

INTRODUCTION

In India, each state is practically equivalent to a country with its specific socio-economic and ethnic groups, food habits, health infrastructures and communication facilities. The nutritional status of population groups also shows significant variation between states since it results from a number varying combination of factors (FAO, 2010). India has the largest tribal population which accounts for 8.6 per cent of the total population of the country, numbering 104.3 million (Census, 2011). Indian tribals reside primarily in approximately 15 per cent of the country's area, in various ecological and geo-climatic conditions ranging from plains, forests, hills and inaccessible areas, scattered throughout the country, in different states. More than half of the Indian tribal population is concentrated in the states of Madhya Pradesh, Chhattisgarh, Maharashtra, Orissa, Jharkhand and Gujarat (India Net zone, 2012). It is due to the presence of these tribes that the country has such a diverse and varied flavour.

Post India's independence in 1947, there was a temporary influx of literature on tribals, and tribal research institutes were set up in states that had substantial tribal populations. The purpose of these institutes was to undertake problem-oriented research for the formulation and implementation of development programs in tribal areas. However, though a significant amount of research was carried out in the early stages of these institutes, the output of these institutes has "steadily declined both in quality and quantity". As a result, there have been few sustained interventions employed to combat region specific issues in tribal areas (<http://www.tihf.in/scdcenter.pdf>).

Around 635 tribal groups are located in several pockets of the Indian sub continent in the different states. In Tamil Nadu, tribals are mainly found in the Western Ghats, particularly in the Nilgiris district which is located in the southwest region of the Indian Peninsula, bounded on the West by Kerala, on the North by Karnataka on the East and South by Tamil Nadu. The District lies between 11°, 12' and 11°, 43' N Latitude and 76°, 14' and 77°, 1 'E Longitude. The Nilgiri hills are vast mountain ranges covering an area of about 2545.40 Sq. Km. with undulating hills and elevations varying form 350-2623 m. The Nilgiri district comprises six Taluks, four blocks and 54 villages. The community development blocks in the districts are Gudalur, Udhamandalam,

Kotagiri, Coonoor, Manjur and Pandalur. The annual rainfall ranges from 150-280 cm and the temperature ranges from a minimum of 0°C to a maximum of 30°C. The total population of the district according to latest official figures (2011) is 7,35,394, of which about one-third is natives and tribals and the rest are migrants.

The Primitive tribal population in Nilgiris district accounts for 22,702 (Census, 2011). The main tribal communities found in the district are Thodas, Kotas, Kurumbas, Irulas, Paniyas, Mullukurumbas and Kattunaickers. Out of the 234 Tribes scheduled in India 's inventory, six are present in Tamilnadu, viz., Kotas (artisans), Thodas (herdsmen with buffaloes), Kurumbas (hunter tribes), Paniyas (food gatherers and bonded labourers), Kattunaickers (forest dwellers), Irulas (hunters and gatherers); have been known to maintain their teams and live with the vagaries in their dwellings. Of all the distinct tribes, the Kotas, the Thodas, the Irulas, the Kurumbas form the larger groups, who mainly have a pastoral existence. They are left to fend for themselves without any systematic or structured or holistic support from the government or from the philanthropic world.

These tribal communities are not evenly distributed in the four Taluks of this district. There is a heavy concentration of about 50 percent of the tribes in Gudalur Taluk followed by Kotagiri Taluk with 25 percent of the Tribal population. Udhagamandalam and Coonoor Taluks have with 16 percent and nine percent of the tribal population respectively. It is interesting to note that Paniyas, Mullukurumbas and Kattunaickers live on the lower western slope of the district up to an altitude of 1200 m. In Gudalur Taluk, Kurumbas and Irulas mainly live in tracts between an elevation of 1200 m and 1500m. In the Kotagiri Taluk, the Kotas live in places at an elevation of about 1800m mean sea level. In Udhagamandalam and Kotagiri the Thodas occupy the top of the plateau mainly in Udhagamandalam Taluk. This geographical distribution has invested the different tribes with distinct characteristics and mode of living.

The tribals have been exploited since colonial days which got worse since pre independence periods. Their social and economic status became a casualty for 'civilization and development'. Tribal situations in Tamilnadu that prevent active intervention support for them by the government are remoteness and inaccessibility of the terrain to reach them (51%), alienation by language, culture, food habits, social norms (32%), isolation by habits, customs, beliefs, practices, value systems (11%), non-currency trading practiced till date by many of them (4%), compactness of their domain of activity- Within the Confines of forests (2%) (Saaisutharshan, 2012).

While the tribes blend with nature and the environments that surround them for their livelihood and for their career, they live without a concept or a context called 'tomorrow'. This was exploited by the 'civilized' world to its full and beyond. In Nilgiris, the pioneering efforts of philanthropists such as Ms Armstrong, Dr. Narasimhan, Dr. Newin Wilson, and of late by Dr. Nandakumar, the lives of the tribes got a bit better. Health became the deciding factor for all activities of the tribes, hence their dwindling number became a concern for the pioneers who devoted their time and energy for the cause of the tribals. This led to the discovery of sickle cell anemia, a chronic, incurable, congenital health condition. Studies undertaken in the country indicate that the primitive tribes have distinct health problems, mainly governed by multidimensional factors like their habitat, difficult terrain, ecologically variable niches, illiteracy, poverty, isolation, superstition and deforestation. Most of them have been practicing endogamy for a long period of time, for which tribal communities are highly vulnerable to various hereditary diseases. Hence an integrated multidisciplinary approach has been adopted by different researchers to study the tribal health problems (ICMR, 2003). Currently Diabetes and genetic disorders such as sickle cell anemia, alpha- and beta-thalassemia and glucose-6-phosphate dehydrogenase (G6PD) deficiency are reported among tribals (Balgir, 2004).

Tribal communities in general and primitive tribal groups in particular, are highly disease prone. Common diseases such as acute respiratory infections, sexually transmitted diseases, diarrhoeal diseases and nutritional disorders are rampant among them (Chakma *et al.*, 2006). They do not have required access to basic health facilities. They are most exploited, neglected, and highly vulnerable to diseases with high degree of malnutrition, morbidity and mortality (Balgir, 2004). The misery of Indian tribals is further compounded by poverty, illiteracy, ignorance of causes of diseases, hostile environment, poor sanitation, lack of safe drinking water and blind beliefs. Preventable diseases such as tuberculosis, malaria, gastroenteritis, filariasis, measles, tetanus, whooping cough and skin diseases (scabies) are also high among the tribals (Balgir, 2004). Tribal people suffer disproportionately from malaria (Chhotray, 2003). A majority of the studies on tribal communities report that scheduled tribes live in forest and rural areas. However, there is a trend towards increasing urbanization through urban migration among these tribes in India like in other social groups. As a result, they live in different habitations like urban, rural and forest areas (Census of India, 2001).

Prior to social and governmental policies that displaced them from their homes and means of livelihood, they were a self-sufficient forest-dwelling people. Changes within the past few decades, however, including deforestation, exploitation as seasonal unskilled workers, and marginalization from mainstream society, led to an overall degradation of their lifestyle. They suffer deterioration in their general health status, demonstrating high rates of maternal mortality, child malnutrition and morbidity due to preventable causes. The health status of tribal populations is very poor and worst of primitive tribes because of their dependence for food from nature. Moreover, the isolation, remoteness and being largely unaffected by the developmental process going on in India, also contribute to under nutrition among PTGs. Tribal groups are known to have low food and nutrition security. They have very close association with the ecosystem and the environment since their daily nutritional requirements are fulfilled with food foraged from nature. To date, there has been limited data on the anthropometric and nutritional status of various tribal populations of India (Arlappa 2005; Bose and Chakrabarty, 2005; Bose *et al.*, 2006). Bose and Chakrabarty (2005) suggest that there is an urgent need to evaluate the nutritional status of various tribes of India.

Adolescence in general is a significant period of growth and maturation. The nutritional status of adolescent girls, the future mothers, contributes significantly to the nutritional status of the community (Helegson, 2006). Tribal women and girls in particular have minimal to no power in the decision making process and are discriminated and exploited at virtually every level of society. They experience violence within their homes and prejudice when entering local politics or community initiatives. Many women suffer awful health conditions as a result of early marriage and child birth and a lack of trained assistance being available (Irula Tribe Women's Welfare Society, 2007). Teenage pregnancies with double physiological and nutritional burden are common among tribals. Such women are at increased risk of having pre-term deliveries, still births, maternal mortality, morbidity and neonatal deaths (Spear, 2002). Average calorie and protein consumption is found to be below the recommended level for the pregnant as well as lactating tribal women. Nutritional deficiencies (such as night blindness) and sexually transmitted diseases are well known public health problems of tribals in India.

The chief causes of high maternal mortality rate are found to be poor nutritional status, low haemoglobin (anemia), unhygienic and primitive practices for parturition. There are very few studies on tribal population especially on school children although it has

been found that 53 per cent of school children in developing countries are suffering from Iron Deficiency Anaemia (ACC/ SCN, 2000). Global anaemia prevalence when examined for each physiological group using the WHO global database on anaemia reports that most affected groups are pregnant women (48%) and 5-12 years old children (46%). In developing countries most highly affected population groups are pregnant women (56%), school age children (53%), non-pregnant women (44%) and pre- school children (42%). On the whole, Iron Deficiency Anaemia affects 3.5 billion people in the developing world (ACC/SCN, 2000). Surveys conducted under the aegis of ICMR in different parts of India have revealed that a large segment of the population approximately 50 per cent suffer from nutritional anaemia (NIN, 1998). National Family Health Survey II (2000) also reported that overall 52 per cent of married women and 74 per cent of children aged 6-35 months are anaemic in India, out of which majority are moderately anaemic. There is no nation-wide or state-wide data available for prevalence of anaemia in school age children especially among tribal school age children.

Tribal population has the poorest nutritional status on almost every measure with 55 per cent underweight, 54 per cent stunted and 28 per cent wasted children (http://mospi.nic.in/mospi_new/upload/Children_in_India_2012.pdf). Tribal population is particularly vulnerable to undernutrition, because of their geographical isolation, socio-economic disadvantage and inadequate health facilities. According to statistics in 2007-08, 46.9 per cent tribal children between one to five years in Gujarat were underweight, 53.8 per cent were stunted and 23.8 per cent were wasted ([www.gujhealth.gov.in/pdf/ PresentationofGSN MmadetoHon_bleCM.ppt](http://www.gujhealth.gov.in/pdf/PresentationofGSN MmadetoHon_bleCM.ppt)).

The studies on nutritional status of pre-adolescent and adolescent tribal children aged between 5 to 19 years have rarely been carried out at a national level. In 1998-1999, the NNMB had extensively studied the nutritional status of tribal adolescent children from nine Indian states mainly from southern India (Rao *et al.*, 2006). Maurya and Jaya (1997) reported similar poor conditions from multiple tribal children in Bihar. Tribe specific studies also revealed undernourished conditions among Oraon, Santal and Munda communities in Bihar (Rao and Vijay, 2006). In the Kalahandi district of Orissa, 89.3 per cent of Gond children aged between 6-14 years was underweight (Balgir *et al.*, 2002). A recent study showed that the prevalence of under-nutrition [stunting (17.9%), underweight (33.7%) and wasting (29.4%)] among Santal children of the rural area of Puruliya district of West Bengal was not an exception (Chowdhury *et al.*, 2008).

The nutritional status of children was affected by school enrollment (Fentiman *et al.*, 2001), socio-economic status, income constraint, type of family etc. The Orissa Health Strategy (2003) has advocated for improving the health status of tribal populations by reducing mortality and morbidity (Health and Family Welfare Department, 2010).

Dispensation of health care services to this population, however, by the government and private sector alike, is disproportionately lacking (mohfw.nic.in/np2002.htm). Remoteness of villages, uncooperative attitudes among medical personnel, limited manpower, and a lack of awareness within tribal communities all pose difficulties in achieving adequate health care delivery (www.tnhealth.org/notification/tdp.pdf). Government initiatives within recent years have highlighted the need to rectify these incongruities and address tribal health care issues. Health care targeted to serve the needs of the adivasi community is critical in maintaining an acceptable and adequate level of health care for all strata of Indian society.

Several strategies are deployed to combat malnutrition those targeted for tribal upliftment should be strictly inexpensive, nutrient dense and to an extent easily doleable even in remote tribal areas. Supplementation and nutrition education are relatively easy twin strategies which can be carried out in tribal areas. Spirulina is one such supplement which is ideal for distribution among tribal populations. It is a microscopic and filamentous cyanobacterium that derives its name from the spiral or helical nature of its filaments. It has a long history of use as food and has been reported to have been used in the Aztec civilization (Dillon *et al.*, 1995). It is a low-fat, low-calorie, cholesterol-free source of easily-digestible vegetable protein containing all the essential amino acids that cannot be produced by the body but are needed to synthesize the non-essential amino acids. It has no cellulose in its cell walls and is therefore easily digested and assimilated. It is called a 'super food' because its nutrient content is more potent than any other food. Many of the essential nutrients needed by our bodies are concentrated in spirulina. It is comprised of at least 60 per cent all-vegetable protein, essential vitamins and phytonutrients such as the rare essential fatty acid GLA, sulfolipids, glycolipids and polysaccharides. In its content of Vitamin A and iron – the two most important micronutrients – Spirulina is cheaper than any other natural product, including carrots and spinach.

The term 'Spirulina' refers to the dried biomass of *Arthrospira platensis*, an oxygenic photosynthetic bacterium found worldwide in fresh and marine waters. This alga presents an important staple diet in humans and has been used as a source of protein

and vitamin supplement in humans without any significant side-effects. Apart from the high (up to 70%) content of protein, it also contains vitamins, especially B12 and provitamin A (β -carotenes), and minerals, especially iron. It is also rich in phenolic acids, tocopherols and γ -linolenic acid. Many toxicological studies have proven Spirulina's safety. Spirulina now belongs to the substances that are listed by the US FDA under the category GRAS (Tarantino, 2003, Salazar *et al.*, 1998, Chamorro *et al.*, 1997, Belay, 2002). It is relatively easy to cultivate and flourishes only in alkaline lakes with an extremely high pH and in large outdoor ponds under controlled conditions. There are only a few areas worldwide that have the ideal sunny climate for production of this alga, including Greece (Nigrita, Serres), Japan, India, United States and Spain. Currently, Spirulina can be found in health food stores and is sold mainly as a dietary supplement in the form of health drinks or tablets in India. The traditional food practices and lifestyle of tribes are changing slowly and gradually. Thus, there is an urgent need to educate and enlighten these tribes on importance of proper nutritional aspects and to retain the traditional foods and food habits and thereby keep them in good health. In view of this, imparting nutrition education to reduce the incidence of life style diseases is planned to avoid any ill health and to stress that the greatest panacea is indeed prevention.

Daniel (2010) defined nutrition education as “any combination of educational strategies, accompanied by environmental supports, designed to facilitate voluntary adoption of food choices and other food- and nutrition-related behavior”. Nutrition education is delivered through multiple venues and involves activities at the individual, community, and policy levels. Nutrition education plays an important role in generating social understanding as well as acceptance of broader interventions to elevate nutritional status and give a better understanding to maintain a healthy life. Nutrition education plays an important role in improving nutritional status of an individual or community with respect to food, health and nutrition and in convincing them to adopt desirable food habits (Begum *et al.*, 2011). Nutrition education is the vital aspect of health care. For delivering health and nutrition messages any modern media as well as traditional media like radio, TV, folk song, drama, puppetry and storytelling and printed materials like handouts, booklets, posters and pamphlets can be used (Patnaick, 2004).

Positive Deviance/Hearth Nutrition Program is a home-based and neighborhood-based nutrition program for children who are at risk for protein-energy malnutrition in developing countries. The program uses the “positive deviance” approach to identify

those behaviors practiced by the mothers or caretakers of well-nourished children from poor families and to transfer such positive practices to others in the community with malnourished children. The “Hearth” or home is the location for the nutrition education and rehabilitation sessions (Child Survival Collaborations and Resources Group, Nutrition Working Group, 2003).

Kitchen gardens have an established tradition and offer great potential for improving household food security and alleviating micronutrient deficiencies. Gardening can enhance food security in several ways, most importantly through: 1) direct access to a diversity of nutritionally-rich foods, 2) increased purchasing power from savings on food bills and income from sales of garden products, and 3) fall-back food provision during seasonal lean periods.

Most important determinants of the women’s nutrition knowledge were educational level, age and their kind of occupation. Women who had better knowledge of nutrition also exhibited better dietary behavior, thus underlying the importance of nutrition education for improving dietary behavior. Thus, nutrition education offers a great opportunity to individuals to learn about the essentials of nutrition for health and to take steps to improve the quality of their diets, thus their well being and have a healthy life (Robinson, 2003). A study conducted by (Yusoff *et al.*, 2012) reveals that nutrition education along with supplementation for a period of six months improved the Knowledge, Attitude and Practice as well as hemoglobin status of young women. This shows that intervention along with nutrition education is more effective.

Thus there is no database on nutritional status per se, or malnutrition and micronutrient deficiencies particularly vitamin A and iron among PTG. Since general malnutrition, its etiology and strategies to combat are taken care of by the Integrated Child Development Services, the present study is directed towards the creation of a data base for micronutrient malnutrition which is rampant among tribals. There is an urgent need to quantify it in order to provide effective pointers to policy makers and stake holders to plan and implement intervention programmes so as to wipe out all forms of malnutrition among PTG. This study could help to understand the socio economic and nutritional status of children of PTG and plan appropriate interventions to improve them. It is the duty of every well meaning citizen to help improve the health of our tribal brethren. Enhancement of their nutritional status could form the very basis for the empowerment of tribals.

This study is an attempt towards this end and has the following objectives:

Primary objectives

- Assess the prevalence of Vitamin A and Iron deficiencies among Primitive Tribal Children in Nilgiris district
- Quantify the impact of selected interventions on the children

Secondary objectives

- Assess the prevalence of Vitamin A and Iron deficiencies among 1-14 years Primitive Tribal Children
- Administer and compare the effect of nutritional supplements [Spirulina Candies (SC) and a formulated Spirulina Incorporated Food Supplement (SIFS)]
- Impart and evaluate the impact of maternal nutrition education on KAP of mothers
- Develop kitchen gardens and assess their effect on KAP of mothers.