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Assessment of Nutritional Status among the Bhil in Desert Region

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ABSTRACT

The study reflects the nutritional status of preschool children and its influencing factors. Side by side degrees of nutritional status indices have been estimated. Nine villages selected from three different tehsil of Barmer district, Rajasthan. Household data were collected using structured questionnaire from Bhil households. Height-for-age, weight-for-age and weight-for-height were calculated to assess the influence of the explanatory variables on nutritional status. Results revealed that about 15 percent boys and 20 percent girls suffered from moderate to severe forms of malnutrition according to weight for height, whereas 18 percent of boys and girls suffered from moderate to severe forms of under nutrition with respect to height for age. Similarly, 37 percent of boys and 40 percent of girls suffered from moderate to severe forms of malnutrition with respect to weight for age. In the present study girls were found to be more vulnerable as compare to boys in weight for age. Dietary consumption, mother's education, mother's position among housewives and child's height were positively related to the child's nutritional status. Also, mother's age, child's age and dependency ratio were negative influenced on nutritional status. Policy options that would promote formal education for women, home use of nutritional diet and reduction in dependency ratio were recommended to achieve meaningful improvement in nutritional status.

Key Words: Nutritional status, Malnutrition, Bhil, Barmer district, Rajasthan

INTRODUCTION

Malnutrition is devastating problems, particularly for the poor and unprivileged. Children are most vulnerable to malnutrition due to low dietary intakes, inequitable distribution of food within the household, improper food storage and preparation, dietary taboos, infectious diseases, and care. Prevalence of malnutrition has remained a problem of considerable magnitude in most developing countries (Devi and Geervani, 1994). Malnutrition causes both emotional and physical suffering (Smith and Haddad, 2000) and is responsible for more than one-half of all children's deaths worldwide (Pelletier *et al.*, 1995). Adults who survive malnutrition as children are less physically and intellectually productive and suffer from higher levels of chronic illness and disability (Smith and Haddad, 2000).

Among the Bhil prevalence of malnutrition among rural preschool children of desert belt are remarkable. Empirical investigations have identified the problems of poverty and food insecurity which have prevailed among the low income population as well as high costs of living and dearth of animal protein among the causes of malnutrition.

The objective of this study is to measure the nutritional status of preschool children, determine the factors that influence nutritional and estimate the degree of nutritional status. It is expected that the findings from the study would serve as a guide to policy makers, extension staff, food nutritionists and households seeking to achieve some meaningful improvement in Bhil children's nutritional status in Rajasthan.

MATERIAL AND METHOD

Data Collection

The population of Rajasthan in 2001 Census has been 56,507,188. of this 7,097,706 persons are the Scheduled Tribes (STs) constituting 12.6 per cent of the total population of the state. In the western part of desert district of Rajasthan Bhil tribe of Barmer district has been investigated for the present study. Though, there are certain other districts of Rajasthan having a higher concentration of Bhils like Udaipur, Bhilwada, Baswara, Jalore etc., and the Bhils of Barmer were selected because of the desert condition. The research work on Bhil of Barmer has brought important information nutrition and their bio-cultural determinants. The quantum of qualitative and quantitative anthropometric and other data is presented in table 1.

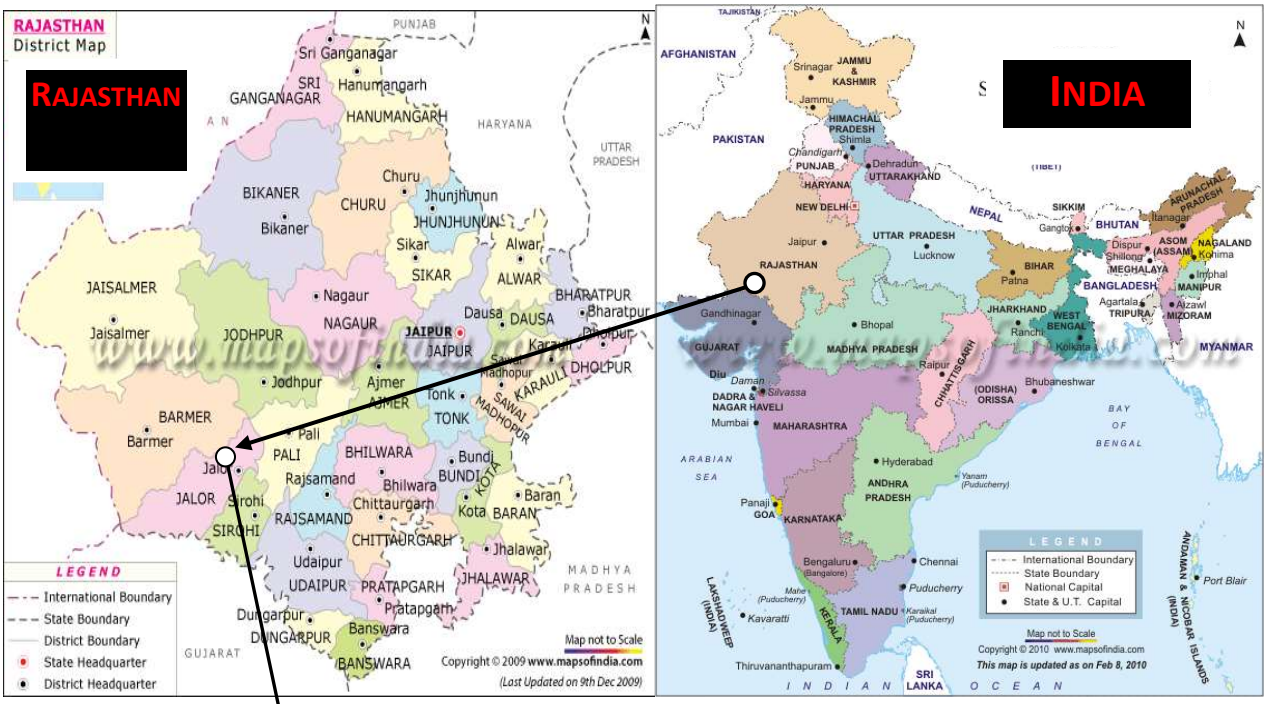
Table: 1 Quantum of qualitative, quantitative, anthropometric and other data collected during field work

District/ State/ Population (Sample Size)	Qualitative (Sample Size)	Quantitative (No. of subjects)	Anthropometric (No. of subjects)	Haemoglobin content estimation (No. of subjects)
Barmer, Rajasthan (Bhil)	FGD= 9 Case studies= 27	Household Schedule= 450	352 Subjects	298 Subjects

Study Area

Barmer is one of the western partly desert district of Rajasthan. Barmer district is bounded on north by Jaisalmir district and on the south by Jhalor district and on the east by Palli and Jodhpur districts and on the west by Pakistan (international border), which is 270 kms. away from the district head quarters. It is situated between 24°58' and 26°32' north latitude and between 70°5' and 72°52'east longitude. (Fig.1) The total area of the district is 28387 sq. kms., which is the second largest district of Rajasthan.

Information on 450 households has been collected from 9 villages from three tehsils namely Barmer, Chohtan and Ramsar. The list of these villages along with tehsil name is given in Fig. 1.



Tehsil	Village	Surveyed Household
Barmer	Mahawar	50
	Barmer Agar	63
	Kabas	59
Chohtan	Dhok	32
	Kelnaur	46
	Arti	62
Ramsar	Bhilo Ka par	55
	Jhadua	35
	Chadar	48
Total		**450**

Fig. 1: Location of Study Area

There are two important parameters which are followed for determination of nutritional status of Pre-school going children (1) haemoglobin estimation and (2) Assessment of nutritional status through anthropometric measurements. These are given below:

Collection of blood sample

1 ml. intravenous blood was collected through disposable syringes in EDTA bulb. 1 ml. blood was utilized for hemoglobin determination. A total of 298 blood samples comprising 195 males and 103 females were collected for the analysis for haemoglobin determination.

Haemoglobin determination

Nutritional anaemia is a disease syndrome caused by malnutrition in its widest sense. It is a condition in which the haemoglobin content of blood is lower than normal as a result of a deficiency of one or more essential nutrients, regardless of the cause of such deficiency. Anaemia is established if the haemoglobin is below the cut-off points recommended by WHO. By far the most frequent cause of nutritional anaemia is iron deficiency and less frequently folate or Vitamin B_{12}. Details of procedure can be seen in laboratory manual for Health professionals in Tribal/ Rural Areas (Verma et. al., 1994).

RESULTS AND DISCUSSION

The results of the analysis are presented table 2. It can be seen that mean Hb content for males was be 12.80 g/dl±2.56 g/dl; and for females 12.64 g/dl ± 2.84 g/dl. The normal value for men varies from 14 through 18 g/dl and for women are towards the lower range of the normal values. Thus Hb values of both Bhils men and women are towards the lower range of the normal values. It can be inferred that the degree of malnutrition in Bhil is of moderate degree and which is substantiate by the fact that a significant proportion of children also reveal to mild to moderate degree of malnutrition. The findings can be viewed in the context of their socio-cultural practices relating to environmental sanitation, personal hygiene, food habits and their attitudes towards modern medicines.

Table: 2 Level of Haemoglobin Estimation

Sex	Number	Mean value of haemoglobin (g/ 100 ml. blood)	S.D.	Max. Value	Min. Value
Male	195	12.80	2.56	19.58	5.71
Female	103	12.64	2.84	19.53	4.94

Box: 1

Major Observation

- *Mean Hb values for men (12.80 gm/ 100 ml. blood and women (12.64 gm./100 ml. blood) are towards lower range of normal values.*
- *Nutritional anaemia as reflected from Haemoglobin determination, both in men and women Bhils, is of moderate nature.*

Assessment of nutritional status through anthropometric measurements

For assessing the nutritional status of the children less than or equal to six years old belonging to Bhil tribal population group Desert district in Rajasthan, a set of anthropometric measurements was under taken on them. Anthropometric data were collected from the Anganwadi centers of different villages, the households and primary schools. The data were based on the cross-sectional sample of 352 children ages less than one through six years. Out of these 352 subjects, 168 were males and 184 females. Salient findings of the present study are reported in the text below. In all, 12 body measurements were taken, viz. Crown heal length (up to two years)/ standing height, body weight, skin folds (skin fold at biceps, triceps, sub-scapular, supra iliac and calf sites), Waist circumference, Hip circumference, Head circumference, Chest circumference and Mid upper arm circumference.

The results of each of the 12 measurements mentioned above for both boys and girls are presented in table 3 through 16. The statistical values are provided for each variable include mean, standard deviation and standard error of mean and the range. It is clearly evident from the tables that irrespective of sex, there is even growth in each of the body measurements at successive ages. The t-values calculated for estimating the significance of the bisexual differences at different ages among Bhil are presented in 17. It can be seen from the table that the bisexual differences, in general, are statistically significance for most of the measurement from one to six years of age. It can, thus be inferred that Bhil boys and girls under six years of age, in general, do not reveal similar pattern of growth for various body measurements in the present study.

Besides numerous other contributory factors, cultural practices among Bhils are also responsible for these dissimilarities. Though is no oppression and incidence of domestic violence, a girl child never looked like boy child in the society. As far as diet is concerned, both sons and daughters do not get equal preference in general boys have to preference to meal and other things. Girls have also downloaded some restriction.

Data on Indian population is available for six measurements on boys and girls of various ages an ICMR Technical Report Series No. 18 (1994) of which only four measurements, viz. body weight, standing height/ crown heel length, chest circumference and head circumference are comparable to the present study. Similarly, Ghosh (1992) provides data on additional measurements i.e. mid upper arm circumference for the children belonging to better socio-economic class.

Thus, a comparison of Bhil boys and girls has been made with the data available on boys and girls of rural India and of better socio-economic class. It can be seen that the pattern of growth of Bhil children (boys and girls) in the five measurements taken for comparison with rural Indian children and children of better socio-economic class.

Protein calorie malnutrition (PCM) has been identified as a major health and nutritional problem in India. It appears among children in the early childhood, generally below six years. It is an important cause of morbidity and mortality in children and leads to impairment of physical and mental growth of the individuals who survive. The incidence of PCM in India in preschool age children is one to 2 percent. A great majority of cases are in the category of to moderate to severe form, which frequently go unnoticed. To identify children requiring nutritional and health intervention, a number of classifications have been proposed. Gomez classification which is weight for age percentage is based on weight retardation. Water lows classification defines two groups for PCM. Retarded growth with low height for age (<-2 SD) considered as stunting and low weight for height indicated as wasting.

Another indication of PCM is mid upper arm circumference, which is a reliable estimate of body's muscle mass. Between age one and five years, mid upper arm circumference hardly varies. Any arm circumference exceeding 13.5 cm is sign of a satisfactory nutritional status followed by 12.5 to 13.5 cm as mild to moderate malnutrition and below 12.5 cm is considered as severe malnutrition, respectively.

Tables 15 and 16 show frequency of under nutrition according to various classifications. It can be seen from the tables that about 15 percent boys and 20 percent girls suffer from moderate to severe forms of malnutrition according to weight for height where as 18 percent of boys and of girls suffer from moderate to severe forms of under nutrition with respect to height for age. Similarly, 37 percent of boys 40 percent of girls suffer from moderate to severe forms of malnutrition with respect to weight for age. Thus, weight loss is less pronounces as compared to stunting in girls. In the present study girls are found to be more vulnerable as compare to boys in weight for age.

Moreover, mean mid upper arm circumferences in the present study among boys and girls are invariable above 13.5 cms. in age groups four and above for girls and two and above for boys indicating their satisfactory nutritional status. We can estimate the prevalence of under nutrition in terms of weight for age and height for age and weight for height following the methodology proposed by the World Health Organisation. For each child z scores for weight for age, height for age and weight for height were calculated. For estimating z scores, the Anthro software package developed by the World Health Organisation was used and the WHO standard was adopted (WHO, 2010). A child having a z score less than -2 was classified as under nourished in terms of either weight for age or height for age or weight for height. Finally, the prevalence of under nutrition was calculated as the proportion of children under 3 years of age who were classified as under nourished in terms of either weight for age or height for age or weight for height. Subsequently, the proportion of children who were stunted and wasted (SW), only stunted (S), only wasted (W) and the proportion of children who were neither stunted nor wasted was also calculated. As per the recommendation of the World Health Organisation that the nutritional status of the child should be assessed after taking into consideration both the height for age and the weight for height and not on the basis of the weight for age or weight for height alone. Following the recommendations put forwarded by the World Health Organisation, a child can be classified in any of the following four categories:

The child has low height for age as well as low weight for height (SW)	The child is stunted as well as wasted. The child is under nourished in both the dimensions of child nutrition.
The child has only low height for age (S)	The child is stunted but not wasted. The child is under nourished in one dimension of child nutrition.
The child has only low weight for height only (W)	The child is wasted but not stunted. The child is under nourished in one dimension of child nutrition.
The child has normal height for age as well as weight for height (N)	The child is neither stunted nor wasted. The child is not under nourished in any dimensions of child nutrition.

The entire ratios and mean upper arm circumference in the present study do not indicate any extra ordinary situation regarding malnutrition. These children are apparently small but not unhealthy. One must also consider that this group of tribal children belongs to desert populations, of Rajasthan. Further few severe cases of clinical signs of malnutrition like marasmus and protein calorie malnutrition have been recorded in the annual report of District hospital, Barmer district, Rajasthan. The prevalence of the high frequency of moderate to severe forms of malnutrition can be attributed to infections like diarrhea, respiratory infections besides poor maternal health during and at the time of delivery, unavailability and under utilization of health services among many. Cultural practices relating to environmental sanitation, personal hygiene, food habits and their attitudes towards modern medical care go a long way in elevating their suffering.

Box: 2

Major Observation

- *Bisexual differences for 12 body measurements were not statistically significant for most of the measurements, revealing significant for most of the measurements, revealing similar pattern of growth among boys and girls.*
- *At least 56 percent of boys and girls suffer from mild to moderate form malnutrition according to weight for height and height for age.*

Factors affecting Nutrition

Place of residence

Three tehsils of Barmer district were studied under present investigation namely Barmer, Chohtan and Ramsar. Among these three tehsils, Barmer Barmer is the center place of the district and is the administrative center. The collector office campus have all the important administrative offices. The distance of different village under study form tehsil headquarters is given in table 18. The average distance of different villages from tehsil headquarters in Barmer is 16 kms., while in Chohtan it is 48 kms. and in Ramsar it is 48 kms. It can be observed from the table 18. that the villages of Barmer and Ramsar tehsil are nearer to the tehsil headquarters while in Chohtan tehsil, villages are situated far off and in remote area. A comparative study showed that rural children are more likely to suffer from chronic energy deficiency than children in urban areas. These higher rates of rural malnutrition were also reported by local District Hospital, Barmer district, Rajasthan.

Table:18 Distance of villages from tehsil headquarters

Name of taluka	Distance villages from tehsil headquarter (in kms)		
	Average	*Maximum*	*Minimum*
Barmer	16	25	7
Chohtan	48	74	5
Ramsar	19	30	5

Household economic status

The pattern of annual household income obtained from different households on the present study is presented in table 19. It can be clearly seen that 78.16 percent of the total population of Bhil are relatively poor. Middle income group constitutes 21.12 percent of total population and only 0.72 percent of Bhil population can be considered as prosperous. As in the case of women, the economic status of a household is also one of the most important determinants of child nutritional status (UNICEF, 1990). Comparative studies on child nutrition for more than 15 countries (Sommerfelt et al., 1994) and Bhil studies in showed that the higher the level of economic status of the household, the lower the level of child stunting.

Table: 19 Annual household Income

Category	Percentage of Household (n= 450)
<Rs. 25,000 (Poor)	78.16
Rs. 25,000- 60,000 (Lowe middle)	14.21
Rs.60,000-1,50,000 (Moderate)	6.91
> Rs. 1,50,000 (Prosperous)	0.72

Education of mother

Literacy rate, as evident from table 20 turns out to be just 26.64 percent among Bhils in the present study. Female literacy was found to be only 11.37 percent. Out of those who are literate; 67 percent are primary educated 21 percent middle school educated, 6 percent high school educated, 3 percent higher secondary educated and another 2 percent are graduates. Literacy rate among the Bhils corresponds to 26 percent in Indian tribal groups, but much lower than its corresponding figure of 61.03 percent for Rajasthan and 65.38 percent for Indian National Population. Education is one of the most important resources that enable women to provide appropriate care for their children, which is an important determinant of children's growth and development (Engle and Menon, 1996). This study

Table: 20 Literacy rate among Bhils

Literacy	Percentage (n= 1452; < 6yrs excluded)
Illiterate	73.36
Literate	26.64
Total	**100**
Literates	
Primary	67.62
Middle	21.21
High School	6.06
Higher Secondary	3.03
Graduate & Other	2.08
Total	**100**

shows a decreased incidence of malnutrition among young children with an increase in the level of mothers' education. The significance and direct relationship of the child's mother's education concurs with the assertion that maternal schooling is strongly associated with good child care and good health (Maxwell *et al.,* 2000). More education for women is associated with higher levels of household food availability, higher quality diets, better care practices and behaviours and better nutritional outcomes. This finding makes a good case for the use of educational empowerment and capacity building of women as a means of promoting food and nutritional status of children in particular and household members in general.

Employment status of mothers

It can be seen from Table 21 that the pattern of occupation among Bhils varies greatly 74.4 percent are labourer and 20.90 percent are agriculturists. Very few of them have taken up private and government jobs and also have started their own business. Although women's employment enhances the household's accessibility to income, it may also have negative effects on the nutritional status of children, as it reduces a mother's time for childcare. Some studies have revealed that mothers of the most malnourished children work outside their home (Popkin, 1980; Abbi et al., 1991). Another study argued that there is no association between maternal employment and children's nutritional status (Leslie, 1988).

Table: 21 Types of occupation among Bhils

Type	Percentage (n= 450)
Labour	74.11
Pvt. Job	0.43
Agriculture	20.90
Govt. Job	2.30
Business	2.26
Total	**100**

Source of water and availability of toilet facility

In the present investigation it was found that 79 percent of the household (Table 22) use water from boring and tap and 20 percent of the household use drinking water from the open well. All most all families use drinking water from the tank during reany season. In 81.57 percent of cases, the source was located within the village and in 18.12 percent of cases out side the village. Thus, quite a few Bhil households have their own tank in the house.

Table: 22 Sources of Drinking Water

Source	Percentage of families users (n= 450)
River	0.41
Boring/Tap shared	79.40
Tap (owned)	0.10
Well	20.08
Total	**100**

In the present study among Bhils, it can be seen (Table 23) that 98.98 percent of the houses have no drainage and 1.02 percent of the houses have only open drainage which is a perpetual source of poor environmental hygiene and is chiefly responsible for mosquito breeding and also a potential source of fungal and bacterial infection leading to communicable diseases. Unfavorable health environment caused by inadequate water and sanitation can increase the probability of infectious diseases and indirectly cause certain types of malnutrition (UNICEF, 1990; Engle, 1992). This study showed that unprotected water source and non-availability of latrine were associated with low child stature.

Table:23 Disposal of waste water among Bhils

Disposal Category	Percentage of Houses (n= 450)
Closed drainage	0.00
Open drainage	1.02
No- drainage	98.98
Total	**100**

Child morbidity

Diarrhea and other infectious diseases manifested in the form of fever affect both dietary intake and utilization, which may have a negative effect on improved child nutritional status. Crude Death Rate (CDR) has been estimated to be 8.7 for Indian National Population and 8.5 for the population of Rajasthan. CDR for Bhils has been estimated to be 9.22, which is higher than the figure of Rajasthan and Indian National Population. Infant Mortality Rate (IMR) is a very sensitive indicator of mortality

indicating a prenatal and post natal care of mother and infants. IMR has been estimated to be 70/1000 live births for Indian National Population and 79/1000 live births for Rajasthan. IMR for Bhils was estimated to be 94/1000 live births, which is very as compare to both Indian National Population and Rajasthan. A comparative study on children's nutritional status (Sommerfelt et al., 1994) indicated that stunting was highest among children with recent diarrhea.

Child care practices in Bhils

Table 24 presents childcare practices among Bhils. It can be seen from the table that 35 percent of the infants get their first feed as mother's milk with colostrums. Thus, at least 35 percent of children are not deprived of essential nutrition in the form of colostrums. 53 percent of infants receive their feed in the form of curd, butter or poppy. Only 12 percent of infants get mothers milk without colostrums as their first feed. As far as initiation of supplementary diet is concerned, 98 percent of infants get their first supplementary diet between 6 -12 months of age. Similarly, 91 percent of Bhils newborns are breast fed up to two years. Only one percent newborns leave their mothers milk by the end of first year of life. In the present context two years of breast feeding is a long duration and can be reasoned out from the fact that most of the Bhil women are involved in household activities and in those income generation activities, which do not require them to leave their kids at home.

Age of child

Children's nutritional status is also more sensitive to factors such as feeding/weaning practices, care, and exposure to infection at specific ages. A cumulative indicator of growth retardation (height-for-age) in children is positively associated with age (Anderson, 1995 as cited in Aschalew, 2000). Bhil Children have also shown an increase in malnutrition with increase in age of the child.

Table: 24 Child care practices among Dhodias

Child care practices	Percentage
I. First feed given to infant (n= 395)	
a. Mothers milk with colostrums	34.69
b. Mothers milk without colostrums	11.71
c. Jaggery water	0.45
d. Any other	53.15
II. Age at first supplementary diet (n= 121)	
a. 6 months	2.39
b.6- 12 months	97.61
c. After one year	-
III. Duration of breast feed (n= 314)	
a. 1 years	0.91
b. 2 years	90.63
c. 3 years	8.07
d. More than 3 years	0.39

Immunization status

Table 25 presents status of child immunization among Bhils. In the present study 30 percent children were found to be immunized against DPT, 73 percent against Polio and 30 percent against BCG. The performance is not up to the mark and lot more is desired. Performance in administration of vaccination of DPT, BCG, measles and vitamin-A prophylaxis needs further strengthening of efforts in this direction. Incidentally government institution is the primary source of vaccination in more than 70 percent of cases. By and large coverage is not satisfactory in Bhils of Barmer district. Lack of literacy, awareness and slackness among Bhils were the main reasons for not immunizing their children.

Table: 25 Status of child Immunisation among Bhils

Type of Vaccination	Percentage of Responses	
	Yes	No
DPT (n= 402)	30.14	69.86
Polio (n= 415)	73.17	26.83
BCG (n= 397)	29.85	70.15
Measles (n= 381)	28.84	71.16
Vit. A (n= 316)	28.83	71.17

Birth order

It has been found that Bhil parents give less attention to older children when they give birth to a new child who needs much attention and care. Crude birth rate has been estimated to be 26.1 for India and

31.4 for Rajasthan. CBR for Bhils has been estimated to be 34.05 in the present study. The estimated CBR is higher than the CBR of the state of Rajasthan and Indian National Population. Total fertility rate of Bhil women in various child bearing age groups indicate a total fertility of 5.92 estimated from the average parity of women in the age group 45 through 49 years. Indirect estimation of total fertility calculated from $(P_{(3)})^2/P_{(2)}$ has been found to be 6.09 which differs little from the observe fertility rate from the women in the age group 45 through 49 years. One study showed that stunting is rare in birth order 2-3 (Sommerfelt et. al., 1994), and higher birth order (5+) is positively associated with child malnutrition (Jeyaseelan, 1997).

Birth interval of the child

Closely spaced pregnancies are often associated with the mother having little time to regain lost fat and nutrient stores (ACC/SCN, 1990). Higher birth spacing is also likely to improve child nutrition, since the mother gets enough time for proper childcare and feeding. Studies in developing countries showed that children born after a short birth interval (less than 24 months) have higher levels of stunting.

Interrelationship between maternal and child nutrition

Birth weight, child growth, and adolescent growth determine nutritional status before and during pregnancy (maternal nutrition). Maternal nutrition also influences fetal growth and birth weight (ACC/SCN, 1992). The presence of an intergenerational link between maternal and child nutrition means a small mother will have small babies who in turn grow to become small mothers. Some findings on the relationship between maternal and child nutrition (Loaiza, 1997; Teller et al., 2000; Genebo et al., 1999) showed that a high proportion of low-birth-weight and stunted children were observed among malnourished mothers.

Conclusion and Policy Implications

It was found that household economic status, education of parents, prenatal care, visits of the mother (for access to health services), child's age, birth order and preceding birth interval are important determinants of child stunting.

This study arrives at the following conclusions to improve women and children nutritional status. Most of the socio-economic variables are affecting the nutritional status of children. It was also found that there exists a strong association between maternal and child nutritional status and maternal nutritional status and birth weight. This indicates that actions towards improving women and child nutrition should always be integrated for effective utilization of scarce resources and to reduce the link (mother-child) of under nutrition.

This study revealed that children of very poor or low economic status households have the highest rates of malnutrition. This may be due to food insecurity in these households that negatively impacts the nutritional status of children in particular and the other household members in general. Therefore measures should include government action to support the very poor, and to bring about rapid economic growth at the national level. It is important to develop community-based interventions giving priority to very poor households as a short-term solution. Urgent implementation of poverty reduction strategies and programs designed by the Government could also serve as a long-term solution to the problem.

It should be noted that over 88 percent of women reported having no education. It is therefore necessary to promote universal education of girls and women. The results showed that education of parents is one of the important determinants of children's nutritional status. Children of educated parents are at a lower risk of malnutrition, if the risks observed for other variables are

eliminated. This indicates that parents who receive even a minimal basic education (even in the poor households) are generally more aware than those who are not educated of the need to utilize available resources for the improvement of the nutritional status of their children. It is therefore imperative that young girls and boys be enrolled in compulsory primary school education and opportunities should also be given to adult women and men to take part in non-formal education. Health and nutrition education should also be an integral part of the education process.

Close spacing of births, i.e. having a preceding birth interval of less than 24 months, showed a significant nutritional deficit in the younger children, particularly in the rural areas of Barmer district of Rajasthan. This may be associated with risk factors such as mothers' inadequate capacity for caring for her children. The mother herself may be biologically depleted from too frequent births, and this could also negatively affect the nutritional status of the newborn baby. Therefore, access to services for child spacing could benefit the youngest child and the mother. Prolonging the intervals between births, through increasing demand for family planning and/or fulfilling unmet need for family planning, could be important elements of strategies to improve child nutrition.

This study has also indicated that exclusive breastfeeding up to 6 months of age is not widely practiced nor is the timely introduction of weaning foods at about 6 months. Therefore, education with this regard is also important intervention.

Therefore, further research on socio-cultural practices, intra-household food distribution, women's workload, seasonal food insecurity and other related factors is suggested.

Table: 3 The Statistical Values for Standing Height/ Crown Heel Length Among the Bhil of Rajasthan

S. No.	Age Group (Year)	Sample Size		Mean (Cm.)		S.D.		S.E.M. (Cm)		Range			
										Min.		Max.	
		Male	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
1	0—1	25	30	65.92	62.38	2.29	2.79	0.46	0.52	63.1	57.0	69.9	68.2
2	1—2	26	28	69.87	75.86	5.30	5.07	1.06	0.97	61.8	70.0	79.2	81.6
3	2—3	29	30	84.79	83.44	4.41	7.05	0.83	1.29	72.3	61.8	97.0	91.7
4	3—4	30	33	87.29	91.89	4.14	4.59	0.75	0.79	81.2	83.0	101.1	100.4
5	4—5	28	30	100.10	92.61	4.83	4.96	0.91	0.90	94.6	82.1	115.3	100.2
6	5--6	30	33	109.20	106.4	6.46	2.59	1.18	0.45	96.6	101.1	122.1	110.8

Table: 4 The Statistical Values for Weight Among the Bhil of Rajasthan

S. No.	Age Group (Year)	Sample Size		Mean (kg.)		S.D.		S.E.M. (kg.)		Range			
										Min.		Max.	
		Male	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
1	0—1	25	30	6.48	4.99	0.93	0.82	0.18	0.15	5.0	3.1	8.5	6.2
2	1—2	26	28	7.19	7.82	1.16	1.09	0.23	0.23	5.6	6.4	9.3	9.1
3	2—3	29	30	11.44	10.65	1.50	1.07	0.28	0.19	8.2	9.0	14.8	13.0
4	3—4	30	33	11.75	11.63	0.92	0.99	0.17	0.18	9.9	10.0	13.0	13.2
5	4—5	28	30	14.26	12.99	1.05	2.09	1.99	0.36	12.3	10.4	17.0	18.3
6	5--6	30	33	16.50	16.00	2.13	1.84	0.39	0.32	13.2	13.2	22.4	20.5

Table: 5 The Statistical Values for Skin Fold at Biceps Among the Bhil of Rajasthan

S. No.	Age Group (Year)	Sample Size		Mean (mm.)		S.D.		S.E.M. (mm)		Range			
										Min.		Max.	
		Male	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
1	0—1	25	30	4.32	4.63	0.59	0.74	0.12	0.15	3.1	3.1	5.2	5.6
2	1—2	26	28	4.25	5.50	0.53	1.31	0.10	0.25	3.3	3.5	4.9	7.2
3	2—3	29	30	5.65	6.42	0.99	0.91	0.19	0.16	1.3	5.0	7.8	8.2
4	3—4	30	33	6.10	6.90	2.17	1.85	0.39	0.32	3.8	4.3	16.7	10.9
5	4—5	28	30	1.67	5.56	0.65	0.36	0.12	0.06	3.3	5.1	5.9	6.2
6	5--6	30	33	4.90	6.17	0.98	1.66	0.18	0.29	3.1	4.3	6.7	8.9

Table: 6 The Statistical Values for Skin Fold at Triceps Among the Bhil of Rajasthan

S. No.	Age Group (Year)	Sample Size		Mean (mm.)		S.D.		S.E.M. (mm)		Range			
										Min.		Max.	
		Male	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
1	0—1	25	30	6.49	6.32	1.49	1.50	0.29	0.31	4.1	3.8	8.6	9.1
2	1—2	26	28	5.32	7.20	1.17	1.19	0.23	0.22	3.8	5.3	8.6	8.9
3	2—3	29	30	7.96	8.53	1.29	1.62	0.25	0.29	4.9	4.0	11.0	15.1
4	3—4	30	33	6.87	9.05	1.67	0.99	0.30	0.17	4.8	7.3	12.8	10.9
5	4—5	28	30	6.63	8.14	1.27	1.26	0.24	0.23	4.8	4.2	1.6	9.8
6	5--6	30	33	36.92	8.01	1.33	0.96	0.24	0.17	3.8	6.8	9.1	9.6

Table: 7 The Statistical Values for Sub-Scapular Skin Fold Among the Bhil of Rajasthan

S. No.	Age Group (Year)	Sample Size		Mean (mm.)		S.D.		S.E.M. (mm)		Range			
										Min.		Max.	
		Male	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
1	0—1	25	30	5.02	4.73	0.41	0.85	0.08	0.17	4.2	3.4	5.6	6.3
2	1—2	26	28	4.85	6.64	0.65	1.55	0.13	0.29	3.2	4.3	6.1	8.7
3	2—3	29	30	6.10	5.01	0.82	0.45	0.15	0.08	3.6	4.3	7.8	5.9
4	3—4	30	33	6.26	5.88	2.03	0.95	0.37	0.16	3.5	4.2	15.9	7.6
5	4—5	28	30	5.36	5.53	0.92	0.85	0.17	0.15	3.4	3.9	6.9	6.8
6	5--6	30	33	4.75	4.35	0.48	0.67	1.38	0.12	3.4	3.3	5.5	5.3

Table: 8 The Statistical Values for Supra-Iliac Skin Fold Among the Bhil of Rajasthan

S. No.	Age Group (Year)	Sample Size		Mean (mm.)		S.D.		S.E.M. (mm)		Range			
										Min.		Max.	
		Male	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
1	0—1	25	30	7.35	7.59	1.57	2.26	0.31	0.42	4.1	2.7	9.9	13.2
2	1—2	26	28	7.17	8.25	2.48	3.20	0.49	0.60	3.1	3.3	12.0	13.1
3	2—3	29	30	7.71	8.00	1.67	1.26	0.31	0.23	3.9	5.8	10.6	11.0
4	3—4	30	33	6.94	7.69	2.23	1.80	0.40	0.31	3.3	4.7	15.6	13.2
5	4—5	28	30	5.59	7.70	1.38	1.29	0.26	0.23	3.4	5.7	8.3	9.9
6	5--6	30	33	5.11	5.75	1.17	1.30	0.21	0.22	2.9	4.1	7.8	8.4

Table: 9 The Statistical Values for the Skin Fold at Calf Among the Bhil of Rajasthan

S. No.	Age Group (Year)	Sample Size		Mean (mm.)		S.D.		S.E.M. (mm)		Range			
										Min.		Max.	
		Male	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
1	0—1	25	30	8.63	8.34	1.55	1.77	0.31	0.31	4.1	5.8	11.3	13.4
2	1—2	26	28	8.67	9.36	2.18	1.83	0.43	0.35	5.2	6.3	18.1	11.2
3	2—3	29	30	9.03	8.89	1.14	1.50	0.21	0.27	5.1	6.8	11.9	12.1
4	3—4	30	33	6.80	8.88	1.08	1.48	0.19	0.26	4.9	5.9	9.6	11.0
5	4—5	28	30	6.84	7.20	1.25	1.01	0.23	0.18	4.8	5.3	10.9	8.9
6	5--6	30	33	7.33	6.56	1.44	1.19	0.26	0.21	4.6	4.6	9.9	9.5

Table: 10 The Statistical Values for Waist Circumference Among the Bhil of Rajasthan

S. No.	Age Group (Year)	Sample Size		Mean (Cm.)		S.D.		S.E.M. (Cm)		Range			
										Min.		Max.	
		Male	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
1	0—1	25	30	36.53	36.14	1.58	2.27	0.32	0.44	34.1	32.0	39.4	41.3
2	1—2	26	28	41.07	37.11	2.93	2.67	0.58	0.50	37.2	34.2	46.5	41.5
3	2—3	29	30	45.65	42.18	1.97	3.25	0.36	0.59	41.9	36.5	48.9	48.9
4	3—4	30	33	46.46	45.70	2.28	1.80	0.22	0.34	39.8	43.0	51.1	49.0
5	4—5	28	30	47.46	47.12	2.94	1.49	0.55	0.27	43.3	44.8	54.6	50.0
6	5--6	30	33	48.82	47.85	2.53	2.77	0.46	0.48	41.7	41.6	52.9	53.0

Table: 11 The Statistical Values for Hip Circumference Among the Bhil of Rajasthan

S. No.	Age Group (Year)	Sample Size		Mean (Cm.)		S.D.		S.E.M. (Cm)		Range			
										Min.		Max.	
		Male	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
1	0—1	25	30	37.02	36.34	1.45	2.91	0.29	0.54	33.2	30.9	39.2	42.6
2	1—2	26	28	39.46	41.04	3.20	2.55	0.64	0.48	33.4	38.2	44.3	45.0
3	2—3	29	30	45.08	43.99	2.66	1.62	0.50	0.29	40.5	41.3	49.6	46.7
4	3—4	30	33	46.12	46.54	1.18	3.54	0.22	0.62	43.6	40.2	48.1	53.2
5	4—5	28	30	48.66	49.84	2.48	3.70	0.47	0.64	43.8	45.1	53.1	57.8
6	5--6	30	33	53.51	51.00	4.21	2.76	0.77	0.48	46.2	47.0	61.8	56.9

Table: 12 The Statistical Values for Head Circumference Among the Bhil of Rajasthan

S. No.	Age Group (Year)	Sample Size		Mean (mm.)		S.D.		S.E.M. (mm)		Range			
										Min.		Max.	
		Male	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
1	0—1	25	30	42.65	42.19	1.1	2.23	0.22	0.44	40.2	39.2	44.8	49.8
2	1—2	26	28	46.66	44.22	2.71	1.77	0.54	0.33	40.3	42.1	52.1	46.9
3	2—3	29	30	46.70	45.46	2.4	1.50	0.45	0.27	41.9	40.3	50.1	49.1
4	3—4	30	33	46.85	47.18	1.29	1.06	0.24	0.18	44.5	45.0	49.9	49.2
5	4—5	28	30	48.93	48.14	1.1	3.19	0.21	0.55	46.3	44.2	51.2	57.9
6	5--6	30	33	49.37	48.68	1.01	1.44	0.18	0.25	46.9	46.0	52.3	51.0

Table: 13 The Statistical Values for Chest Circumference Among the Bhil of Rajasthan

S. No.	Age Group (Year)	Sample Size		Mean (Cm.)		S.D.		S.E.M. (Cm)		Range			
										Min.		Max.	
		Male	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
1	0—1	25	30	39.64	39.3	1.64	2.12	0.33	0.39	36.3	36.0	42.1	43.9
2	1—2	26	28	43.58	40.89	1.62	2.39	0.32	0.45	40.9	38.1	46.0	44.5
3	2—3	29	30	45.42	45.66	2.15	1.54	0.40	0.28	41.9	43.1	49.3	49.2
4	3—4	30	33	46.59	48.11	1.47	1.84	0.27	0.32	43.5	45.0	48.6	51.3
5	4—5	28	30	48.55	49.29	1.91	1.87	0.36	0.32	44.7	46.0	52.8	53.7
6	5--6	30	33	51.45	50.22	5.02	1.93	0.91	0.33	42.3	46.2	59.8	54.0

Table: 14 The Statistical Values for Mid-Upper Arm Circumference Among the Bhil of Rajasthan

S. No.	Age Group (Year)	Sample Size		Mean (Cm.)		S.D.		S.E.M. (Cm)		Range			
										Min.		Max.	
		Male	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
1	0—1	25	30	11.45	11.46	1.07	1.26	0.21	0.23	9.3	8.9	13.5	13.6
2	1—2	26	28	11.98	12.35	1.03	1.41	0.2	0.27	10.1	10.3	13.9	14.3
3	2—3	29	30	13.59	12.45	0.82	0.83	0.15	0.15	11.8	11.0	15.0	13.7
4	3—4	30	33	13.85	12.48	0.84	1.14	0.16	0.19	12.2	10.3	15.1	14.2
5	4—5	28	30	14.06	13.72	0.81	0.86	0.15	0.15	12.0	12.3	15.2	14.9
6	5--6	30	33	14.34	13.96	0.99	1.17	0.18	0.20	12.0	12.0	16.3	16.4

Table: 15 Nutritional Status of Bhil Children According to Weight for Height and Height for Age

Nutritional Status	% of Weight / Height			% of Height for Age**		
	Boys (n= 167)	Girls (n= 176)	Total (n= 343)	Boys (n= 168)	Girls (n= 184)	Total (n= 352)
Normal	38.32	36.39	35.86	29.16	32.60	30.96
Mild	46.70	43.18	44.89	52.97	49.45	51.13
Moderate	12.57	9.65	11.07	12.50	16.30	14.48
Severe	2.39	10.22	6.41	5.35	1.63	3.40

Normal >90** ***<95
Mild 80-90 ***87.5 – 95***
Moderate 70 – 80 ***80 – 87.5***
Severe < 80 ***< 80***

Table: 16 Assessment of Degree of Malnutrition of Bhil Children to Weight for Age

Nutritional Status	% of Weight / Age*		
	Boys (n= 170)	Girls (n= 179)	Total (n= 349)
Normal	11.11	11.73	11.46
Mild	51.76	45.81	48.71
Moderate	29.41	33.51	31.51
Severe	7.64	8.93	8.30

Normal** ***90 – 110
Mild** ***75 – 89
Moderate** ***60 – 74
Severe** ***< 60

Table: 17 Test of Significance (t-test) for Estimating Bi-Sexual Differences in Various Body Measurements at Different Ages Among the Bhil of Rajasthan

S. No.	Name of the Body Measurement		Age Group					
			0-1	1-2	2-3	3-4	4-5	5-6
1	Standing Height/ Crown Heel Length	t- value	5.288*	4.18*	0.88	4.89*	6.04*	2.22*
2	Body Weight	t- value	6.77*	6.62	2.39*	0.75	6.35*	2.00*
3	SF at Biceps	t- value	1.82	4.80*	3.25*	1.88	7.25*	3.73*
4	SF at Triceps	t- value	0.41	6.09*	1.44	7.03*	2.47*	3.76*
5	SF at Sub-Scapular Region	t- value	15.0*	5.67*	7*	1	0.05	1.29
6	SF at Supra-Iliac Region	t- value	2.66*	1.40	0.76	3.89*	8.07*	2.10*
7	SF at Calf	t- value	3.33*	1.27	0.44	10.4*	1.54	2.36*
8	Waist Circumference	t- value	4.33*	5.21*	5.02*	3.3*	0.53	1.47
9	Hip Circumference	t- value	2.55*	2.45*	1.87	2.0	2.31*	2.79*
10	Head Circumference	t- value	2.30*	3.87*	2.38*	1.06	3.90*	0.68
11	Chest Circumference	t- value	3.40*	5.0*	0.51	1.74	1.76	1.27
12	Mid-Upper Arm Circumference	t- value	0.0	1.15	5.38*	9.06*	2.26*	1.40

T- values are significant at 5% level

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