
*Summary and
Conclusions*

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The present study is on "**Morbidity rate and nutritional status of tribal and nontribal preschool children in backward districts of Northern Kerala**". Here an attempt has been made to assess the morbidity profile and nutritional status of preschoolers in tribal areas in comparison with nontribal children of the same districts of Northern Kerala.

As tribal population is significantly concentrated in Palakkad, Wayanad, and Kasargod districts, these Northern districts of Kerala were identified as the potential area for the study.

The tribal pockets in the three districts were identified with the help of the panchayat records. The list of households comprised of preschool children (3 to 6 years) were obtained from the Public Health Centre (PHC). The houses were then selected randomly to get the required sample size (n=200). Same sampling technique was adopted in the case of nontribal group also (n=200). Care was taken to select sample of comparable economic status.

Direct interview method with the help of a pretested questionnaire was used to procure information on the family profile of the tribal and nontribal sample and their morbidity pattern.

Anthropometrical assessment, diet survey and estimation of blood haemoglobin and test for worm infestation were done on all sample (200 tribal and 200 nontribal children). Clinical survey was conducted with the help of a physician on a sample of 300 preschoolers including 150 each of tribal and nontribal sample.

ANOVA, 't' test, 'z' test, χ^2 analyses, Pearson's correlation and Regression analysis were used to data analysis and interpretation of results.

The major findings of the study are detailed below:

Majority of tribal (70.42%) and nontribal (60.14%) families followed joint family system. Most of the tribes (61.27%) and nontribes (72.03%) were married. But unmarried mothers, remarriage and polygamy were also observed. All of them were Hindus. Regarding family size, 18.31 per cent of tribal and 15.38 per cent of nontribal families had more than three children.

Demographic profile showed that majority of the population (40.56 percent of the tribes and 40.84 per cent of nontribes) were in the age group of 20 to 40 years. The preschool children comprised of 32.84 per cent and 35.29 per cent in tribal and nontribal communities respectively.

Educational status of tribal and nontribal population showed that 19.05 per cent of tribes and 5.56 per cent of nontribes were illiterates. Semiliterate constituted 18.39 per cent of tribes and 16.37 per cent of nontribes. The percentage of people were found to decrease with the increase of the

educational level. Only 0.16 per cent of tribal people had higher secondary education where as it was 1.20 per cent in the case of nontribes. Educational level of parents has also revealed the same trend in which 14.79 per cent of fathers and 16.19 per cent of mothers among tribe were illiterate, while it was 3.85 per cent and 3.49 per cent respectively in the case of nontribal fathers and mothers.

Occupational status of the parents revealed that majority of tribal (39.45%) and nontribal (66.43%) males were engaged in agricultural labour. The mothers on the other hand were mostly housewives (38.73% of tribes and 55.24% of nontribes). This was followed by agricultural labourers involving 30.98 per cent of tribal mothers and 34.96 per cent of nontribal mothers. It was also reported that majority of people had virtually no work during summer and rainy seasons to earn their daily food. Majority of tribes were moderate workers and among nontribes, majorities were observed to be heavy workers.

All families studied belonged to low income group with an average annual income of Rs. 3285/- for fathers and Rs. 2188/- for mothers of tribal preschoolers; and Rs. 3390/- and Rs. 3095/- respectively for fathers and mothers of nontribal children. 80.28 per cent of tribes and 89.51 per cent of nontribes had no land of their own. None of the families disregard of their community had any savings, whereas all of them had debt and majority of the tribal (45.07%) and nontribal (55.94%) families were indebted to different agencies like Bank/ ITDP / Govt. sources. With regard to house ownership, almost all families in tribal (100%) and nontribal (97.13%) groups had their own house. Houses with asbestos roof, mud wall and cement floor were found to be most common in nontribal communities, whereas it was replaced by the hamlets with

mud wall, thatched roof and cow dung floor in tribal community. Majority of tribal (80.99%) and nontribal (81.13%) families lived in houses with two rooms only without any separate kitchen and had only common toilets for the whole colony. Provision for artificial lighting was observed only in 14.08 per cent tribal and 59.4 per cent nontribal families. Inadequate drainage facilities were also noticed in all the tribal (100%) and 61.54 per cent nontribal houses.

Hygienic practices of the people have direct relation with the morbidity pattern and also the nutritional status of an individual. So practices regarding environmental hygiene, water hygiene, food hygiene and personal hygiene were assessed and it was found that nontribes had comparatively better practices than tribes. The differences were also found to be statistically significant. Drainage facilities and access to safe drinking water were observed to be very poor in both tribal and nontribal areas.

Food habits of tribal and nontribal people were also assessed and it was observed that all families were nonvegetarians. Majority of tribal (92.96%) and nontribal (52.45%) families was observed to plan their meal according to the cost of foodstuff and its availability. Most of the tribal people had only one meal per day whereas most of the nontribes had two-meal pattern. Zero meal per day was also noticed in 2.11 per cent and 3.49 per cent of tribal and nontribal families respectively.

Food purchasing pattern and food pattern were also studied. It was observed that most of the tribes (65.49%) spent 71 to 80 per cent of their total monthly income on food items while majority of nontribes (70.62%) spent 61 to 70 per cent of their monthly income on it. Purchase of flesh foods, fats and oil, nuts and oil seeds was found to be very low or negligible. Purchase of

green leafy vegetables, fruits, milk and milk products was not reported either by tribal or nontribal communities. The quantity of food purchase indicated that purchase of cereals and roots and tubers was comparatively higher than that of the other food items. Food expenditure pattern showed that the expenditure was comparatively more (above 70%) for cereals (19.72% of tribes and 45.45% of nontribes). Percentages of income spent on ready-to-eat foods were also observed to be very high in both the communities. Tribes spent more than 50 per cent of their income on ready-to-eat foods and the amount spent by their nontribal counterparts was 31.69 per cent. Less than 10 per cent of the monthly income was spent on pulses, other vegetables, fats and oils and nuts and oil seeds. A highly commendable (1% level) difference was found between the food expenditure pattern of tribal (901.99 ± 170.0) and nontribal (958.08 ± 147.00) communities.

While studying the sources of food procurement and mode of purchase, it was found that for the majority of tribes and nontribes (78.87% and 63.64%) the source of food purchase was the nearby shops. Among tribes majority collected the food available in the premises or borrowed it. 39.44 per cent of tribes and 100 per cent of nontribes reported that they purchased food items by paying cash or on credit basis. Barter system was observed among 2.11 per cent tribal families.

Cooking practices followed by tribal and nontribal communities had been analysed and the results indicated that majority of tribes (71.83%) and nontribes (22.38%) did not have the habit of washing cereals before cooking it. Washing of pulses was not done by any of the tribes, but all the nontribes washed it prior to cooking. Tribes predominantly used earthen pots whereas use of aluminium

vessels was observed to be predominant among nontribes. Iron vessels were seldom used by both the communities. About the food preparation techniques, boiling and straining was observed to be the most common methods used for cooking cereal. Vegetables were cooked only by absorption method by all the tribal and nontribal families.

Infant feeding practices among the tribal and nontribal mothers showed that all the babies were breast-fed without fail but the duration of breast-feeding varied widely. Breast-feeding up to one and half years was done by majority of tribal (40.0%) and up to one year was done by majority of nontribal (46.0%) mothers. Colostrum was not given to infants by 51.28 per cent of tribal mothers and 44.44 per cent of nontribal mothers. When tribal and nontribal mothers were compared with regard to the breastfeeding practices, it was found that tribal mothers scored higher than that of their nontribal counterparts and the difference was also highly commendable (significant at 1% level).

Supplementary feeding started between six to eight months by majority of nontribal (40.56%) mothers whereas tribal mothers (50.70%) introduced weaning foods to their children when they attained one year of age and more. The mean score obtained for supplementary feeding practices proved that the practices were more appropriate among nontribal communities and the difference was also found to be significant (at 5% level).

Food fads and fallacies were observed among almost all the families irrespective of their communities. The number of beliefs, the majority (58.04%) of the nontribal mothers had ranged between 10 to 13, whereas majority of tribal population (55.63%) had food beliefs with the number ranging between 5

to 9. The most commonly prevalent food beliefs among the tribal and nontribal communities were egg consumption during pregnancy (66.19% and 51.75% of tribes and nontribes respectively) leads to foetus enlargement, papaya induces abortion (55.63% and 33.57%) beetroot gives red colour to blood (76.76% and 41.26%), spices weaken the intestine (67.61% and 38.46%) etc. Though percentage of tribes was higher with regard to specific food fads and fallacies, the nontribal mothers exceeded their tribal counterparts as far as the number of beliefs possessed by them.

Intra-family food allocation with top priority for children (58.18% of tribal and 72.58% of nontribal families) followed by head/father (25.45% and 11.29%) and aged parents (7.27% and 8.06%) was practised by the majority of tribal as well as nontribal families. Invariably, the least preference was given to the women/mothers in all the tribal and nontribal families.

Physical Quality Life Index (PQLI) computed based on 10 variables from socioeconomic, food and water, and hygienic aspects, as done by Dhanasekharan (1991), indicated that PQLI of all the families studied were either 'very poor' or 'very very poor' category. Majority of them irrespective of the communities (tribes - 63.38% and nontribes - 56.6%) secured a score between 12 and 15 where the maximum possible score was 39. A significant difference (at 5% level) was also observed between PQLI of tribes and nontribes.

Poverty index of the tribal and nontribal families was computed using the list of risk factors suggested by Srilatha and Gopinathan (1995). Accordingly, the mean value obtained by the tribes for poverty index was 1.68 ± 0.82 and that of the nontribes was 3.13 ± 1.46 . This indicated that all the families

studied belonged to 'high risk' group. When they were further classified into two groups ('high risk' and 'very high' risk) it was found that majority of tribal families (84.51%) came under 'very high risk' group and majority of nontribal families (62.24%) under 'high risk' group. The difference was also found to be highly significant (1% level).

Health care management and participation in welfare programmes were found to be poor. 100 per cent accessibility to primary health centres was reported by both the tribal and nontribal communities whereas availability of physicians in these centre was only 79.58 per cent as given by tribes and 83.92 per cent by nontribes. Mothers of nontribal communities showed more interest and enthusiasm to participate in such health and awareness building programme than their tribal counterparts. The difference in the utilization of these services by the tribal and nontribal group was also found to be highly significant statistically (at 1% level). Awareness of tribal and nontribal mothers on the health care management showed that their existed a highly commendable difference with respect to the awareness and practice regarding good nutrition, good health care, safe drinking water, utilization of ICDS and RCH services.

Regarding of common illnesses during childhood excluding last one year showed frequent occurrence of diarrhoea and dysentery was common among both tribal (23.5%) and nontribal (22.0%) children followed by fever (11.5% and 15.0% in tribal and nontribal children respectively), scabies (9.5% and 3.5%), accidents (7.5% and 4.0%), cholera (2.5% and 2.0%), eye or ear infection (0.50% and 1.50%) and respiratory infections (1.0% and 1.5%). With regard to the occurrence of different illnesses also there existed a statistically significant difference (at 5% level) in the case of scabies and the multiple

episode of illness like fever, skin and gastro intestinal problems in which tribal children were more affected than their nontribal counterparts. It was also observed that 37 per cent of tribal and 39.5 per cent of nontribal preschoolers were found to be free of any diseases during last one-year period. Likewise the percentage of children declined with the occurrence of multiple occurrence of diseases.

Data regarding occurrence of six vaccine preventable diseases of childhood was collected as reported by the workers of PHC and nearby hospitals. It was found that 82 per cent of tribal and 76.50 per cent of nontribal children never had an attack of vaccine preventable diseases. Whooping cough and measles were occurred more commonly, followed by diphtheria, tuberculosis, polio and tetanus. However the occurrence of preventable diseases was reported to be more among the nontribal children than tribal ones but the difference was not significant statistically. Sex-wise comparison also brought out the same result.

Immunisation coverage was reported to be very poor in both the communities. Only 20 per cent of tribal and 16.50 per cent of nontribal children completed the full course of immunisation.

Effect of immunisation status on the occurrence of vaccine preventable diseases showed that occurrence of the diseases was highest among children who were not immunized and lowest in fully immunized children. However these differences were not statistically significant. Effect of immunisation status on the occurrence of vaccine preventable diseases among the tribal and nontribal children, exhibited a significant difference (5% level) between them.

The prevalence rate of morbidity (diseases occurred during entire childhood) computed for the children in both the tribal and nontribal communities found to be 630 per 1000 for tribes and 605 per 1000 for nontribes. The incidence rate (diseases occurred during last one year) was 900:1000 for tribes and 805:1000 for nontribes.

Incidence of childbirth, death and type of delivery were also taken into consideration. It was reported that death of children under six was 4.23 per cent in tribal families whereas no such cases was reported by nontribal families. Childbirth occurred in 10.56 per cent of tribal and 6.29 per cent of nontribal families and the type of delivery was normal in 60.0 per cent of tribal and 44.44 per cent of nontribal families. Premature birth was also reported by both the families. Breech birth was reported only among tribal mothers (6.67%).

Morbidity score for tribal and nontribal children was developed by considering the number of episode of illnesses occurred and the frequency of occurrence during the last one year. The score obtained for tribal children was 27.44 ± 23.60 and for nontribal children it was 25.69 ± 22.63 . But the difference, however, was not significant statistically.

Mean score secured by the tribal and nontribal mothers regarding their awareness on the care and management of illnesses varied with respect to different type of illnesses. Statistical significance (at 5% level) was reported only in the awareness of mother on management of respiratory infections, in which nontribal mothers exceeded the tribal mothers and home accidents, in which nontribal mothers was found to score lesser than their tribal counterparts.

Nutritional status of the preschool children was one of the major thrusts of this study and was assessed through various parameters like anthropometrical measurements, clinical examinations, dietary survey and estimation of blood haemoglobin.

Anthropometrical measurements like body weight, height, mid upper arm circumference (MUAC), head and chest circumferences were used to assess the growth pattern of tribal and nontribal children. Weight for age of tribal and nontribal preschool children showed that the mean weight of tribal children ranged between 11.4 kg to 15.7kg and that of nontribal children was found between 11.39 kg to 17.15kg. A highly significant (at 1per cent level) difference was noticed between the tribal and nontribal children with tribal children lighter than nontribal counterparts. The weight deficit was more prominent with the advancement of age. Sex-wise comparison indicated that the female children, in general were comparatively lighter than the male children irrespective of the community. But the difference was not statistically significant.

Distribution of children according to the nutritional grades based on weight for age classification showed that all the children disregard of gender, grouped under different grades of malnutrition. Majority of tribal preschoolers were classified under grade III malnutrition (moderate wasting) and nontribal children under grade II malnutrition (mild wasting). As the age advanced there observed a gradual shift towards normal nutritional status.

The body weight of both tribal and nontribal children was significantly (at 1% level) lower than the ICMR and NCHS standards for all age groups.

The mean height of most of the tribal children was found to be slightly more than their nontribal counterparts but the difference was insignificant statistically. Sex-wise comparison also showed the same trend with out significant difference between the children of the two communities studied. Severe form of stunting (i.e. having less than 85% of recommended height for age) was observed in three-year age group. With the advancement of age there obtained a gradual shift from severe grade of malnutrition to moderate and marginal stages with regard to height for age also. The mean height of preschool children except the three-year age group was found to be significantly (at 1% level) lower than the NCHS and ICMR standards. It was also observed that the body length of children in three years age group exceeded the standard height recommended by NCHS. The difference was found to be significant in the female children of both tribal (at 1% level) and nontribal (at 5% level) communities.

Weight / height² of the children showed that the highest percentage of tribal male (52.38%) and female children (54.76%) were categorized in the undernourished category, whereas it was 56.76per cent and 57.14per cent for males and female children respectively of nontribal community. Highest percentage of normally nourished children was found in the age group of six years. Here also nutritional situation seemed to improve with age.

The mean MUAC of children ranged from 13.84±0.84 cm to 15.60±0.87 cm for tribes and 14.36±0.93 cm to 16.95±0.66 cm for nontribes. There obtained a highly significant (at 1% level) difference between the tribal and nontribal children of all age groups with respect to MUAC with nontribal preschoolers in an advantageous position. Age and sex-wise comparison of

MUAC also indicated that the age of three year was most critical, where irrespective of gender and communities, the preschoolers had MUAC significantly lower (at 1% level) than the recommended values.

Nutritional grades of children computed based on the mean MUAC values showed that majority of tribal (77.0%) and nontribal (90.0%) were nutritionally normal. The moderate and severely malnourished children were more among tribal population than nontribes. Likewise the female children in both the communities were found to be more malnourished than their male counterparts.

Chest circumference of the tribal preschool children ranged from 47.51 ± 0.88 cm to 51.18 ± 1.26 cm and that of the nontribal children from 48.0 ± 0.8 cm to 51.9 ± 0.7 cm. The mean value of chest circumference was 49.06 ± 1.51 cm and 49.4 ± 1.4 cm for tribes and nontribes respectively. The difference was also found to be significant (at 5% level) in which the nontribal children had better status than their tribal counterparts.

The mean head circumference of tribal and nontribal preschool children was 48.38 ± 1.54 cm and 48.10 ± 1.51 cm respectively. There found no significant difference between the children of tribal and nontribal communities, when analysed statistically.

As far as food consumption pattern is concerned the mean food intake by both the male and female preschoolers of tribal as well as nontribal communities was significantly (at 1% level) lower than the levels recommended by ICMR (2004).

Food weightment survey revealed acute deficiency in the consumption of fruits, egg, milk, fats and oils, sugar and jaggery among tribal male and female children as well. Cereal intake of tribal children was only 46 per cent of RDA and pulse intake 15 per cent. As it comes to nontribal children cereal intake was further less (36.5% of RDA) and pulse intake was found to be only 16.2 per cent of RDA. The fish consumption was 0.9 per cent of RDA among tribes and 10.9 per cent for nontribes. Comparison of food intake of tribal and nontribal children indicated the existence of a statistically significant difference in the case of the cereals (at 1% level), other vegetables (at 1% level), fats and oils (at 5% level), fish (at 1% level) and egg (at 5% level). Here except in the case of cereals, the intake was comparatively more among nontribal children than their tribal counterparts. However the difference in consumption pattern was not to any significant extent.

Sex-wise comparison based on the percentage of RDA indicated a significant difference (at 5% level) between the males and females of the tribal community, only in the consumption of cereals and roots and tubers, whereas no such significant differences were reported in the case of nontribal community.

Nutrient intake was also found to be far below the RDA recommended by ICMR (2004). Energy intake was only 16.15 per cent of RDA, protein intake 33.7 per cent, fat intake 14.95 per cent and iron intake was 12.25 per cent of RDA in the case of tribes, whereas it was 16.32 per cent, 38.73 per cent, 30.94 per cent and 13.11 per cent respectively for nontribes. There obtained a significant difference (at 1% level) only in the consumption of fat between the tribal and nontribal children. Sex-wise comparison showed that there existed

a significant difference (at 5% level) between the male and female children of tribal community with regard to the energy intake.

Clinical examination of preschool children brought out the presence of vitamin A deficiency in the form of night blindness (20% tribes and 8% nontribes) and xerosis of conjunctiva (36.67% tribes and 20% nontribes), vitamin C deficiency as spongy and bleeding gum (54.0% and 41.3% tribes and nontribes respectively), flourosis in the form of mottled enamel (78.67% in tribes and 62.0% in nontribes), dental caries (58.0% and 76%) and B-complex deficiency as angular stomatitis (10% and 4.0%). The clinical score computed also indicated high prevalence of clinical symptoms among tribal (72%) and nontribal (46%) children.

Estimation of blood haemoglobin of the sample showed a range of 8.18 ± 0.83 g/dl to 8.93 ± 1.0 g/dl for tribal preschoolers and 9.04 ± 0.64 to 9.34 ± 0.66 g/dl for nontribal children. There existed a significant (1% level) difference in the haemoglobin status of tribal and nontribal population. When the extent of severity of anaemia was computed using the classification of anaemia by ICMR (1993), it was obtained that majority of tribal children (65% males and 58.33% females) fell under the category of moderate anaemia with haemoglobin level between 7 to 9 gm/dl, whereas the majority of nontribal children (62.24% males and 55.88% females) had mild anaemia with haemoglobin level between 9 to 11 gm/dl.

Stool examination showed the presence of different types of worm load in tribal and nontribal children such as hookworm, tapeworm, pinworm and roundworm. Only two per cent of tribal and 10 per cent of nontribal children were free from any kind of worm infestations.

Correlation of worm load and haemoglobin status indicated a negative correlation. An increase of worm load resulted in reduction of haemoglobin levels and the correlation was statistically significant (at 5% level) in the case of nontribal children and not for tribal children.

By considering all the anthropometrical factors such as height, weight, weight/height², MUAC, chest circumference, head circumference together with the results obtained from biochemical and clinical investigations and nutrient intake, the Nutritional Status Index (NSI) of tribal and nontribal preschool children was computed. The mean NSI was found to be highest for children of six years age group and lowest (in both the communities) in the age group of three years. Also there observed a significant difference in the NSI of children in different age groups and also between the communities. But sex-wise analysis did not show any significant difference in NSI.

When socioeconomic variables were matched with the health and nutrition awareness of mothers it was found that educational status and occupation of mothers had a significant (at 1% level) influence on awareness of nontribal mothers regarding health and nutritional facts. As far as tribal mothers are concerned, only 'type of house' showed a significant influence.

Correlation of anthropometric measurement with NSI of tribal and nontribal preschoolers showed a highly significant positive relation (at 1% level) between all the anthropometric parameters and NSI of children in both the communities. Correlation of anthropometric indices among themselves was also analysed. Almost all anthropometric parameters studied demonstrated a significant (at 1% level) positive correlation with each other.

Correlation of nutrient intake and NSI of preschool children indicated a significant positive correlation at five per cent level in the case of energy intake and NSI of nontribal children. The rest of the nutrients failed to show any significant relation with NSI.

Most of the independent variables studied viz. ordinal status (at 5% level), PQLI (at 5% level) and hygienic practices (at 5% level) and food fads and fallacies (at 1% level) had significant association with NSI of tribal children. Whereas, in case of nontribal children, ordinal status, PQLI and environmental hygiene alone exhibited a significant (at 5% level) association with the NSI.

Nature and extent of correlation of specific independent variables studied with the NSI showed that ordinal status and smoking / drinking habits of parents had a negative correlation with the NSI of children in both the communities. Dietary adequacy showed a significant (at 5% level) negative association with NSI in the case of nontribal children whereas it was positively correlated (significant at 5% level) with the NSI of tribal children.

Influence of morbidity pattern on the anthropometrical parameters indicated a negative influence on the weight-for-age, MUAC and chest circumference of the tribal children and height for age, weight for height and head and chest circumferences of nontribal children. But it was not significant statistically. Whereas a significant (at 1% level) association of morbidity pattern with NSI as well as the ordinal status of children was observed in both tribal and nontribal children. In the case of tribal children personal habits of parents like smoking and drinking also showed a highly significant (at 1% level) association with their morbidity pattern. In fact the ordinal status of children and smoking and drinking habits of the parents correlated positively (significant

at 1% level) with the morbidity pattern. Whereas NSI of children showed a highly significant negative correlation with the morbidity pattern of both tribal and nontribal children. The rest of the variables did not show any significant correlation with the morbidity pattern.

CONCLUSIONS

- The socioeconomic status indicated that:
 - All the families in both the tribal and nontribal groups were below poverty line with high illiteracy.
 - Most of the tribes and nontribes were engaged in agricultural labours. Most of them had virtually no work during summer and rainy season to earn livelihood.
 - Hygienic practices were also found to be unsatisfactory in both the tribal and nontribal groups. There observed a highly significant difference (at 1% level) regarding hygienic practices in which tribes excelled in water and food hygiene and the nontribes in hygiene in house and its surroundings and personal hygiene.
 - As per PQLI (Physical Quality Life Index) computed both the groups (tribal and nontribal preschoolers) fell under the category of either 'high risk' or 'very high risk' group. There existed a significant (1% level) difference between the risk factors and also between the tribal and nontribal communities.

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- Health care management and awareness regarding good nutrition, good medical care, use of safe drinking water, proper immunisation and utilisation of ICDS and RCH schemes were not satisfactory in both the groups. But nontribes scored higher than the tribal group and the difference was found to be significant.
- Morbidity pattern of tribal and nontribal preschool children revealed a high prevalence of common childhood illnesses. Statistically significant difference was observed with regard to occurrence of scabies and multiple episode of illnesses like fever, skin and gastro intestinal disorders in which tribal children were more affected than their nontribal counterparts. With regard to vaccine preventable diseases, whooping cough and measles were predominantly observed among both the groups. But the difference between the preschool children of tribal and nontribal communities, in this respect, was proved to be insignificant. Accidents were observed as a leading contributor in the occurrence of morbidity. Immunisation status was observed to be poor among both the communities.
- Anthropometrical measurements like weight for age and height for age of both tribal and nontribal preschool children were below the standard measurements recommended by ICMR as well as NCHS. Weight for age was significantly lower than the standard weight in all age groups. MUAC was also below the standards.

There found highly significant difference between tribal and nontribal children with regard to weight, MUAC and chest circumference. Though nontribes found to be slightly better in the measurements of height and head circumference than the tribal preschoolers the difference was insignificant.

- Food and nutrient intake of both tribal and nontribal preschoolers was far below the allowances recommended by ICMR (2004). The difference in intake was significant at one per cent level in all the food groups. Comparison of tribes and nontribes indicated that there was a significant difference between the communities in the intake of cereals, vegetables, fish and fats and oils, in which tribes exceeded in the consumption of cereals only. In the case of majority of tribal and nontribal children the intake of nutrients was also found to be much lower than the RDA and the difference was found to be significant only in the case of fat intake.

- Blood haemoglobin levels were also found to be far below the normal value recommended by ICMR (2004). The difference between tribal and nontribal children with regard to blood haemoglobin content was highly significant. Classification of children based on haemoglobin level showed that all the children disregard of their community were having either mild or moderate type of anaemia.

Unavailability of foods owing to low purchasing power, ignorance and increased requirement due to infections and infestations may be the cause of malnutrition in low income groups in general, whereas, all the above factors combined with deep-rooted cultural beliefs, customs and inaccessibility to the dwelling area etc. might have boosted up the severity of malnutrition among the tribes.

Further studies recommended

1. A study with wider coverage including tribes and nontribes of other parts of Kerala may be carried out.
2. Increasing trend of smoking and substance abuse among the tribal population and its effect on their health and wellbeing may be studied.
3. A detailed biochemical assessment of nutrients and other metabolites in blood and urine may be done to get an accurate picture of the sub-clinical deficiencies.
4. Changing lifestyle of the tribes and its effect on child rearing practices on nutritional status and morbidity pattern of preschoolers may be considered.
5. Erosion of traditional knowledge in the preparation of nutritious foods prevailing in both tribal and nontribal communities may be studied in detail.
6. Details of child rearing practices by the elder children in the absence of mothers may also be collected.

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7. Regarding morbidity pattern, occurrence of vaccine preventable diseases among the study population itself may be carried out. So that the effect of the diseases on health and nutritional status and chances of survival of the particular children can be understood.
 8. Common food fads and fallacies among tribal and nontribal groups can be studied to analyse and interpret their impact on health/nutrition profile of children.
 9. Developmental profile of tribal children in comparison with their nontribal counterparts may be considered.
 10. Educational intervention to improve the health nutritional profile of tribal children.

Steps to be taken to improve the overall profile of tribal children

1. Problem of undernutrition amongst preschool children needs to be addressed through comprehensive, preventive, promotive and curative measures. The community needs to be educated about environmental sanitation and hygiene and also proper child rearing, breast-feeding and weaning practices, especially in the context of changing lifestyles of tribal people.
2. Socioeconomic empowerment of tribal women would help to improve their purchasing power and ability to take appropriate decisions in the right time so as to protect and promote the health and well being of our future generation.

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3. Governmental initiatives to improve the literacy rate of tribes in general, and women in particular, along with functional literacy to improve the health and nutritional status of the children should be given priority.
 4. Provision for safe drinking water, clean and safe environment should be ensured. Measures to control water borne diseases in tribal and rural areas should be curbed.
 5. A comprehensive child survival programme with supplementary feeding, growth and development monitoring and early detection and prompt treatment during illness needs to be devised and implemented ensuring community participation.
 6. Weak administrative system also broadens the gulf of problems. So officials with special interest and willingness to work among the tribes should be given priority to render service in tribal schemes.
 7. Campaigning against alcoholism and substance abuse smoking, which can alter the lifestyle of tribes drastically, affecting their health adversely and also reduce their purchasing power and economic security.
 8. Awareness programme regarding minor illnesses, which can be treated in the village; early detection of health problems, which need immediate medical attention, immunisation coverage for pregnant women and children should be promoted.
 9. Economic empowerment of tribal women to improve their purchasing power would be helpful to improve family food nutritional wellbeing of tribal children.

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10. For the overall development of the child – special package programmes sponsored by the Governmental and Non-Governmental agencies to identify tribal children with talents and skills, potential and capabilities, and equip them with education and appropriate training so as to enable them to join the main stream.
 11. Tribes, their culture and lifestyle can be integrated in the curriculum at the school and higher levels so as to create an awareness among the nontribal groups and also to enable them to understand, respect and appreciate the tribal culture and accept them as a part of the general public.