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A study on nutritional status of tribal children and enlightment of herbal nutrients as curative

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Abstract
Malnutrition has become a major issue among children, particularly in developing countries. India is undergoing rapid socioeconomic, demographic, nutritional and health changes. The main objectives of the study were to determine the prevalence and determinants of nutritional status of tribal children from Pillur beat, Coimbatore District, Tamil Nadu. The study is based on a survey conducted among the 60 tribal children aged between 4 to 11 during January - March 2020. A Chi-square test was used to analyze the nutritional status by weight for age, height for age and weight for height based on anthropometric measurements. The food consumption profile of the tribal children was documented through official interviews and respondent questionnaires. The nutritional status of tribal children in India is dangerous. Among the sixty surveyed tribal children, 53.33 % of respondent's tribal child not had any nutritional deficiency and 46.67 % of them had some nutritional deficiency. Further, the most common food eaten by the tribal children was rice, millets and dhals. The development in herbal products and medicinal herbs for three species has been concentrated and identified in the present study. The present finding indicates that the nutritional programs and health policies are to be implemented among tribal children to solve the problem of undernutrition. The knowledge generated by this study can help policymakers to develop synergies between nutrition programs and poverty reduction strategies.

Keywords: tribal children; pillur Beat; under-nutrition; stunting; wasting and nutritional evaluation

Introduction

Children are not only the future of a nation; they are the pillars of the world and mankind also. An expectation of the country mainly depends upon healthy children. Children's health is focused on the interaction of a multitude of persuades that reflecting complex processes. Malnutrition in early childhood has serious, long-term consequences because it impedes motor, sensory, cognitive, social and emotional development [1]. Usually, malnutrition deficiency symptoms are developed from an inequity between the body's requirements and the daily intake of nutrients. In conditions with the uptake of nutrients, it was grouped into under-nutrition in which nutrients are underprovided and over-nutrition, in which nutrients are oversupplied [2]. Malnutrition greatly affects all groups in a community, but tribal infants and young children are most vulnerable due to their nutritional requirements for growth and development. The Coimbatore District constitutes a total of 683 numbers of Scheduled Tribe populations. The ethnic dominant groups of tribes like Irula, Badaga, Toda, Kota and Kurumba are living in the Western Ghats of Coimbatore District, specifically found in the hilly track of Nilgiris Districts. By nature, geographically tribals are barred from formal education, inappropriate health behavior, bounded socio-cultural taboos, poverty and dependency on primal agriculture practices for livelihoods [3].

India having its wealthy heritage of medicinal plants, the usage of herbals by tribal people for treating health issues seems to be an interesting and encouraging step. On account of the least side effects, safety and cost affordability of traditional herbs is being practiced for a long time to control such problems. Culinary herbs are broadly used by women for correction of many health issues in day-to-day life, there is an urgent need and awareness to be created among tribes of all ages to apply and for the usage of such herbals for their effective healthy life, which is very much essential nowadays. Generally, the nutritional status of Irulas in the Western Ghats is critical. They need appropriate measures taken by the respective authorities to improve childhood health and nutritional status. The food consumption pattern of people is vital not only for assessing the nutritional status of the community but also for explicates the food needs of the population.

With the above background, the present study makes the first attempt to explore the different factors contributing to malnutrition among 3 - 11 years of children in Pillur Beat, which is situated in the Karamadai Range of Coimbatore Forest Division, Western Ghats of Tamil Nadu, India. Together, analyzing the nutrient content of three important species, occasionally used by Irula tribes that are collected in and around their region by initiating nutritional counseling through education. For that, the medicinally important nutritional species like *Withania somnifera* Dun, *Moringa oleifera* Lam. and *Solanum trilobatum* L. were collected from different villages of Pillur beat and its surrounding area in Karamadai Range during 2020 – 2021.

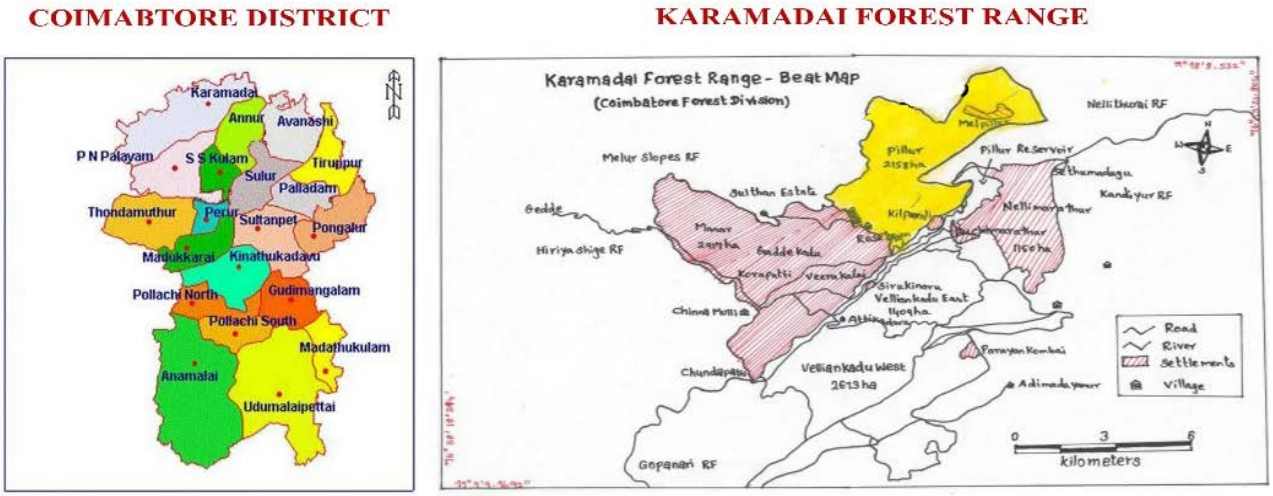
For that the following objectives were framed: i) To determine the socio-demographic, environmental factors and anthropometric evaluation among selected tribal children ii) Addressing the food consumption pattern and nutritional needs of tribal children iii) To analyze various micro and macronutrients from some medicinally important nutritional species and assess the knowledge and practice of the family regarding the young children nutrition by nutritional counseling.

Limitations of the Study

The study is mainly based on primary data. There is a risk that because of the presence or influence of the interviewer in face-to-face interaction, the interviewer might unknowingly bring out an untrue response to sensitive questions, eg. The respondent may craft an answer to please the interviewer instead of answering truthfully or the interviewer might record a verbal response incorrectly because the statement is not interpreted correctly.

Study Area

The study was conducted in the Irular tribal blocks of Western Ghats situated in the Coimbatore District. There are four tribal blocks were situated in Coimbatore District namely Karamadai, Madhukkarai, Perianayakanpalayam and Thondamuthur. The study area Karamadai Range is situated in the Southern Western Ghats of Coimbatore District, Tamil Nadu. The area of investigation approximately lies between 11˚18' latitude and 76˚ 53" longitude, which contains a total of twenty-two tribal inhabited villages. Each village is occupied by the altitudinal range between 442 – 493 MSL. The Karamadai Range consisting of 5 beats, which include Velliangadu East Beat, Velliangadu West Beat, Nellimarathur Beat, Pillur beat and Manar Beat. Amongst these, the Pillur Beat comprises Korappathi, Veerakkal, Baralikkadu, Poochamarathur and Melpillur localized villages with 97 households, approximately 369 people (Irula tribals) in the forest slopes, who are living in small groups, where the study was undertaken with Irular tribals (Map 1).



SATELLITE MAP SHOWING THE STUDY AREA

Map 1: Location of Study Area

Materials and Methods

Climatic data of the study area were collected from District Forest Office, Coimbatore Circle, Tamilnadu, India and from the Regional Metrological Centre, Metrological Department, Chennai, Tamil Nadu, India.

Sources of Data Collection

For analyzing demographic profiles, the study was conducted for a period of three months from January 2020 to March 2020. At the time, the demographic profile of these tribal blocks was assessed through semi-structured interviews cum personal observation by the investigator. Data were collected from 60 parents-tribal children (3-11 years). The infrastructures available for the tribals like a network of roads, water and electricity, drainage facilities, hospital and school facilities were observed and recorded by the investigator during her visits to these tribal areas. The respondents (that is parents) and their children were selected by simple random sampling techniques. All the necessary data were collected by face-to-face interview by the researcher himself. Nutritional status is determined from a nutritional assessment, typically consists of anthropometrics, dietary assessment, socio-demographic and drug-nutrient interaction. The food habit, awareness of the food items provided to the tribal child, distribution of the tribal children according to their frequency of food consumption were also screened by the food frequency questionnaire method [4]. The major cereals, pulses, green leafy spinach, vegetables, roots and tubers are taken by the tribal children as food were also studied. Finally, the Knowledge Attitude Practices (KAP) of the tribal children was assessed through standard questionnaires, the scores were allotted for each question and the impact was assessed.

Anthropometric Measurement

The weight was taken in kilogram with the help of a weighing machine, the height of the child was measured with the help of measuring tape in cm and Mid Upper Arm Circumference (MUAC) of the left hand was measured by using measuring tape, also assessed through weight-for-age (underweight), height-for-age (stunting) and weight-for-height (wasting) standards according to Gomez and Water low's classification.

Dietary Assessment and Nutrition Counselling

The method Diet history is useful for obtaining qualitative details of diet and studying the patterns of food consumption at household. The procedure includes assessment of the frequency or consumption of different foods daily or weekly or occasionally [5]. Nutrition counseling was imparted to the selected tribal children and their parents for two months at the interval of 15 days using demonstration. The duration of the counseling was 30 minutes.

Nutrient Analysis

The medicinally important nutritional species like *Withania somnifera* Dun, *Moringa oleifera* Lam. and *Solanum trilobatum* L. were collected from different villages of Pillur beat and its surrounding area in Karamadai Range during 2020-2021 for analyzing nutrient content.

Proximate analysis of medicinally important Nutritional Species

The moisture and total ash values were determined from the plant materials [6, 7]. The proximate compositions like carbohydrate, crude fibre, proteins and fat of the plant samples were determined [8].

Estimation of Minerals in the Medicinally important Nutritional Species

The macro and micronutrients like Calcium (Ca), Phosphorous (P), Potassium (K), Magnesium (Mg), Iron (Fe), Manganese (Mn) and Zinc (Zn) were analyzed with the use of respective cathode lamp [9].

Knowledge Attitude Practices (KAP)

Knowledge Attitude Practices (KAP) was assessed by using a checklist to find out the effect of intervention programs with the component on nutritious rich foods. Multiple-choice questions were prepared to find the pre and post-knowledge, attitude and practices of the selected tribal children. Scores were allotted for each question and the impact was assessed. Scores of one, half and zero were awarded respectively to each correct, partially correct and wrong answer. A gain in scores and percent improvement was calculated by using the following equation: Gain in scores = Scores of post-tests - Scores of pre-tests

$$\text{Percentage of improvement} = \frac{\text{Gain in scores}}{\text{Pre test scores}} \times 100$$

Ethical issues

Ethical clearance was obtained from the Research Ethics Forum of Vellalar College for Women (Autonomous), Erode-12.

Statistical Analysis

The use of statistical tests like Mean, Standard Deviation, Simple Percentage Analysis and Chi-square test were used to analyze the data.

Results and Discussion

Malnutrition in children has globally decreased over the past few decades, climate change has the potential to reverse the recent gains in the global reduction of malnutrition [10]. The climatic data such as temperature, rainfall, rainy days, relative humidity and cloudy of the study area were observed for 12 months from January 2020 to December 2020. The intensity of solar radiation is generally high in April and May months and the same month exhibited a maximum temperature of 35ºC. The total rainfall for the year 2020 (January to December) was 1879.4 mm. The maximum high rainy days were observed in July. The annual relative humidity of the study area was ranged between 49 - 80 %. Considering rainfall and rainy days, the cloud conditions occurred in the range of 22 – 62 %.

Socio-Demographic Determinants of Malnutrition among the Tribal Children

Gender is defined by FAO as 'the relations between men and women, both perceptual and material [11]. Among the sixty tribal children surveyed, 35 % of the children were from 4 to 6 years of age group. Generally, the concept of gender is vital because they are applied for social analysis. The most vital determinants of the women's nutrition

knowledge were educational level, age and their kind of occupation [12]. The percentage of females in eleven-year age groups declines 21 (35 %) steadily with increasing age of male 39 (65 %). Whereas, the gender-wise distribution of the respondents showed 24 (40 %) were boys and 36 (60 %) were girls. The present investigation depicts that the majority of the respondents were labour (56.67 %) followed by farmers (21.67 %) and self-employed (8.33 %) respectively (Table 1). Anup Kumar Kapoor and Meenal Dhall (2016) pointed out that education is one of the most powerful means of bringing socio-economic development among Scheduled Tribes which should be promoted and encouraged.

In the present observation, more than half (56.10 %) of the tribal children have stunted whose parents were primary level educated. Together, 57.89 % of tribal children's parents were normal in height and completed primary school level. The calculated Chi-Square value (3.83) is lesser than the tabulated value (9.49) therefore, the association between the education of parents and nutritional status (Height-for-Age) of children is found not significant. Most of the studies stated by UNICEF (2019) found that there is an important relationship between parent's education and the nutritional grade of children.

Table 1: Demographic determinants of Malnutrition among the tribal children n=60

Factors		No. of Subjects	Percentage
Socio-demographic determinants			
Age of tribal children	Below 4	12	20
	4 to 6	21	35
	6 to 9	17	28.33
	9 to 11	10	16.67
Gender	Male	39	65
	Female	21	35
Gender of Tribal Children	Boys	24	40
	Girls	36	60
Occupation	Labour	34	56.67
	Agriculture	13	21.67
	Self-employed	5	8.33
	Others	8	13.33
Environmental determinants			
Average monthly income	<5,000	26	43.33
	5,000-10,000	14	23.33
	10,001-15,000	11	18.34
	> 15,000	9	15
Source of Water	Paanchayat Pipes	11	18.33
	Pipe with house connection	16	26.67
	Rain Fed	14	23.33
	Irrigation by canal	19	31.67
Type of Household	Hut	23	38.33
	Mud	12	20
	Tiled Roof	15	25
	Terrace	10	16.67
Toilet facility	Yes	37	61.67
	No	23	38.33
Quantity of Food (Opinion)	Yes	46	76.67
	No	14	23.33
Socio-cultural determinants			
Hospitalized Child Ratio	Yes	17	28.33
	No	43	71.67
Sleeping Hours	Less than 5 Hours	11	18.33
	5 – 7 Hours	19	31.67
	More than 7 Hours	30	50
Child Nutritional Deficiency	Yes	28	46.67
	No	32	53.33
Child Medications	Yes	22	36.67
	No	38	63.33
Major Food Items taken by the tribal children			
Cereals	Rice	18	30
	Maize	21	35
	Bajra	14	23.33
	Other Millets	7	11.67
Pulses	Peas	13	21.67
	Green Grams	23	38.33
	Black Grams	17	28.33
	Others	7	11.67
Green Leafy Spinach	Amaranth	13	21.67
	Fenugreek leaves	21	35

	Drumstick leaves	17	28.33
	Others	9	15
Vegetables	Bottle gourd	8	13.33
	Brinjal	10	16.67
	Ladies Finger	13	21.67
	Tomato	9	15
	Bitter gourd	14	23.33
	Others	6	10
Roots and Tubers	Sweet Potato	11	18.33
	Onion	16	26.67
	Tapioca	25	41.67
	Others	8	13.33
Anthropometric Evaluation			
Height (in cm)	Below 85	6	10
	86 to 110	31	51.67
	111 to 125	18	30
	Above 125	5	8.33
Weight (in kgs)	Below 12	5	8.33
	12 to 16	23	38.33
	16 to 20	17	28.34
	Above 20	15	25
Nutritional Status (Weight-for-Age) (Gomez)	Normal (90-110)	24	40
	Mild Malnutrition (Gr-I) (75-90)	18	30
	Moderate Malnourished (Gr-II) (60-75)	13	21.67
	Severe Malnourished (Gr-III) (≤60)	5	8.33
Nutritional Status (Height-for-Age) (Waterlow's)	Normal (>95 %)	19	31.67
	Mild impaired (87.7 - 95 %)	29	48.33
	Moderate impaired (80 % - 87.5 %)	8	13.33
	Severely impaired (<80 %)	4	6.67
Nutritional Status (Weight-for-Height) (Waterlow's)	Normal (>90 %)	28	46.67
	Mild Impaired (80 % - 90 %)	17	28.33
	Moderate Impaired (70 % - 80 %)	10	16.67
	Severely Impaired (<70 %)	5	8.33
Nutritional status (MUAC)	Normal	22	36.67
	Mild Malnutrition	38	63.33
Diet Preference	Vegetarian	33	55
	Non-Vegetarian	27	45

Environmental determinants of Malnutrition among the tribal children

Moreover, 23.33 % of the family respondents had their family income between Rs. 5,000 and 10,000 (14 Households) and 18.34 % of them had between Rs. 10, 001 to 15, 000 (11 Households). The fact indicates that nearly half of the family household's income is below Rs.5, 000. Similar conclusions were arrived [15] wherein the association between family, annual income and nutritional status of children are insignificant because almost all children were normal whose family income was low. 31.67 % of the respondents get water sources for irrigation by a canal. Initially, Borooah (2004) pointed out the relative effects of diverse factors like quality of water supply, mother's literacy, housing conditions and the level of growth of the villages.

According to Sivaraman (2014) survey report, the Irulas are live in the pockets of Western Ghats of Coimbatore District. The 38.33 % of the respondent's house type was a hut, 25 % of the respondent's house was made up of the tiled roof, 20 % of the respondent's house was made up of mud and finally, 16.67 % of the respondents' house was made up of terrace. The scores assessment was mainly based on certain household characteristics like house building material, piped water, electric light, presence of a refrigerator and a toilet inside the house and the totaling values ranged from 0 to 10 assessed [18]. Similarly, in the present study, 38.33 % of the respondents did not have any toilet facilities. They are using common toilets provided by the Government and also using open forest areas for their daily routines. Foods and beverages sold at schools outside of the federally reimbursable school nutrition programs are referred to as "competitive foods" because they compete with the traditional school lunch as a nutrition source [19]. The current study indicated that 76.67 % of respondent's children get a sufficient quantity of food from their school and 23.33 % of respondent's children don't get a sufficient quantity of food from their school (Table 1).

Socio-cultural determinants of Malnutrition among the tribal children

Socio-cultural factors like demography, socioeconomic status, feeding practices, knowledge and beliefs are related to malnutrition in children. This was supplemented by a detailed physical examination and anthropometric assessment [20]. From the table, 55 % of respondents received child care assistance from Anganwadi, 38.33 % of respondents received from primary hospitals, 48.33 % were received from senior persons, 31.67 % of respondents were received from newspaper and 43.33 % of respondents received through radio or television.

Among 60 respondents surveyed, 71.67 % of respondent's tribal child was not hospitalized in last two weeks of the study period. The private trusts and foundations were used

to conduct medical camps occasionally in these irular tribal areas as a part of their community welfare activities [21]. Narasimhan *et al*. (2020) discussed sleep problems during infancy and early childhood is fairly common and rarely recognized in pediatric practice. 50 % of the respondent's tribal children sleep more than 7 hours daily, 31.67 % of the respondents' tribal children sleep 5 - 7 hours daily and 18.33 % of them slept less than 5 hours daily. Among the sixty surveyed tribal children, 53.33 % of respondent's tribal child not had any nutritional deficiency and 46.67 % of them had some nutritional deficiency. The nutritional status of tribal children in India is dangerous. Appropriate measures should be taken by the respective authorities to improve childhood health and nutritional status [23]. About 63.33 % of the respondent's tribal child does not take any medications for a long time and also 36.67 % of the respondent's tribal child takes medications for a long time.

The 81.67 % of respondents (father and mother) reported their children had measles, 93.33 % of them had reported with ARI morbidity condition, 83.33 percent were reported with fever, 88.33 % of them had cold, 91.67 % of respondents reported ear problem during their childhood and 90.00 % were reported anemic and vomiting (Table 2). Similarly, Brajesh Kumar Singh (2020) observed many difficulties among the respondents and reported that 40 % of respondents know contraceptive pills and irrespective of both sexes.

Table 2: Distribution of Morbidity status of the tribal children n=60

Diseases	Yes		No		Total
	No. of Subjects	Percentage	No. of Subjects	Percentage	
Measles	11	18.33	49	81.67	100
Acute Respiratory Infection (ARI)	4	6.67	56	93.33	100
Fever	10	16.67	50	83.33	100
Cold	7	11.67	53	88.33	100
Ear Problem	5	8.33	55	91.67	100
Anemic and Vomiting	6	10.00	54	90.00	100

Anthropometric Evaluation

The significant anthropometric measures are weight, height, waist circumference and hip circumference [25]. The table values indicate that 51.67 % of the respondent's tribal children belonged to the height of 86 to 110 cm. Anthropometric measurements of the present study indicate that 38.33 % of the respondent's child weight was ranged between 12 to 16 kg. The table shows that 40 % were normal in weight but around one-third (30 %) were mildly malnourished, 21.67 % of them were moderately malnourished and very few (8.33 %) were severely malnourished. This study found that underweight children are lower than national status which is 29 percent [26]. Abha Aggarwal and Padam Singh (2002) estimated the nutritional status of children in Delhi by using three indices like weight-for-age, height-for-age and weight-for-height.

Among 60 tribal children, 48.33 % of the children were affected with the mildly impaired condition they need proper nutritional requirements. In respect to height-for-age, more than one quarter (31.67 %) were in normal height, 13.33 % of the children were in moderately impaired condition and 6.67 % were severely impaired with malnutrition. This study found that underweight children are lower than national status which is 29 percent (NDHS, 2011). The 8.33 % of children were associated with a high wasting rate which indicates severe acute malnutrition. According to the report [28] wasting (low weight-for-height) indicates an acute decline in nutritional status experienced by a normally well-nourished child. Out of 60 respondents, the majorities (63.33 %) were under mild malnourished and around 36.67 % of them were well-nourished based on measurement of MUAC. Similar findings were reported [29] where the majority of children (40 %) were normal in weight for age but around 30 % were mild malnourished followed by 21.67 % percent were moderately malnourished and very few (8.33 %) were severely malnourished (Table 1).

Anthropometric Evaluation based on the relation

The 35.3 % of the tribal children were in the range of 1st degree who were from 9 to 11 years of age group, 50 % of the tribal children were in the range of 2nd degree who were from the age group of 6 to 9 years and 40 % of the children were in the range of 3rd degree who were from below 4 years and 6 to 9 years of age group. And the above information reveals that the calculated Chi-square value (13.92) is less than the table value (16.919). Hence the null hypothesis is accepted at a 5 % level of significance. So, there is no significant relationship between the nutrition level and age group of tribal children corresponding with the weight of the children (Table 3.1).

Among the 60 respondents tribal child, 55.56 % of malnourished condition was noted in female children and 75 % of the malnourished condition was noticed in male children. Totally 38 tribal children were living under malnourished conditions. The calculated Chi-square value (2.34) is lesser than the tabulated value (3.84). Therefore, there is no association between the gender of the tribal children and malnutrition (Table 3.2).

The table values show that more than one quarter (78.5 %) of the tribal children were normal whose family annual income was between Rs. 5000 to 10000 but 77.8 % of the tribal children were malnourished whose family income was above Rs.15000. Also, the calculated value (13.88) is greater than the tabulated value (7.82). Therefore, the close association between family annual income and the nutritional status of the tribal children is noted. Seetharaman *et al*. (2007) applied a CIAF (An index that gives the composite effect of anthropometric measurement) and found that this index permits disaggregation of the undernourished children into different subgroups (Table 3.3).

Table 3: Anthropometric Evaluation based on the relation n=60

Table 3.1: Relation between Nutritional status and Age of the tribal children (Waterlow's Classification)

Age of the Tribal Children	Weight for Height*				
	Normal	1st Degree	2nd Degree	3rd Degree	Total
Below 4	7 (25.0 %)	3 (17.6 %)	0 (0.0 %)	2 (40.0 %)	12
4 to 6	12 (42.9 %)	5 (29.4 %)	4 (40.0 %)	0 (0.0 %)	21
6 to 9	7 (25.0 %)	3 (17.6 %)	5 (50.0 %)	2 (40.0 %)	17
9 to 11	2 (7.1 %)	6 (35.3 %)	1 (10.0 %)	1 (20.0 %)	10
Total	28	17	10	5	60

χ^2 cal = 13.92, df = 9, χ^2 tab=16.919 (Not Significant)

Table 3.2: Relation between Nutritional status and Gender of the tribal children (MUAC - Anthropometry measurement)

Gender	Normal	Malnourished	Total
Male	6 (25 %)	18 (75 %)	24 (40 %)
Female	16 (44.44 %)	20 (55.56 %)	36 (60 %)
Total	22 (36.67)	38 (63.33)	60

χ^2 cal = 2.34, df = 1, χ^2 tab=3.84 (Insignificant)

Table 3.3: Relation between Annual family income and Nutritional status of the tribal children (MUAC - Anthropometry measurement)

Income	Normal	Malnourished	Total
<5,000	6 (23.1)	20 (76.9)	26 (43.33)
5,000-10,000	11 (78.5)	3 (21.5)	14 (23.33)
10,001-15,000	3 (27.3)	8 (72.7)	11 (18.34)
> 15,000	2 (22.2)	7 (77.8)	9 (15)
Total	22 (36.67)	38 (63.33)	60

χ^2 cal = 13.88, df = 3, χ^2 tab=7.82 (Significant)

Distribution of the tribal children according to their Food habit and Aware of the Food items provided to tribal child

Insufficient dietary consumption and infectious diseases are major contributing factors to the poor nutritional status of children [31]. About 65 % of the respondents were aware of food items that are provided to their tribal child and 35 % of the respondents were not aware of the food items.

Distribution of the tribal children according to their frequency of Food consumption

The food consumption pattern of the tribal children was documented through formal interviews and questionnaires with the respondents.

As shown in Table 4, 43.33 % of the respondent's tribal child consumed cereals as their food frequently, 38.33 % of them were consumed pulses as their daily food, 55 % of the respondent's tribal child were taken green leafy spinach rarely, 66.67 % of them takes vegetables as their food frequently and finally, 43.33 % of them consumes roots and tubers as their daily food. So, there is a great demand among the women with the usage of medicinal plants with their health coverage and minimum ill effects [32].

Table 4: Distribution of the tribal children according to their frequency of Food consumption n=60

S. No.	Food Products	Food frequency						Total
		Daily		Frequently		Rarely		
		Nos.	Percent	Nos.	Percent	Nos.	Percent	
1.	Cereals	22	36.67	26	43.33	12	20.00	60
2.	Pulses	23	38.33	17	28.33	20	33.33	60
3.	Green Leafy Spinach	15	25.00	12	20.00	33	55.00	60
4.	Vegetables	11	18.33	40	66.67	9	15.00	60
5.	Roots and Tubers	26	43.33	21	35.00	13	21.67	60

The results depict that 35 % of the respondent's tribal child were consumed maize as the main cereals in their food, 30 % of the tribal children consumed rice, 23.33 % of the respondent's tribal children were taken Bajra and 11.67 % of the individuals consumed other types of millets. Together, 38.33 % of the respondent's tribal child consumes green grams as main pulses in their food and 35 % of the respondents consume fenugreek leaves as main green leafy spinach in their day-to-day food chart. The 23.33 % of the respondent's tribal child takes bitter gourd as the main vegetable in their food and 26.67 % of them were taken onion for their daily requirements (Table 1).

Awareness of medicinally important nutritional species among Household respondents

The development in nutritional sciences, herbal products and medicinal herbs are gaining wide attention in the public. Nowadays, people started to eat more fruits, vegetables, dietary supplements, culinary herbs, Phyto-therapeutical substances and other plant foods. Among the 60 household respondents, 71.67 % of respondents were aware of herbal medicinal plants and were know about their importance. Similarly, 28.33 % of the respondents were not aware of herbal medicinal plants.

Evaluation of Physico-chemical parameters of some nutritionally important species in the study area

The proximate analysis is an important criterion in the determination of contamination and the quality of the sample used for the experiment [33]. Malnutrition may be due to undernutrition or overnutrition and is responsible for morbidity and mortality. The moisture content was varied among the individual species, from 69.93 - 80.29 % in the study region. The overall highest 80.29 % of moisture content was recorded in whole aerial plant powders of *Solanum trilobatum* and it is varied individually among the species. The overall highest 19.15 % of ash content was recorded in *Solanum trilobatum* followed by 16.80 % in *Withania somnifera* and 13.65 % in whole aerial plant powder of *Moringa oleifera*. Similarly, the data shows that the fiber contents were ranged between 23.06 - 41.30 %.

Like other Physico-chemical characteristics studied, the protein content also varied among the species. The protein content of the three different species was ranged between 06.70 - 14.43 %. The fat contents were varied between 0.43 - 4.83 %. The carbohydrate contents swayed from 49.79 - 74.78 %. Together, the minimum percentage of carbohydrates was recorded in *Withania somnifera* (49.79 %) (Table 5). Similar nutritional-related findings were observed [34].

Table 5: Physico-chemical parameters of some medicinally important nutritional species in the study area n=60

Name of the Species	Values in Percentage					
	Moisture	Total Ash	Fiber	Protein	Fats	Carbo hydrate
Withania somnifera	69.93±2.16	16.80±0.96	41.30±1.12	06.70±1.21	0.43±0.90	49.79±2.46
Moringa oleifera	71.32±0.31	13.65±0.74	23.06±0.59	14.43±1.54	4.07±0.15	50.48±1.42
Solanum trilobatum	80.29±1.14	19.15±0.58	34.16±2.58	12.09±0.70	4.83±0.56	74.78±0.58

Estimation of minerals in the medicinally important nutritional species in the study area

Among the species tested, the percentage of calcium, potassium and manganese were higher in *Withania somnifera* (411.1 %, 624.5 % and 220.5 ppm). The *Moringa oleifera* registered a higher amount of phosphorous (267.7 %), magnesium (397.0 %), iron (327.2 ppm) and zinc (268.0 ppm) respectively (Table 6). Overall, the species *Solanum trilobatum* registered a trace amount of micro and macronutrients. Similar tests were made [35].

Table 6: Estimation of minerals in the medicinally important nutritional species in the study area n=60

Name of the Species	Ca (%)	P (%)	K (%)	Mg (%)	Fe (ppm)	Mn (ppm)	Zn (ppm)
Withania somnifera	411.1±10.1	263.7±48.3	624.5±127.1	236.9±36.7	257.9±48.7	220.5±14.8	230.1±10.2
Moringa oleifera	135.6±13.6	267.7±2.9	513.3±10.6	397.0±5.3	327.2±44.9	111.7±2.1	268.0±3.3
Solanum trilobatum	92.3±7.05	182.3±3.24	407.7±5.85	272.0±6.54	186.7±6.73	186.7±11.41	80.0±1.05

[#] Values are means of triplicate determinations ± Standard Deviation

Nutritional Attitude test for the selected tribal children Knowledge Attitude Practices (KAP)

The nutrition knowledge of the tribal children in the scores of pre and post-tests of nutrition knowledge and health practices, the pre-test scores of the respondent's child were less when compared with the post-test scores of the child. After the administration of nutrition knowledge to the tribal child, the gain in scores was noted. Simultaneously, the percentage of improvement in nutrition knowledge, lifestyle and hygiene was improved through education (Table 7). Previously, UNICEF (2019) reported that the results of several studies are not similar to the present study because the income of the family alone is not sufficient for the progress of nutritional records.

Table 7: Knowledge Attitude Practices (KAP) n=60

Attitude	Percentage of Tribal Children			
	Before Nutrition Counseling		After Nutrition Counseling	
	No.	%	No.	%
Milk is rich in Calcium and it is good for heart patient	23	38.33	37	61.67
Maximum number of family is suffering from Anemic - Risk is high in Children	21	35.00	39	65.00
Always clean and use the floor	27	45.00	33	55.00
The medicinal plants are having high amount of nutrients	25	41.67	35	58.33

Conclusion

As the tribal population is immobile regarded as the disadvantaged group of population in the society, a special spotlight is required to advance their standard of living which in turn will help to reduce child malnutrition. The various Government NGOs and enlargement organizations should work combine and intentionally to address the poverty and other underlying socio-demographic factors which brutally distress malnutrition status among children. From this documentation among the tribal communities, it is concluded that the nutritional status of the children has been improved after providing education and awareness about the intake of nutritious food and herbal medicines. There is an improvement not only in nutrition but also in their physical hygiene and healthy surroundings.

Authors' contributions

All the authors contributed equally to this paper. Some authors were involved in writing and revising the manuscript and also some authors help with the work presented.

Conflict of interests

The authors declare that no conflict of interest.

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