

Nutritional problems and nutrition policy
among pre-school children in rural
Purnea, Bihar.

by
J. M. Rodgers.

NUTRITIONAL PROBLEMS AND NUTRITION POLICY AMONG
PRE-SCHOOL CHILDREN IN RURAL PURNEA, BIHAR.

by Janine M. Rodgers.

I INTRODUCTION.

Various nutritional programmes have been set up or are currently in progress in India but most of these have been restricted to urban slum areas or tribal development blocks. Because of the greater complexities shown by rural problems (mostly on the distribution side) policies to relieve rural distress have suffered from relative neglect though over 80% of the Indian population is still rural.

Bihar is one of the less developed states in the country and Purnea one of the less favoured districts in this state; furthermore, economic research investigating various facets of rural problems was being carried out in the area and could provide economies of scale to any additional research effort; for these reasons it was decided to undertake a study to look into the feasibility of a supplementary food programme for pre-school age children in rural areas of Purnea District¹.

The feasibility of any relief programme is meaningless without testing its desirability and acceptability, and a solution cannot be advanced without prior identification of the problems and needs of the particular region under study. It was therefore necessary not only to assess the nutritional status of the segment of the population that we assumed to be "vulnerable", but also to identify the major nutritional problems of the rural population as a whole with regard to its environment.

A- Description of the study area and background information.

Direct nutritional assessment of the children to be studied, e.g. by means of clinical examination or anthropometric techniques², was beyond the competence of the investigator. The study therefore aimed to establish an indirect assessment through health indicators and ecological factors. Baseline and background information was collected on (i) health problems, (ii) consumption habits, and (iii) socio-economic and environmental variables. Secondary data were provided by various departments of the local administration, hospital records, and interviews with doctors, while primary data were collected through

1. This study was suggested by Dr P.L.H. Eavey from F.A.O. and Professor J.L. Joy from the Institute of Development Studies at Sussex. Finance to cover expenses was provided by the Freedom From Hunger Campaign-UK. Field work was carried out between November 1970 and April 1971.

2. See Jelliffe, D.B., "The Assessment of the Nutritional Status of the Community", (W.H.O., Geneva, 1966).

a household sample survey and a village cropping pattern survey.

A purposive sample of 62 children under 6 years of age, from low-income families³, was drawn from 8 villages selected in four different blocks⁴ of the district - 4 Hindu majority villages and 4 Muslem majority villages. Seven of these villages covered areas between 581 and 1278 acres with populations between 456 and 1841 people (according to the 1961 Census). The eighth village belonged to a much wider administrative area: 5242 acres and 4390 inhabitants; it was the only significantly irrigated village - a little over 25% of cultivated land - included in the sample.

B- Characteristics of the household sample.

a- sex distribution of children : males 30, females 32, total 62.

b- religion : Hindus 38 (61%), Muslems 24 (39%), total 62.

c- distribution of children by age⁵ :

under 1 year	1
1 and less than 2	10
2 and less than 3	17
3 and less than 4	25
4 and less than 5	6
5 and less than 6	3
total	62

d- classification of the families according to land tenancies :

landless	28
landowners	23
landowners-cum- share-croppers	5
share-croppers	
total	62

II HEALTH PROBLEMS.

It should be noted here that data deficiencies limit appraisal of the health sector; however, though quantitative findings based on secondary data must be accepted with caution, they can provide support to tentative qualitative conclusions.

The importance of health factors when dealing with nutritional matters cannot be overestimated in view of the close interaction existing between them. Malnutrition influences morbidity rates for various diseases, maternal and perinatal mortality rates, and life expectancy. Low levels of nutrient intakes can induce greater susceptibility to most infectious diseases due to bacteria, rickettsia, intestinal helminths and intestinal protozoa while some of these in turn reduce nutrient absorption. It has been shown for example that hookworms decrease protein absorption by 15%⁶. Certainly as far as

3. Income estimates are given on p.15.

4. See appendix.

5. A higher weight was given to the age-groups 2 to 3 and 3 to 4 since the survey aimed to get a recalled picture as complete as possible of all stages of a child's diet - i.e. milk feeding, weaning, shift to a solid diet. Preliminary inquiry had shown that under 1 year children were almost exclusively breast-fed and that in most cases solid food was started in the course of the second year.

6. See Scrimshaw, N.S., Taylor, C.E., and Gordon, J.E., "Interactions of Nutrition and Infection", (W.H.O., Geneva, 1968).

morbidity and mortality are concerned, malnutrition has its most striking ill-effect among children and pregnant women.

A- Morbidity among children.

These findings are based on the analysis of "bedhead tickets" of indoor patients under 6 years of age who had been treated at the main hospital of the district in 1969.

a- Male-female differences.

72% of the children treated were male. Three possible explanations can be suggested for this discrepancy in male and female rates :

(i) the male children are more vulnerable than the female children in this age group,

(ii) traditionally more care is given to male members of the family,

(iii) females are taken away from home less easily.

Explanation (iii) is insufficient since the difference in percentage between sexes among patients treated is higher for children than for adults (44 against 30). Explanation (i) is contradicted by studies carried out in other parts of India and also by our survey findings. Whether relative neglect of female infants occurs and/or biological factors operate has not been proven yet but a Punjabi study⁷ showed that growth curves of female children were constantly below those of male children while deaths were in the ratio of 2:1 female to male. The death ratio found in our investigation was 5:4 female to male.

b- Seasonality.

The seasonality of admissions of child patients showed two peaks : (i) July-October, and (ii) December-January. The first peak, sharper, coincides with the monsoon months and this period of high admissions is prolonged by the fact that the second part of September and October is a time of low foodgrain availability. November registers a substantial drop in hospital admissions due for one part to a drop in the temperature which makes November one of the mildest months of the year and for another to the beginning of the main paddy harvest, which eases the food problem. Then the cold months of December and January show a renewed rise in admissions. And from February to June the trend goes slowly upwards, starting from its lowest level over the year, as the temperature steadily increases and the level of the water table goes down.

c- Common illnesses.

Doctors in charge of outdoor clinics quote as the most frequent diseases affecting children : (i) diarrhoea or dysentery, (ii) chronic bronchitis, and (iii) helminthic or parasitic infections; these statements corroborate our survey results.

7. Neuman, C.G., Shanker, H., Uberol, I.S., "Nutritional and Anthropometric Profile of Young Rural Punjabi Children", Indian Journal of Medical Research, (57, 6, June, 1969).

In hospital children are mostly treated for : accidental injuries (30.5%), diphtheria (17.5%), bronco-pneumonia (10.2%), tetanus (5.8%), diarrhoea and dysentery (4.3%), typhoid (3.9%). Accidental injuries, diphtheria, tetanus and typhoid seem to have a higher incidence among children than among other groups of the population. One comment should be made on smallpox which, though the major identified cause of infant mortality in villages, was not mentioned in the hospital records examined. Three hypotheses may be advanced to explain this apparent contradiction : (i) no epidemic occurred in 1969; (ii) the hospital under study is an urban establishment to which patients come from the nearby area; and any vaccination programme is more likely to be successful where permanent medical facilities are available, and (iii) smallpox is considered as a "normal" disease by the population and no medical care is sought for it.

B- Infant mortality.

This information is drawn from our household survey. Among the families surveyed there were 222 children alive while 54 had died, i.e. for the given age structure of the children alive, 19.5% of children born alive had died. Moreover, some of the children sampled will die before exceeding the age limits with which we are concerned - i.e. the true ^{death} rate of children under 6 will exceed 19.5%. The infant mortality ratio, calculated as the number of children dead within the first year per 1000 children born alive is 79.7, (this again is a slight underestimate, as not all the children alive have exceeded 1 year). The all-India rate was 81%⁸. Another significant variable is the neonatal mortality in relation to all deaths occurring in the first year of life. In our survey 63.6% of the infant deaths occurred within the first month after birth; the corresponding figure published in "Vital Statistics of India", 1962, was 44% for all-India and 54% for Bihar State. The 9.6% difference between the State figure can be explained by (i) a difference between districts of Bihar, (ii) a difference between income groups - our sample concerned only low income groups, and (iii) sampling random variation.

High neonatal mortality is mostly due to the poor state of viability of the infant arising from maternal conditions during pregnancy. Among older children mortality rates are higher below the age of three - i.e. while children are being breast-fed or transferred to a solid diet - than in the older age-groups (5 times higher). A high mortality rate in these age-groups is normally an indicator of malnutrition, or of high incidence of certain parasitic infestations and infectious diseases.

8. See Gopalan, G., and Raghavan, K. Vijaya, "Nutrition Atlas of India", National Institute of Nutrition, (ICMR, Hyderabad, 1969).

The causes of death which had occurred after the first month of life were recorded as follows :

1. "don't know, no cause, can't remember, illness, witch"	32.5%
2. smallpox	22.5%
3. diarrhoea, dysentery	15%
4. fever	7.5%
5. typhoid	5%
6. cholera	5%
7. boils, eczema	5%
8. pain in stomach	2.5%
9. roundworms	2.5%
10. drowned	2.5%

Smallpox is the disease which caused the most damage. A current programme of vaccination is in operation in the district but its success depends greatly on the number and dedication of vaccinators. Of the 62 children surveyed, 38 (61.2%) had been injected against smallpox. Most parents of non-vaccinated children would be willing to have them vaccinated, but no vaccinator had come to the village. In a few cases parents had objected to the vaccination on the grounds that the child was too young (e.g. below 3) or was ill. A programme of vaccination against cholera also operates but does not seem to be as widespread as the smallpox one - there is variation between blocks. None of the children surveyed had been injected against cholera.

C- Seasonality of birth rate.

Its relevance lies in the seasonal variation in birth rate compared with that in nutritional intake⁹. This relation influences the nutritional status of pregnant women and the neonatal mortality rate, and also the timing of weaning insofar as weaning is linked to pregnancy.

The birth rate shows two peaks : (i) between mid-January and mid-April - this peak can be partly explained by the season of marriages among Hindus (i.e. April to June), and (ii) between mid-August and mid-October.

D- Medical facilities.

The district disposes of just under one hospital bed per 10,000 inhabitants; but the relative proportion of beds available for females and children is much lower than those available for adult males. There are 42 state dispensaries or hospitals and 14 District Board dispensaries. At least one dispensary with permanent medical staff is found in each block (for about 100,000 inhabitants), where there are usually also three health sub-centres under the supervision of a medical auxiliary. These sub-centres should be visited once a week by the Block Medical Officer but for reasons of inaccessibility many are rarely visited during the rainy season.

The two main features of the official medical structures are (i) an acute shortage of staff and (ii) corruption. For example the district should have 38 Lady Health Visitors but only 3 posts were filled at the time of the investigation, 2 of which were filled by

⁹For seasonal variation in nutritional intakes see section IV.

Keralan women with different culture and different mother-tongue. Emancipation of women in Bihar lags behind most other states in India and does not help to ease the problems of medical auxiliaries. Better salaries might attract reluctant doctors to rural areas, but it is a solution difficult to justify in terms of equity.

Weak as they may be, how are the existing medical facilities looked upon by the population? Of the 62 families surveyed, 33 had seen a doctor for their child; 80% of these had seen the local "quack" and only 20% had been to a government doctor, whose services are free¹⁰. The reason advanced for not going to a government doctor was in a few cases a question of distance but for an overwhelming majority "government doctors do not give good medicine". There is here a crucial problem : make people believe in what is offered to them. Certainly more efficient medicine would be the best publicity for itself though the elimination of corrupt practices would be a prerequisite to any effort in this field. There is an urgent need to create incentives for a better functioning of medical services but at the same time to educate people in rural areas. If their children die, there is a reason - it is not because of a witch, and it is not just an acceptable part of everyday life - and something can be done about it.

III CONSUMPTION HABITS.

A- Child diets.

a-Milk feeding.

Age-groups	children surveyed		children having animal milk		children breast-fed and having animal milk		children not breast-fed nor having animal milk	
	No.	%	No.	%	No.	%	No.	%
1 year	1	100	-	-	-	-	-	-
1 to 2	10	90	3	30	2	20	-	-
2 to 3	17	71	8	47	5	30	2	12
3 to 4	25	28	13	52	4	16	9	32
4 to 5	6	-	4	66	-	-	2	33
5 to 6	3	-	3	100	-	-	-	-
total	62	29	31		11		13	

note : all percentages have been calculated within the same age-group, i.e. base 100 = total children in the same age-group.

All children under 2 have milk - either mother's or animal's milk; in the age-group 2 to 3 the proportion drops to 83% and then to 68% for children between 3 and 4. Almost all children under 1 year are breast-fed¹¹; the proportion drops respectively to 90, 70 and 28% in the subsequent age-groups; no children were breast-fed beyond the age of 4.

10. A few respondents indicated that this was not in fact the case.

11. Out of a sample of 95 mothers in the North-West part of the district 2 had not been able to breast-feed their child and had given them cow's milk; this information comes from P. and S. Blaikie. In our sample all children had been breast-fed.

50% of the children surveyed never had animal's milk, of which the intakes seemed to be related mainly to (i) whether the family owned an animal and (ii) the size of the village cattle. The animal milk consumed was either cow's or buffalo's (more often the former); buffalo's milk has much higher fat and protein contents¹². Milk was never diluted whatever the kind of milk given; 57% of the mothers were boiling it before giving it to the child, 27% never boiled it and 16% boiled the milk only occasionally.

Twenty-nine mothers could recall the quantities of animal's milk given to the child and its frequency. Sixteen children were having milk daily; the daily intakes varied between 100 and 400 g., the mode being between 200 and 300g. Ten children were having milk once or more every week (but not every day); the total weekly intakes varied between 100 and 1500g. with three-quarters of the children drinking between 100 and 500g. Three children had milk at least once a month, but not as often as once a week; the total monthly intakes varied between 100 and 500g.; but this is too little to have a significant impact on their diet.

The most common practice in breast-feeding is to feed a child 5 to 6 times a day, on demand. When the mother is working away from home she either takes her child along with her or goes back home every 2-3 hours. This would suggest a kind of regularity, but not all women work outside and if they do, they are not occupied the whole year round. Women (others than Muslims) usually work in their own fields, or take wage employment at harvesting and weeding times for example.

b- Weaning practices.

We have seen that 10% of the children in the age-group 1 to 2 were not breast-fed any more and that the proportion rose to 30% and 72% respectively in the age-groups 2 to 3 and 3 to 4. Among weaned children, the ages at which breast-feeding was completed were as follows :

	Absolute frequencies		Cumulative frequencies	
	No.	%	No.	%
1 year	1	3.6	1	3.6
between 1 and 1½	5	17.8	6	21.4
between 1½ and 2	10	35.7	16	57.1
between 2 and 2½	8	28.6	24	85.7
between 2½ and 3	4	14.3	28	100.0
total	28			

note : the table shows a bias against the older age-groups, since it does not take into account children as yet unweaned.

One third of the children are weaned abruptly, while ^{for} the others the period of weaning varies from 1 month to 1 year - half of them are weaned within 3 months and another third is weaned over a 6-month period. The most current cause of weaning is pregnancy of the mother (60.7%), followed by "the child was starting to take solid meals" or "the child himself left breast-feeding" (28.6%) and child's illness (10.7%).

12. See Aykroyd, W.R., "The Nutritive Value of Indian Foods and the Planning of Satisfactory Diets", 6th revised edition by Gopalan, C., and Balsubramanian, S.C., (ICMR, New Delhi, 1966) p.82.

Not enough information has been collected on pregnancies but it would be relevant to have more details about how long a mother continues to breast-feed her previous child while pregnant. The order of birth of children might then become important in formulating policies as perinatal mortality and infant mortality ratios might be higher among second, third and subsequent born than among first born, and this independently of the fact that when the number of children increases the family dependency ratio increases as well and the real income per consumption unit decreases.

c- Solid diet.

Children always eat a part of or the whole of the family's diet. The only special foods given to infants were biscuits (25% of the children had them before starting cereals but these were found in one block only), and special powdered baby food (exceptional, met once only). Two-thirds of the children surveyed started all items of an adult diet at once while the remaining third was shifted to it gradually, starting with cereals¹³. Local habits and family traditions seemed to be the strongest determinant of this feature of the diet since in two blocks 85% of the children started a complete adult diet at once whereas in the other two this percentage fell to 32%.

The proportion of children who received a solid supplement to their milk diet before they reached 1 year of age was very low - around 5 to 6%. The majority of children would start a solid diet between 1 and 1½ years (i.e. when the child started to walk), their proportion being at least 50% and most probably closer to 75%. The remainder would start later - a few mothers stated as old as 3 years? - but further precision is impossible without testing response reliability by elaborate cross-checking.

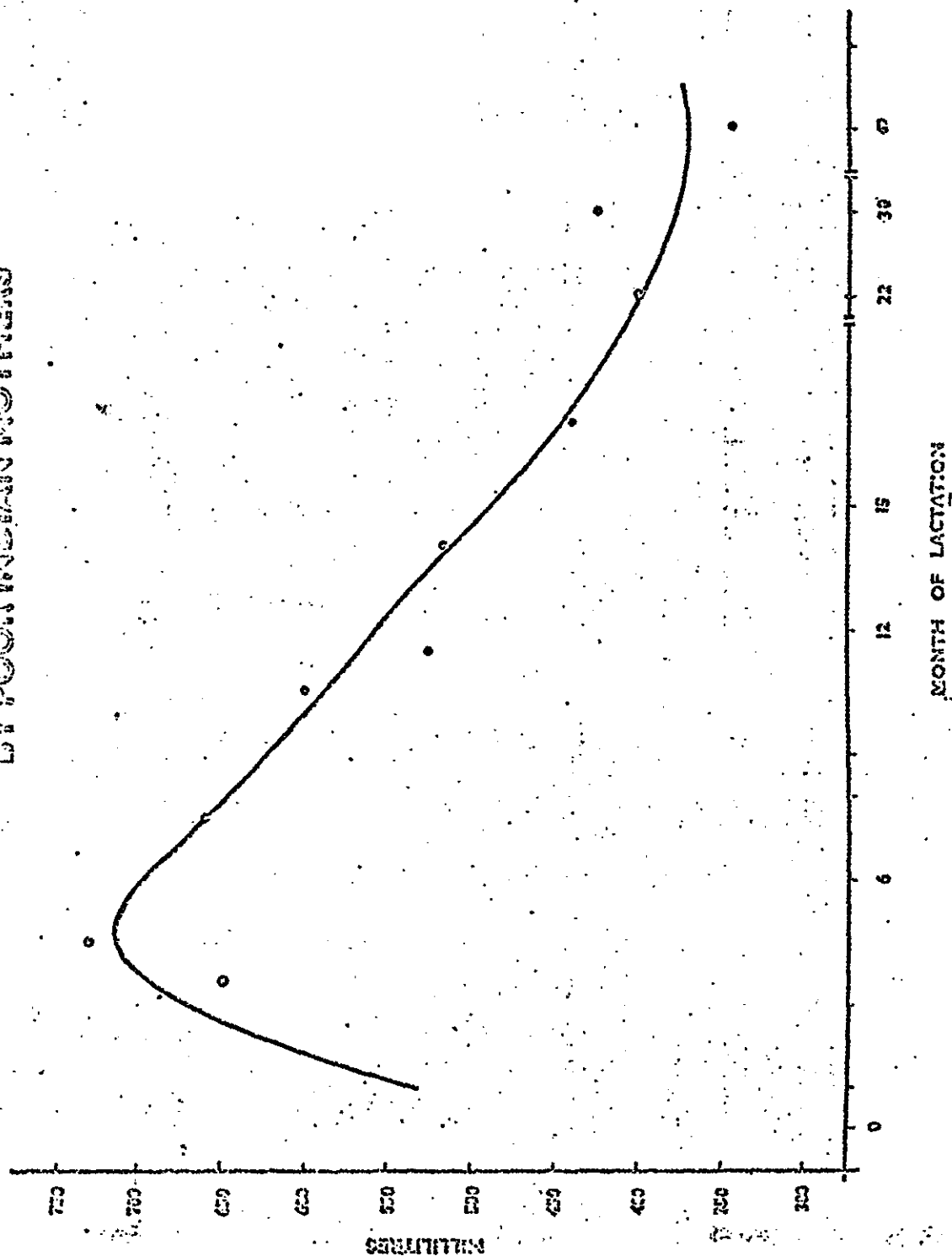
In 39% of cases, weaning was started at the same time as the introduction of a solid diet, which was viewed as a replacement rather than a supplement; a third of these children were weaned abruptly.

The age at which a child's milk diet starts to be supplemented or replaced is important because studies have shown that the volume of breast milk secreted by poor Indian mothers seemed to suffice to meet the nutritional requirements of a child until the 6th month only, after which the amount of milk decreases regularly, (see graph next page). Leaving aside for now the question of the adequacy of the child's solid diet, we can therefore conclude that from the age of 6 months up to 1-1½ years at least, the nutritional status of an overwhelming majority of poor children in Purnea district deteriorates steadily.

When all elements of an adult diet were not started at once we have seen that cereals were given first. The main foodgrains grown in the district were rice, wheat, maize and barley. Among villages surveyed barley was not grown and maize was cultivated in one block only. Though stocks (and of course prices) fluctuate rice was eaten the

13. The adult diet will be discussed in the next section.

VOLUME OF BREAST MILK SECRETED
BY POOR INDIAN MOTHERS



Source : Gopalan, C., Raghavan, K. Vijaya, "Nutrition Atlas of India", National Institute of Nutrition, (ICMR, Hyderabad, India, 1969), p 9.

whole year round to a greater or lesser extent while wheat was accessible to low-income groups only after the harvest (March-April). A child shifting to a solid diet during the period July-March would therefore not eat wheat before the next harvest.

Vegetables were generally started at the same time as cereals, though 15% of the children started them 6 months later. Pulses were the main source of protein in the adult diet of the region; the age at which a child started eating them followed the same pattern as for vegetables. Eggs were only eaten by Muslem children and two-thirds of these started to eat them at the same time as rice. Among the remaining third the delay varied from 3 months to 2 years with a modal delay of one year.

Meat and fish were normally started together; in two exceptional cases fish was started respectively 6 months and 1 year before meat. The delay in starting these items varied from 3 months to over 2 years with the mode around 1 year. For these children the earliest these foods were started was 15 months, and the latest $3\frac{1}{2}$ years; but it did not seem that the delay in the intakes of meat and fish was related to the age at which a child started cereals - for example one child was started on a complete solid diet at 8 months while another one who was reported as having started cereals after 2 years, still did not start meat and fish for another year.

Fruit was seasonal and this explains some of the delays found in introducing it in the child diets, but allowing for seasonality it seems that in most cases the fruit starting age followed the vegetable pattern, and only in 15% of cases the meat and fish pattern.

B- Adult diet.

One family only was recorded as being vegetarian. This characteristic seemed to depend mainly on the caste to which a family belonged; in Purnea district vegetarians are mostly found among castes with middle and upper class status.

Three meals a day appeared to be the usual feeding pattern : one breakfast (nasta) and two cooked meals. Normally a fire was not lit for breakfast - left-overs, cooked food from the previous night or dishes requiring no cooking were eaten. Cooking was done on an open oven made of mud; wood and leaves were used as fuel.

a- Cereals : they were eaten daily and formed the base of the diet. Rice was the most important but according to the season wheat or maize could be substituted for it. After the wheat harvest "chapatti" were eaten daily for two months, but in most cases no more than once a day. The different weight given to each cereal in the diet depended ^{also} on the on the cropping pattern of a locality. Rice was eaten either boiled (always for a cooked meal), beaten (churra) or puffed (murhi). In villages it was never milled but hand-pounded, which was done by female labour.

b- Pulses : they were the most common supplement to cereals and the main suppliers of proteins. 42% of the households were eating pulse daily, 27% three to four times a week, 22% once or twice a week. Some families indicated that they would not have pulse when they have fish, meat or vegetables. The kind of pulse consumed depended on the season but moong and khesari were the most eaten, especially by poor segments of the population (khesari being the cheapest); gram and masoor were also of some importance. Pulses were either curried ($\frac{2}{3}$ of the time) or boiled. Some special preparations were also made, such as "sathu" which was gram roasted in sand and then powdered; it was consumed mixed with water, adding to it a little salt or sugar; it was eaten mostly at breakfast (maize could be prepared that way too).

The general pattern of distribution of essential amino-acids in cereal and pulse proteins being dissimilar, they are capable of supplementing each other so that cereal-pulse mixture protein is of superior nutritive value. Studies have shown however that proteins in Bengal gram, black gram, green gram (moong) and red gram do not supplement rice protein but supplement wheat, jowar and bajra proteins¹⁴. In Purnea district, rice and the above mentioned pulses (with khesari) are the base of the diet.

It should also be mentioned that khesari leaves are eaten as well as the pulse crop; a link between lathyrism and khesari consumption has been demonstrated.¹⁴

c- Vegetables : 80% of the families were eating vegetables daily and the others 2 or 3 times a week. Vegetables are seasonal and these percentages are likely to change over the year. They were either curried (42%), fried (33%) or boiled (23%); in cases such as sweet potatoes they were sometimes roasted too.

d- Eggs : only Muslim households were eating eggs. The majority were having them once or twice a week. They were usually hen's eggs - most Muslim families owned some hens. Eggs were boiled but half the families were sometimes cooking omelettes.

e- Meat : the distribution of intake frequencies showed two distinct peaks : 60% of the families were having meat 1-2 times a month and 27% were eating it 1-2 times a week. Meat was always curried. Both religious communities ate goat and, according to their creed and in much smaller quantities, they would eat chicken, pork or beef. Some Harijan families ate snails and tortoises during the rainy season.

f- Fish : fish was eaten more frequently than meat : half the households were having it at least 1-2 times a week (40% of them even more often), and the others ate it at least 1-2 times a month. Fish consumption

14. See Kuppaswamy, S., Srinivasan, M., and Subrahmanyam, V., "Proteins in Foods", (ICMR, New Delhi, 1958).

is affected by seasonal factors such as the level of the water table. All families cooked fish in a curry and a quarter of them sometimes fried it too.

g- Fats and oils : they are expensive items and therefore used sparingly. The most used is mustard oil, sometimes adulterated with its inferior substitute linseed oil. Ghee - clarified butter - is the best quality fat produced in the region but mostly beyond the reach of the poor.

h- Fruit : this is seasonal. Fruit is very rarely bought, and if so for children only. Bananas, mangoes, papayas, guavas, jackfruit and lychees are grown locally.

IV FACTORS INFLUENCING THE DIET.

A- Religion and caste.

Religious taboos are more numerous among Hindus than among Muslims for whom the only dietary prohibition is pork. Among Hindus beef, and usually eggs and chicken are not eaten, though the latter two items do not seem to be excluded from the diet on orthodox religious grounds. The fact that eggs and chicken are eaten by Hindus in urban areas would indicate that egg consumption for example could be encouraged and that it shows an "urbanisation effect".

Religion also affects the diet indirectly through the family income. Social obligations (e.g. weddings and funeral ceremonies, dowry system etc...) varying with religion and caste impose a heavy burden on families who might have to borrow money; repayment - at high interest rates - could affect consumption for many years. Also, by custom wage employment is not as widespread among Muslim women as among Hindu women, therefore all other things being comparable a lower income would be found among Muslim families.

The effects of caste on vegetarian practices have already been noted.

B- Transport facilities and market access.

Foodgrains were either grown by the family, or earned as wages in kind, or purchased. Half the families grew some vegetables, 14 kept one or more goats, 18 had some hens and one kept pigs. Some people were doing some fishing especially at times of slack employment. When items of the diet had to be purchased, this was done either in the village or at the nearest market place. In the course of our survey we have come across three types of village :

Type 1 : there were no market facilities in the village, the nearest market was 5 miles away and the village was cut off during the monsoon season for about 2 months. Grain and pulses were bought within the village but meat and fish were purchased from a seller from outside who did not always come regularly - he could come 2-3 times one month and be 2 months without coming. This explained why the dietary pattern was so well defined at village level. Most people would...

Type 2 : a small market took place twice a week in the village itself which could be cut off from access to bigger centres for a more or less long period during the rainy season (one village of this type was inaccessible by jeep for 4 months and for a lesser period by bullock cart).

Type 3 : the village was close enough to a major market town for people to have the alternative choice of buying there. The frequency of these markets was also twice a week.

The degree of dependence of a village on its own resources was very high in villages 1 and 2. The frequency of the markets or the passage of the seller seemed to explain a large part of the two peaks found in meat and fish consumptions - one at 1-2 times a week and the other at 1-2 times a month.

C- Seasonal variations in the availability of food.

a- Cereals : there are two crops of paddy a year but local varieties of these two crops do not normally follow one another on the same land. Aghani paddy - harvested in November and December¹⁵ - represents 75% of the total paddy production. Bhadai paddy is harvested between mid-July and mid-September. High yielding paddy which as yet occupies only a small fraction of the total paddy acreage, can also be grown in early Summer on irrigated land. Wheat is harvested between mid-March and mid-April. Maize is harvested in August and another crop is possible which is cut towards the end of May beginning of June¹⁶.

b- Pulses : khesari, gram, masoor, and peas are harvested between mid-March and mid-April, moong between mid-May and mid-June; kurti and kalai are harvested between mid-November and mid-January, and raharh a month later. Though grown in the district all these pulses are not grown in all villages, moong and khesari being the most important ones.

c- Vegetables : from the beginning of March to the middle of June at least - i.e. during the hot months - there is a lack of green vegetables. Potatoes are mostly dug up between mid-December and mid-February but in one village surveyed farmers were growing 4 crops a year.

d- Fruit : bananas are available from May to December, mangoes from the end of May to the end of August, guavas from June to November, papayas from April until at least July, jack-fruit from June to August, and lychees in May and June; bananas and mangoes are the most grown.

e- Milk : the production drops from April until mid-June; this is the hot season, the grass dries off and the cattle have more difficulty to find adequate food. ..

15. Slight variations of a week or two may occur between villages.

16. This latter possibility has not been encountered in the villages surveyed.

f- Fish : the consumption of fish is at its lowest level between the end of March until the end of June and this is due to the dropping level of the water table. Fish consumption shows two peaks : (i) during the monsoon and (ii) between mid-January and mid-March which is a period of slack employment in agriculture; people have more time to spend on complementary activities, including fishing.

D- Effect of income.

a- Fluctuations of income over the year in relation to seasonal employment.

Consumption is not only determined by the availability of food but also by the level and fluctuations of real family income, in particular among low income families. In the Purnea area, there are two well defined periods of slack employment in agriculture¹⁷ - the worse one, from mid-January to mid-March, which might extend to April and May in villages where wheat is of little importance, and a second one, from mid-September to mid-November if little jute is grown. In three of our blocks, wheat covered around 10% of the gross area sown in 1969-70, generating significant employment in the winter months, but in the fourth one it covered only 1.7%. This explains why a much higher proportion of agricultural labourers and some farmers of this latter block have a regular second activity such as barber, pot-maker, tea-shopkeeper, blacksmith, etc... while in the other blocks people would take up only temporary employment between mid-January and mid-March in activities such as house-repairing, fishing, sale of pictures, rural public works, etc...,¹⁸. For the second period of potential low employment, the presence or absence of jute is the main determinant. In 1969-70, jute and its inferior substitute mesta occupied respectively 7.8%, 10.3%, 11.4% and 20% of the gross area sown of the block concerned.

b- Level of income and dependency ratio.

The 62 families surveyed have been classified into two equal groups, according to their income per adult male equivalent consumption unit. For each household, the total income over the year previous to the interview (i.e. produce of the land + wages in cash + wages in kind + other income) has been calculated. The produce of the land and the wages in kind have been translated into monetary terms applying the average village price over the year for each foodstuff. Then the total yearly income has been divided by the number of "consumption units" in the household¹⁹. The following assumptions were made in calculating consumption units : (i) the whole household income is

17. For more detailed analysis see Rodgers, J.H., "Draft Report on some Nutritional Problems of Purnea District, North Bihar, India", unpublished report prepared for the Freedom From Hunger Campaign - UK, (Institute of Development Studies, Sussex University, September, 1971).

18. For an analysis of the labour market in Purnea District see Rodgers, G.B., "Poverty and Policy : the Impact of Rural Public Works in the Kosi Area of Bihar, India", (Unpublished D.Phil thesis, University of Sussex, 1972).

19. For a discussion of the methodology used see Rodgers, G.B., op.cit.

spent on food consumption and (ii) the consumption per head is proportional to the household members' needs in calorie terms, The needs of women and children were assessed in terms of the average man, different coefficients being applied to the various age and sex groups²⁰.

According to our calculations we had 31 households (group A) with a yearly income below Rs.200 per adult man equivalent consumption unit and 31 households (group B) with a yearly income above Rs.200 per adult man equivalent consumption unit. The consumption unit of a household was obtained by adding the calorie need coefficients of all members of the household. These consumption unit coefficients vary from 2.4 to 11.6 per household and the mean coefficient for our whole sample is 4.7. The mean coefficient in group A is 5.0 and that of group B is 4.5. The mean income per adult man equivalent consumption unit in group A is Rs.152, while for group B it is Rs.286 per year (overall mean is Rs.219).

One important determinant of income is the age structure of the members of a household and the ratio of workers to dependents. No attempt was made in this study to calculate dependency ratios²¹ but we can assume that when there is only one nuclear family per household, the higher the consumption unit coefficient the higher the dependency ratio. In fact, the consumption unit coefficients explain 12% of the difference of income between groups A and B. Since the age structure of a household's members varies from year to year, the income per adult man equivalent fluctuates over the life-time of a household.

We shall see now whether some of our findings can be explained by a difference in income per adult man equivalent consumption unit :

(i) income per consumption unit and children's animal milk intakes.

	total	group A	group B
children having animal milk	31	16	15
children having daily intakes	16	9	7
children neither breast-fed, nor having animal milk.)	13	7	6

Within our low income sample whether a child was given animal's milk did not seem to be affected by a difference in income. We have already noted that the size of the village cattle and whether the family owned an animal seemed to be determinant.

(ii) income per consumption unit and the family's diet.

	total	group A	group B
families having pulses daily	17	8	9
families having meat at least 1-2 times a week)	17	7	10
families having fish at least 1-2 times a week)	29	15	14
families having eggs at least 1-2 times a week)	19	13	6

20. The coefficients used come from Aykroyd, W.R., "The Nutritive Value of Indian Foods and the Planning of Satisfactory Diets", op.cit.

21. For a study of dependency ratios and its incidence on the income of the poor, see Rodgers, G.L., op.cit.

The only items which seem to be affected by income are meat and eggs. The better-off group may eat proportionally more meat, though the difference in this sample is not statistically significant, but paradoxically the worse-off group seems to eat more eggs.

On the whole our results show that within the bottom segment of the population a difference in the level of income does not seem to affect the pattern of the diet, though it is likely to affect the volume of the intakes. It would be interesting to know at what level income becomes significant for both the volume of the intakes and the pattern of the diet for it should be considered in formulating policies aiming at an improvement of the diet. A policy, for example, of which the target is a 5% or 10% increase in real income of the poor, might under certain diet responses result in an increase in food prices (if supply elasticities are low) and ultimately benefit big farmers or middlemen, with the situation of low income groups remaining the same or even worsening.

To sum up, it appears that the main factors influencing the pattern of the diet of rural low income families are :

- (i) the food availability which variations are determined primarily by the season and the cropping pattern of a village, and secondarily by the local trading facilities;
- (ii) the fluctuations of the family income over the year which are induced by the pattern of employment in a village and to a lesser extent by that outside.

Food scarcity is at its peak just before the harvest of a food crop and this is reflected in the market prices. The first critical period for cereals in Purnea was between mid-June and mid-August, the second one between mid-September and mid-November. At these times people reduced the volume of their intakes; with low supply elasticities these would then depend on villagers' purchasing power which was related to the level of employment and the dependency ratio within each household. During the two mentioned periods for cereal shortage the main agricultural activities were respectively a) transplanting of paddy and harvesting of jute and b) cutting and retting of jute. The dependency ratio had a tendency to be higher during these two periods since women would take part in those activities less frequently than in other agricultural operations.

For the other items of the diet, the vulnerable period was the hot season i.e. from March to mid-June. There was a lack of green vegetables, a drop in fish supply, and a drop in milk production. This followed a period of slack employment and if the village grew little wheat the unemployment period would last longer; some agricultural labourers were then forced to contract loans to solve their liquidity problems.

V POLICY IMPLICATIONS.

The aim of this study was to look into the need for and the feasibility of a supplementary food programme for pre-school age children in rural areas of Purnea district. The need for such a programme has been strongly suggested by our findings in sections II and III-A : a high infant mortality rate (over 80%) has been observed while mortality rates dropped after the age of 3 i.e. after children have been fully shifted onto a complete adult diet; children up to 1-1½ years were fed only with mother's milk which is probably insufficient to meet their needs beyond the 6th month. The feasibility of such a supplementary programme has now to be established by analysing the implementation problems the scheme would be faced with in the light of the socio-economic and environmental factors underlined in section IV.

A- Supplementary food programme for children aged between 6 months and 3 years.

1- Acceptability of the programme by the population.

All families except one wished they could give supplementary food to their children, Their preferences ranked as follows : fruit 37%, milk 27%, "better food" (referring mostly to sweet milky preparations and biscuits) 13%, "everything" or "anything" 8%, meat 6%, fish 4%, eggs 3% and bread (wheat) 2%.

2- Food-content of the programme.

In rural area only dry food which could last for at least 4 weeks can be considered. The two kinds of dry food which have been used in other programmes are C.S.M. and processed biscuits. For all age groups powdered milk could be distributed.

3- Distribution of food.

The setting up of feeding centres in villages (in a large scale scheme) would not be a workable solution. Both religious communities have strong food taboos so that a Hindu woman would not accept milk or C.S.M. gruels prepared by Muslim hands and vice-versa. Tins of milk and biscuits or gruel ingredients would have to be distributed to mothers of selected children. This solution would avoid storage of food at village level, investment in cooking utensils and payment of assistants to attend feeding centres. On the other hand we could not be sure that the food would be given to the child to whom it was intended, and we could anticipate that food prepared at home would be considered as a "substitute" rather than as a "supplement".

4- Requirements.

(i) training of the mothers.

Demonstrations could be done by itinerant teams including members of both religious communities. The recruitment should be exterior to the existing medical structures which already suffer from an acute insuffi-

ciency of staff.

(ii) storage.

Storage space should be provided at the headquarters of the 4 administrative subdivisions of the district and also at each block headquarters.

5. Implementation.

The implementing body at village level could be the Panchayat Council. The food supply could be delivered regularly to the block headquarters from where it could be picked up by the responsible Panchayat official and distributed directly to the mothers. A list of recipients should be established and random spot checks made by a specially recruited team of inspectors not connected with any other aspect of the administration.

6. Selection of children.

An unambiguous criterion should be chosen in order to identify the group of children beneficiary of the scheme - e.g. children aged between 6 months and 3 years whose fathers take some wage employment in agriculture either as primary or secondary activity (these could be identified through the last Census records and the family planning registers). Such a selection would not cover all children who could justify the supplementary programme but the selection criterion could be modified accordingly. The question of selecting children on the basis of a specific criterion - even imperfect - is absolutely fundamental. In the current Centrally Sponsored Nutrition Scheme for urban slum areas for example, no criterion has been defined and the selection of children is left to the discretion of the implementing agencies, i.e. for Bihar different volunteer organisations.

7. Adaptation of the scheme to the food seasonality problem.

The rations distributed could vary over the year according to the variation of food availability. Milk could certainly be given the whole year round. From our study, it came out that there was a likely vitamin shortage from March until at least June. Cereal-based supplements would be most needed between mid-June and mid-August and then between mid-September and mid-November.

8. A major constraint : the rainy season.

What is the proportion of villages which cannot be reached by bullock cart during the monsoon months and for how long ? This question can be answered at the headquarters of each block. In some villages, it might be necessary to interrupt the programme for 2 months after mid-June although this would be one of the period when it would be most needed. Food in tins however would not be vulnerable to the wet and supplies to provide for the monsoon months could be distributed.

B- Other measures suggested by the study.

a- A programme for pregnant women.

Our inquiry showed that pregnant women were also a vulnerable segment of the population from a nutritional point of view. A scheme similar to the supplementary food programme for children could be set up; the same channels of distribution could be used as well as the same criterion of selection.

b- Improvement of the medical structures and the level of sanitation. There is an urgent need for an increase in medical and para-medical staffs. Any measures such as an immunization programme or a deworming programme can only be effective if enough vaccinators and health workers are recruited and ready to work at village level. Enteric and helminthic infections could have a lower incidence if a rural water supply and drainage was launched on a large scale.

c- Measures aiming at a more even availability of food over the year.

(i) the share of Aghani paddy in the cereal supply is overwhelmingly predominant; any measure which would tend to reduce its relative share should be considered. Such policies would tend to : increase the acreage under wheat, increase the Summer and Bhadai paddy crops, increase the acreage under maize. Obviously these measures are subject to constraints such as the quality of land; irrigation however, allows more wheat and Summer paddy to be grown and schemes supporting an extension of the irrigated area should therefore be welcomed for their effect on seasonal supply as well as for their associated increase in yield and their impact on incomes in the labouring sector²²

(ii) another means aiming to get a more evenly distributed cereal supply over the year, would be to break the speculation in food grain. This would be very difficult to achieve; speculation is widespread and very profitable, and any measure taken to reduce it would have to face the opposition of strong vested interests.

(iii) fish is eaten more than meat and the population would probably respond readily to any programme tending to increase the fish supply - e.g. a programme of fish tanks in villages. The cost of these tanks could be reduced in some cases by using the borrow pits of canal or roads. A fish tank programme is included in the "Applied Nutrition Programme" but in 1971 only 2 blocks from Purnea district (out of 38) were included in this programme.

d- Improvement in communications and employment generation.

We have underlined the relationship between accessibility of a village

22. See Joskins, M., "Land, Labour, Capital and Income Distribution in an Area of Rural India", (Institute of Development Studies, University of Sussex, unpublished mimeo, 1970).

and (i) the rounds of medical officers, and (ii) the pattern of the diet. A rural construction programme should improve the situation and could have indirect beneficial effects by generating employment during months of slack employment²³.

In the end the responsiveness of people is what makes any programme successful, and fixing reasonable targets is not enough. Sufficient time and effort has to be devoted to explaining and discussing with people the aims of a scheme. People would certainly readily welcome a supplementary food programme for children but they might not see any advantages in changing cropping patterns for example. If the likely success of a scheme is the ultimate criterion on which choices have to be made, this type of considerations has to be taken into account in ranking priorities.

23. For a thorough analysis of rural public works and their impact on poverty see Rodgers, G.B., op.cit.

APPENDIX.

AGRICULTURAL AND DEMOGRAPHIC INFORMATION FOR PURNEA DISTRICT AND
THOSE BLOCKS IN WHICH VILLAGES WERE SAMPLED. 1969-70 (unless stated).

	DHAWANIPUR	KASBA	BAHADUR- URGANJ	KRITYAN- ANDNAGAR	PURNEA DISTRICT
Population, 1961	50086	78076	82276	88013	3089128
Population, 1971	63900**	99600**	104900**	112300**	3941499
Total area (acres)	41478	70014	60358	107942	2695323
Pop'n density per sq. mile a) 1961	808	716	778	526	731
b) 1971	986**	911**	946**	659**	936
Net area sown* (acres) 1968-9	32693	54616	46167	64429	1800044
1969-70	n.a.	n.a.	n.a.	n.a.	1779669
Area irrigated 1968-9	88	7131	131	14882	138877
1969-70	n.a.	n.a.	n.a.	n.a.	129831
Gross area sown* 1969-70	44964	75161	53672	90683	2316576
Crop areas as a percentage of gross are sown 1969-70					
1. Aghani paddy	35.7	46.1	61.0	45.8	42.5
2. Bhadai paddy	1.7	8.0	7.9	9.6	14.4
3. Wheat	10.7	11.2	1.7	9.7	7.2
4. Maize	12.3	0.6	-	1.7	4.0
5. Barley	2.9	1.5	0.4	2.8	1.8
6. Gram (Bengal gram)	1.1	1.0	0.1	0.7	0.9
7. Masoor (lentil)	1.5	1.1	0.5	0.8	0.8
8. Arhar (Redgram)	0.6	0.1	-	0.5	0.2
9. Khesari	5.0	3.4	2.4	1.9	2.9
10. Peas	1.0	0.2	-	0.3	0.3
11. Kalai (black gram)	1.0	0.3	0.1	0.9	1.4
12. Moong (green gram)	4.7	3.4	0.1	1.8	1.6
13. Kurthi (horse gram)	0.7	0.8	0.6	2.1	1.5
14. Total pulses (6 to 13 above + other minor varieties)	15.8	10.3	3.8	9.6	9.7
15. Potato	1.8	1.3	0.5	1.4	1.2
16. Sweet potato	1.2	0.3	neg.	1.7	0.7
17. Mustard	3.9	6.1	3.0	2.3	2.3
18. Jute	4.7	8.9	19.9	7.6	10.4
19. Mesta	3.1	2.5	0.1	2.7	1.8
20. Mango	2.0	1.1	0.7	1.2	1.0
21. All other crops	4.2	2.1	1.0	3.9	2.9

Notes :

* Gross area sown counts land the number of times a separate crop is sown; net area sown counts land only once in the year.

**These are approximate figures, based on the assumption that the rate of growth of population has been the same in every block.

Sources :

- population from the 1961 Census, and preliminary results from the 1971 Census.
- agricultural information from the Kosi Area Development Commissioner's office, Purnea and the Agricultural Production Commissioner, Bihar (Patna), mostly collected for or by S. Biggs (I.D.S., Sussex).

Names of villages surveyed in the course of the study :

Barhari (Bhawanipur block), Jhankua (Bhawanipur block), Dubaili Biswaspur (Kasba block), Phulwaria (Kasba block), Chanuar (Bahadurganj block), Korat bangaon (Bahadurganj block), Jhiljhili (Bahadurganj block) and Kajha (Krityanandnagar block).