

Calorie and Protein Consumption Pattern Among Desert People of Rajasthan During Drought

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Abstract A two point survey of the Cereal (millet) consumption pattern of selected rural families residing in six desert districts of Rajasthan, viz., Jodhpur, Jalore, Nagaur, Sikar, Jaisalmer and Barmer was carried out during the drought years of 1987 and 1988. Two thousand persons representing each district and drawn from ten villages were examined with regard to their millet consumption pattern. In a sub-sample of 800 persons drawn from ten villages in each district from five of the former six districts. Similar information was obtained during the second point of the study. The mean calorie intakes were ranging from 301 to 982 kcals per day in preschool children. Accordingly the deficit was more than 50% in all the districts except in Jodhpur district. Similarly among 5-15 years age group in both the sexes the deficits were observed to be ranging from 31.9% to 68.5%. The deficits ranging from 11.9% to 57.0% among 15-45 years age group, however in all the districts except in Jodhpur and Jalore the intakes were lower as compared to ICMR recommended dietary allowances. Protein deficiency were seen in all the age groups in all the districts but were relatively less as compared to corresponding calorie intake. The body weights and calorie consumption were observed to be comparable among districts as well as among different physiological groups. However calorie deficits ($> = 35\%$) was relatively more in Barmer district as compared to other districts. The mean body weight and actual calorie consumption were observed to be around 46 Kg and 2400 Kcals. respectively.

Key Words Calorie intake, Protein intake Drought, Desert, People.

Drought conditions periodically prevail in the desert districts of Western Rajasthan. This periodic recurrence of water scarcity condition invariably influences agricultural production and food intake of the human population in the desert. Even during normal rainfall years, cereals including millets contribute the maximum proportion of calories and proteins in their diet. It has been estimated that cereals contribute over 85% of the total daily calorie intake of the rural population of India. This is true for the residents of the desert too. The staple food in the rural parts of the desert region is the nutritious pearl millet (Bajra). However, during scarcity conditions, consumption of

bajra is significantly reduced. In an earlier study in the drought affected districts of Maharashtra, it was shown that more than 80% of the households had calorie intakes below the recommended allowances (Krishnamachari et al. 1974). During 1987, almost all the desert districts of Rajasthan experienced drought. A two point field study (in Oct. 1987 and in Feb. March 1988) of representative population belonging to six desert districts was carried out for; a) evidence of clinical nutritional deficiencies, b) anthropometric evaluation, and c) cereal (millet) consumption pattern. The results are presented in this communication.

Table 1 Mean calorie intake per day (Kcals/day) in different age (Years) and gender groups in districts of western Rajasthan

District	< 5		5-15		15-45	
	Male	Female	Male	Female	Male	Female
Jodhpur	982 ± 464.9	870 ± 436.1	1588 ± 526.4	1567 ± 498.3	2466 ± 896.4	2288 ± 856.6
Jalore	579 ± 294.8	702 ± 481.6	1587 ± 625.9	1350 ± 644.8	2443 ± 837.9	2347 ± 767.7
Nagaur	425 ± 260.8	456 ± 316.2	1027 ± 453.2	981 ± 429.8	1589 ± 740.3	1644 ± 724.5
Sikar	521 ± 322.0	552 ± 339.4	955 ± 392.4	852 ± 422.4	1500 ± 573.1	1441 ± 575.0
Jaisalmer	326 ± 233.2	301 ± 181.6	787 ± 310.1	743 ± 312.8	1562 ± 649.3	1519 ± 524.7
Barmer	392 ± 324.8	390 ± 301.7	902 ± 538.6	732 ± 440.0	1204 ± 700.3	1030 ± 724.6

Value are mean ± SD

Materials and Methods

The study was conducted at two points of time covering a drought period with a gap of three months between the study periods.

The rapid drought survey (RDS) was carried out simultaneously in the six desert districts, viz. Jodhpur, Jalore, Nagaur, Sikar, Jaisalmer and Barmer, using a common schedule for assessment of both family level consumption pattern as well as individual consumption pattern. From standard tables of Nutritive values of Indian Foods (Anonymous 1989), calorie and protein intakes of the respondents were calculated.

Ten villages were selected in each of the 6 districts such that atleast two villages from each tehsil were included in the study. From each selected village atleast 30 pre-school children, 60 school children and 120 adults were included in the overall study. Information on cereal consumption pattern was obtained for atleast 2000 people by interrogating the mothers or elderly female members of the family who were interviewed either at the site of their work spots or at their households in the villages.

The follow up survey was carried out in all except Barmer district. In each district 10 villages were selected in such a way that 2 villages per district were repeated (reincluded) out of the original 10 villages surveyed in the rapid drought survey. In this survey only 800 individuals were studied per district. Information on calorie and protein consumption was obtained in a sub sample of 40 percent of women. The information obtained was essentially similar to that in the first point survey.

Results and Discussion

Calorie intake

The highest consumption figures for male and female pre-school children of less than 5 yr were obtained for Jodhpur district and lowest intakes were recorded for Jaisalmer district (Table 1). ICMR's (Anonymous 1987) daily intakes for

calories for this age group are 1220 (upto 3 years) and 1720 (4-6 years) Kcals. Thus the pre-school children in the desert districts met the recommended daily requirements during drought. For boys and girls in the school going age group, the corresponding recommended are 2200 Kcals and 2300 Kcals respectively. In comparison, the mean calorie intakes for boys and girls (5-15 Yr) were well below the recommended figures in all the districts (Table 2). During drought conditions, due to non-availability of agricultural work, the rural population are expected to be sedentary, although some of them who were appointed on relief work-spots did undertake moderate to hard work. However, even considering the recommended calorie intake of 2400 Kcals for sedentary male workers, only adult males of Jodhpur and Jalore districts were just meeting the requirements while those of the other four districts were much below the ideal intake level. When a value of 2800 Kcals needed for a moderate worker is taken for comparison, in none of the six districts males met the requirement. When a recommended value of 2200 Kcals for moderately active adult female workers was considered, varying degrees of calorie deficit existed in Jodhpur and Jalore districts only.

Based on information obtained through interrogation, all the women were further classified into three groups, viz. pregnant, lactating and non-pregnant non-lactating. As regards pregnant women, the recommended allowance for calories is 2500 Kcals-day⁻¹ for a moderate worker which, in none of the five districts, the pregnant women were having (Table 3). The closest value was observed in Jodhpur, Jalore and Nagaur. For lactating mothers the recommendation is for 2700 Kcals-/ day⁻¹ which again was not met by the average intakes of this group in any one of the districts surveyed. While severe calorie deficits were recorded in pregnant women of Barmer and Jaisalmer districts only, the lactating mothers experienced severe deficits in almost all the districts, the worst sufferers being those observed in Jaisalmer and Barmer districts (Table 3). In contrast, when the value for non-pregnant, non lactating women were separated from those for the other

Table 2 Per cent deficit of daily intake of calories in different age (years) and sex groups in districts of Rajasthan

District	Range				Average		Average			
	< 5				(<5)		5-15		15-45	
	Male		Female		Male	Female	Male	Female	Male	Female
Jodhpur	19.5 -	42.9	28.7 -	49.4	27.0	35.3	36.5	31.9	11.9	N.D.
Jalore	52.5 -	66.3	42.5 -	59.2	57.0	47.8	36.5	41.3	12.8	N.D.
Nagaur	65.2 -	75.3	62.6 -	73.5	68.5	66.1	58.9	57.4	43.3	25.3
Sikar	57.3 -	69.7	54.8 -	67.9	61.3	59.0	61.8	63.0	46.4	34.5
Jaisalmer	73.3 -	81.1	75.3 -	82.5	75.8	77.6	68.5	67.7	44.2	31.0
Barmer	67.9 -	77.2	68.0 -	77.3	70.9	71.0	63.9	68.2	57.0	53.2

N.D. = No. Deficit.

two groups, the recommended requirement of 2200 kcals was met except in Barmer and Jaisalmer.

Protein intakes

The protein intakes were calculated (derived) from the intakes of millets as the millets (Bajra) constituted the sole source of protein, for the villagers. The computed protein figures were directly related to calories as well. The ratio between mean calorie intake and mean protein intake in each group was 30:1. The protein intake data for various age groups are presented in table 4.

The ICMR recommended values for protein intake for different age, sex and physiological groups (Anonymous 1987) were utilized to calculate adequacy or deficiency for each category from all the districts. It is seen that except in Barmer, adult females had met their protein requirements (Table 5). Small numbers of adult males had protein deficiency in Nagaur, Sikar and Jaisalmer districts and more than a quarter of the people surveyed in Barmer. Children of either sex in the 5-14 years age group has exhibited deficits of 25-45 percent in different districts except in Jodhpur and Jalore. In contrast, pre-school children in many districts had shown deficits ranging from 10 to 65

percent. Jaisalmer and Barmer had shown the maximum deficit in all age groups.

Rehabilitation

The drought continued for 8-10 months. In the interim period various supportive activities were initiated by Governmental and voluntary agencies. Relief programmes meant to provide additional income to each family by finding work for one person per family at the work-spots were intensified. Distribution of massive doses of vitamin A was also started.

In general there was significant increase in mean calorie intake in all age groups in either sex. However, it is noted that the maximum increase in calorie intake above the first survey value (RDS) was seen among the adult men and women. The least increases in calorie intake between the two points of the study occurred in pre-school children. This is corroborated by our finding that clinically severe protein energy malnutrition cases in pre-school children continued to be high even during the follow-up (second point of the study) period also.

The study clearly showed that during the 1987 drought a severe deficit of calories existed leading

Table 3. Mean body weight (kg) and mean daily intake and % deficit of calories in working women in western Rajasthan

District	Total number	Pregnant			Lactating			NPNL**		
		Body weight	Calorie intake	Deficit %	Body weight	Calorie Intake	Deficit %	Body weight	Calorie intake	Deficit %
Jodhpur	403	49.4±0.9 (19)	2413±219.1 (19)	3.5	44.8±0.5 (124)	2533±84.3 (124)	6.2	43.3±0.4 (261)	2521±59.3 (258)	N.D.
Jalore	190	49.3±2.6 (7)	2397±264.4 (7)	4.1	44.8±0.8 (49)	2183±88.6 (49)	19.1	43.4±0.5 (132)	2240±56.5 (131)	N.D.
Nagaur	262	45.8±2.0 (7)	2423±194.6 (7)	3.1	46.1±0.6 (48)	2405±78.1 (48)	10.9	44.7±0.4 (204)	2355±42.6 (145)	N.D.
Barmer	250	48.9±2.6 (8)	1579±85.2 (8)	36.8	45.8±0.6 (92)	1460±86.2 (92)	45.6	44.4±0.5 (148)	1415±65.3 (145)	35.7
Jaisalmer	200	48.1±3.7 (17)	2135±122.2 (17)	14.6	47.3±0.7 (55)	2136±82.6 (55)	20.9	48.8±3.5 (128)	2070±55.4 (128)	5.9

** NPNL = Non-pregnant Non-lactating * Value are mean ± SD

N.D. = No deficit Values in Parenthesis are number covered.

Table 4 Mean protein (g) intake day⁻¹ in different age (years) and gender groups in drought affected districts of Rajasthan

District	<5		5-15		15-45	
	Male	Female	Male	Female	Male	Female
Jodhpur	32.3 ± 14.9 (136)	29.0 ± 14.5 (93)	52.9 ± 17.5 (376)	52.2 ± 16.6 (147)	82.6 ± 29.9 (571)	76.3 ± 28.5 (583)
Jalore	19.3 ± 9.8 (98)	23.4 ± 16.0 (71)	52.9 ± 20.9 (474)	45.0 ± 21.5 (114)	81.5 ± 27.9 (571)	78.2 ± 25.6 (582)
Nagaur	14.2 ± 8.7 (126)	15.2 ± 10.5 (95)	34.2 ± 15.0 (422)	32.7 ± 14.3 (188)	53.0 ± 24.7 (543)	54.8 ± 24.1 (308)
Sikar	17.2 ± 10.7 (90)	18.4 ± 11.3 (81)	31.8 ± 13.1 (319)	28.5 ± 14.1 (187)	50.0 ± 19.1 (280)	48.1 ± 19.2 (308)
Jaisalmer	10.8 ± 7.8 (157)	10.2 ± 6.0 (95)	32.3 ± 10.3 (246)	24.8 ± 10.4 (143)	52.0 ± 21.6 (497)	50.6 ± 17.5 (494)
Barmer	13.1 ± 10.8 (141)	12.9 ± 10.1 (90)	30.1 ± 17.9 (236)	24.4 ± 14.8 (91)	40.1 ± 23.3 (537)	34.3 ± 24.4 (542)

Value are mean ± S. D.

Number in parenthesis indicate the number of positions studied.

Table 5 Percent deficit of daily intake of proteins in different age and sex groups in districts of Rajasthan

District	Range		Average (< 5)				Average			
	<5		Male		Female		5-15		15-45	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Jodhpur	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Jalore	12.3-34.4	N.D.	24.1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Nagaur	35.5-51.7	30.9-48.3	44.7	40.9	27.4	24.3	27.4	24.3	3.6	N.D.
Sikar	21.9-41.5	16.4-37.4	33.1	28.4	32.5	44.0	32.5	44.0	9.1	N.D.
Jaisalmer	50.9-63.3	53.6-65.3	58.0	60.3	31.4	42.6	31.4	42.6	5.5	N.D.
Barmer	40.5-55.4	41.4-56.1	49.1	49.8	36.2	43.5	36.2	43.5	27.1	23.8

N.D. = No Deficit.

to varying degrees of under nutrition, particularly in pre-schoolers and school-going children. Prompt action by various agencies had resulted in restoration of calorie adequacy. The practical implications of community hunger (calorie deficit) are too obvious.

The desert region should have a definite strategy to combat repeated droughts. The objective of such a strategy should aim at prevention of vitamin A deficiency and provision of needed calories through cereals in order to maintain body weight. The worst affected population groups are pre-schoolers, and lactating and expectant mothers. The latter two groups of women suffer from the twin disadvantages of being mothers and working women. Apart from the additional calorie needs to meet the demands of pregnancy and lactation, the work loads of these women in the drought-relief programmes involve additional calorie expenditure. This makes women additionally susceptible to undernutrition during drought. The consequences of maternal undernutrition on birth weight, intra-uterine growth and post-natal growth are well documented.

This physiological implication must be taken into account while drought-relief programmes are launched. Pregnant and lactating mothers should be either provided with additional calorie allowances commensurate with their body demands or be required to be engaged in less strenuous physical work.

A working model for establishment of drought management strategy in the desert is as follows.

Non-drought years

1. Surveillance for birth weight, infant mortality and pre-school morbidity.
2. Detection of prevalence of vitamin A deficiency.

3. Efforts to sustain adequate calorie intake.
4. Increased Agricultural production.

Early drought condition

1. Detect the number of pre-school children with grade III under nutrition.
2. Organise community supplementation of Vitamin A.
3. Protect pregnant and lactating mothers.

Drought condition

1. Supportive drought relief measures to ensure adequate intra-familial distribution of calorie.
2. Efforts to sustain minimum body weight in vulnerable segments of the population.
3. Immunization and protective dose of Vitamin A.

Tide over

1. Reduce all mortality.
2. Prevent nutritional deficiencies.
3. Increase work out put.

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