

## A Study on Diet and Nutritional Anthropometry of the Population of Mirpur, District Midnapore, West Bengal

K. K. Bhattacharya, P. Bharati, R. Gupta and A. Bazu

### ABSTRACT

Dietary and nutritional anthropometric investigations were done on the Christian population of Mirpur village, Tamluk Subdivision, Midnapore district, West Bengal, as part of a bio-medical survey being carried out there since early 1976. A quantitative diet survey was done on 48 out of a total of 56 households. The investigations were done during the post-harvest period of January-February 1978. The dietary intakes of calories, protein, calcium and some of the vitamins were found to be inadequate in comparison to allowances recommended by the Indian Council of Medical Research.<sup>1</sup> Calorie intake was also inadequate in terms of calorie need based on body weight according to FAO standards.<sup>2</sup> The average physique of the population as measured by Pignet index was poor. The observed poor physique may be due to inadequate dietary intakes, as well as heavy parasitic infestation, as has been reported elsewhere.

### Introduction

Studies on nutritional status of Indian populations are scarce, especially considering the wide range of regional, ecological, ethnic, socio-economic and cultural variations prevailing in the country<sup>3</sup>, and those involving both nutritional status assessment and nutritional anthropometric data are even scarcer. In view of the paucity of such information, particularly from populations of the State of West Bengal, a quantitative diet survey was conducted and nutritional anthropometric data collected on the population of Mirpur, as part of a wider bio-medical study being conducted there since early 1976. The major purpose of the Mirpur study was to evaluate the health status of the population, health being defined not merely in terms of

mortality and morbidity<sup>4</sup> but more positively as a »state of complete physical, mental, and social well-being«<sup>4</sup>. The dietary data are presented in this report as a measure of the level of nutrition, one of the important determinants of health status, and anthropometric data as indicators of body size, an important consequence of the same. Apart from reporting the data, which may eventually be useful in formulating developmental programmes for the community, the possible relationship between dietary intakes and anthropometric measurements are considered.

### Material and method

Mirpur is a small, Christian village of 58 households, as of our census of early 1978, isolated from its Hindu and Mu-

Received for publication November 13, 1980

slim neighbouring villages especially in respect of intermarriage because of religious barriers. Historically, they are known to have descended from 12 Portuguese gunmen who settled down in this area about 200 years ago, married local women and founded this small partially isolated community. The present study was carried out in 48 households during January-February 1978. These households were studied simply because they were readily available for study, while 8 households were either reluctant or most of their members were away during our survey. Each of these 48 households was visited for consecutive three days, twice daily, prior to cooking, and food items to be cooked for each meal were weighed. Food consumed outside home by member(s) of a given household, household member(s) not taking meal at home, or guest(s) taking meal in the household, during the investigation were recorded. Information regarding occupation of the adults, sufficiency in food grains produced, dietary habits, etc. were also recorded.

The average number of members in a household was 5.5. The average consumption unit per household, as distinct from the average number of household members, was 4.5. The consumption units per household were estimated in the following manner: Calorie need was the basis of calculating the consumption units. The people of Mirpur were treated as «moderately active», considering their occupations. According to ICMR<sup>1</sup> the recommended allowance of calorie for a moderately active adult male (equivalent to 1 consumption unit) is 2800, which was taken as 1. For each individual in the household, the ratio of the calorie need of that individual, considering his/her age and sex, to 2800 was calculated. These ratios were summed over all the individuals of the household to get the total consumption units for that household.

An example of the method of estimating the consumption unit is given below. A certain household consists of (say) the following 7 members: males aged 55,

24 and 14 years and females aged 52, 23, 18 and 17 years.

Thus,

Individual	Calorie need by ICMR recommendation
M 55	2800
M 24	2800
M 14	2500
F 52	2200
F 23	2200
F 18	2200
F 17	2200

  

Consumption unit	
2800/2800 = 1	
2800/2800 = 1	
2500/2800 = 0.89	
2200/2800 = 0.79	
2200/2800 = 0.79	
2200/2800 = 0.79	
2200/2800 = 0.79	

Total household consumption unit: 6.05

The nutrient intakes were estimated by household using food tables prepared by the ICMR<sup>1</sup>. Anthropometric data were obtained for 34 adult males and 57 adult females out of a total of 78 in each sex. The body measurements of males comprised height, weight, chest girth (inhalation and exhalation), bicipital diameter, biacromial diameter, upper arm girth and skinfold thickness at three sites, namely, triceps, biceps and subscapular. Only two measurements, i.e., height and weight, were made in female subjects.

## Results and discussion

### 1. Occupational pattern and self-sufficiency in food production

About 50% of the adults are cultivators by occupation, and about 31% are engaged in service as well as agricultural work. Of the 48 households, about 29% produce food grains sufficient or nearly sufficient for 1-12 months in a year in

a normal food production year, more than 27% do not produce grains at all, 21% produce sufficient quantities for one to three months of a year, and the rest produce enough grains for about half the year. The principal and only cereal produced by the Mirpurians is rice, besides which Khesary dal (*Lathyrus sativus*), a kind of pulse, is also grown. Most families have kitchen gardens where seasonal leafy vegetables and some other vegetables, e.g., egg plant, bean, green chilli, gourd, potato, etc. are grown in limited quantities. Many families own one or more ponds where some fresh water fishes are grown. Apart from these, chicken, pig, cow, etc. are reared by some.

## 2. Dietary habits

The staple food of the Mirpurians is rice. Generally, each family cooks food in the late hours of morning and afternoon. Either puffed rice or «chapati», i.e., hand made bread, is consumed as snacks. Three-fourths of the households consume vegetables, including leafy vegetables, regularly whereas about 48% consume pulses regularly. Meat, fish, egg, etc. which are the sources of animal protein, are consumed regularly by about 40% of the households. Alcoholic beverages (country liquor and palm toddy) are consumed by many adult males, but due to social stigma against drinking the consumption may be underreported. Consumption of fruit and milk/milk products is negligible. Tea is generally taken without milk and sugar, but often with saccharin.

## 3. Food and nutrients consumption

The average daily consumption of different food items and nutrients per consumption unit are given in Tables 1 and 2.

The nutrient requirements suggested by ICMR for a «reference man» having body weight of 55 kp. contrasted to the actual intakes as estimated from our survey (Table 2) shows that the diet of Mirpurians is deficient in calorie, protein,

calcium, vitamin A (Carotene) and vitamin B<sub>1</sub>. The actual body weight of an adult male in Mirpur is, however, much lower than that of the reference man, i.e., 46.6 kp., as we shall see later. Using the following formula suggested by FAO<sup>1</sup>, the calorie need for a male weighing 46.6 kp. was estimated to be 2460 calories (Calorie need =  $152 \times W^{0.75}$ , where W is weight in kp.) (Thus, calorie intake per consumption unit is lower than required by more than 15%, even if the intake is estimated from actual body weight). The severity of calorie deficiency is also clearly demonstrated in Table 3, which shows that about 46% of the households get less than 2000 calories per consumption unit per day.

Again, considering that the recommended allowance for protein for a male adult is one pond per kp. of body weight<sup>1</sup>, and given that the average weight of Mirpurians is 46.6 kp., the protein requirement in Mirpur is about 47 p. per consumption unit, which is apparently lower than the observed intake of 51.3 p. However, as most of the households under survey include a number of adolescent boys and girls, and some include pregnant or lactating women, and as the protein needs of such categories of individuals is much higher than 1 p. per kp. of body weight, the protein requirement per consumption unit should be higher than 47 p. Anyway, the observed protein intake of the Mirpurians may not be very much short of the recommended allowance.

The major source of the calorie and protein consumed by after harvest when food (cereal) availability was maximal, and that is even in this period the diet was inadequate in respect of most nutrients, i.e., calorie, protein and vitamins, it must be still more inadequate in the lean period immediately before and during harvest. Unfortunately, no specific period is representative of the whole year and we were unable to conduct our survey during the entire year, so that at present we have no way of evaluating how inadequate the diet is during the pre-harvest period.

TABLE 1  
AVERAGE PER DAY CONSUMPTION OF DIFFERENT FOOD GROUPS  
PER CONSUMPTION UNIT IN MIRPUR

Cereals	Pulses	Leafy vegetables	Vegetables (other)	Roots & tubers	Fish, cereals, eggs, etc.	Oil	Sugar	Milk	Fruit
486.6	15.4	60.8	73.9	89.1	29.2	9.3	23.9	0.1	1.1

TABLE 2  
AVERAGE PER DAY CONSUMPTION PER CONSUMPTION UNIT OF DIFFERENT  
NUTRIENTS WITH STANDARD DEVIATIONS IN MIRPUR

Calorie	Protein (gm.)		Fat (mp.)	Cal- cium (mp.)	Iron (mp.)	Vit A (I. U.)	Vit B <sub>1</sub> (mp.)	Vit B <sub>2</sub> (mp.)	Nico- tic Acid (mp.)	Vit C (mp.)
	Animal	Vege- table								
Intake	5.2	46.1	15.6	336	34.6	1957	1.5	0.6	21.2	70
Recom- mended allow- ances*	±5.0	±14.8	±11.4	±158	±12.6	±2052	±0.5	±0.3	±5.6	±54
2800	55	?	?	400 to 500	20	3000	1.4	1.5	19	50

\* ICMR

TABLE 3  
DISTRIBUTION OF FAMILIES ACCORDING TO CALORIE CONSUMPTION  
IN MIRPUR

Calorie intake	Less than 1300	1301 to 2001	2001 to 2600	2601 & above
Distribution	2.08%	43.75%	37.50%	16.67%

TABLE 4  
MEAN VALUES OF ANTHROPOMETRIC MEASUREMENTS WITH  
STANDARD DEVIATIONS IN MIRPUR

Sex	No.	Age	Height	Weight	Bicrist. diam.	Chest girth		Upper arm girth	Upper arm diam.	Skinfold thickness			
						Inphala-tion	Exphala-tion			Triceps	Biceps Subscap.		
Male	34	45.00 ± 15.45	163.03* ± 6.71	46.59 ± 7.71	25.29 ± 1.32	35.26 ± 1.83	79.65 ± 4.89	77.59 ± 4.72	23.03 ± 2.66	6.72 ± 0.78	6.29 ± 2.56	3.32 ± 0.71	9.79 ± 4.05
Female	57	38.65 ± 15.89	148.22** ± 4.98	41.79*** ± 7.85									

\* Two men had stooping gait and were excluded from this analysis.

\*\* Three women had stooping gait and were excluded from this analysis.

\*\*\* One woman was pregnant and was excluded from this analysis.

#### 4. Nutritional anthropometry

Table 4 sets out the anthropometric data of the adult males and females, respectively.

Pignet's<sup>8</sup> suggested the following index for evaluation of body build: Pignet index = stature in cm. (chest circumference in cm. + weight in kp.). The index is complex and difficult to interpret but has, nevertheless, been used as a ready measure of body build.

He, further, proposed the following classification of Pignet index:

- 1-10 — very sturdy
- 11-15 — sturdy
- 16-20 — good
- 21-25 — average
- 26-30 — weak
- 31-35 — very weak
- 36+ — poor

The Pignet index was calculated on 32 adult males. The mean value of the index was 38.28 indicating that the average physique of Mirpurians was poor. The percentage distribution of the subjects in different categories is given in Table 5.

Brozek<sup>9</sup> devised the following method for predicting body weight from body measurements of the length and width of the skeletal frame, musculature and age and interpreted the deviation of the actual body weight from the predicted one (also called standard weight) as a measure of adiposity, which in its turn is a rough measure of nutritional status:

Predicted weight (kp.) =  $0.411 \times \text{height (cm.)} + 1.204 \times \text{bicipital diameter (cm.)} + 0.885 \times \text{biacromial diameter (cm.)} + 7.342 \times \text{upper arm diameter (cm.)} + 0.220 \times \text{age (years)} - 137.51$ .

The coefficient of multiple correlation for the equation is  $R = 0.769$ .

The diameter of the upper arm, corrected for subcutaneous fat, which serves as a measure of muscularity was computed as follows: upper arm diameter = upper arm circumference — triceps skinfold thickness.

Predicted weight was computed, using Brozek's<sup>9</sup> multiple regression equation, on 32 adult males. The average predicted weight was found to be 49.44 kp. whereas the average actual weight was 46.30 kp., i.e., the average actual weight was found to be 93.63% of the average predicted weight, indicating poor adiposity, and therefore, poor nutritional status, of the Mirpurians. The difference between actual and predicted weights, however, was not significant at 5% level ( $\chi^2 = 21.904$ ; 31 d.f.). The distribution of actual weights of the 32 male subjects, expressed as percentages of their predicted weight, is shown in Table 6.

Table 6 shows that more than 60% of the people are underweight compared to the predicted weight. Most of the individuals who were overweight compared to the standard were found to belong to households in which calorie consumption was adequate according to the FAO standard<sup>2</sup>.

It thus appears that our dietary and anthropometric data corroborate each other, in so far as both indicate a poor nutritional status of the Mirpur population.

#### 5. Limitations of the study

Several points of caution should be noted at this point, however. First, the present estimates of nutrient intake are maximal estimates of nutritional status of the population for the following reasons: (a) in computing the food values from the raw food materials the loss due to cooking is ignored; (b) the process of absorption of nutrients may be hampered for various reasons; (c) availability of food in most seasons is lower than in the post-harvest period during which our survey was done. Second, use of the regression coefficients obtained from a sample of American firemen to estimate the standard weight of Mirpurians may be questionable. Third some adult males studied anthropometrically live in Calcutta and visit home generally during weekends, and considering their body measurements to assess the nutritional status of the Mirpurians

TABLE 5  
PERCENTAGE DISTRIBUTION OF PIGNET INDEX  
IN DIFFERENT CLASSES

Category	Range	Frequency	Percentage
Very Sturdy	Upto 10	0	0
Sturdy	10-15	1	3.1
Good	16-20	0	0
Average	21-25	1	3.1
Weak	26-30	4	12.5
Very Weak	31-35	8	25.0
Poor	36+	18	56.3

TABLE 6  
DISTRIBUTION OF RELATIVE BODY WEIGHTS (ACTUAL AS %  
OF PREDICTED)

Less than predicted	85% of wt.	86-95%	96-105%	106%
7(21.9%)	13(40.6%)	7(21.9%)	5(15.6%)	

may introduce an element of error in our assessment. In spite of the above mentioned difficulties, however, many of which were unavoidable, our data, hopefully, may be assumed to provide as realistic an approximation to the nutritional status of the Mirpurians as is feasible in most such studies done in India.

#### 6. Bio-cultural interrelations

It is intuitively understandable that poor nutritional level is a function of low socio-economic status, which in a rural setting is generally indicated by the extent of landholding, cropping pattern, yielding capacity of land, etc. Mohammad<sup>10</sup> has shown, in a study conducted in the Uttar Pradesh that calorie intake is directly related to land productivity. The relationship between socio-economic factors and nutritional status has already been shown for Brazil<sup>11</sup>, and for certain Indian populations<sup>12,13</sup> in a general way. Although we do not have appropriate data, it seems to us, impressionistically (for data on landholding are impossible to obtain in most Third World countries

for socio-political reasons) that most Mirpur households own very little or no land at all, and/or are unable to maximally utilise whatever land they own for financial inability to buy fertilizers, improved varieties of seed, etc. That more than one fourth of the households do not produce any food grains, while only 25% produce food grains sufficient for 1-12 months' consumption, has been noted earlier.

We have not yet been able to study the socio-economic correlates of malnutrition and the associated health hazards, e.g., high parasitic load, retarded growth and development, etc. in Mirpur, but such studies, which we intend to take up in future, could initiate explorations in an interesting field in which biological and cultural anthropologists could fruitfully join hands to render their discipline more meaningful to the lives of the people they aim to study, and thereby mark a turning point in the history of anthropological researches in India.

#### Acknowledgements

We are indebted to the Directors, Anthropological Survey of India and Indian Statistical Institute for providing administrative and financial support to this work, to the Sub-divisional authorities, Tamluk for providing organizational

help, to Geonkhali High School for providing accommodation in the field, to Dr. Partha P. Majumder for rendering statistical help, to Mr. Subhas Datta and Mr. Paritosch Adhikary for typing the text and last but not the least, to the people of Mirpur for their hearty cooperation.

#### REFERENCES

1. ICMR: Recommended daily allowances of nutrients and balanced diets (National Institute of Nutrition. ICMR Spl. Rep. Ser. No. 60 Hyderabad 1968) — 2. FAO: Caloric requirement (Rome 1957), Nutritional studies no 11 — 3. GOPALAN, C., BALASUBRAMANIAN, S. C., RAMASASTRI, B. V., and VISWESWARA RAO, K.: Diet atlas of India (National Institute of Nutrition. ICMR. Hyderabad 1971) — 4. WHO: Family planning in health services. WHO Tech. Rep. Ser. No. 476. (WHO—Geneva 1971) — 5. BASU, A., GUPTA, R., and BHATTACHARYA, K. K., J. Biosoc. Sc. 12 (1980), 227. — 6. ICMR: The nutritive value of Indian foods and planning of satisfactory diets (National Institute of Nutrition. ICMR

Spl. Rep. Ser. No. 42 Hyderabad 1963) — 7. PIGNET, Du.: As quoted by KROGMAN (1941) — 8. KROGMAN, W. M.: Growth of man (Den Haag: Uitgeverij Dr. W. Junk Groetschel and V. Assema Metz. 1941) — 9. BROZEK, J., Hum. Biol. 28 (1956), 111. — 10. MOHAMMAD, A.: Food and nutrition in India (K. B. Publication, New Delhi 1977) — 11. ROUTLINGER, S., and SELOWSKY, M.: Malnutrition and poverty. Magnitude and policy options. World bank staff occasional papers no 23 (Johns Hopkins University Press 1978) — 12. DEVDAS, R. P., and EASWARAN, P. P., Indian J. Nutrition and Dieties. 4 (1967), 156 — 13. PANDIT, C. S.: As quoted by DEVDAS and EASWARAN (1967).

A. Basu

Anthropometry and Human Genetics Unit, Indian Statistical Institute,  
203 B. T. Road, Calcutta — 700035

#### ISTRAŽIVANJE PREHRANE U POPULACIJI MIRPURA, POKRAJINA MIDNAPORE U ZAPADNOM BENGALU

#### SAŽETAK

U okviru bio-medicinskog istraživanja koje se provodi još od početka 1976. godine izvršeno je antropometrijsko ispitivanje prehrane na kršćanskoj populaciji sela Mirpur u pokrajini Midnapore, Zapadni Bengal. Kvantitativno ispitivanje prehrane izvršeno je u 48 od ukupno 56 domaćinstava, u siječnju i veljači 1978. godine u razdoblju poslije žetve. Utvrđeno je da je potrošnja kalorija, proteina, kalcija i nekih vitamina nedovoljna u usporedbi s količinama koje je preporučio Indijski savjet za medicinska istraživanja. Potrošnja kalorija također je nedovoljna s obzirom na potrebe određene na temelju tjelesne težine prema FAO mjerilima. Prosječan fizički status populacije mjeren Pignetovim indeksom je izrazio nizak. Uzrok slabog fizičkog statusa vjerojatno leži u nedovoljnoj prehrani, kao i u prisutnosti parazita.