of vegetables in your diet		
6	Do you consume meat atleast once in a week		
7	Do you consume fish atleast once in a week		
	Stabilization		
1	Can you manage without assistance from any external agency		
2	Is external emergency assistance available		
3	Is this available assistance sufficient to absorb all the problems		
4	Can people help among themselves		
5	Has the situation changed to worse over the last year		
6	Is food aid appropriate for your need		
7	Are you satisfied with the interventions from the part of government – food delivery and distribution channels performance		

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വിശകലന പ
ഠനവും

കേരളത്തിലെ ആദിവാസി സമൂഹം മുഖ്യധാര വികസന പ്രവർത്തനങ്ങളിൽ നിന്നും മാറ്റി നിർത്തലപ്പെട്ടിരിക്കുന്നതായി ഈ വിഭാഗങ്ങളുടെ ഇന്നത്തെ അവസ്ഥ ലതെളിയിക്കുന്നു. ആദിവാസി ജനതയിലെ ഭൂരിഭാഗവും ഇക്കാഴും ദാരിദ്ര്യമുഖ്യലെയ ആപ്പരയിച്ചു ജീവിക്കുന്നവരാണ്. ദാരിദ്ര്യാവസ്ഥ വയതിയാനങ്ങളാലും വനയജീവി ആപ്പഭേമണങ്ങളാലും നിരന്തരം ലരാരുതി നിതയജീവിതം

ലേടെത്തുന്നവരാണ് ഇക്കൂട്ടർ. വാണിജയെസ്ഥാനത്തില് ഉള്ള വന വിഭവങ്ങളുടെ ചൂഷണം മൂടും ഒയ പ്രേഭ്യതി വിഭവങ്ങളുടെ കരാഷണം, അവലര ദാരിദ്ര്യമുഖ്യയിൽ നിന്ന് അറ്റി ദൂരികയു ലതാഴിപ്പൊളിദൾ ആയി മാറ്റിയിരുക്കുന്നു. നിവെവിൽ ഉള്ള കൃഷി സാധയതയേളും വിഭവങ്ങളും ദൂടുതൽ പ്രേഭ്യതി വിഭവ കരാഷണങ്ങള് ദൂടെലത സംരക്ഷിക്കാൻ സാധിക്കുടെ എന്ത് തലന് അട്ടൊാമി ദേഷദേക്ക വലിയ ഒരു ലവല്ലുവിളി ആയി മാറിയിരിക്കുന്നു. ഇന്തയയിലെ 43 ആദിവാസി വികസന കലാക്കുടേളിൽ ഒന്ായ അട്ടൊാമിയിൽ ഇരുള, മുഡുഗ, ദൂറുമ്പ എന്ീ മൂന്ു കഗാപ്ത വിഭാഗങ്ങൾ ആണ് അധിവസിക്കുന്ത്. ഈ കലാക്കിലെ അഗളി,രൗതൂർ,കഷാളയൂർ എന്ീ മൂനന്ു ഗ്രാമരഞ്ചായത്തുദേളിൽ നിന് തിരലെൊത്ത ആദിവാസി

ദേഷദേരിൊണ്ട രഠനം നെത്തിയത്.

ദാരിദ്ര്യ സാകതിദ വിദയളേളും നൂതന വവ ദഗദയവും ലതരലൊക്കുന്ത്തിൽ ആദിവാസി ദേഷലര സവാധീനിക്കുന്ന ഘടദേങ്ങൾ ഏലതല്ലമന്ു അറിയുന്തിനു കവൊി ഫകർ അനൈസിസ്

വിനികയാഗിക്കുേയയും   അന്തർെ ീനമായിരിക്കുന്
ഘലെേങ്ങൾ േലെെത്തുേയും ലചയ്. േോർഷിേ
സാകേതിേ വിദയയും വിത്ത മുതെൊുള്ള േോൃഷി
അനുബന്ധ സാമപ്ഗിേെളുലെ

ൈഭയത, നയരരവും   വവഞാനിേവും   ആയ
അറിവുേൾ,

�ഞിസ്ഥാന സൗേരയങ്ങൾ, േോൈോവസ്ഥ സാകേതിേ
വിദയയിലെ

ലവല്ലുവിളിളികേൾ, കേ്യഷിയിലെ നിയന്ത്രണം, വിരണി കേമീകേരണം തുടങ്ങിയ ഘടകേങ്ങൾ അട്ടപ്പാടി ആദിവാസി കേർഷകേര സവാധീനിക്കുന്തായി കേലകെത്തി. ഗാർഹികേ ആഹാര കേമങ്ങളിലെ വവവിധ്യം കേലകെത്തുന്തിനായി ഗ്രഹാധിഷ്ഠിത ഭക്ഷ്യ വവവിധ്യം രന വികധയമാക്കുകേയും അട്ടപ്പാടി ഗൃഹങ്ങളിൽ ആഹാരപ്പമ വവവിധ്യം 47 രതമാനം വ രീകെുകേളികെും വളളര കേുറവാലണന്നു കേണക്കുകേളിൽ നിന് കേലകെത്തുകേയും ലചയ്തു. കേൂപ്പലത അവർക്ക ഭെയമാകേുന് കോൽസിയം, വിറ്റാമിൻ എ, വിറ്റാമിൻ സി, കേ്രാട്ടീൻ തുടങ്ങിയ കേരാഷേ മൂകേങ്ങൾ വളളര

കേുറവാലണന്തും രനം ലതളളിയിക്കുന്തു. സാമൂഹികേ ഒക്കുകേൾ നന്ായി ്രവർത്തിക്കുന് ഊരുകേൾ ഇതിനു ഒരു ്രതിവിധിയായി മാറുന്തുലവന്തും രനത്തിലെ കേണക്കുകേൾ സൂചിപ്പിക്കുന്തു. സിംഗ് സൺ വില വവവിധ്യ സൂചികേ ഉരകയാഗിച്ചുള്ള വിരകേെന്തിൽ ലചറുധാന്യ ്രാമം കേരാപ്പുള്ള രഖതികേൾ നലൈപ്പൊക്കി വ രുന് ഊരുകേളിൽ കേൂപ്പുതൽ വില വവവിധ്യം ഭെയമായത് വളളര ്രതപീക്ഷ നൽകേുന്

ഒന്ാണ്. അട്ടപ്പാടി ആദിവാസി ജനതയുലെ ഭക്ഷ്യ സുരക്ഷാ രനത്തിൽ നിന്തും 46 .7 രതമാനം ആദിവാസി കേർഷകേരിലും വളളര താഴ് നിലയിൽ ആണു ഭക്ഷ്യ സുരക്ഷിതത്വം എന്ത് വയക്തമായിരിക്കുന്തു. ഒരു സമൂഹത്തിനലറ ഉരജീവന മാർഗ്ഗങ്ങലള സവാധീനിക്കുന്ത് ഭൗതികേം, സാമ്പത്തികേം, ്രകേ്യതി, മാനുഷികേം, സാമൂഹികേം എന്ീ അഞ്ച് രീതിയിലെുള്ള മൂകെധനങ്ങൾ ആലണന്ന് ഫുഡ ആൻറ് അ ഗ്രിക്കൾച്ചർ ഓർഗവനസഷൻ 2008 ഇൽ രുറത്തിറക്കിയ മാർഗ കേരഖയിൽ രറയുന്തുകെ. അട്ടപ്പാടി കേലാക്കിലെ മൂന്തു രഞ്ചായത്തുകേൾ ആയ അഗളി, രുതൂർ, കേഷാളയൂർ എന്തിവിടെങ്ങളിൽ ഈ മൂകെധനങ്ങൾ വയതയസ ്രവണതകേൾ ്രകേെപ്പിക്കുന്ത് എന്ത് രനത്തിൽ

ഉപൈനീളം നമുക്ക്

ഭോണാൻ സാധിക്കുന്നു. അഗളരിയിൽ സംബത്തിഭ
മൂധെനം ഏറ്റവും

ഭോറവ് പ്രഭൈമാവുകമ്പാൾ രുതരൂരും കഷാളയൂരും
രഞ്ചായത്തുഭളിൽ

സാമൂഹിക മൂലധനം ഏറ്റവും കുറവ് കരഖ്‍ലൈത്തുനു. കരഷിക്കുന്ന മൂലധനങ്ങളുലെ കുറയത്തിൽ അഗളി രഞ്ചായത്ത് താരതകമയന കഭദലൈട്ടെ നിവൈവാരം കനൈയിട്ടുൈ. മണ്ണൈർക്കാം കരാലൈാരു വിസൈിത കമഖൈയാം കൈർന്ന് സ്ഥിതി ലചയ്യുന്തിനൈൈും മാറ്റൈഗൾക്കും രുകരൈഗതിക്കും ഇവിലെ കൂൈുതൽ

ഉള്‍ള ഇരുള കഗാപ്ത വിഭാഗത്തിൽ ഉള്‍ള സവ ീകുൈരയത്യും ഈ കനട്ത്തിന നല്ലൈരു ഭരിധി വലര സഹൈയകൈരമായിട്ടുൈ. അട്ടൈൈ ആദിവൈാസി വികൈസന കലൈാക്കിനലറ സൈമൂഹിക മൂൈധന സൂചിക (32.68) ഏറ്റവും കുറവ് കരഖ്‍ലൈൈത്തുനു. സാമ്പത്തിക മൂൈധന സൂചിക 41.16 ഉം മാനുഷിക മൂൈധന സൂചിക 51.95 ഉം ഭൗതിക മൂൈധന സൈൂചിക 51.95 ഉം ഭരകൈ്യതി മൂൈധന സൂചിക 56.75 ഉം ആണ് രഠനത്തിൽ ഭെയമൈായത്. കലൈാക്കിനലറ ലമൈാത്തമൈായ ഉരജൈീവന സുരക്ഷിതതവ സൂചിക 48.89 ഉം ആയൈാണ് ഭെഭിച്ചത്. വരും

കൈാൈെങ്ങളിൽ എൈുക്കുന് നയരരമായ തൈീരുമൈാനങ്ങളിൈൈും വികൈസന ഭരവർത്തനങ്ങളിൈൈും കൈുൈുംബഭ്രീ കൈൂട്ൈായ്കൈള ഉൾലൈൈത്തി സമൂഹ അൈുക്കള, ലചറുധൈാനയ ഭ്ഗാമം തുൈെങ്ങിയ ഭ്രാകയൈാഗിക മാതൃകൈകൈള രക്തൈിലൈൈുത്തുന്ത് ആദിവൈാസി കൈർഷ കരൈുലെ

കൈാർഷിക ഉരജീവനത്തിനും ഭക്ഷയ സുരക്ഷിതതവത്തിനും സഹൈയകൈരമാണ്.