Malnutrition and Micro-nutrient Deficiencies among the tribal people in Kerala state: A Contrasting Views on Kerala Model of Development

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Abstract

There has been marked improvement in the health scenario in India especially in the state of Kerala since late seventies due to the various public health initiatives. This, along with the phenomenal growth in female education has given rise to the concept of 'Kerala Model of Development'. This model shows that despite income levels being very low as compared to developed countries, health and educational attainments of Kerala are comparable to that of the developed countries. However, the Kerala model considers the average situation only to establish the point. On deeper scrutiny, it would appear that the success is only in the periphery and is not percolated to the downtrodden. It is an undeniable fact that the robust growth of the economy has reduced poverty in general. However, it has failed to attain substantial changes in the health status of the tribal communities. Malnutrition and micro-nutrient deficiencies are still persisting among these vulnerable groups in Kerala. This being the situation, an attempt is made to understand the present status of the marginalised groups in their health and nutrition, taking in to account the global scenario as well.

(The present paper is based on the data set of the major research project awarded by University Grants Commission (India), entitled, "The Problem of Hunger and Malnutrition-A study among the Tribes of Kerala". The study undertaken during the period 2008-2010 among thousand tribal families.)

Keywords*: Height for Age, Weight for Age, Weight for Height, Chronic Energy Deficiency, Body Mass Index.*

Height for Age*: This index examines linear growth retardation and is an indicator of chronic under nutrition. Low height-for-age index identifies past under nutrition or chronic malnutrition. It cannot measure short-term changes in malnutrition. It shows the prevalence of stunting.*

Weight for Age*: This is a composite measure of both chronic and acute under nutrition. Low weight-for-age index identifies the condition of being underweight, for a specific age.*

Weight for Height*: This index compares body mass to body length and it reflects acute under nutrition (Wasting). Low weight-for-height helps to identify children suffering from current or acute under nutrition or wasting and is useful when exact ages are difficult to determine.*

Chronic Energy Deficiency (CED): It is defined as a "steady state" where an individual is in energy balance, i.e. the energy intake equals the energy expenditure, despite the low body weight and low body energy stores.

Body Mass Index*. A key index for relating a person's body weight to his height. It is measured by dividing weight in kilograms by height in meter square.*

1. Introduction

Kerala is a state that had grabbed the attention of researches from across the world for its unique development experience wherein high social development co-existed with low economic growth, disproving existing ideas of development. It has also been noted by other researchers that there has been outliers to this development experience. Tribes were one of the excluded groups who did not significantly benefit from this remarkable Kerala experience. Though the tribes in Kerala are a heterogeneous group, most of them remain at the lowest stratum of the society due to various factors like geographical and cultural isolation, low levels of literacy, primitive occupations and extreme levels of poverty. Majority of the tribal

people are dependent only on small agriculture and wage earnings. The income from small agriculture and wage earnings are inadequate to meet the requirements of balanced diet. Therefore, majority of tribal families are living below poverty line are facing the problem of malnutrition. Malnutrition and micro-nutrient deficiencies place a heavy burden on the country's resources. It is linked to half of all child deaths and nearly a quarter of all cases of diseases. Malnourished children tend not to reach their potential, physically or mentally and they do worse at school than they otherwise would. Malnourished mothers give birth to babies that are born stunted and thin. In the backdrop of the above revelations, an attempt is made in the present paper to assess the problem of malnutrition and micronutrient deficiencies of tribal women and children using statistical techniques and anthropometric measurements.

2. Literature review

The health and nutritional status of a nation is an important indicator of the development of the country. Mortality rates, malnutrition and micronutrient deficiencies are some of the important indicators that can be used to assess the health status of the people.

While India is surging ahead at an average growth rate of 7 per cent since 1997, 48 per cent of children under three in the country are underweight, malnourished stunted and wasted. Related to nutritional status of tribal children Rajiv Hari (2008) conducted a comparative study on tribal and non tribal pre schoolers revealed that the prevalence of dysendry, fever and scabies to be high in tribal children compared to non tribal children. This may be due to better health care facilities rendered to the non tribal people.

The study of R. Radakrishna and C. Ravi (2004) analyses trends in malnutrition in India over the past two decades and shows that improvements in nutritional status have not kept pace with the reduction in poverty. About half of the pre-school children are malnourished, some of the middle income states such as Kerala and Tamilnadu have comparatively better nutritional achievements than higher income states like Maharastra and Gujarat. The study made it clear that, in Madhyapradesh, there existed very high level of inequality among tribes in all variables.

Another study conducted by S.C. Jai Prabhakar and M.R. Gangadhar (2009) observed that the Jenukuruba tribal children of Mysore district of Karnataka state suffered from different grades of malnutrition in the form of wasting, stunting and under weight. The study found that about 41.5 per cent of mild (-2 SD to -1 SD) stunting was recorded in all the age groups and gender, followed by moderate (39.3 per cent) and severe (< –3 SD) was 6.7 per cent. Only 10.4 per cent children were normal in their height for age.

Related to micro-nutrient deficiencies among women Kamala Raj (2010) conducted a comparative study on tribal and rural women consisting a sample of 8,036 tribal families and 7,078 rural households found that inadequate dietary intake during pregnancy and lactation causes micro-nutrient deficiency (hidden hunger). This study also found that a sign of Vitamin A deficiency was 0.6 per cent among tribal and only 0.3 among rural women and the prevalence of angular stomititis, a sign of B complex vitamin deficiency was 1.1 per cent and 0.8 per cent in tribal and rural women respectively. Compared to rural women the prevalence of goitre was more in tribal women (4.9 per cent) and the prevalence of chronic energy deficiency was 56 per cent among tribal women against 36 per cent in rural.

Similar study conducted among the tribes by Mathew et al. (1988) in Rajasthan found that 88 per cent of the tribal adolescents had the presence of one or more visible clinical signs of nutritional disorders. They manifested nutritional deficiencies such as calcium, iron, vitamin A and iodine. Fungal infections were also common among the tribal adolescents.

Another study conducted by Kodavanti Mallikharjuna Rao et.al (2006) about diet and nutritional status of adolescent tribal population in nine states of India revealed that the prevalence of conjunctival xerosis and Bitot spots, the signs of vitamin A deficiency among tribal adolescents were found to be 4.9 per cent and 2 per cent respectively. About 3 per cent of the adolescents had angular stomititis; indicative of B-complex vitamin deficiency and the prevalence of goitre was 3.5 per cent, which was relatively higher among girls (5 per cent) than boys (1.8 per cent). These are few studies conducted in this area to focus the degree and nature of malnutrition and micronutrient deficiencies among different castes and groups of people in the country. The present study focused the prevalence of this problem among the women children of the major tribal groups in the state of Kerala.

3. Calculation Formula

Nutritional status of ***women*** was evaluated by using internationally accepted Body Mass Index (BMI) guidelines (WHO, 1995), with the BMI (weight in Kg/height in Mr^2) of <16.0 as considered CED Grade III, 16.0-16.99 as CED Grade II, 17.0-18.49 as CED Grade I form of malnutrition and BMI of 18.50-24.99 considered as normal, 25-29.9 as overweight and ≥30 as obese.

For assessing nutritional status of ***children,*** we have adopted three anthropometric indices of nutritional status (height- for- age, weight- for- age, and weight- for- height) which are considered as good indicators of nutritional status. Weight for age, height for age and weight for height were calculated in standard deviation values (transformed as Z scores) using reference median as recommended by WHO (WHO, 2006).

$$(Z = \frac{\textit{Individual Value - Median value of reference population}}{\textit{Standard deviation of reference population}}$$

Children who were more than two standard deviation below the reference median (<-2 SD) on the basis of weight for age, height for age and weight for height nutritional indices were considered to be underweight, stunted and wasted respectively. It means that < –3 SD considered as severe malnutrition, -3SD to -2SD as moderately malnourished, -2 SD to -1 SD as mildly malnourished and >1SD as considered normal.

Analysis of micronutrient deficiencies is based on visible clinical signs of nutritional disorders, past history of the sample respondent, medical reports and informations from health workers etc.

4. Paper Content
Tribal women and Malnutrition

The most underprivileged group is the tribal communities both in terms of socio economic conditions as well as nutritional status. Kerala comprises of 1.14 per cent of total tribal population of the country (Census of India, 2001) and half of them is living below the poverty line. Poverty leads to deficiencies in energy in take. Chronic Energy Deficiency (CED) is defined as a “steady state” where an individual is in energy balance, i.e. the energy intake equals the energy expenditure, despite the low body weight and low body energy stores. Thus, by never growing to a normal size or having experienced one or more stages of energy deficiency, the individual has arrived at a reduced body weight with possibly limited physical activity, which have allowed the energy demands of a lower basal metabolic rate (BMR) and reduced amounts of activity to balance the lower intake. Economic and modern life style force them to get mixed

with the new generation, but they did not get proper attention and respect to their earlier lifestyle and hence most of them still live below the poverty line. Changes in food habits lead to high prevalence of chronic energy deficiencies among tribal communities.

Body Mass Index (BMI) is a useful anthropometric indicator of measuring nutritional status and for assessing the prevalence of CED between population groups. The main reason for the CED is inadequate intake of energy accompanied by higher level of physical activities and infections. It is associated with reduced work capacity, performance and productivity, increased morbidity due to suppressed immune function and behavioural changes. According to the NFHS-3 survey, in India 47 per cent of tribal women are having CED compared to 35 per cent among the general population (IIPS and Macro2007).

The percentage distributions of the gradation of body mass index for distinguishing the prevalence of chronic energy deficiency among females of selected tribal communities are presented in table 1. In Wynad district, 22 per cent of Kadar, 28 per cent of Kattunaika and about 19 per cent of Paniya are suffering from severe form of CED and at the same time 25 per cent of Paniyas and 26 per cent of Mavilas are in the group of CED Grade I1 form of malnutrition in Kannur district. This may be due to poor diet intake, improper feeding practices, ignorance, early marriage, and high morbidity due to unhygienic practices and surroundings. Insignificant literacy fails them to understand the situation in proper perspective in health conditions. This pushed them in less productivity and ill health. Using BMI <18.5 as the criteria for CED, nearly 60 per cent of the tribal women are found to suffer from various degrees of energy deficiencies. About 13 per cent are found to suffer from CED Grade III (<16.0- severe), 18.8 per cent from CED Grade II (16-16.99-mild), and 13.6 per cent from CED Grade I (17-18.49- moderate) form of malnutrition. About 9 per cent of them are overweight and 5 per cent obese.

Table-1 Caste wise Distribution of BMI (%) According to Chronic Energy Deficiency

Caste	CED Grade III (Severe) (BMI<16.0)	CED Grade II (Mild) (BMI=16.0-16.99)	CED Grade I (Moderate) (BMI=17.0-18.49)	Normal (BMI= 18.50-24.99)	Overweight (BMI > 25.0-29.9)	Obese (BMI≥30)	Total
Wynad							
Adiya	7(14)	11(22)	3(6)	23(46)	4(8)	2(4)	50(100)
Kadar	11(22)	12(24)	14(28)	10(20)	3(6)	0	50(100)
Kattunaika	14(28)	9(18)	10(20)	13(26)	4(8)	0	50(100)
Mullu Kurumar	3(6)	8(16)	4(8)	25(50)	7(14)	3(6)	50(100)
Thachanadan Moopan	9(18)	7(14)	9(18)	17(34)	5(10)	3(6)	50(100)
Urali	7(14)	8(16)	5(10)	23(46)	5(10)	2(4)	50(100)
Kurichiya	11(7.3)	29(19.4)	18(12)	73(48.7)	11(7.3)	8(5.3)	150(100)
Paniya	28(18.7)	19(12.7)	31(20.6)	51(34)	13(8.7)	8(5.3)	150(100)
Kannur							
Kurichiya	12(8)	28(18.7)	16(10.7)	73(48.7)	14(9.3)	7(4.6)	150(100)
Paniya	16(10.7)	38(25.3)	19(12.7)	56(37.3)	12(8)	9(6)	150(100)
Mavila	6(12)	13(26)	2(4)	18(36)	7(14)	4(8)	50(100)
Karimbala	3(6)	6(12)	5(10)	27(54)	6(12)	3(6)	50(100)
Total	127(12.7)	188(18.8)	136(13.6)	409(40.9)	91(9.1)	49(4.9)	1000 (100)

Note: Figures in parenthesis indicate percentages to horizontal totals.
Source: Survey data.

Malnutrition among tribal children

The physical well being and maintenance of normal health of an individual is closely related to his nutrition status. Nutrition plays a vital role, as inadequate nutrition during childhood may lead to malnutrition, growth retardation, reduced work capacity and poor mental and social development (Awasthi and Kumar 1999). Around 28 per cent of all children in developing countries are underweight or stunted (R.Kothekar, 2009). In India, though only 26 per cent of the population lives below the poverty line, 46 per cent of children under the age 3 are malnourished. Though the health indicators of Kerala are higher when compared to other states in India, the status of nutrition in some areas of population does not portray a rosy picture, particularly among marginalised groups. According to NFHS -3, in Kerala one quarter of children under age five are stunted, 16 per cent are wasted and 23 per cent are underweight. The nutritional studies in India by Choudhury and Bhuyan (1994), Begum (1996), Begum and Chuodhry (1996), Mukarjee (2002), Tsope (2003) reveal that a good majority of the children of the regions suffer from various forms of malnutrition. The reports of the Asian Legal Resource Centre (ALRC) states that in Madhya Pradesh, the chance of survival of a tribal child is low, with 71.4 per cent tribal children being malnourished and 82.5 per cent children being anaemic (Chronicle, 2010).

In the present study, a total of 1891 children from different tribal groups in the age group of 1 to12 years are included. The following table shows the anthropometric measurements of these children's nutritional status in the age group of one to twelve years. It shows that there 63 children were stunted, 52 were wasted and 29 were underweight.

Table 2 Nutritional Status of Children According to Height for Age

Age	Severely stunted (<-3ZScore)	Moderately stunted (-3to-2ZScore)	Mildly stunted (-2to-1ZScore)	Near to stunted (-1to1ZScore)	Normal (>1 Z Score)	Total No. of children
1	0	0	7(6.4)	73(65.8)	31(27.8)	111(100)
2	0	0	37(38.5)	15(15.7)	44(45.8)	96(100)
3	2(1.6)	44(34.9)	25(19.8)	38(30.3)	17(13.4)	126(100)
4	12(8.8)	16(11.8)	35(25.9)	20(14.8)	52(38.7)	135(100)
5	13(11.6)	20(17.8)	24(21.5)	26(23.3)	29(25.8)	112(100)
6	28(18.5)	13(8.6)	4(2.6)	43(28.6)	63(41.7)	151(100)
7	0	0	5(2.8)	7(4)	163(93.2)	175(100)
8	0	0	4(2.3)	82(46.5)	90(51.2)	176(100)
9	2(1.5)	11(7.9)	19(13.7)	61(43.8)	46(33.1)	139(100)
10	0	3(1.2)	5(1.8)	134(48.7)	133(48.3)	275(100)
11	0	5(4.5)	7(6.5)	55(50.5)	42(38.5)	109(100)
12	6(2.1)	5(1.8)	112(39.1)	35(12.2)	128(44.8)	286(100)
Total	63(3.3)	117(6.2)	284(15.1)	589(31.1)	838(44.3)	1891(100)

Note: Figures in parenthesis indicate percentages to horizontal totals.
Source: Survey data.

Table 2 shows the nutritional status of tribal children according to their height-for-age. This index examines linear growth retardation and is an indicator of chronic under nutrition. Low height-for-age index identifies past under nutrition or chronic malnutrition. It cannot measure short-term changes in malnutrition. It shows the prevalence of stunting. Out of 1891

children, about 44.3 per cent are with normal nourishment and the rest face some form of malnutrition. The data reveals that 15.1 per cent are mildly stunted, 6.2 per cent moderately stunted, 3.3 per cent are severely stunted and 31.1 per cent are near to stunting. Stunting is the result of long-term energy / protein deficiency. The above table shows that the prevalence of stunting is considerably less in first two years of life when most babies are fully breastfed, than at older ages. The prevalence of stunting increases rapidly up to 3–6 years of age, after which it increases more slowly.

Table 3 Nutritional Status of Children According to Weight for Age

Age	Severely underweight (<-3Z Score)	Moderately underweight (-3to-2Z Score)	Mildly underweight (-2to-1ZScore)	Near to underweight (-1 to1ZScore)	Normal >1Z Score	Total No. of children
1	0	0	12(10.8)	84(75.6)	15(13.6)	111(100)
2	0	0	2(2.1)	64(66.7)	30(31.2)	96(100)
3	2(1.5)	6(4.7)	20(15.8)	82(65.4)	16(12.6)	126(100)
4	0	2(1.5)	12(8.8)	75(55.5)	46(34.2)	135(100)
5	12(10.7)	14(12.5)	13(11.6)	24(21.5)	49(43.7)	112(100)
6	3(1.9)	7(4.7)	8(5.4)	48(31.7)	85(56.3)	151(100)
7	2(1.3)	17(9.7)	22(12.5)	51(29.1)	83(47.4)	175(100)
8	5(2.8)	21(11.9)	64(36.5)	29(16.4)	57(32.4)	176(100)
9	2(1.4)	4(2.8)	12(8.6)	31(22.5)	90(64.7)	139(100)
10	0	0	5(1.8)	167(60.7)	103(37.5)	275(100)
11	0	2(1.8)	2(1.8)	89(81.7)	16(14.7)	109(100)
12	3(1.1)	35(12.2)	49(17.2)	25(8.7)	174(60.8)	286(100)
Total	29(1.5)	108(5.7)	221(11.7)	769(40.7)	764(40.4)	1891(100)

Note: Figures in parenthesis indicate percentages to horizontal totals.
Source: Survey data.

Table 3 presents the nutritional status of tribal children according to their weight- for-age. This is a composite measure of both chronic and acute under nutrition. Low weight-for-age index identifies the condition of being underweight, for a specific age. The advantage of this index is that it reflects both past (chronic) and/or present (acute) under nutrition. Underweight is the result of more recent energy / protein deficiency. Out of 1891 children, 108 were moderately underweight whereas 221 were mildly underweight and 29 children were severely underweight. Remaining children (769) were near to underweight and only 40 per cent were with normal weight. It is evident from the table that severe undernutrition is absent or low in the first four years of life. But it is about 11 per cent at the age of 5, and then it falls slowly when age increases.

Table 4 Nutritional Status of Children According to Weight for Height.

Age	Severely wasted (<-3ZScore)	Moderately wasted (-3 to-2ZScore)	Mildly wasted (-2to-1ZScore)	Near to wasted (-1to1Z Score)	Normal >1ZScore)	Total No. of children
1	2(1.8)	0	6(5.4)	65(58.6)	38(34.2)	111(100)
2	0	2(2.1)	14(14.6)	37(38.5)	43(44.8)	96(100)
3	12(9.5)	11(8.7)	47(37.4)	22(17.5)	34(26.9)	126(100)
4	19(14.1)	35(25.9)	20(14.8)	18(13.4)	43(31.8)	135(100)
5	7(6.3)	25(22.4)	56(50)	11(9.7)	13(11.6)	112(100)
6	9(5.9)	19(12.6)	65(43)	16(10.7)	42(27.8)	151(100)
7	0	0	21(12)	57(32.6)	97(55.4)	175(100)
8	0	9(5.2)	12(6.8)	66(37.5)	89(50.5)	176(100)
9	3(2.2)	5(3.6)	25(17.9)	54(38.8)	52(37.5)	139(100)
10	0	0	8(2.9)	146(53.1)	121(44)	275(100)
11	0	0	6(5.6)	52(47.7)	51(46.7)	109(100)
12	0	8(2.8)	5(1.7)	142(49.7)	131(45.8)	286(100)
Total	52(2.7)	114(6.1)	285(15.1)	686(36.3)	754(39.8)	1891(100)

Note: Figures in parenthesis indicate percentages to horizontal totals.
Source: Survey data.

Table 4 shows the nutritional status of tribal children according to their weight for-height. This index compares body mass to body length and it reflects acute under nutrition (Wasting). Low weight-for-height helps to identify children suffering from current or acute under nutrition or wasting and is useful when exact ages are difficult to determine. Weight-for-length or weight-for-height is appropriate for examining short-term effects such as seasonal changes in food supply or short-term nutritional stress brought about by illness. Out of 1891 children, 754 (39.8 per cent) children are with normal nourishment and the rest suffer from some form of malnutrition. 52 children are severely wasted, 114 were moderately wasted and 285 were mildly wasted. It is clear from the above table that in the first two years of life the prevalence of wasting is less and then it starts slowly increasing up to 3-6 years of age.

The data indicates that children in the youngest age group of 12 to 24 months were at a significantly lower risk of underweight, stunting and wasting as compared with children in the older age groups. This low risk may be due to the protective effect of breast-feeding as almost all children continue to be breast-feeding during their first year of life.

The proportion of underweight, stunted and wasted children starts to increase with increase in age. The proportion of underweight children ranges from 1.5 per cent to 36.5 per cent in the age group 4-9, wasting was 6.3 per cent to 43 per cent in the age group 4-6 and the highest proportion of stunting was 1.6 per cent to 34.9 per cent in the age group 3-6. It is clear that the prevalence of stunting and wasting was higher in the age group3-6 years and underweight was more in the age group 5-9 years. This may be due to the high levels of poverty as well as a lack of knowledge and understanding of mothers on child health care practices. After 9 years, the prevalence of stunting, wasting and underweight decreases. In adolescent age, the prevalence of stunting and underweight starts to increase. Children start going to school at the age 6 own wards. In some tribal areas, lack of transport facilities compel the children to walk long distances to reach the school. Regular travelling of long distance without adequate food intake may make the children weak in their nutritional status. It is also possible that parents give less attention to older children when a new child is born who needs much attention and care.

The prevalence of malnutrition is tends to decline in children in the age group of 10 to 12 years. This may be due to the reason that these children may be able to get nutritious food by their own choices with their increasing age. In some cases, the parents keep their children engaged in the household activities since very childhood. Children are also made to work as labourers and earn very little from their wages to support the family. The girl children are compelled to carry water from long distances for daily household requirements which will have its ill effects on their health and nutrition. Generally, poor nutritional status can be the consequences of either low level of nutritional intake through the food consumed or of frequent infections caused by the lack of hygiene and healthcare. The low level of nutritional intake makes the children more vulnerable to infection and the presence of infection prevents them from absorbing food. The consequences of an unfavourable nutrition –infection nexus is a slow rate of physical and cognitive growth of the children. One of the reasons for this persistent child malnutrition is that malnourished mothers give birth to low birth weight babies. As the immune system of these babies is severely impaired, they tend to suffer from frequent bouts of infections, and through the nutrition- infection nexus, they tend to get more malnourished and with less than normal weight.

Micro-Nutrient deficiencies

Apart from the problem of poverty and malnutrition, micro nutrient deficiencies are also a major problem among marginalised communities. Micro nutrient deficiency is occurred when diet lacks variety. Diets which lack adequate amounts of essential vitamins and minerals leads to micro nutrient deficiency. The main micro-nutrient deficiencies are iron deficiency anaemia, vitamin A deficiency and iodine deficiency disorders. A recent global progress report states that 35 per cent of the people in the world lack adequate iodine, 40 per cent of the people in the developing world suffer from iron deficiency and more than 40 per cent of children are Vitamin A deficient which increases the risk of early death (World Bank Report, 2008). In India, more than 75 per cent of pre-school children suffer from iron deficiency anaemia. The overall prevalence of anaemia among children with 6 to 35 months of age is 74 per cent and most suffer from mild (23 per cent) or moderate (46 per cent) anaemia (IIPS and Orc Macro 2000). The prevalence of iron deficiency anaemia is an extremely serious health problem especially among women and children in tribal areas.

The study found that about one third of tribal children suffer from iron deficiency anemia and about 34 per cent of women have some degree of iron deficiencies. This percentage is higher among the caste like Kadar, Kattunaika and Paniyas in Wynad district. Insufficient intake of iron rich foods may be the reason for the iron deficiencies. Increased consumption of meat and fish, which are rich in bio available iron, and vitamin rich foods which enhance the absorption of iron from plant sources, as well as fortification of commonly eaten foods with iron, can help to prevent anaemia.

The prevalence of Vitamin A deficiency (VAD) in India is one of the highest in the world, especially among women and pre-school children. An estimated one million additional children die each year of infectious diseases because VAD impairs their resistance to infection. VAD is also prevalent among women of reproductive age, among whom clinical symptoms of night blindness are extremely widespread. About one in every 20 pregnant women has subclinical VAD and almost 12 per cent of them suffer from night blindness. Clinical VAD affects about 5 per cent of women and subclinical VAD about 12 per cent of women (West 2002). The study reveals that 36 per cent of tribal children and about 37 per cent of women suffer from vitamin A deficiency. In Kannur district, the prevalence of vitamin A deficiency and iodine deficiency disorders are more in Paniya and Karimbala women. Vitamin A deficiency in the form of Conjunctival Xerosis also exists in tribal women. Insufficient and poor nutritive foods may be the reason for this type of vitamin A deficiency.Regular consumption of low cost foods such as green leafy vegetables and certain yellow foods can prevent Vitamin A Deficiency.

The consequences of iodine deficiency include severe mental retardation, goitre, abortion, stillbirths and low birth weight and mild forms of motor and cognitive deficits.

Among those who suffer from iodine deficiency disorder in India, 51 million are school-age children (6-12 years). About one in four school children has a goitre sign of severe iodine deficiency (UNICEF and MI 2004). One-third of all children in the world that are born with mental damage related to iodine deficiency disorders live in India (ACC/SCAN 2004). Iodine deficiency in pregnant women in India is estimated to have caused the congenital mental impairment of about 6.6 million children (UNICEF, 2003). The prevalence of Nutritional deficiency Goitre in the age range of peak prevalence (20 to 35) was almost 12 per cent among Paniyas. Adding iodine to salt is the most common and effective method of preventing iodine deficiency. About one fourth of the Adiya, Kadar and Uralies are suffering from visual

impairment. Due to increased awareness, economically advanced groups like Kurichiya and Kuruma are free from this type of nutritional deficiencies.

5. Conclusion and implications

The problem of malnutrition and chronic energy deficiencies is alarming and of great complexity. Majority of tribal women suffer from nutritional deficiencies. Children are stunted, wasted and underweight due to malnutrition. Positive inputs are needed to improve growth and to overcome body weight deficits. Preventive measures are also required to improve food security, strengthen the supplementary feeding programs and also to encourage the mothers for weaning. Micronutrient deficiencies can be overcome by dietary diversification, food fortification and supplementation with vitamins and minerals. One of the key points of intervention is to concentrate on the mother's nutrition status, health and education. Maternal nutritional status, independent of all other factors, is a strong predictor of nutritional status of the children.

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