

## SELECTED ARTICLE

### Economic Aspects of the Problem of Nutrition in India

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Within the last 30 years science has reached definite conclusions as to what constitutes a *good* diet for human beings. The principles of correct feeding are fairly well understood and "optimum" dietary standards based on these principles have been drawn up by League of Nations Commissions and other authoritative organisations. Now generally speaking a "good" diet—i. e., a diet which approaches or attains the physiological optimum—costs more than a diet which fails at various points to satisfy human nutritional requirements, and consequently there is a close correlation between the economic status of a family or population group and the physiological value of its diet. In a sense this is a platitude, perhaps better expressed in a simple phrase such as "the poor can't afford to buy enough of the right sort of food to eat". But a more detailed analysis of the relation between income and diet than such a phrase provides helps in the understanding of the problem of nutrition in India.

*Dietary Standards.* The League of Nations "optimum" type of diet is rich in first class proteins and in all the essential vitamins and mineral salts. In terms of actual foods, this means a high intake of milk and milk products, meat, fish, vegetables and fruit, and a relatively low intake of cereals. The staple grain foods of mankind—rice, wheat, maize, etc.—are relatively deficient in certain essential food constituents required by human beings and must be adequately supplemented by other foods—in general more expensive foods—which are richer in these necessary constituents. A diet composed exclusively, or almost exclusively, of cereals will not support proper growth in young animals.

Let me illustrate the above point by reference to Indian diets. In Table 1, a typical "ill-balanced" Indian diet is compared with a "well-balanced" diet which more nearly approaches the League of Nations standard and in the same table the chemical composition of the two diets is given.

Table 1.

*A Typical "Ill-balanced" Diet and a "Well-balanced" Diet (both yielding 2,600 calories) (ozs. per consumption unit per day)*

Food.	"Ill-balanced" diet.	"Well-balanced diet.
Cereal ... ..	23	17
Pulses ... ..	0.5-1.5	3
Milk ... ..	None or negligible amounts	8
Leafy vegetables ... ..	0.5-1.0	2
Non-leafy vegetables ... ..	2.0-5.0	4
Fruit ... ..	Negligible	2
Vegetable fats and oils ... ..	Less than 1.0	2
Fish, meat and eggs ... ..	0.5-1.0	2-3 (if no milk is included)

*Approximate Chemical Composition (assuming the cereal to be milled rice)*

Calories ... ..	2,600	2,600
Protein (g.) ... ..	55	80
Fat (g.) ... ..	25	70
Calcium (g.) ... ..	0.25	1.00
Phosphorus (g.) ... ..	0.90	1.20
Vitamin A (International units)	1,100	3,000
Vitamin C (mg.)	60	150

The well-balanced diet is much richer in the very important B<sub>1</sub> group of vitamins than the ill-balanced one. Both the diets have the same calorie content or energy value; 2,600 calories represents approximately the daily energy requirements of an average Indian male. Both therefore will satisfy hunger. But the more varied "well-balanced" diet, containing less cereal and more of everything else, is infinitely more satisfactory in quality, and the health and development of a population consuming this kind of diet will be superior to those of a population whose diet resembles the "ill-balanced" diet.

The "ill-balanced" diet shown in the table will cost from Rs. 2/- to 3/- per adult per month, depending on the nature of the cereal and of course on differences and fluctuations in food prices. The cost of the "well-balanced" diet may be estimated as Rs. 4/- to 6/- per adult monthly. A family containing four consumption units—i. e., the equivalent of 4 adult males—must therefore spend Rs. 16/- to 24/- per month on food, or let us say, Rs. 240/- annually to obtain a diet of this satisfactory standard, and rather more if allowance is made for an intake of 8 ozs. of milk daily on the part of children. An ill-balanced diet, sufficient in quantity but defective in quality, will cost, let us say, Rs. 10/- monthly for a family of the same size.

These figures may be set against actual income levels in India in so far as these can be determined. The income of urban or industrial groups can be assessed with fair accuracy; for example, the average monthly wage of an unskilled urban worker, such as a peon, is about Rs. 12/-, or Rs. 144/- annually. But when agricultural families are concerned the assessment of real income on a monetary basis is a very difficult matter. A number of attempts have been made to estimate income in terms of cash in village groups, and some of these may be quoted, though with considerable reserve. Average total annual income per family in Bengal has been estimated as Rs. 150/-<sup>1</sup>, in a group of very poor rural families in Madras as Rs. 100/-<sup>2</sup>, and Rs. 125/-<sup>3</sup> in families in the Kangra Valley in Punjab. The following analysis of net income per family in a rural area in Mysore, with a population of about 50,000, was made by the Closepet Health Training Centre<sup>4</sup> in 1935. The survey included 11,142 families, giving an average family membership of about 5 individuals.

Family Income per Month Rs.	No. of Families	Percent of all Families
0-5	2,597	23.3
5-10	3,417	30.7
10-15	2,344	21.0
15-20	1,142	10.3
20-30	968	8.7
30-40	559	5.0
40-50	115	1.0
Total	11,142	

In more than half the families estimated annual income per family was below Rs. 120/-.

Estimates of national *per capita* income must also be regarded with a dubious eye, because the basic statistics necessary for such calculations are not fully available. One of these may be quoted—that of V. K. R. V. Rao<sup>5</sup>, who has worked

<sup>1</sup> Azizul Huque—*The Man Behind the Plough*. Book Co., 1939, (Calcutta).

<sup>2</sup> Aykroyd and Krishnan—*Indian Journal of Medical Research*, 1937; 24: 668.

<sup>3</sup> Punjab Public Health Dept., "An Inquiry into Diets, State of Nutrition and Factors Associated Therewith, in Relation to Health in the Kangra Valley, Punjab, 1939."

<sup>4</sup> *Handbook of the Rural Welfare Centre*, 1939, Closepet, Mysore.

<sup>5</sup> *The National Income of British India—(1931—1932)*, Macmillan, 1940.

out a figure of Rs. 65/-. with an error of 6 per cent, for annual *per capita* income in British India. His estimate is somewhat higher than those made by various other investigators.

Such figures, approximate and open to criticism though they may be, serve at least to indicate the gulf between possible and desirable expenditure on food. It is clear that a well-balanced diet of the kind shown in Table 1 is far beyond the means of a large section of the population. Having established this point, we can proceed to consider the problem in greater detail.

*Diet and Economic Status*—The following passage, which refers to England in 1933, is illustrative of the subject under discussion.

" Amongst the lowest income groups are still some who suffer from actual hunger, but these are a declining element which could and should be lifted out of their present situation without delay. Immediately above is a much larger group, estimated to cover between 10 and 25% of the population, who can afford enough food to fill their bellies, but cannot afford a diet of the type and quality now known to be essential as a safeguard against malnutrition and disease. On the next step upwards, measured by incomes, comes another large group which commands enough purchasing power to obtain an adequate diet for the whole family, provided that this purchasing power is completely spent on the lines suggested by such applications of modern research as the report of the British Medical Association Committee on Nutrition. Actually many of the incomes in this group, and especially the lower ones, are often unwisely spent, at any rate from the strict standpoint of nutrition, and thus a further large number of families falls, for practical purposes, into the zone of malnutrition. The higher the income and the more money spent on food, the smaller this risk becomes, but there is a reason to suppose that even among supertax payers a standard based upon the optimum established by recent research would disclose the presence of malnutrition due to a faulty diet,"<sup>6</sup>

The same groups exist in India but the proportion of the population falling into each is very different. The lowest group includes a much greater percentage, and the higher groups a much smaller percentage. It is impossible to estimate accurately the percentage of population which "suffers from actual hunger", but certainly it is a large one. Over 70 diet surveys of groups of families, both urban and rural, have been made in various parts of the country within recent years, and in about 30 per cent. of the groups average daily calorie intake per consumption unit was below 2,300—i. e., below any reasonable standard of requirements. In various surveys in villages and industrial areas an approximately similar proportion of families was found to be underfed by the same standard. These observations cannot legitimately be generalised into a statement about the extent of under-nutrition in India, because the sample of the population—about 1,500 families—investigated was small and cannot in a strictly statistical sense be taken as typical of the country as a whole. But there can be no possible doubt that many millions in India never get enough food to eat and this fact is of fundamental importance in connection with agricultural policy. "Enough food" takes precedence over "the right sort of food". The principal aim of agricultural policy must be to produce *more* food. India cannot afford to import food in large quantities. Agricultural departments and research institutes, and other departments concerned with food supply, should never lose sight of this primary need, or dissipate the major part of their energies in prosecuting schemes of secondary importance, however useful and attractive.

<sup>6</sup> *Political and Economic Planning*, Broadsheet No. 44, 1935.



One step out of the abyss, and we have the group which "can afford enough food to fill their bellies, but cannot afford a diet of the type and quality now known to be essential as a safeguard against malnutrition and disease". This includes those whose diet resembles the ill-balanced but quantitatively sufficient diet shown in Table 1, costing Rs. 2/- to 3/- per consumption unit per month. Certainly a much higher proportion than 10 to 25 per cent. of the population falls into this category—it is futile to attempt a precise estimate. The higher groups, with sufficient "purchasing power to obtain an adequate diet for the whole family", are correspondingly reduced in comparison with the English classification. Ignorance as well as poverty operates strongly in extending the zone of malnutrition. Plenty of people in India, who could afford to consume an excellent diet and feed their children on an excellent diet, do not in fact do so because of ignorance of the elementary principles of nutrition.

*Analysis of Expenditure.*—Comparison of the cost of various kinds of diet with estimates of total income are illuminating but crude, because they do not take into consideration other expenditure items in the family budget. A number of detailed family budget enquiries have been carried out, mainly by Labour departments, among industrial groups in various Indian cities; these valuable studies, all too little known to the educated Indian public, throw further light on the subject under discussion. Industrial workers in towns and cities are a relatively highly paid class; it is the prospect of what appears to be a high wage which attracts the villager from the countryside into the squalid slums of Bombay or Ahmedabad. Family budget enquiries based on field investigations among rural groups not in receipt of regular wage, and in fact for the most part not living on a cash basis, are obviously more difficult than similar enquiries in towns and cities, and few rural studies have been made in India.

Adyanthaya<sup>7</sup> carried out a family budget enquiry on a miscellaneous group of labourers and coolies in Madras City, using standard International Labour Office methods. Some of the data obtained in this investigation are shown in Table 2 on the following page. Various interesting points emerge from this Table. We may note first of all that monthly expenditure on food, even in the lowest group, was slightly above that necessary to purchase an ill-balanced diet sufficient in quantity. Presumably, therefore, the majority of families were above the starvation level—they had *enough* to eat. The percentage of total income spent on food averaged 52.6 per cent. in all families,

As income rises, so does the number of consumption units per family. A rise in total income per family does not therefore necessarily result in a rise of similar proportions in income *per consumption unit*. This means that workers who are in receipt of incomes above the lowest levels gather needy dependents and may themselves lose much of the advantage of superior pay—a striking illustration of the poverty of India and the strength of family ties which gives the destitute the right to share in the meagre goods of relations a little better off than themselves. I do not think that a regular increase in the number of dependents with increasing income occurs in industrial groups in England and U. S. A. Apart from other factors, a cold climate and a higher standard of housing would discourage the crowding in of extra dependents. Probably, however, a similar trend could be observed in China and Japan. In any group consisting of poor families at approximately the same economic level, families including the largest number of dependents naturally tend to be the worst fed; this is always strikingly apparent in diet surveys in India and has been observed in similar surveys in other countries. But it is clearly not the

<sup>7</sup> *Report on an Enquiry into the Family Budgets of Industrial Workers in Madras City* Dept. of Industries, Govt of Madras, Govt. Press, 1940, Madras.

same thing as a steady growth in the number of dependents with rising income. These facts have a bearing on the population problem, and the question of family limitation, discussion of which is outside the scope of this article.

**Table 2.**  
*Income and Expenditure of Labourers in Madras City (1935).*

Income per family.	Below Rs. 20/- per month.	Rs. 20/- to 30/-	Rs. 30/- to 40/-	Rs. 40/- to 50/-	Rs. 50/- to 60/-	Rs. 60/- to 70/-	Above 70/-	All families
No. of families ...	47	167	198	118	69	20	20	639
Per cent. in each income group...	7.4	26.1	31.0	18.5	10.8	3.1	3.1	
No. of consumption units per family ...	3.03	4.19	4.89	5.26	6.15	7.63	6.08	4.92
Monthly income per consumption unit ...	Rs. 5-12-6	6-0-8	6-15-6	8-8-7	8-13-4	8-7-2	12-3-3	7-9-6
Monthly expenditure per consumption unit on food ...	Rs. 3-5-0	3-5-8	3-8-1	3-14-8	3-12-0	3-10-2	5-3-6	3-10-8
Percentage of total income spent on food ...	57.06	56.34	54.93	50.41	49.25	48.81	48.58	52.63
Expenditure on milk per consumption unit.	Rs. 0-1-2	0-2-4	0-3-5	0-4-7	0-4-1	0-4-0	0-7-11	0-3-6

Consumption units were calculated on Lusk's sale.

Another point of great importance is that expenditure on food per consumption unit did not rise proportionately to income per consumption unit. While the incomes per consumption unit of families with incomes of Rs. 40/- to 70/- were definitely above those of families with total incomes below this level, only the highest income group spent enough on food to purchase a well-balanced diet. There was a rise in expenditure on milk with increasing income but this was small until the highest income group is reached. The probable explanation is that an ill-balanced diet is the normal diet of the poor in South India, and poor families will not readily make sacrifices in other items of expenditure to purchase a diet of superior quality. It is only when income reaches a level which allows needs other than food to be fulfilled with relative ease that more money is devoted to buying a better diet.

Very similar tendencies were elicited in family budget enquiries carried out in Ahmedabad<sup>8</sup>, Sholapur<sup>9</sup>, Howrah, Bengal<sup>10</sup> and Bombay<sup>11</sup>, on industrial

<sup>8</sup> *Report on an Enquiry into Working Class Family Budgets in Ahmedabad, 1928*, Labour Office, Bombay, Govt. Press, Bombay.

<sup>9</sup> *Report on an Enquiry into Family Budgets of Cotton Mill Workers in Sholapur City, 1928*, Labour Office, Bombay, Govt. Press, Bombay.

<sup>10</sup> *Report on an Enquiry into the Standard of Living of Jute Mill Workers in Bengal, 1930*, A. C. R. Choudhury. Govt. of Bengal, Commerce Dept., Secretariat Book Depot.

<sup>11</sup> *Report on an Enquiry into Working Class Family Budgets in Bombay City 1935*, The Labour Office, Bombay, Govt. Press, Bombay.

workers with monthly income ranging from below Rs. 20/- to Rs. 80/- or thereabouts per family. The percentage of total income devoted to food ranged from 50 to 60 per cent. Mitra<sup>12</sup> has surveyed a group of families in Jharia, Bihar, with monthly incomes of Rs. 5—2—0 per consumption unit or below, in which 73 per cent. of total income was spent on food. In general the results of family budget enquiries in India confirm Engel's "law" that percentage expenditure on food falls with increasing income. In all these urban groups rent was a relatively important item of expenditure. It is of interest to note that even when poverty is extreme 15 to 25 per cent. of the budget is almost invariably devoted to miscellaneous items including recreation and amusements. To prefer luxuries to necessities is characteristic of the human species.

#### *Improvement in Diet with Increasing Income*

A detailed investigation of the relation between diet and income in Great Britain has been carried out by Sir John Boyd Orr<sup>13</sup>. The population was divided into six income groups, and by means of the study of family budgets and diet surveys average expenditure on food in the various groups was estimated. The various groups were as follows:—

	<i>Income per head per week (shilling)</i>	<i>Estimated average weekly expenditure per capita on food (shillings)</i>	<i>Percent of population</i>
I	Up to 10	4	10
II	10 to 15	6	20
III	15 to 20	8	20
IV	20 to 30	10	20
V	30 to 45	12	20
VI	Over 45	14	10

The type of diet consumed by each group was compared with optimum standards of intake. It was found that the consumption of the more valuable foods, e. g., milk, butter, cheese, meat, fresh eggs, fruit and vegetables, rose with increasing income. A steady increase in the intake of protein, fat, vitamins, and mineral salts was observed in passing from the lowest to the higher income groups.

In India interesting investigations of the same type but on a much smaller scale have been made by Mitra (*loc. cit.*), Nutrition Officer in the Province of Bihar. Mitra carried out diet surveys among industrial workers in Bihar by the method of daily visits and weighing of food which provides more accurate data about food intake and expenditure than family budget enquiries conducted by means of questionnaires. He was able to correlate income level and the amount of each kind of food consumed. Data obtained in an enquiry in Jamshedpur, Bihar, in which the works of the Tata Iron and Steel Company are situated, are given in Table 3 given on the next page.

The proportion of ghee in the item "oils and fats" rose with increasing income and in group 4 ghee was the chief source of fat. This is one of the reasons for the relatively high expenditure on food per consumption unit in this group, which probably paid somewhat more for most articles of food including rice because articles of better commercial quality were demanded.

Mitra's figures again demonstrate the increase in dependents in the higher income groups. This is not quite as striking as in the families in Madras City. Jamshedpur is a relatively isolated town to which labourers migrate from other districts. In Madras City, families in receipt of regular wages are more

<sup>12</sup> Mitra, K., *Ibid. Jour. Med. Res.*, 1940, 27: 887

<sup>13</sup> *Food, Health and Income*, 1936, Macmillan.

accessible to penurious relatives. Similarly Bhawe<sup>14</sup> recorded a considerable difference between the number of consumption units per family in a group of cotton-mill operatives in Nagpur, the capital of the Central Provinces, and that in another group of workers employed in a manganese mine in a small town, Tirodi, in the same province. While total income per family was higher in the Nagpur families, income per consumption unit was considerably lower because of the greater number of dependents, and the diet consumed by these families compared unfavourably, both in quantity and quality, with that of more poorly paid families in Tirodi.

The main point of interest in Table 3 is that it clearly demonstrates an improvement of diet in the right direction as income rises above very low levels. Intake of pulses, non-leafy vegetables, fruits, milk products, meat and sugar in general rises with income and the same is true of intake of protein, fat, calcium and certain vitamins. There was a corresponding reduction in the percentage of calories from cereals. The diet of Group 4 resembled the well-balanced diets recommended by nutrition workers more closely than did that of Group 1. This does not, of course, mean that the better-paid families arranged their budgets and food expenditure to the best possible advantage, but it indicates a general tendency of great importance. In India, as in England and other countries, an increase in income leads in general to a change in diet which is to some extent in conformity with the principles of sound nutrition. It follows that an increase in the material prosperity of the country—a rise in the national *per capita* income—will *per se* tend to improve standards of nutrition and with them the health of the population.

Table 3.  
*Income and Diet in an Industrial Group*  
(Jamshedpur, Bihar, 1939)

Group.	1	2	3	4
Monthly income ... ..	Up to Rs. 30/-	Rs. 30/- to 45/-	Rs. 45/- to 90/-	Rs. 90/- and above
No. of families ... ..	110	35	19	13
Percent in each group ... ..	62.1	19.8	10.7	7.3
No. of consumption units per family ... ..	3.35	3.93	4.46	7.82
Monthly income per consump- tion unit ... ..	Rs. 6-2-0	Rs. 9-12-0	Rs. 15-0-0	Rs. 25-15-0
Monthly expenditure on food per consumption unit ... ..	Rs. 3-12-0	Rs. 5-9-0	Rs. 7-10-0	Rs. 10-1-0
Daily intake (ozs.):—				
Cereals ... ..	23.9	24.4	27.1	21.0
Pulses ... ..	2.4	3.1	3.8	3.4
Non-leafy vegetables ... ..	2.3	2.7	5.5	6.2
Green leafy vegetables ... ..	1.2	1.0	0.3	0.1
Fruits and nuts ... ..	0.1	0.3	0.9	0.9
Oils and fats ... ..	0.5	0.8	1.3	1.8
Milk ... ..	0.5	1.4	2.6	5.7
Meat, fish and eggs ... ..	0.6	0.7	1.3	1.0
Condiments ... ..	0.7	1.0	1.6	1.6
Sugar and jaggery ... ..	0.2	0.3	0.7	0.8
Calories ... ..	2940	3190	3250	3330
Percentage from cereals ... ..	83.9	74.9	68.0	61.8
Protein ... ..	68	78	85	85
Fat ... ..	21	35	45	68
Calcium ... ..	0.41	0.51	0.55	0.92

<sup>14</sup> Bhawe, P. D., *Ind. Jour. Med. Res.*, 1941, 29: 99.



In Mitra's groups there was a fairly steady rise in the consumption of most non-cereal foods from Group 1 to Group 4, and the rather sudden rise in expenditure on food per consumption unit at a certain level of income, apparent in the Madras group, was less evident. Comparison between the two groups as regards this point is, however, made difficult by the difference in income classification and possible difference in the real value of wages, depending on the cost of living and other factors. More detailed investigations would be required to establish the suggestion previously made that an abrupt change for the better in diet tends to occur when the income reaches a certain level. It is, however, probable that the low paid worker will insist on his quota of so-called non-essentials or luxuries, even at the cost of consuming a cheap and ill-balanced diet. But once his wages attain a level at which his "non-essential" needs can be reasonably satisfied, leaving a fair margin for other requirements, he will improve the quality of his diet.

Table 3 brings out another point of significance. Consumption of one valuable food—green leafy vegetables—was in inverse relation to income. Green leafy vegetables are a rich source of certain vitamins, minerals and salts. The better paid families tended to despise this food, which they could easily afford, and actually intake of pro-vitamin A, a constituent abundantly present in leafy vegetables, was lower in Group 4 than in Group 1. This shows that while a general tendency for diet to improve with increasing income may exist, prejudice may operate in the opposite direction, and incidentally provides an illustration of the part which education could play in improving dietary habits. Although the diet of higher income groups was in many respects superior to that of the lower income groups, it was far removed from the ideal.

Mitra<sup>15</sup> has demonstrated approximately similar relationship between income and the proportion of various foods in the diet in another industrial group in Bihar. Probably these are relatively uniform in urban areas throughout the country, but further investigations on this point are necessary. Change in dietary habits would therefore appear to be a useful index of change in economic status. If in 20 or 30 years time it can be shown that the national diet has changed in the direction indicated by these figures, it can be assumed that an improvement in economic condition has taken place.

*The possibility of Progress.*—The nutrition research worker in India is often told, in effect, that he is wasting his time. The cause of malnutrition is poverty, ignorance, population pressure and so on, and no amount of research on food values and the causes of deficiency disease, no experiments on rats and guinea pigs, however pretty and ingenious, will enable the poor to obtain a proper diet. But in order to solve a problem it is necessary first of all to define it. Knowledge of the nature and defects of Indian diets, and how the latter can most easily be corrected, is a necessary basis for effective action. Even in existing economic circumstances much can be done. Nutrition work can be included in the programmes of Public Health departments, school medical services, rural reconstruction agencies, and so on. The development of agriculture, animal husbandry, and fisheries can be influenced by knowledge of dietary requirements.

Health education, which naturally includes education about diet, can be extended. Improve health and you increase energy and economic capacity; the vicious circle, poverty, malnutrition, ill-health, poverty, is broken and replaced, so to speak, by an ascending spiral. Take, for example, malaria. Malaria causes a million deaths annually in India and an untold amount of physical debility; it is a direct cause of malnutrition because victims of the disease, languid from

<sup>15</sup> Mitra, K., *Ind. Jour. Med. Res.*, 1941; 29: 143.



impoverished blood, cannot cultivate their land properly and improve their lot. Vigorous anti-malarial measures will thus tend to improve food supply and the national diet, and the same is true of many other public health activities. Health education has not yet been developed to any extent in India. Recently the writer put two questions to a senior class of boys in a High School. These were: What is the cause of malaria? Do you know anything about the nutritive value of different foods? Blank silence greeted both questions; the boys had not heard of these subjects, of vital importance to their own welfare and that of their country. Every school child should be taught some elementary facts about health diet and disease.

A detailed discussion of the various means of improving standards of nutrition—of the various aspects of public health nutrition work—would be outside the scope of this article. Numerous reports of the League of Nations and the International Labour Office have dealt with these questions. But one interesting and remarkable possibility may be briefly referred to in conclusion. Normally, when we are considering the improvement of diets, we think in terms of ordinary familiar foods—more milk, more vegetables, and so on—a point illustrated in Table 1. But within recent years, the chemical composition of a number of the important vitamins has been discovered and some of these can now be manufactured in large quantities. Vitamins produced in this way are just as valuable to the body as vitamins contained in foods.

Further developments in research and industry may make it possible to manufacture vitamins at very low cost. In England pure synthetic vitamin B<sub>1</sub>, costing about four shillings per gramme, is being added to refined wheat flour to bring its nutritive value nearer to that of whole wheat. Human daily requirements of vitamin B<sub>1</sub> are one to two thousandths of a gramme (1-2 milligrammes). This is a war measure, perhaps unnecessary in normal times when there is less danger of the diet of the population being deficient in this particular vitamin. But considerable discussion is at present taking place in America about the value of "fortifying" foods such as bread with synthetic vitamins, although the American diet has not been restricted by the war. Similarly, certain essential mineral elements, such as calcium and iron, could be given in the form of a pill or capsule, as an addition to the diet. Consumed in this form they produce the same effect in the body as when they are taken as ingredients in ordinary foods.

In some of the Southern United States there is a great deal of malnutrition among the poor whites and negroes—economically depressed and backward groups. It has been found that supplying such people with the vitamins they lack, in the form of daily doses additional to their ordinary diet, may produce an immediate improvement in their general health and shake them out of the lethargy engendered by malnutrition. Dispirited and chronically wretched individuals, it is claimed, may be thus transformed into healthy and active citizens. The cost of the necessary synthetic vitamins is even now not very great.

The idea of giving malnourished school children in India a daily capsule containing more than their daily requirements of various essential vitamins and minerals at present seems rather outlandish. But to any one unfamiliar with discoveries in bacteriology and immunology, the idea of preventing various diseases by the systematic inoculation of thousands or even millions of people would seem equally peculiar. In this instance the state produces the vaccines—against the small-pox, plague, cholera, enteric, etc.—very cheaply and the people have learnt, or are learning, to take advantage of them. A few properly staffed and equipped "vitamin factories" might produce vitamins by the ton and the cost of per capita requirements might work out at a low figure.

These speculations are perhaps somewhat out of tune with existing realities. But they may serve to emphasise the fact that science, so to speak, usually has a few aces up her abundant sleeve. Failure to produce results is not characteristic of the scientific method. An impartial analysis of the economic aspects of the problem of nutrition in India may leave little ground for optimism. But it is surely true that if the resources of science are brought to bear on the problem, progress can be made, however formidable the obstacles of poverty and ignorance.

(*The Indian Journal of Social Work* Vol. II, December 1941).

## EXTRACTS

**Industrial Prospects for P. I. Rice.** When we consider rice, however, particularly as it is used in the Philippines, we find that its century old uses have not increased. We still harvest the palay leaving the stubble in the fields to be burned before the next planting season. We still thresh the grain from the straw and just leave most of the straw to waste. We still mill the palay to get the polished rice and leave the hulls as a municipal nuisance and the best use we make of the bran and screenings is for animal feed.

*Stalk and straw for building boards, paper.* Once upon a time when the agricultural and industrial stage of the United States was at a level comparable with what we have in the Philippines now, the only use for corn was for feed. So we dare prophesy that in the future when the Philippines will have progressed much farther in her agricultural and industrial development, the utilization of rice will follow the trends enumerated below. Instead of cutting the rice at harvest time leaving a stubble varying from one to two feet, machines will probably be used to cut the rice plant close to the ground for the best recovery of the stalks and the straw. After threshing the grain the stalk and straw will probably be baled in the fields and deposited in central locations for ready transportation to factories. As we see it at present, the use will be in the building board and in the paper industry. The past three years of research undertaken by the NARIC have shown that building boards can be made on commercial machines from Philippine rice straw at a cost that will enable the finished product to meet open competition against similar products now in the market. These researches were not ordinary test tube experiments although, of course, they had their beginnings in a chemical laboratory. But after the work outgrew the test tube stage, studies were made in a commercial pilot plant in the United States with a firm of consulting engineers and chemists. A full report has been made and all that is now necessary is patience and courageous outlook to visualize future implications. For example, to make all the insulating wall-boards used in the Philippines the past year, a factory capable of making 50,000 square feet of board a day would be required. This would utilise the straw produced in at least 2,000 hectares plus the rice hulls produced in a mill area twice the size of Cabanatuan. The quantity of boards used in this country last year was almost double that used in the year before and almost four times that used three years ago. Building boards of this kind are so convenient and so logical for Philippine conditions that the use will no doubt extend farther and farther. Especially so if we can manufacture special kinds of boards for sidings, for floor and for roofings. It has been shown that these boards can be made from rice straw and rice hulls or a mixture of the two. As in most grain producing countries, our rice areas are already denuded of forests, and therefore construction lumber in these places is costly. Nipa roofing has grown into disfavour and people are more and more turning to galvanised iron roofings.

*Uses of the hull.* The above scheme of manufacturing building boards from straw includes hulls, especially for fuel. But the rice hull, in its own right, has