

## PROTEIN VALUES OF PAKISTANI DIETS AND MEALS\*

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Protein values of the East and West Pakistan diets and meals were determined according to the method of Miller and Bender. The Net-dietary Protein Calories % (NDp Cals%) of the East Pakistan diet is 5.3 and of the rice based meals lie between 6.3-6.6. Such a diet or meal is unsuitable for the nourishment of vulnerable groups of population i.e. growing children, pregnant and nursing mothers. The protein values of the West Pakistan diets and dishes generally range from 6.8 to 7.7 which make them slightly superior to the East Pakistan diet although these do not fulfill the protein requirements of the vulnerable groups.

### Introduction

There is much information in the literature on the consumption of various foodstuffs and analysis of their dietary constituents. Some information is also available regarding biological value of foods. But evaluation of individual foodstuffs is of little value in practical dietetics unless the nutritive value of the whole food protein as eaten by man is known. No attempt has been made in the past to work on these lines. There is an obvious need to determine the protein value of Pakistani diets and meals as consumed in different parts of the country and compare it with the needs of different population groups, i.e. adults, adolescents, infants, pregnant women and lactating mothers. Such a study can provide information as regards the nutritional status of the people in the light of which recommendations for improvement could be made.

Methods developed for the evaluation of nutritive value of food protein can be divided into two forms; biological assays where living organisms are used as experimental materials and chemical methods. The latter are based on the determination of amino acids composition or amino acids availability of the protein and physical tests which measure the physical properties of the protein such as digestibility.

Of the biological assays, nitrogen balance,<sup>1</sup> although tedious and slow has constantly been employed as a method of choice. In this method two parameters are determined: (a) digestibility, which is defined as the percentage of intake nitrogen absorbed and (b) biological value, the percentage of absorbed nitrogen which is retained. Miller

and Bender<sup>2</sup> developed a rapid method for the determination of biological value and digestibility. This measurement is termed as 'net protein utilization operative' (N.P.U.op.) and is the percentage of nitrogen intake which is retained. In this method nitrogen balance is determined directly by analysis of the carcass rather than of food, urine and faeces. Subsequently they found a relation between water ratio and body nitrogen which absolves the estimation of carcass nitrogen. N.P.U.op. is a measure of the quality of protein. The quantity of protein in the food is expressed as the proportion of metabolizable energy which could be derived from it and is termed protein calories per cent. The product of N.P.U. (op) and protein calories per cent is called net dietary protein calories per cent<sup>3</sup> (NDp Cals%).

This measurement expresses the protein value of a food in a single figure which takes into account both quality and quantity and hence affords a better method of determination of protein value of human diets.

In the present investigations, East and West Pakistan diets and some of the common meals prepared according to the survey figures of former Bengal, Assam and Punjab have been assayed for NDp Cals% and their nutritional adequacy with respect to protein needs of various population groups has been discussed.

### Experimental

*Preparation of diets.*—The composition and method of preparation of the East and West Pakistan diets has been described earlier.<sup>4</sup>

Two diets representative of middle class people of Pakistan were prepared according to the survey figures of the undivided Bengal and Punjab<sup>5</sup> representing East and West Pakistan respectively. The composition of the middle class diets is shown in Table 1.

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TABLE 1.—COMPOSITION OF MIDDLE CLASS DIETS OF EAST AND WEST PAKISTAN.

Food Item	East Pakistan g.	West Pakistan g.
Rice	510.0	205.0
Whole wheat flour	155.0	580.0
Lentil	37.0	30.0
Gram	38.0	30.0
Cabbage powder	3.5	15.0
Potato mash powder	116.0	30.0
Apple powder	16.5	16.5
Mustard oil	55.0	17.0
Butter	27.0	36.0
'Vanaspati'	28.0	17.0
Whole milk powder	75.0	50.0
Meat powder	8.0	27.0
Fish meal	68.0	3.0
Egg powder	8.0	3.0
Sugar	50.0	55.0
Curry powder	10.0	10.0
Salt	10.0	10.0

*Preparation of Dishes.*—Out of a wide variety of dishes prepared, only a few common ones were selected. Due to lack of information and accurate recent survey data, reliance was made on old survey figures, personal communication with Pakistani colleagues and housewives and personal observations. Representative meals of lower, middle and upper classes of both the wings of Pakistan were prepared according to traditional methods and cooking practices and freeze dried for assay.

It was found earlier that cooked rice and bread (chappati) did not differ significantly in NDP Cals % from uncooked rice and wheat flour and so they were added in proper proportions to the cooked and dried curry mixture.

The various food items were purchased in London. Pulses were represented by lentils, green vegetables by peas, non-leafy vegetables by potatoes. For milk and skimmed milk, whole milk powder and skimmed milk powder respectively were substituted. The composition of various meals is presented in Tables 2 and 3.

TABLE 2.—THE COMPOSITION OF PAKISTANI MEALS.

Food Item	1	2	3	4	5	6	7	8	9	10	11
Rice	—	—	—	45 <sup>6</sup>	—	45 <sup>6</sup>	—	—	43 <sup>6</sup>	—	50 <sup>0</sup>
Wheat flour	45 <sup>0</sup>	—	40 <sup>0</sup>	—	45 <sup>6</sup>	—	45 <sup>6</sup>	76 <sup>0</sup>	—	50 <sup>0</sup>	—
Maize	—	45 <sup>0</sup>	—	—	—	—	—	—	—	—	—
Lentils	—	—	20	24	24	48	48	—	435	—	—
									(P. aureaus)		
Minced beef	—	—	—	—	24	—	—	50 <sup>0</sup>	—	—	—
Fish	—	—	—	24	—	—	—	—	—	—	—
Potato	—	—	30	48	48	72	72	—	—	15 <sup>0</sup>	15 <sup>0</sup>
Peas	—	—	20	24	24	—	—	—	—	—	—
Onions	6	6	12	24	24	12	12	—	—	—	—
	(Powder)	(Powder)									
Whole milk powder	—	—	—	—	—	—	—	—	—	—	5
Skimmed milk powder	12	12	—	—	—	—	—	—	—	—	—
Butter	—	—	—	—	—	—	—	—	120	—	—
Mustard oil	—	—	—	—	—	24	24	—	—	—	—
Hydrogenated oil (Vanaspati)	—	—	15	—	24	—	24	50	—	25	25
Curry powder	—	—	12	12	12	12	12	12	—	12	12
Salt	12	12	12	12	12	12	12	12	10	12	10

### Methods

*Net Protein Utilization (Operative), N.P.U. (op.)*.—N.P.U. (op.) was determined according to the method of Miller and Bender.<sup>2</sup> The method essentially consists of feeding the test diet and a non-protein diet to serve as a control separately to two groups of rats of approximately equal weights for a period of ten days. The rats were then killed and the carcasses were dried to a

TABLE 3.—COMPOSITION OF PULAO, ETC.  
(MEAL NO. 12).

1 Pulao	(Rice-meat dish)	gm.
	Rice	900
	Mutton	680
	Butter	450
	Onion	318
	Spices(10)	31
2 Qorma	(Fried meat dish)	
	Mutton	730
	Butter	300
	Onion	450
	Spices(13)	80
3 Shami Kabab	(Meat cakes)	
	Minced beef	900
	Margarine	50
	Onion	135
	Gram pulse	165
	Green chillis	18
	Spices(7)	58
4 Zarda	(Rice sweet dish)	
	Rice	320
	Butter	32
	Sugar	200
	Condiments(3)	50
5 Firini	(Rice-custard)	
	Ground rice	500
	Milk	500
	Sugar	50

*Composition of the Meal*.—Each of the dishes was freeze-dried and the dried material was mixed in the following proportions along with freeze-dried yogurt and whole wheat flour:

	g.
Pulao	1100
Zarda	500
Qorma	500
Shami kabab	240
Firini	200
Yogurt	120
Whole wheat flour	300

constant weight. The nitrogen content was calculated from the water content by applying the formula:  $\frac{N \times 100}{H_2O} = 4.02$ , and the

N.P.U. was calculated from the following equation:

$$N.P.U. = B - (B_k - I_k) / I$$

where B and B<sub>k</sub> are the total body N of the animals on the test and non-protein diets respectively, and I and I<sub>k</sub> are the intake of N in the two groups. For details and composition of non-protein diet the original paper should be consulted.<sup>2</sup>

*Calories*.—Calories (Cals./g) were determined according to the method of Miller and Payne.<sup>6</sup>

*Nitrogen*.—Nitrogen content of the diet was determined by Kjeldhal method followed by micro-distillation by the method of Markham.<sup>7</sup>

*Net Dietary protein calories per cent (NDp Cals %)*.—NDp Cals % of the diets and meals were calculated as follows:

$$\begin{aligned} \text{NDp Cals \%} &= \text{NPU (op)} \times \text{Protein Cals \%} \\ &= \text{NPU} \times \frac{6.25 \text{ N} \times 4}{\text{Cals/g}} \end{aligned}$$

where N represents % Nitrogen in the diet

Results of assay of Pakistani diets and dishes are given in Tables 4 and 5 respectively.

### Discussion

Human protein requirements for the maintenance of a healthy life have been the subject of discussion since the time of Voit. Various authorities have put forward the requirements for maintenance and growth in terms of 'reference protein' i.e. the quality of completely utilizable protein. In the present state of our knowledge data presented by F.A.O.<sup>7</sup> are considered the most acceptable. Platt *et al*<sup>3</sup> using the data given by F.A.O.<sup>8,9</sup> and allowing arbitrary increment of 50% over average minimum requirements to take care of individual variations calculated the protein allowances for different age groups in terms of NDp Cals% which are 8.0, 7.8, 5.9, 8.0 and 9.5 for infant, toddler, child (4-9 years), adolescent and lactating mother respectively.

When adjudged in terms of NDp Cals% the protein value of an average East Pakistan diet is 5.3. Such a diet is suitable only for the adult section of the population and is inadequate for

TABLE 4.—PROTEIN VALUES OF PAKISTANI DIETS.

Diets	No. of rats	N %	Cals/g	Protein Cals %	NPU %	N Dp. Cals %
East Pakistan diet	32	1.49	4.1	9.0	59.0	5.3
West Pakistan diet	16	2.25	4.25	13.1	51.0	6.8
Middle class East Pakistan diet	8	2.48	4.35	14.3	59.0	8.4
Middle class West Pakistan diet	8	2.61	4.35	15.0	58.9	8.7

TABLE 5.—PROTEIN VALUES OF PAKISTANI MEALS.

Meals	No. of rats	N %	Cals %	Protein Cals %	NPU (op) %	NDp Cals %
1. Wheat - onion - skimmed milk	8	2.25	3.9.0	14.4	59.7	8.6
2. Maize - onion - skimmed milk	„	1.63	3.93	10.4	51.5	5.4
3. Wheat-veg.	„	2.23	3.95	14.7	52.7	7.7
4. Rice-fish-veg.	„	1.86	4.00	11.6	56.5	6.6
5. Wheat - meat - pulse-veg.	„	2.41	4.15	14.5	52.1	7.5
6. Rice-pulse-veg.	„	1.68	4.05	10.4	62.7	6.6
7. Wheat - pulse - veg.	„	2.35	4.15	14.2	53.7	7.6
8. Wheat - meat (kabab-roti)	„	4.52	4.10	27.6	47.7	13.2
9. Rice - pulse - fat ('Khichri')	„	1.83	4.75	9.6	66.3	6.3
10. Wheat-potato	„	2.4	4.31	13.9	50.0	7.0
11. Rice - potato ('Tahri')	„	1.46	3.98	9.1	49.1	4.5
12. Rice - wheat - meat-('Pulao - qorma etc.)	„	1.92	4.75	10.1	63.6	6.4

the nourishment of children, adolescents and women during pregnancy and lactation.

The East Pakistan middle class diet is however suitable for adults and growing children but falls short of the requirements of pregnant and nursing mothers.

The average West Pakistan diet is adequate for the protein requirements of adults and children beyond the toddlers' stage but it is unsatisfactory for toddlers, adolescents, pregnant and lactating mothers.

The West Pakistan middle class diet has the same net-dietary protein value as that of the East Pakistan middle class and is likewise unsuitable for nursing mothers.

The meals assayed represent the dietary of peasants and the common people living in towns. Meals No. 1 and 2 are eaten by the rural population of the former Punjab province which is now in West Pakistan. They are conspicuously low in fat and consequently have to be eaten in greater quantities to satisfy caloric requirements. The maize-onion meal is low in N.D.p Cals % and continued dependence on it should be avoided. The other wheat based meals generally follow the pattern of the West Pakistan diet except meal No. 3 which demonstrated the effect of supplementation with skimmed milk.

Rice based meals are equally popular in West Pakistan, though rice with fish is typical of East Pakistan. The N.D.p. Cals% of these meals generally lie between 6.3 to 6.6 making them slightly superior to East Pakistan diet. 'Tahri' (rice-potato) and 'pulao' etc. are occasional meals, the latter being commonly served on festive occasions. The low protein value of this delicious 6-component meals was somewhat surprising. The reason obviously is that cereals, fat and spices form the bulk of the food. Calories derived from proteins are only 10%. The protein value is almost equal to 'khichri' (rice-pulse-fat meal) which has an N.D.p Cals% of 6.3. Khichri is also not a very common meal and is often served to persons who are convalescing. It is sometimes specially prepared for toddlers who are learning to eat and cannot take the usually highly spiced family meal. The dangers of continued feeding of 'khichri' to toddlers are obvious and may lead to diseases of protein malnutrition.

Meal No. 8 which is chosen to represent North West Pakistan is superior to the rest of the meals.

The good physique and the general well-being of the 'Pathans' is in consonance with their dietary. However diet based on an accurate dietary survey figures will provide a correct picture of the dietary of the North West Pakistanis, which at the moment are lacking.

With the exception of occasional meals and the diet of north west Pakistanis, the protein values of West Pakistan meals which are based on wheat lie between 7.0-8.6. They are superior to the East Pakistan diet and meals and satisfy the protein requirements of the adults and children, but are not good enough for toddlers, adolescents and lactating mothers except for wheat-onion-skimmed milk which satisfied the needs of toddlers and adolescents but not for pregnant and lactating mothers.

The above results are approximate and should be treated with caution until more reliable data based on a recent survey are available for analysis. However they throw some light on the poor nutritional status of the vulnerable groups of our population, which is also confirmed by a high rate of infantile and maternal morbidity and mortality.

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