

## Original Article

# Dietary habits, food consumption and nutrient intake among the Sugali, a tribal population of Andhra Pradesh, India

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In this study an attempt has been made to know the food consumption and dietary intake of Sugalis, the largest tribal population of Andhra Pradesh, India. The sample consisted of 492 males and 474 females (drawn from 200 families) in the age group of 1–60 years. The 24-h recall diet survey revealed that the mean consumption of different foodstuffs by different age groups compared to the RDA was grossly inadequate. During preschool ages, Sugali boys and girls showed larger deficiencies in their nutrient intakes. Inadequacy in protein and calories (P-C) is high both among males (47.0%) and females (41.6%). Caloric deficiency (C-) is higher in Sugali males (66.9%) and females (59.3%) than is protein deficiency (P-), which is 48.2% in males and 43.5% in females.

**Key words:** food consumption, nutrient intake, protein–calorie adequacy status, Sugali, tribal population, India.

## Introduction

India has several socially disadvantaged communities, among which scheduled tribes are the most deprived. The tribal population that constitutes 7.7% of the total population is characterized by widespread poverty, illiteracy, malnutrition, lack of safe drinking water and unhygienic living conditions, which are contributing factors for dismal health conditions. Nutrition is one of the most powerful environmental factors to influence the optimal health of an individual and it is indirectly influenced by family income, occupation, family size and other environmental constituents. In general, recent work on growth status has tended to suggest that environmental influences, especially nutrition, are of greater importance than genetic background or other biological determinants.<sup>1–5</sup> Though health is one of the crucial parameters of the development of a community, the researchers have not paid much attention to studying the nutritional status of the tribal communities in India. Moreover, there are absolutely no works which deal with the nutritional status of the Sugali, the largest tribal population of traditional pastoral nomads of Andhra Pradesh, India. Hence, in this study an attempt has been made to know the nutritional status of the Sugalis inhabiting the Palakonda Hill ranges of Andhra Pradesh, India through a '24-h recall' diet survey.

The Sugali is the largest notified scheduled tribe of Andhra Pradesh. They are also known as *lambadi*, *lambani*, *banjari* and *brinjari* in various parts of India. The Sugalis are supposed to be the descendents of the original Aryan Gypsies or Roma Banjaras of North-West India, whose descendents are also found in various parts of the Central and Southern Europe and in Central Asia. The traditional dress pattern of the Sugali is colourful, attractive and a distinctive identity marker of the community. They live in exclusive settlements

of their own called '*thandas*', named after the headman ('*Nayak*') of the group. The Sugali language closely resembles the Marvari language of Rajasthan both in accent and in script. Owing to the cultural contact with the surrounding Telugu people, they have become bilingual and can speak Telugu fluently. The economic life of the people varies from agriculture, lime-selling, fire-wood selling and agricultural labour.

## Materials and methods

The sample for the present study was drawn from 200 families belonging to 10 Sugali *thandas* (settlements) located in four *mandals* (revenue divisions) of Cuddapah District, Andhra Pradesh (Fig. 1). The sample consisted of 492 males and 474 females in the age group of 1–60 years.

For the purpose of the survey a family was considered to be a unit and the survey was conducted. The '24-h recall' method was applied in order to assess the dietary pattern of the Sugali population. The 24-h recall diet survey method is considered reliable and feasible for recording individual food intakes of various age groups.<sup>6–10</sup> The housewife or the elderly woman who cooks and serves the food was the respondent. The individual food intake of all of the family members for the previous day was assessed first through oral enquiry. Following this, the quantity of raw foods used for various preparations was assessed in terms of local measures. The metric values of cooked quantities of such preparations

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were established by using a set of standardized cups and spoons of varying sizes as recommended by the National Institute of Nutrition (NIN) of Hyderabad. The quantity of cooked items consumed in the previous day by each individual of the family in terms of standardized cups and spoons were recorded with the help of the respondent. The quantity of raw food was calculated by using the following formula:

$$\text{Quantity of raw food consumed by the individual for each item} = \frac{\text{Total quantities of raw food used for each item}}{\text{Total volume of the cooked food item}} \times \text{Volume of cooked food consumed by the individual}$$

The nutritive values for the quantity of raw foods consumed by the individuals were calculated by using the food consumption tables from 'Nutritive Values of Indian Foods'.<sup>11</sup> The average nutritive values for each age group in a day in terms of calories, proteins, fats, minerals and vitamins were also calculated. The food and nutrient intakes were then compared with Recommended Dietary Allowances (RDA) for Indians.<sup>12</sup>

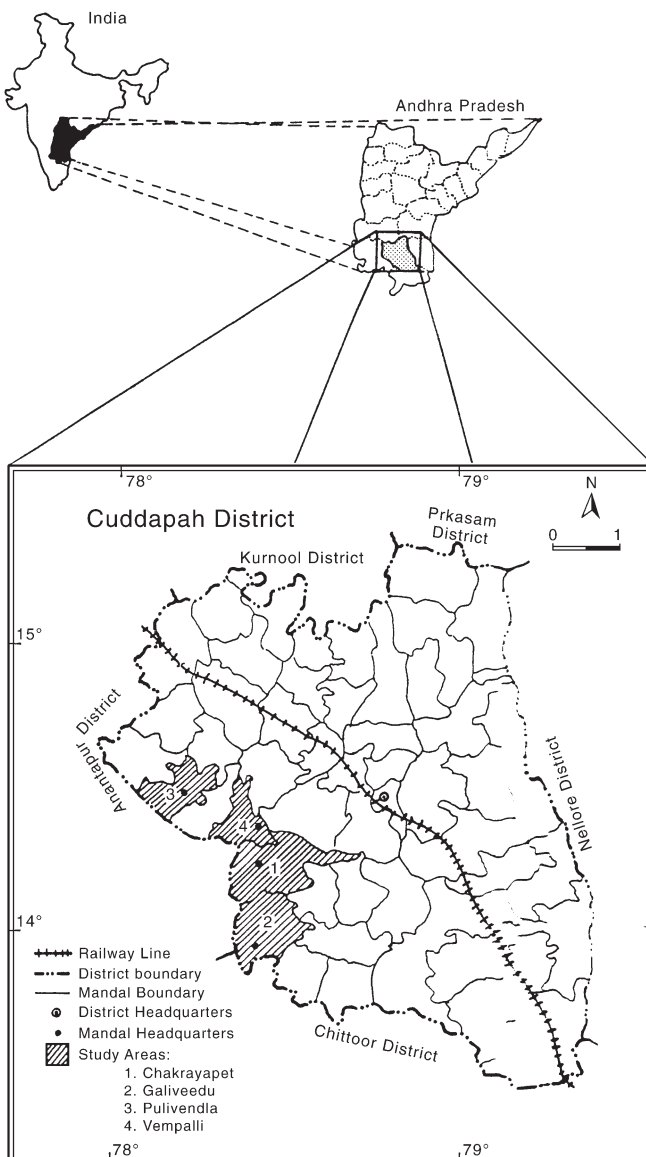


Figure 1. Map showing the study area.

### Protein-calorie adequacy status

The categorization of individuals into protein and calorie adequacy and inadequacy has been undertaken according to the methods suggested by the Indian Council of Medical Research expert committee.<sup>12</sup>

The protein and energy requirement curves are assumed to follow Gaussian Distribution with a coefficient of variation of 15%. Gaussian Distribution has the property that mean  $\pm 2$  SD would cover approximately 95% of the individual values within the distribution. If any individual value falls below mean  $-2$  SD, it cannot be treated as having occurred by chance. Hence, an individual is considered to be consuming adequate calories or protein if the intakes are equal to or greater than mean  $-2$  SD of the RDA for the corresponding age, sex and activity. An individual is considered to be consuming inadequate calories or proteins when the intakes are less than mean  $-2$  SD of the RDA. Using the above cut-off levels for protein-calorie adequacy of the individuals who were included in the diet survey, the following categorizations were made:

- P + C+ = protein adequacy-calorie adequacy
- P + C- = protein adequacy-calorie inadequacy
- P - C+ = protein inadequacy-calorie adequacy
- P - C- = protein inadequacy-calorie inadequacy.

## Results and discussion

### Dietary habits

The staple food of the Sugalis is unleavened bread (*Jowar* or *bajra roti*) made out of great millet or spiked millet flour. The Sugalis usually had two major meals in a day, one in the morning and the other in the evening. They took the morning meal between 8.30 and 10.00 am, an afternoon meal between 12.00 and 2.00 pm and the evening meal between 7.30 and 9.00 pm. During the morning they ate dumpling (*sangati*) made out of *Jowar* or *Bajra* flour with a mixture of finger millet (*ragi*) flour with red chilli chutney or groundnut chutney. During the afternoon they usually ate *roti* made out of great millet (*jowar*) or spiked millet (*bajra*) flour with dhal made out of red gram or green gram. In the afternoon, some families ate the same food that was prepared in the morning. In the evening, they usually ate rice or rice made out of black millet (*korra*) accompanied by a curry or chutney.

A few families regularly drank coffee in the morning and occasionally at other times, such as during visits from their relatives. The Sugalis consumed non-vegetarian foods such as lamb meat, chicken and pork at least once every 2 weeks. Most of the Sugali families consumed buttermilk or curd along with their meals.

The Sugalis consumed vegetables such as *brinjal* (egg-plant), ladies finger (okra), cluster beans and tomatoes. Of the underground stems and tubers, they consumed onions and potatoes. Of the leafy vegetables, they consumed *gogu* (*Hibiscus cannabinus*), durmstick leaves (*Moringa oleifera*) and curry leaves (*Murraya koenigii*). They consumed condiments such as chillies, coriander, garlic and turmeric. Groundnut oil was used in all preparations. *Poori* or *chapati* made out of wheat flour was consumed occasionally by the Sugalis, usually during festivals and other special occasions. The Sugali men and some women consumed liquor on all socio-religious occasions. A few men took liquor everyday. It

was observed from the dietary habits of Sugalis that they have a very balanced diet in terms of ingredients but that their diets are low in caloric value.

### Food consumption

The average intake of different foodstuffs by Sugali males and females of different age groups is given in Tables 1 and 2. It can be observed from the tables that carbohydrates from cereals and millets are the main source of Sugali diets. In general, the consumption of different foodstuffs steadily increases with age in both sexes, while the consumption of milk and milk products decreases with age. During preschool ages the consumption of milk and milk products was high. The mean consumption of different foodstuffs by different age groups when compared to the RDA was found to be grossly inadequate.<sup>12</sup>

### Nutrient intake

Table 3 shows the average intake of nutrients by different age groups of Sugali males. The consumption of calories in all age groups was found to be lower than the RDA. The mean consumption of protein also fell below the RDA, except in adults. The consumption of fats and calcium was high during adulthood compared with the RDA of that group. Adequacy

in calcium during adulthood is possibly due to the routine consumption of *ragi* (*Eleusine coracana*). It appears that Sugali males consume relatively large amounts of thiamine, which is largely available in *raagi* or *jowar*. However, it appears from Table 3 that the overall consumption of different nutrients of Sugali males is considerably below the RDA. The consumption of Vitamin A seems to be lower than the RDA in all groups.

Table 4 presents the average intakes of nutrients by different age groups of Sugali females. The average consumption of calories and proteins by Sugali females was considerably nearer to the levels of RDA. In the age groups of 13–15 years, 16–18 years and during adulthood they were consuming more calories than recommended in the RDA. The average intake of Vitamin A was lower than the RDA for all age groups. The consumption of fat and calcium at the age group of 16–18 years and during adulthood was higher than recommended in the RDA. The intake of iron at the age groups of 10–12 years, 13–15 years, 16–18 years and adulthood was also higher than RDA. However, the intake of thiamine was higher in all of the age groups than is recommended in the RDA.

It is evident from Tables 3 and 4 that during their preschool ages both males and females show large deficiencies

**Table 1.** Average intake of foodstuffs (g/day) by different age groups of Sugali males

Foodstuffs	Age (years)													
	1–3		4–6		7–9		10–12		13–15		16–18		Adults	
	PS	RDA	PS	RDA	PS	RDA	PS	RDA	PS	RDA	PS	RDA	PS	RDA
Cereals and millets	168	175	234	270	326	–	362	420	384	–	425	–	480	520
Pulses (legumes)	11	35	14	35	18	–	21	45	23	–	28	–	36	50
Green leafy vegetables	3	40	6	50	8	–	11	50	12	–	14	–	15	40
Other vegetables	9	20	15	30	18	–	21	50	25	–	31	–	34	70
Roots and tubers	12	10	18	20	22	–	25	30	33	–	39	–	43	60
Milk and milk products	108	350	63	250	34	–	23	250	18	–	16	–	14	200
Meat products	3	–	6	–	11	–	14	–	19	–	22	–	28	–
Nuts and oil seeds	2	–	6	–	10	–	13	–	17	–	21	–	26	–
Fats and oils	1	15	3	25	4	–	5	40	7	–	9	–	12	45
Condiments and spices	8	–	2	–	6	–	8	–	9	–	12	–	13	–
Sugar and jaggery	5	30	7	40	8	–	9	45	10	–	12	–	14	35
No. individuals	52		58		49		31		32		28		242	

PS, Present study; RDA, Recommended Dietary Allowances.

**Table 2.** Average intake of foodstuffs (g/day) by different age groups of Sugali females

Foodstuffs	Age (years)													
	1–3		4–6		7–9		10–12		13–15		16–18		Adults	
	PS	RDA	PS	RDA	PS	RDA	PS	RDA	PS	RDA	PS	RDA	PS	RDA
Cereals and millets	156	175	220	270	288	–	324	380	362	–	383	–	434	440
Pulses (legumes)	10	35	16	35	15	–	21	45	25	–	29	–	32	50
Green leafy vegetables	2	40	5	50	7	–	9	50	12	–	16	–	18	100
Other vegetables	7	20	14	30	16	–	22	50	25	–	29	–	36	40
Fruits and tubers	11	10	15	20	18	–	21	30	23	–	26	–	32	50
Milk and milk products	112	300	58	250	32	–	26	250	18	–	14	–	12	50
Meat products	2	–	5	–	7	–	9	–	14	–	18	–	22	–
Nuts and oil seeds	2	–	6	–	8	–	11	–	14	–	16	–	19	–
Fats and oils	1	15	3	25	4	–	6	35	7	–	8	–	9	25
Condiments and spices	1	–	2	–	4	–	5	–	7	–	9	–	11	–
Sugar and jaggery	4	30	6	40	9	–	11	45	13	–	15	–	16	20
No. individuals	42		32		64		29		23		26		258	

PS, Present study; RDA, Recommended Dietary Allowances.

**Table 3.** Average intake of nutrients (per day) by different age groups of Sugali males

Nutrients	1-3		4-6		7-9		Age (years) 10-12		13-15		16-18		Adults	
	PS	RDA	PS	RDA	PS	RDA	PS	RDA	PS	RDA	PS	RDA	PS	RDA
Calories														
kcal	846	1287	1458	1752	1634	2075	1854	2194	2132	2447	2318	2642	2464	2750
kJ	3541	5387	6103	7334	6840	8686	7761	9184	8925	10 243	9703	11 059	10 314	11 512
Proteins (g)	18.2	21.3	23.6	29.2	36.5	40.0	42.3	51.9	58.1	67.0	62.3	75.1	66.7	60.0
Fats (g)	12	25	18	25	22	25	28	22	32	22	36	22	39	20
Calcium (mg)	186	400	248	400	353	400	432	600	534	600	618	500	624	400
Iron (mg)	6.4	11.5	14.2	18.4	21.6	26.0	25.1	34.2	31.6	41.4	34.7	49.5	38.2	28.0
Vitamin A (µg)	192	400	233	400	384	600	438	600	463	600	475	600	484	600
Thiamine (mg)	0.58	0.6	0.82	0.9	1.21	1.0	1.28	1.10	1.32	1.20	1.41	1.30	1.58	1.40
Riboflavin (mg)	0.43	0.8	0.81	1.10	0.93	1.20	1.32	1.30	1.12	1.50	1.08	1.60	1.16	1.70
Niacin (mg)	6.7	8.5	9.8	11.6	13.1	13.7	14.3	14.5	14.6	16.2	16.4	17.4	17.8	18.2
Vitamin C (mg)	11.5	40	18.6	40	28.7	40	26.8	40	29.2	40	33.6	40	39.4	40
No. individuals	52		58		49		31		32		28		242	

PS, Present study; RDA, Recommended Dietary Allowances.

**Table 4.** Average intake of nutrients (per day) by different age groups of Sugali females

Nutrients	1-3		4-6		7-9		Age (years) 10-12		13-15		16-18		Adults	
	PS	RDA	PS	RDA	PS	RDA	PS	RDA	PS	RDA	PS	RDA	PS	RDA
Calories														
kcal	824	1193	1538	1630	1652	1833	1867	1965	2032	2056	2104	2064	2158	2100
kJ	3449	4994	6438	6823	6915	7673	7815	8225	8506	8606	8807	8640	9033	8791
Proteins (g)	17.2	19.9	21.6	28.4	28.8	39.6	37.8	55.0	52.4	62.1	58.3	60.4	67.4	50.0
Fats (g)	14	25	19	25	22	25	26	22	28	22	32	22	36	20
Calcium (mg)	158	400	243	400	364	400	422	600	468	600	536	500	584	400
Iron (mg)	6.3	11.5	16.4	18.4	22.3	26.0	26.8	18.9	32.6	28.0	34.3	29.9	36.5	30.0
Vitamin A (µg)	184	400	238	400	296	600	354	600	422	600	467	600	483	600
Thiamine (mg)	0.61	0.6	0.82	0.8	0.93	0.9	1.12	1.0	1.16	1.0	1.28	1.0	1.32	1.0
Riboflavin (mg)	0.53	0.7	0.71	1.0	0.92	1.1	0.96	1.2	1.18	1.2	1.26	1.2	1.28	1.3
Niacin (mg)	5.8	7.9	8.3	10.8	11.6	12.1	12.6	13.0	13.4	13.6	13.8	13.6	14.2	13.9
Vitamin C (mg)	14.3	40	18.6	40	22.4	40	24.8	40	26.7	40	32.5	40	36.3	40
No. individuals	42		32		64		29		23		26		258	

PS, Present study; RDA, Recommended Dietary Allowances.

in the intakes of different nutrients when compared to the RDA. This is most probably due to the practice of prolonged breast feeding without dietary supplementation. It was noticed in the field that most of the Sugali mothers continued to breast feed their children for up to 2 years. They did not extend much attention to supplementing nutrients in the chil-

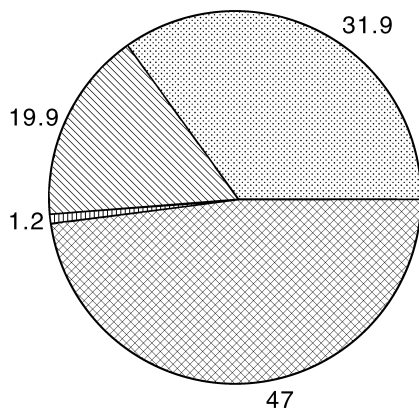
dren's diets. Though breast feeding is most beneficial to the child, after 6 months of age the practice of breast feeding without supplementation can be detrimental to the health of the child.<sup>13</sup>

**Protein-calorie adequacy status**

Protein-calorie adequacy status of Sugali males and females by different age groups was derived and presented in Tables 5 and 6, respectively.

It can be observed from Table 5 and Fig. 2 that the majority of Sugali males (47.0%) were deficient in both protein and calories (P-C-). Approximately 31.9% of males were consuming adequate calories and proteins (P+ C+). A total of 19.9% of Sugali males were adequate in protein and inadequate in calories (P+ C-). Only 1.2% of them were inadequate in protein and adequate in calories (P- C+). Thus, the majority of Sugali males were found to have inadequate protein and calorie (P-C-) intakes in all age groups. The deficiency in calories was higher (66.9%) than the deficiency in protein (48.2%) among Sugali males.

Table 6 and Fig. 3 present the protein-calorie adequacy status of Sugali females. Inadequacy in both protein and calories (P- C-) was higher (41.6%) than adequacy in protein and



**Figure 2.** Protein-calorie adequacy status (%) of Sugali males. (■) P+ C+; (▨) P+ C-; (▧) P- C+; (▩) P- C-.

**Table 5.** Protein-calorie adequacy (%) in Sugali males by age

Age (years)	n	Adequacy status					
		P+ C+	P+ C-	P- C+	P- C-	P-	C-
1-3	52	21.2 (11)	17.3 (9)	0.0 (0)	61.5 (32)	61.5 (32)	78.8 (41)
4-6	58	19.0 (11)	22.4 (13)	1.7 (1)	56.9 (33)	58.6 (34)	79.3 (46)
7-9	49	16.3 (8)	28.6 (14)	0.0 (0)	55.1 (27)	55.1 (27)	83.7 (41)
10-12	31	22.6 (7)	29.0 (9)	0.0 (0)	48.4 (15)	48.4 (15)	77.4 (24)
13-15	32	25.0 (8)	18.8 (6)	3.1 (1)	53.1 (17)	56.3 (18)	71.9 (23)
16-18	28	35.7 (10)	17.9 (5)	0.0 (0)	46.4 (13)	46.4 (13)	64.3 (18)
Adults (Moderate)	242	42.1 (102)	17.4 (42)	1.7 (4)	38.8 (94)	40.5 (98)	56.2 (136)
Overall	492	31.9 (157)	19.9 (98)	1.2 (6)	47.0 (231)	48.2 (237)	66.9 (329)

Note: numbers in parentheses indicate the number of individuals.

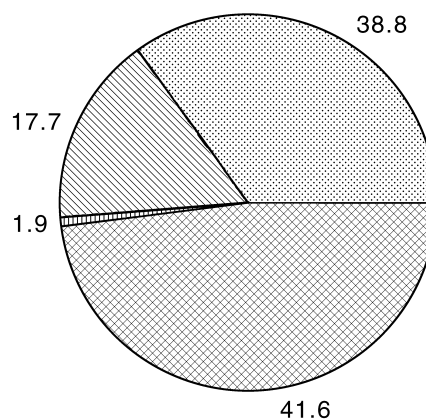
**Table 6.** Protein-calorie adequacy (%) in Sugali females by age

Age (years)	n	Adequacy status					
		P+ C+	P+ C-	P- C+	P- C-	P-	C-
1-3	42	33.3 (14)	9.5 (4)	2.4 (1)	54.8 (23)	57.1 (24)	59.5 (25)
4-6	32	25.0 (8)	18.8 (6)	3.1 (1)	53.1 (17)	56.3 (18)	71.9 (23)
7-9	64	29.7 (19)	14.1 (9)	3.1 (2)	53.1 (34)	56.3 (36)	67.2 (43)
10-12	29	31.0 (9)	20.7 (6)	3.5 (1)	44.8 (13)	48.3 (14)	65.5 (19)
13-15	23	26.1 (6)	30.4 (7)	0.0 (0)	43.5 (10)	43.5 (10)	73.9 (17)
16-18	26	34.6 (9)	19.2 (5)	3.9 (1)	42.3 (11)	46.2 (12)	65.4 (17)
Adults (Moderate)	258	46.1 (119)	18.2 (47)	1.2 (3)	34.5 (89)	35.7 (92)	52.7 (136)
Overall	474	38.8 (184)	17.7 (84)	1.9 (9)	41.6 (197)	43.5 (206)	59.3 (281)

Note: numbers in parentheses indicate the number of individuals.

calories (P+ C+, 38.8%) among Sugali females. Only 1.9% of them were found to be inadequate in protein and adequate in calorie intake (P- C+). Protein adequacy and calorie inadequacy (P+ C-) were noticed in 17.7% of Sugali females. However, they were more deficient in calories (59.3%) and less deficient in protein (43.5%).

It can also be determined from the tables that both Sugali males and females show higher percentages of deficiency in calories (66.9 and 59.3, respectively) than in proteins (48.2 and 43.5, respectively). It is a known fact that in India the primary bottleneck in the diets of poor economic groups is calories and not proteins.<sup>14,15</sup>

**Figure 3.** Protein-calorie adequacy status (%) of Sugali females. (■) P+ C+; (▨) P+ C-; (▩) P- C+; (▧) P- C-.

It is clear from Tables 5 and 6 that Sugali females show a higher percentage (38.8) for adequacy in both protein and calories (P+ C+) than do the males (31.9) for that category. A similar pattern of a higher percentage of protein-calorie adequacy in females was also observed from the survey conducted by the National Nutrition Monitoring Bureau (NNMB) on the tribals of Andhra Pradesh.<sup>16</sup> It was also observed from Tables 5 and 6 that the percentage of females in deficiency of calories is less (59.3) than that of males (66.9).

It was evident from this study of a representative sample of Sugali families that there was a steady gap in food and nutrients from the beginning of preschool age to adulthood. The mainstay of the Sugali diet is cereals and millets, with very low intake of fats and oils, protein-rich foods such as pulses, meat products and mineral/vitamin-rich foods such as leafy vegetables and other vegetables. As a result, a considerable difference was observed between calorie and protein intake in comparison with RDA.

The tribe 'Sugali' suffered from a calorie gap rather than from a protein gap. Without correcting the existing calorie gap, the provision of protein concentrates will not prevent protein-calorie malnutrition. The problem of protein-calorie malnutrition among Sugalis can be corrected by improving the socioeconomic conditions of that group. As a long-term solution to overcome this problem, it will be necessary for the Sugalis to diversify their dietary pattern to include milk, vegetables and usual protein foods such as legumes in order to meet the RDA.

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