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Nutritional Status Assessment of Population in Southern Coastal and Basalt Upland Region of Indian North Western Hot Arid Zone

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INTRODUCTION

It is being widely claimed in agricultural sector that India is producing all time record food grains, it is also true that food grain production is touching an all time high level of 263.20 million tons (The Hindu, 2014). Taking average population of India to be 1.20 billion, enough of grains i.e. 500g per person per day is available, which is sufficient to sustain life as per recommended dietary allowances for Indians. However, it is reported in several studies conducted in various regions of India that despite high production malnutrition is a persistent problem in all sectors of society, more so in women and children. Availability of adequate food resource at country level, therefore, is not a fair indicator to justify enough is eaten by population. Causes of malnutrition may be due to extreme imbalances in distribution of food among population and bio-availability of nutrients to the individual.

Rapid depletion of natural resources is another factor, which directly link ecological and environmental factors to malnutrition. As the cultivable land is limited, if the demand of foods is more the pressure on land is intensified to produce more. If people, agriculture and environment have to coexist, a strategic approach of ecologically friendly farming systems, integrated farming system, integrated nutrient management, integrated pest management and natural resource management assume greater significance than ever before (Raman, 1998). In arid zones only rainfed farming is generally possible which is risk prone, complex and diverse. The erratic nature of rainfall, very high evaporation-transpiration rates, poor quality of soils etc, causes low productivity in this region (Ramakrishna *et al.*, 1998). The situation of agriculture is pathetic here even though the major source of livelihood are agriculture and livestock therefore one can imagine the quality of life people are forced to lead in arid zone. Human health is severely affected due to drought and continued food scarcity over the years. People in desert habitually eat what they grow on their fields, but adverse climatic conditions in desert lead to low to marginal production from land which in turn cause malnutrition of various forms in all segments of population.

Women are especially vulnerable in this region as they have to do hard work in home, farm and also bear and rear children. Data on nutritional status of population residing in arid zone is scantily available and lacks integration of ecological factors to nutrition. Therefore the present study was conducted in Southern Coastal and Basalt Upland Region of Indian North Western Hot Arid Zone.

METHODOLOGY

Study was conducted in four villages of Southern coastal and basalt upland of North Western hot arid region of Thar , Gujrat desert covering a sample of 138 male and 140 female population in three farm size categories marginal, small and large and further categorized into four age groups. The area is scattered in 6.18 million ha constituting 21.7% area of North Western hot arid region, it is scattered in Kachchh, north Saurashtra and Santhalpur plain area of Gujarat. Mean annual rainfall has wide spatial variation of 150-500mm. Ground water resources are scarce and brackish. This region has integrated drainage system as a result runoff water received through rainfall is drained into sea and area experiences extreme drought, sometimes continuously for two or even three years(Faroda, Joshi & Ram, 1999). Life of people

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is primarily dependent on livestock and natural forest resources apart from minor income from farming. Nutritional anthropometry viz., weight and height were recorded for entire population. Weight was recorded through calibrated balance and height in centimeters, was recorded by anthropometric rod using standard procedure. Body Mass Index was calculated for adult population on the basis of weight/ height^2 (g/cm^2). Blood haemoglobin was estimated for adult female through colorimetric method through Sahli's Haemometer. (Table 1).

Data is analyzed here to highlight two prevailing nutritional patterns in population.

- Land availability significantly affects nutritional status of population.
- Male adult population is equally at risk of undernutrition.

Table 1
Age and Sex wise distribution of population in different farm size categories

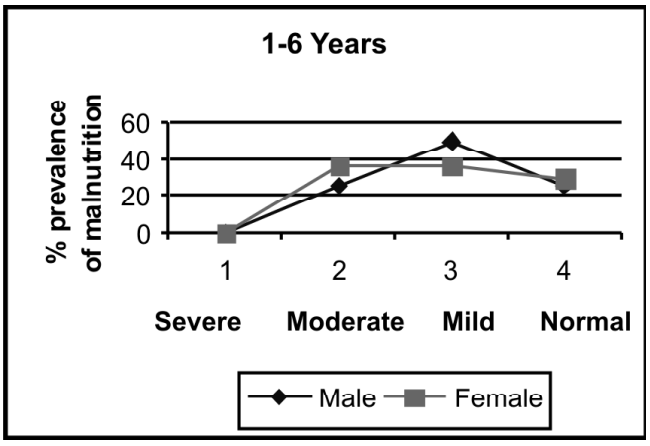
Age group (years)	*Sex*	*Marginal*	*Small*	*Large*	*Total*
1-6 yrs	Male	8	9	10	27
	Female	9	6	8	23
7-12 yrs	Male	11	8	5	24
	Female	14	7	6	27
13-18 yrs	Male	3	7	8	18
	Female	7	7	4	18
> 18 yrs	Male	19	25	25	69
	Female	20	26	26	72
TOTAL		91	95	92	278

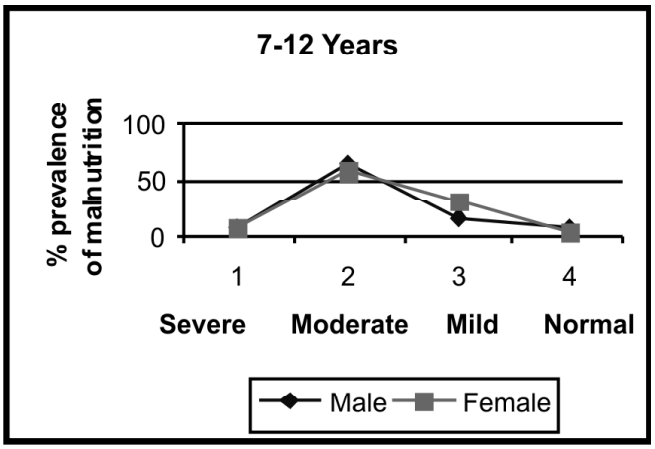
FINDINGS AND DISCUSSIONS

Data based on weight for age revealed that in 1-6 years male children 25 percent are found normal, 50 percent had mild under nutrition and remaining 25 percent had moderate degree of under nutrition. In case of female children of 1-6 years of age group 29.4 percent were normal, 35.3 percent had mild and moderate malnutrition (Table2). Differences in male and female population start occurring from early life however the pattern shows that more female numbers fall in mild category whereas more male children fall in moderate category of under nutrition. Similar findings that children of drought affected Piler region had the highest moderate malnutrition are reported by Dhanalaksmi and Murthy, 1995. The percentage of severely malnourished children increased in 7-12 year male and female. In the age group of 13-18 years, 22.2 percent male adolescents were severely malnourished and 11.2 percent male and 46.2 percent female were moderately malnourished. 33.3 percent male and 30.8 percent female adolescents were mildly malnourished whereas 33.3 percent male and 23 percent female were normal (Table 2 and Fig. 1). Oguz A., Gokalp A.S., Gultekin A 1990 assessed malnutrition grades of 1000 children by various anthropometric measures in Sivas area. The general malnutrition rate was 30.5% according to weight for age, 27.7% for weight for height and 33.7% for mid upper arm circumference (MUAC) to head circumference (HC) ratio. The ratio of severe malnutrition were noted to be low (1.8-2.2%) when using these criteria.

Table 2
Percentage prevalence of malnutrition in children and adolescents based on weight as percentage of standard

Cut off level	*1-6 Years*		*7-12 Years*		*13-18 Years*	
	M	*F*	*M*	*F*	*M*	*F*
<60% Severe	-	-	8.7	7.7	22.2	-
60-75% Moderate	25	35.3	65.2	57.7	11.2	46.2
75-90% Mild	50	35.3	17.4	30.8	33.3	30.8
>90% Normal	25	29.4	8.7	3.8	33.3	23





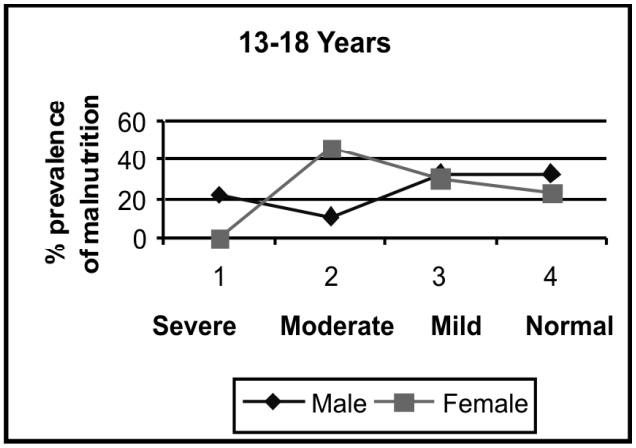


Figure 1: Percentage prevalence of malnutrition in children and adolescents based on weight as percentage of standard

Landholding wise categorization in male children of 1-6 year age group showed that 57.1 percent in marginal category and 12.5 percent in large category were moderately malnourished, while percentage of female children moderately malnourished in marginal and large category was 37.5 and 60 respectively. Percentage of mildly malnourished male children in marginal, small and large category were 28.6, 60 and 62.5 respectively, while 37.5 percent female in marginal category, 50 percent and 20 percent female in small and large category were mildly malnourished respectively. Percentages of normal male in marginal, small and large category were 14.3 percent, 40 percent and 25 percent respectively, whereas the percentage of normal female were 25 in marginal, 50 in small and 20 in large category.

In 7-12 year age group, 20 percent male and 7.7 percent female in marginal category and 16.7 percent female in large category were severely malnourished. 70 percent male and 69.2 percent female in marginal category, 62.5 percent male and 42.9 percent female in small category and 60 percent male and 50 percent female in large category were moderately malnourished. 10 percent male and 15.4 percent female in marginal category, 25 percent male and 57.1 percent female in small category and 20 percent male and 33.3 percent female in large category were mildly malnourished. 7.7 percent female in marginal category, 12.5 percent male in small category and 20 percent male in large category were normal.

In 13-18 year age group, 50 percent male in marginal category and 33.3 percent male in small category were severely malnourished. 66.7 percent female in marginal category, 40 percent female in small category and 25 percent male in large category were moderately malnourished. 33.3 percent female in marginal category, 33.3 percent male and 40 percent female in small category and 50 percent male in large category were mildly malnourished. 50 percent male in marginal category, 33.3 percent male and 20 percent female in small category and 25 percent male and 100 percent female in large category were normal (Table 3).

Table 3
Land holding wise percentage prevalence of malnutrition in children and adolescents based on weight as percentage of standard

Cut off level	*MARGINAL*						*SMALL*						*LARGE*					
	1-6		*7-12*		*13-18*		*1-6*		*7-12*		*13-18*		*1-6*		*7-12*		*13-18*	
	M	*F*	*M*	*F*	*M*	*F*	*M*	*F*	*M*	*F*	*M*	*F*	*M*	*F*	*M*	*F*	*M*	*F*
<60% Severe	-	-	20	7.7	50	-	-	-	-	-	33.3	-	-	-	-	16.7	-	-
60-75% Moderate	57.1	37.5	70	69.2	-	66.7	-	-	62.5	42.9	-	40	12.5	60	60	50	25	-
75-90% Mild	28.6	37.5	10	15.4	-	33.3	60	50	25	57.1	33.3	40	62.5	20	20	33.3	50	-
>90% Normal	14.3	25	-	7.7	50	-	40	50	12.5	-	33.3	20	25	20	20	-	25	100

BODY MASS INDEX (BMI)

BMI was calculated for adult male and female population which is an indicator of chronic energy deficiency to various degrees of obesity in the population.

The data from table 4 reveals that 11.1 percent female in marginal category and 6.3 percent female in small category were severely malnourished while 5.6 percent male in marginal category were moderately malnourished. The percentage of mildly malnourished males in large category was 14.3

Table 4
Percentage prevalence of malnutrition in adult population based on BMI

BMI Class	*Presumptive Diagnosis*	*Marginal*		*Small*		*Large*	
		Male	*Female*	*Male*	*Female*	*Male*	*Female*
< 16.0	CED – grade III Severe	-	11.1	-	6.3	-	-
16.0-16.9	CED- grade II Moderate	-	5.6	-	-	-	-
17.0-18.4	CED-grade I Mild	-	27.8	-	12.5	14.3	4.8
18.5-19.9	Low weight-Normal	-	5.6	-	6.3	-	4.8
20.0-24.9	Normal	33.3	38.9	100	62.5	42.9	76.2
25.0-30.0	Obese- grade I	66.7	11.1	-	12.5	42.9	9.5
>30.0	Obese-grade II	-	-	-	-	-	4.8

whereas females were 27.8 percent in marginal category, 12.5 percent in small category and 4.8 percent in large category. Low weight normal female were 5.6 percent in marginal category, 6.3 percent in small category and 4.8 percent in large category. The percentages of normal males in marginal, small and large category were 33.3, 100 and 42.9 percentage respectively, while the percentage of normal females in marginal, small and large category were 38.9, 62.5 and 76.2 respectively. The percentage of obese grade I was 66.7 percent male and 11.1 percent female in marginal category, 12.5 percent female in small category and 42.9 percent male and 9.5 percent female in large category where as 4.8 percent female in large category were obese grade II (Table 4). Shavan et.al.1995 has also reported majority of adult women had BMI normal range of 20-24.

PREVALENCE OF ANAEMIA

Table 5
Landholding wise Percentage haemoglobin level in adult female population

Category	*Haemoglobin level (g/dl)*	*Marginal*	*Small*	*Large*
Severe	< 8.0	13.3	-	-
Moderate	8.0 – 9.9	80	78.6	60
Mild	10.0 – 11.9	6.7	21.4	40
Normal	> 12	-	-	-

The data revealed that 13.3 percent in marginal category were severely anaemic, their Hb level was found to be less than 8.0 g/dl. Moderately anaemic female in marginal, small and large category were 80, 78.6 and 60 percent respectively. 6.7 percent female in marginal category, 21.4 percent female in small category and 40 percent female in large category were mildly anaemic. No females were found to be normal in any of the three categories. (Table 5 and Fig 2). Shavan et.al.1995 also reported majority of women had Hb levels between 10-12 g/dl in Karnataka region.

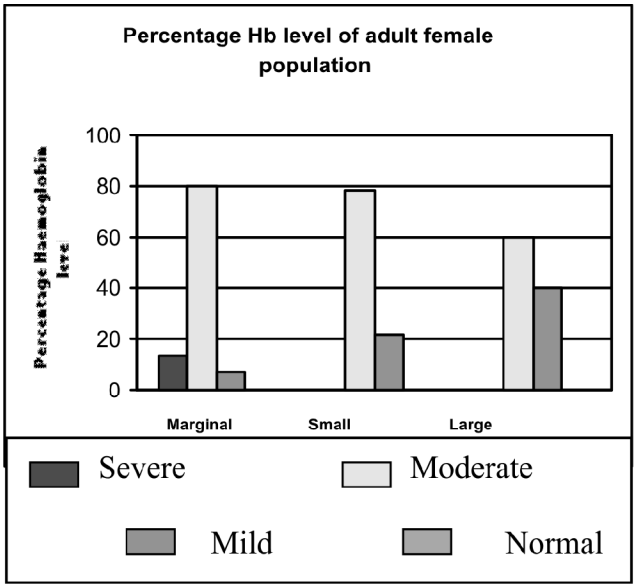


Figure 2: Prevalenc of degrees Anaemia in female adult population

CONCLUSION

The study revealed that female and male population in all the age groups at one or the other period of time had experienced different forms of undernutrition. Long scarcity of food due to climatic considerations has significantly affected the nutritional status of people in general and that of women and children in particular. The vicious cycle of undernutrition has perpetuated in the population over generations. Adolescent mothers give birth to low weight babies who never achieve the normal standard of growth till adulthood. Childhood malnutrition seriously affects the working and mental efficiency of population, as low weight babies born to malnourished mothers are destined to live in environmentally adverse conditions. Continued food scarcity hampers proper physical development depicted in the form of *small for size adults* or *nutritional dwarf*. Another serious consequence of infantile and

childhood malnutrition is inadequate brain development. Maximum physical multiplication of brain cells i.e., neurons occurs in the human body in the initial years of life depicted in the form of chest-head ratio. Inadequacy of nutrition therefore in the initial years leads to lesser development of brain cells and overall brain mass. The mental efficiency of population therefore is greatly affected by undernutrition.

Nutrition is an important determinant of immunological status and that undernutrition could impair immune competence and increase susceptibility and vulnerability of population to infections. The integrated immune system includes several components many of which are affected by nutrient deficiency, in undernutrition deficiency of one and /or more than one nutrient is inevitable which affects one and/or more component of immune system. The lymphoid tissues, which play a dominant role in immunity, are highly vulnerable to undernutrition. Many cells of the immune systems have to depend for their functions on metabolic pathways, which need various nutrients like carotene, iron, vitamins and other micronutrients. Wherever these nutrients are in short supply functioning of the cells is impaired. Morbidity induced by undenutrition is not just limited to nutritional deficiency diseases directly attributed to it indeed, the greater part of morbidity in undernutrition is attributed to the fact that undernutrition facilitates the onset of infection and aggravates their out come. Poor undernourished communities of the arid zone are trapped in vicious cycle of infection and undernutrition leading to higher mortality and morbidity.

Since undernutrition favours infection pockets of undernourished populations with in arid zone act as reservoir of infection and blemishes of epidemics. Undernutrition may not be contagious but infection, which it favours and breeds can take its toll not only among the marginal but also among the large or rich community.

Three types of food problems are found in areas affected by drought

- ***chronic food insecurity.*** Affects individuals or groups of people who consume or have regularly been consuming somewhat less than the minimum needed over a long period;
- ***cyclic food insecurity.*** Affects small farmers who have enough to eat in the immediate post-harvest period but not enough to carry them through to the next harvest;
- ***transitory food insecurity.*** Affects urban dwellers dependent on highly unstable markets and agricultural producers exposed to high incidence of natural disasters.

Ramnath and Krishnamachari 1993 reported data collected on 555 preschool children during a drought survey carried out in 1987 from 4 desert districts of Rajasthan. All the anthropometric measurements viz. weight, height, FFT and weight for height showed an inverse relationship with clinical protein energy malnutrition. Comparison of prevalence among anthropometrically normal and undernourished groups of children showed significant differences in some of the selected deficiency signs. Body weight was more sensitive but less specific while weight for height was more specific but less sensitive to almost all the nutritional deficiency signs when used as the screening parameter. The use of the above measurements as screening tests to quickly identify undernourished children from normal during drought conditions in desert is also shown.

Low birth weight infants born to undernourished mothers have suboptimal immune responses and are therefore more susceptible to infections. High neonatal mortality in low birth weight infants is a direct result of their immunological status attributable to maternal malnutrition during pregnancy. Nutritional injuries inflicted during early years of life are neither forgotten nor forgiven by human body. The close similarity between the immunological profile of undernutrition and that observed in acquired immune deficiency syndrome (AIDS) requires greater attention of policy makers and health professionals to overcome disasters of undernutrition.

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