

Are the Nutritional Needs of the South Indian Tribal Population met?

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Abstract: Jawadhu hills is an extension of the Eastern Ghats and spreads across parts of Vellore and Tiruvannamalai districts in the northern part of the state of Tamil Nadu. The main objective of this research activity was to study the demographic details, anthropometric measures and to assess the adequacy of the food and nutrient intake of the residents living in the Jawadhu hills. **Methods:** This community based cross sectional study which was done among 138 residents (males n=66 & females n=72) of Jawadhu hills. Fourteen villages were surveyed (two stage stratified sampling procedure), which included 155 households. The demographic details, anthropometric measures, BMI and dietary data were obtained (24 hour recall method and food frequency method of an individual) from the household member. **Results:** The mean age of the study participants was 46.6 ± 8.2 years. More than 75% of them were illiterate and nearly 50% of them were malnourished (60% males and 44% females) according to cut-offs by Asia Pacific guidelines. Labor work in the unorganized sector was their major source of income and this was variable. Majority of them hailed from the poorer strata of the society according to modified Kuppasamy scale and this is reflected in their poor food intake. Smoking habits, alcohol and tobacco use was rampant amongst the male population. The nutritional data revealed a gross deficit in the energy, macronutrients and micronutrients intake. This population consumed three major meals per day. Polished rice was the staple food and contributed the major calories, carbohydrate and proteins in their diet. The expensive proteins sources like poultry, flesh foods, fish, milk and milk products were consumed less frequently. Palm oil was the popular oil used in cooking. There was a gross deficit in the intake of fruits and vegetables. The Public Distribution System was their main source of purchasing food items. **Conclusion:** The poor purchasing power and lack of nutritional knowledge were the major impediments to including these nutrients rich foods in the diet. Encouraging kitchen gardens with cultivation of geographically appropriate vegetables and subsidized supply of nutri-grains like millets, pulses and vegetables through the public distribution system will ensure food security to this hill population and improve the quality of their diet. There is an urgent need to improve the nutritional awareness of this vulnerable population.

INTRODUCTION

Tribal population constitutes about 8% of the total population in India, with wide variation between the different States of India. Their concentration is mainly in the

Revised Manuscript Received on April 18, 2019.

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central region comprising the states of Madhya Pradesh, Orissa, Maharashtra and Andhra Pradesh(1).

Their living conditions make them a distinct group, different from the general population. The geographical isolation, socio-economic disadvantages, lack of formal education, cultural and religious taboos makes them a vulnerable population(2). Several studies have highlighted the harmonic relationship between the tribes and their natural ecosystem. The food and nutrient intake of the tribal population is largely affected by the geographical site, climatic condition, accessibility to food markets and forests produce (1). However the primitive agricultural practices often lead to food scarcity resulting in undernourished populations. In addition, the lack of basic health facilities and improper health seeking behaviors makes them prone to various morbidities(3).

Non communicable diseases (NCD) have replaced communicable diseases as the leading cause of global morbidity and mortality (4). The tribal populations are prone to NCDs due to the unhealthy dietary and social practices rampant amongst them (5). Alcohol consumption, tobacco use, smoking habits and decreased physical inactivity coupled with unhealthy dietary practices are the modifiable risk factors for non-communicable diseases(6). Low fruit and vegetable intake accounts for about 20% of cardiovascular disease worldwide (7)The WHO recommends increased consumption of fruits and vegetables, legumes, whole grains and nuts; limiting the energy intake from total fats, free sugars and salt (8). According to the Indian Council of Medical Research 2010, a moderately active adult man should consume 400 gm of fruits and vegetables per day(9).

Studies from across the Indian continent has shown poor nutrient intake amongst tribal population. A study from North Eastern part of India by Misra et al reported that 68% of the Mishing tribal people consumed less than 4 servings of fruits and vegetables (10).Priyanka et al studied the nutrient intake of the Kani tribes from the Southern State of Kerala and reported similar findings(11). According to IDSP -NCD risk factor survey report, in Tamil Nadu, 99% of the population had less than 5 servings of vegetables and fruits(12). National non-communicable diseases(NCD) risk factor surveillance by ICMR reported that 41% of people never consumed fruits (in the last week) in rural area(13).

This study aims to elicit the nutrient adequacy and the food consumption pattern of the tribal population living in Jawadhu Hills of Tamil Nadu, India. Jawadhu hills is an extension of the Eastern Ghats and spreads across parts of



Vellore and Tiruvannamalai districts in the northern part of the state of Tamil Nadu.

The study protocol conformed to the ethical guidelines of the 1975 Declaration of Helsinki (and revised in 2000) and approval was obtained by the Institutional Review Board (IRB Min. No 9558 Observ dated 5/08/2015).

MATERIALS AND METHODS:

Sample Area:

This was a community based cross sectional study conducted in Jawadhu hills block of Tiruvannamalai district, Tamil Nadu. Jawadhu hills block. According to census 2011, the total population of the Jawadhu hills block was 51,999. This area is served by Jammunarathur PHC (Primary health center) and Nammiampattu PHC. There are 11 village panchayats and more than 250 hamlets. Each village is a cluster of 15-100 households. This study was conducted in Nammiampattu and Veerapanur panchayat villages of Nammiampattu PHC where the Community health department of Christian Medical College has been working closely.

The sample consisted of men and women aged between 30 to 60 years. Only permanent residents of Jawadhu hills were included. All bedridden patients, pregnant and lactating mothers, patients with acute disease conditions were excluded from the study. The study period was of 6 months duration (February 2016 to July 2016).

Sample size calculation:

The expected proportion of people consuming adequate calorie and protein was taken as 60% based on the report by National nutrition monitoring bureau (14). Required sample size was 93 with 10% absolute precision.

Sampling method:

Two stage cluster sampling method was used. First stage: The primary sampling units were villages (clusters). Probability proportionate to size sampling (PPS) method was used to select village clusters and 16 village clusters were selected. Second stage: Secondary sampling units were households /Individuals (311 households). From the starting point of the village, first household was identified. Every alternate household was selected in a particular (clock wise) direction as per the pre-defined algorithm. Random sampling was not possible due to non-availability of household census details. From each household either one female or male were selected by lot method. The final sample studied was 138 individuals. (The data of 17 individuals were discarded due to inaccuracy in recollection).

A *pre-tested semi-structured questionnaire* was used to obtain the nutrient intake using the 24 hour food recall method after getting informed consent. Standard cups, glasses, ladles and spoons were used to assess the actual amount of food consumed. The nutrient composition was computed using the database of 'Nutritive Value of Indian Foods' had given by the National Institute of Nutrition (NIN, 2017). A *Food frequency questionnaire* was developed following a pilot study of 10 individuals and this gave us additional information about the food consumption patterns of the study population in the last one month.

The *demographic details* which included age, gender, occupational status, educational status, economic status were obtained by face to face interview. Substance abuse was also noted. *Anthropometric measurements:* The weight and height of the adults were measured using standard procedures and BMI was interpreted according to Asia-Pacific guidelines.

STATISTICS:

Data entry was done with Epidata 3.2.1 and analysis was done using SPSS version 16. P value of <0.05 was considered significant. Descriptive analysis was done to study the baseline demographic characteristics. Chi-square test was done to study the association between significant variables.

RESULTS:

Demographic and anthropometric data: The data of the study subjects (n=138) is represented in the Table 1.

The demography reveals that majority of them followed Hindu religion with Christians constituting a small minority. The percentage of individuals in each age group was almost similar. The mean age of the male and female population was 45.5 ± 8.4 years and 47.8 ± 7.8 years respectively with an overall mean of 46.6 ± 8.2 years. More than three-fourth of them was illiterate and only a handful received education beyond secondary school level. Very few women stayed at home (home maker). Majority of the male and female population were involved in unskilled labor, farming. According to the Kuppusamy scale (Feb 2016) for assessing socio-economic status, majority were in the lower end of the Upper strata.

Chi-square analysis showed that gender was associated with educational status. Men received comparatively more education than the females ($p < 0.0001$). The occupational status of both the males and females were comparable ($p = 0.609$).

The anthropometric data interpreted according to the WHO criteria showed that 51% and 36% of the male and female population were malnourished; the Asia Pacific guidelines classified 60% and 44% of the male and female population to be malnourished. Overweight and obesity was prevalent in a small minority and this was seen more in the male subjects compared to the female subjects. However, the waist circumferences of the majority of the population were within the normal range. The distribution of the male and female population according to their BMI (classified according to Asia Pacific guidelines) was represented in Figure 1.1

ARE THE NUTRITIONAL NEEDS OF THE SOUTH INDIAN TRIBAL POPULATION MET?

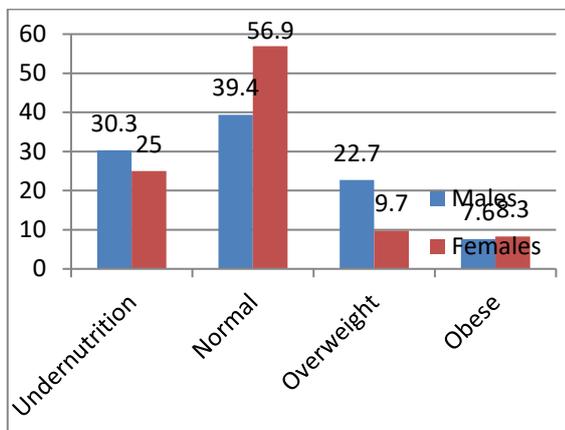


Figure 1.1: Distribution of the tribal population based on their BMI interpreted according to Asia-Pacific guidelines

Use of tobacco and smoking habits:

The above table revealed that 43% and 62% of the males smoked tobacco and consumed alcohol. None of the female smoked or consumed alcohol.

Nutritional Data:

The nutrient intake of the subjects is given in Table 3.

The mean energy intake of the male and female population was deficient. The mean intake of proteins was below the recommended daily allowances (RDA) for Indians. Micronutrient intake was suboptimal in both the male and female population. The overall intake of nutrients as percentages of the RDA is illustrated in Figure 1.2

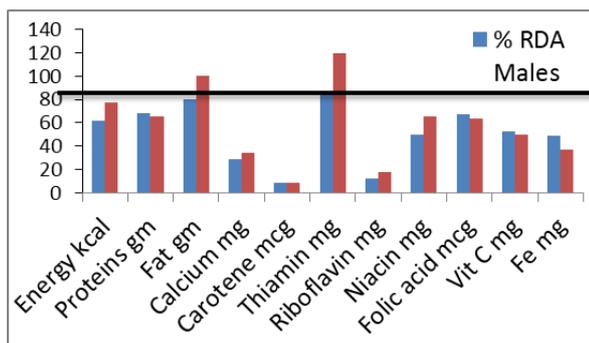


Figure 1.2 Nutrient intake of tribal population as percentage of the RDA (2010)

The population consumed only 60-75% of the total energy intake. The protein intake met 70% of the RDA. However the fat intake was adequate in the female population. In the case of micronutrients, the intake of thiamine alone met 80% of the RDA in males and 100% in the female population. There was a gross deficit in the intake of minerals like calcium, iron and vitamins like riboflavin, niacin, folic acid, carotene and vitamin C in both the male and female population.

Food consumption pattern:

The nutritional data indicates that this population consumed three major meals per day. Polished rice was the staple food and constituted the major component in all their three meals. The high fiber millets like ragi were consumed once or twice a week by 99% of the population. Wheat was

consumed occasionally by 58% (once in two months) of the population while the remaining population did not use it at all. Fermented cereal products like idly, dosa were popular as breakfast items in selected villages. However, majority of the subjects consumed rice and lentils for their three meals.

The intake of protein foods was inadequate. Horse gram was the popular pulse which was cooked into a thin gruel and consumed on a daily basis in 95% of the population. More than three-fourth of the population consumed animal proteins (milk, beef, goat meat, eggs and fish) occasionally (less than once a month) and chicken was consumed fortnightly in 61% and weekly once in 20% of the population. The commonly used cooking oil was palm oil which was available at a subsidized rate from the Public distribution system outlets (Government run outlets).

The intake of fruits and other vegetables was very poor and it was consumed on a monthly basis by majority of the population (91%). Green leafy vegetable and tubers were consumed once or twice a week (99%). Processed foods like biscuits, bakery fried snacks occasionally (less than once a month), while 17% never bought any processed foods.

DISCUSSION:

This study threw light on the demographic and nutritional intake of the tribal population residing in the Jawadhu hills of Tiruvannamalai district of Tamil Nadu. Hinduism was the most popular religion. The majority of the population belonged to the lower strata of society and was employed in farming activities or in unskilled labor. Thus their income was not steady and fluctuated with seasonal and agricultural productivity. The lack of formal education in this community poses further hurdles to social development and increases the risk of non-communicable diseases. Similar findings were reported by Rao et.al in a survey of tribal settlements in the nine States of India- Andhra Pradesh, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Tamil Nadu and West Bengal. They found that 98% were Hindus and majority of the households (44%) were marginal farmers, about 14% were small farmers and 7% were large farmers, while about a third of the households did not possess any agricultural land (35%) (2). The National Nutrition Monitoring bureau of India in their technical report of the nutritional profile of tribal populations across India reported that 93% were Hindus, 55% of adult men and 66% of women were illiterate, 75% were laborers involved in agriculture and others (15).

The anthropometric measures showed that the mean height and weight of both the genders were below that of a reference man as described by ICMR 2010(16). Whether this is an ethnic characteristic of this community or as a result of long term malnourishment needs to be further investigated. Half the male and female population was malnourished. While undernutrition was prevalent in 25-35% of the population, overweight and obesity was present in 16-30% of the population. Men were more prone to being overweight and obese. A study of tribal adolescents found that 63% of the boys and 42% of the girls were



malnourished according to the NHANES cut-offs (2). Laxmaiah et al. found that 51% of the tribal adult population residing in Andhra Pradesh suffered from Chronic Energy Deficiency (17). A Northern Indian study of the Adivasi tribes of Uttar Pradesh and Bihar found that under nutrition was prevalent in 33.3 % and 19.4 % of the females and males respectively, with an overall prevalence of 26.5% of the population. However a study of tribal population, who migrated to an urban slum in Andhra Pradesh, revealed a high prevalence of overweight in men and women (35.3% and 32.4%) with general obesity being 14.3% and 24.3% respectively(5).

Our findings were in agreement with the results of the 2nd technical report from the NNMB (2009); they reported that the mean weight and height was 50.5 kg (± 7.82) and 161.4 cm (± 6.34) respectively for the men and 43.3 kg (± 7.40) and 150.8 cm (± 5.91) respectively for women. The mean BMI was 19.3 kg/m² (± 2.53) for men and 19.0 kg/m² (± 2.86) for women. The mean waist and hip circumference were 71.3 cm (± 7.56) and 80.2 cm (± 5.85) respectively for men, and 67.2 cm (± 8.01) and 80.0 cm (± 6.66) respectively for women.

According to the dietary recommendations by ICMR 2010 (16), a sedentary adult man and woman require 2320 cal/day and 1900 cal/day respectively. In case of moderate activity, the requirements are higher (2730 cal/day for man and 2230 cal/day for woman). Our study results indicated a gross deficit in the mean energy intake. It was less than 80% of the RDA in the male (60% of RDA) and female population (77% of RDA). This is reflected in a high prevalence of malnutrition amongst the study population. Indian tribal studies on the diet profile of adolescent populations in nine States of India has reported comparable deficits(2). Laxmaiah et al. found similar inadequate intake in the tribal population of Khammam district of Andhra Pradesh (17).

An adult man and woman requires 60g/day and 55g/day of proteins (16). Our study subjects had a deficient protein intake and met only 65-68% of the RDA. This was because the protein sources like poultry, flesh foods, fish, milk and milk products are expensive foods hence were consumed less frequently. Horse gram was the popular pulse which was cooked into a thingruel and consumed on a daily basis in 95% of the population. In tune to our findings, Rao et al. has reported that the protein intake of tribal children was only 64-66% of the RDA(2).

The fat intake of the population was 80-100% of the RDA for the male and female subjects of the population. This was higher than the average fat intake of tribal households residing in the ITDA Khammam district of Andhra district (35-40% of RDA)(17).

Majority of the people hailed from the poorer strata of the society and this is reflected in their food intake. The 3 major meals consumed per day were mostly carbohydrates based. Polished rice was the staple food (constituted all meals per day). The high fiber content millets like ragi was consumed less frequently (less than thrice a week). These coarse cereals which constituted the major diet of earlier generations have been replaced by subsidized polished rice which is readily available in the Public distribution system. The intake of protein rich foods like flesh foods, fish, milk

and milk products, pulses were restricted due to the cost factor. Only foods that were available in the PDS were consumed by them. Similar findings have been reported from tribal populations inhabiting nine States of India (2).

According to the Indian Council of Medical Research 2010, a moderately active adult man should consume 400 gm of fruits and vegetables per day(9). WHO recommends that an individual should consume five servings of fruits and vegetables per day (1 fresh serving = 80gm)(8). The intake of fruits and vegetables was very poor since this is an expensive commodity as it is not locally grown. This resulted in a gross deficit in the intake of calcium, iron, thiamine, riboflavin, niacin, folic acid, carotene and vitamin C.

Our data indicates that none of the participants had five servings of fruits and vegetables per day which is comparable with other studies. Rao et al. reported similar finding amongst the tribal populations living in nine States of India(2). Priyanka et al. also reported similar findings among Kani tribes of Kerala (11). According to IDSP NCD risk factor survey report in Tamil Nadu, 99% had less than 5 servings of vegetables and fruits(12). National non-communicable diseases(NCD) risk factor surveillance by ICMR reported that 41% of people never consumed fruits (in the last week) in rural area(13).

The poor nutritional intake, high prevalence of malnourishment, lack of formal education and geographical isolation, indicates that they are vulnerable group with a high risk of developing NCDs. This calls for urgent interventions from the government and medical fraternity.

CONCLUSIONS

The poor purchasing power and lack of nutritional knowledge were the major impediments for including these nutrients rich foods in the diet. Encouraging kitchen gardens with cultivation of geographically appropriate vegetables will ensure adequate supply of micronutrients in the family meal. Subsidized supply of nutri-grains like millets, pulses and vegetables through the public distribution system will ensure accessibility to this vulnerable hill population and improve the quality of their diet. Nutrition education will enhance their knowledge and improve dietary practices of this community.

LIMITATIONS

In this hilly terrain, housing details were unavailable and hence random sampling could not be done. Although standardized vessels were used to assess the food intake, the actual intake was self-reported and there may be reporting errors. Due to geographical isolation, the dietary patterns of this tribe cannot be postulated to any other tribal populations.

ACKNOWLEDGMENTS

We are grateful to the department of community health and development, Christian Medical College, Vellore for



giving permission and support for conducting this study. Dr Mini Joseph extends her gratitude to the University Grants Commission, New Delhi, India for the Research Award (2015-2017) which enabled her to partake in this study.

Conflict of Interest: None declared

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