Original Article

Impact Assessment of ICDS food fortification in the state of Uttar-Pradesh

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Abstract

Background and Objective: The concept of food fortification is relatively uncommon in India. Hence, sometimes due to ignorance or due to paucity of research to assess the impact of fortifying supplementary food in large feeding programmes, there is an apprehension that fortification may either lead to imbalance of nutrients in the body or may not really improve the nutritional status of people consuming marginal diets. This has lead to a prudent approach in taking bold decisions to fortify the ICDS supplementary food to reduce micronutrient malnutrition in different states. The current research planned to provide empirical evidence on the impact of fortified ICDS supplementary food through a well-conducted community based research study among the children between 12-59 months under programmatic conditions in state of Uttar Pradesh.

Methods: The sampling design adopted was quasi experimental design under programme conditions. The study was taken up in Kanpur dehat district of UP. The block where fortified food was to be initiated constituted the experimental universe where as those blocks where fortified food was not to be initiated form the control universe. One block namely Maitha was taken as Experimental block and Rajpur as Control block. The base line was done in both the blocks. However, no intervention with fortified food could take place in Maitha and hence substituted by neighboring block Rasulabad. This block was named as benchmark block. Later after six months; benchmark survey was done in Rasulabad block. An end line survey was done after one year of intervention in all three blocks. At the base line, care was taken that experimental block and control block match in terms of socio economic and demographic parameters. Later, while substituting Maitha by Rasulabad at bench mark stage, it was assured that these two blocks matched in terms of socio economic and demographic parameters. The sample size worked out as 750 which were selected in the form of 30 villages and 25 children per village.

30 villages from each of these blocks were selected by Probability Proportion to population Size (PPS). From the each selected village, 25 children were selected for the anthropometrics measurement and dietary intake, 10 children for clinical examinations and 5 for the bio-chemical examinations. The sample design as well as the sample selection for endline assessment as well as for bench mark assessment was similar to those as was used in the baseline assessment.

Results and Discussion: The majority of the children surveyed in these blocks belonged to lower socio-economic groups and the underprivileged sections of the society. There were considerable improvements in anemia in all these blocks. There is significant improvement in serum retinol levels of children at the end line stage in both the blocks. It is observed that there is significant improvement in Serum levels of children at the benchmark stage. Prevalence of severe malnutrition declined considerably in Maitha and Rajpur though it remained almost static in Rasulabad, giving further support to earlier observations on anemia. Only few (about 15%) children were taking home supplementary food and rest beneficiaries were consuming food at the AWCs. The paper show significant decline in the levels of anemia, vitamin A deficiency and malnutrition levels, an attempt was made to correlate these with the extent of food consumed.

Interpretation and Conclusion: The findings reveal that fortified panjiri has been effective in improving anemia, serum retinol and nutritional status. It is also revealed that short duration of intervention is as effective as prolonged interventions. There are other studies also indicating that fortification of foods with iron has produced improvements in iron status. In India, where double fortification of salt, with iodine and iron, has the potential to prevent both iron and iodine deficiencies and has been effective for improved hemoglobin concentrations.

Key Words: Probability Proportion to population Size (PPS)Sampling, WHO classification , Anemia level, Vitamin-A Deficiency, Standard Deviation classification, Severe malnutrition, base line, benchmark, Endline

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Background:

The prevalence of Anemia is about 40-70% among children in our country. The situation is even more alarming amongst children below 3 years with 74.3 % of them suffering from anemia (NFHS-3/NFHS-2). There is also a sizeable proportion of vitamin A deficiency amongst women and children (5-7% children suffering from vitamin-A deficiency). Amongst these, the clinical evidence in the form of "Bitot's spots" is visible in 0.21% children up to five years (India Nutrition Profile, DWCD, GOI, 1998). This tragically limits their potential for social and economic development. There are several reasons for micronutrient malnutrition and these include poor access to micronutrient rich food, morbidity, parasitic infestations, soil quality, compromised agricultural practices, climatic conditions and geographical isolation of the populace. However, the concept of food fortification is relatively uncommon in India. Hence, sometimes due to ignorance or due to paucity of research to assess the impact of fortifying supplementary food in large feeding programmes, there is an apprehension that fortification may either lead to imbalance of nutrients in the body or may not really improve the nutritional status of people consuming marginal diets. This has lead to a prudent approach in taking bold decisions to fortify the ICDS supplementary food to reduce micronutrient malnutrition in different states. The current research planned to provide empirical evidence on the impact of fortified ICDS supplementary food through a well-conducted community based research study.

Objective:

To study the impact of fortifying the supplementary food provided under the ICDS programme among the children between 12-59 months under programmatic conditions in state of Uttar Pradesh.

Materials and Methods:

The study has been conducted in two blocks namely maitha and Rajpur from Kanpur district of UP. It was considered prudent to select a control block with similar demographic, geographic and programmatic conditions so that the impact of

ICDS food fortification could be isolated from that of any such nutrition, health and other developmental interventions that may have taken place during the intervention period. In order to assess the impact of any intervention at the field level, it is essential that the intervention be made for a minimum specific period. For this study, it was considered essential that the intervention with fortified food must be made for atleast 12-15 months before its impact is assessed.

It was envisaged to conduct end line evaluation in Maitha and Rajpur blocks which were covered in the baseline study about a year ago. However, no intervention with fortified food could take place in the experimental block i.e, Maitha. Therefore, it was decided to substitute Maitha block with another neighboring block, which not only had the supply of fortified food but also matched well with Maitha demographically as well as by way of general nutrition and health status of vulnerable population groups.

The sampling design was same in the base line, benchmark and End line surveys.

During the intervening period, nutrition surveillance on the supply and intake of food under ICDS was undertaken at regular intervals. The observations during nutrition surveillance were taken into consideration while assessing the impact of supplementation of fortified food on the nutrition and health status of ICDS beneficiary children below 59 months.

Study Design

The study design adopted was quasi experimental design under programme conditions. The study was taken up in Kanpur dehat district of UP. The block where fortified food was to be initiated constituted the experimental universe where as those blocks where fortified food was not to be initiated form the control universe. One block namely Maitha was taken as Experimental block and Rajpur as Control block. The base line was done in both the blocks. However, no intervention with fortified food could take place in Maitha and hence substituted by neighboring block Rasulabad. This block was named as benchmark block. Later after six months; benchmark survey was done in Rasulabad block. An end line survey was done after one year of intervention in all three blocks.

At the base line, care was taken that experimental block and control block match in terms of socio economic and demographic parameters. Later, while substituting Maitha by Rasulabad at bench mark stage, it was assured that these two blocks matched in terms of socio economic and demographic parameters.

	Experimental		Control
Base line	Maitha		Rajpur
Bench Mark (after 6 months)		Rasulabad	
End line (after 1year of benchmark)	Maitha	Rasulabad	Rajpur

Since the study was carried out under the programme conditions with the changing scenario at the different points of time due to government decisions, following is important to mention:

- Maitha block, intervention block with planned supply/ distribution of fortified food, did not have any intervention after baseline. However, the regular supply started after July 2003 only. Thus, the block had about 27 months supply at the end-line stage and there was a gap of about 15 months between baseline and start of intervention.
- Rasulabad block was substituted as an intervention block (in lieu of Maitha) because of regular supply of fortified food immediately after the base line. The benchmark in this block was done in October 2003, after more than a year of distribution of fortified food – *panjiri,* starting in June 2002. Thus, Rasulabad had about 41 months of supply of fortified food at the stage of end line. It already had 16 months supply of fortified food at the time of bench mark survey.
- Rajpur block, being control at the baseline stage (April-May 2002), had about 8 months supply of fortified food at the time of end line.
- End line survey was done in Rajpur, Maitha and Rasulabad during November 2005. Maitha was also included on the suggestion of Working Group because it also had supply of fortified *Panjiri* since mid August 2003. It was also noted that fortified *Panjiri* was also started in Rajpur block since April 2005. This block was earlier a control block with no supply of fortified food. Any comparison among the three blocks at the end-line stage has to consider these facts.

It is apparent from above that though end line surveys in all the blocks were done at the same time; their base lines were at different timings. It may be noted that the baseline of Maitha appears to coincide with that of Rajpur, but in effect, in view of the delayed intervention in Maitha, its baseline is not comparable with that of Rajpur.

Sampling Design and Sample Selection

The sample size was worked out by assuming μ = 0.05, 80% power of test, $p_1 = 0.15$, $p_2 = 0.10$ and taking into account the design effect as 1.5. The prevalence of severe anemia was around p_1=15% and it was hoped that it would be reduced to a level of p_2=10% by the fortified ICDS supplementation. With this, the sample size worked out as 750 which were selected in the form of 30 villages and 25 children per village.

Thirty villages from each of these blocks were selected by Probability Proportion to population Size (PPS). From each selected village, 25 children (in the age group 12-59 months) were selected for the anthropometrics measurement and dietary intake, 10 children for clinical examinations and 5 for the bio-chemical examinations. Separate Questionnaires relating to Family profile, Dietary survey, Anthropometrics, Clinical signs and bio-chemical sign were used. The examination of blood samples for hemoglobin and serum retinol level were done under the supervision of Dr. Godbole, Head, Deptt. of Endocrinology, SGPGIMS, Lucknow, (UP).

In the benchmark study, the number of stool examinations were doubled so as gender differentials on the presence of worms. Further, the age cohort for children to be covered was changed from 12-59 at the baseline stage to 24-71 months in the benchmark and end line to account for the gap of one year between two rounds.

At the end line , it was also decided to cover half of children registered for receiving ICDS services from base line survey and remaining taken from the fresh group of children (because of migration and over age).

Results and Discussion:

Socio-economic characteristics

The majority of the children surveyed in these blocks belonged to lower socio-economic groups and the underprivileged sections of the society. More than three fourth children surveyed in these blocks i.e., intervention block, Benchmark block and control block were from the scheduled castes (SC) / scheduled tribes (ST) and other backward classes (OBC). It can be seen, there was hardly any change in the characteristics of households at the end line survey as compared to baseline (Annexure 1).

Age of Children

It is seen that children were appropriately represented by gender and were evenly distributed by age groups between both the sexes (Annexure 2).

Anemia among Children

The details on haemoglobin (Hb) levels of the children of both the rounds (baseline and endline) have been presented in this section. As per the WHO classification, the levels of anemia have been defined as severe anemia (for Hb less than 7g/dl), moderate anemia (for Hb level between 7 g/dl to 9.9 g/dl), and mild anemia (for Hb level between 10-10.9 g/dl). All these types of anemia taken together have been defined as the *any type* of anemia, estimated at <11g/dl.

There was considerable improvement in anemia in all these blocks. In Maitha, the prevalence of any anemia declined from 86.7 percent at the baseline to 66 percent at endline; while in Rajpur, the decline was from 98.7 percent to 51.5 percent, and in Rasulabad Rajpur, any anemia declined somewhat moderately from 82.3 percent (at benchmark with 16 months of intervention) to 60.6 percent (Table 1). Significant differences (P<.05) between baseline/ benchmark and endline in any anemia percentages were observed in all the blocks. These findings lead to the observation that there is decline in anemia in all the blocks irrespective of intervention durations; it was highest in Rajpur where the duration was shortest – fortified Panjiri was administered only for 8 months, and lowest in Rasulabad where it was given for maximum duration of 41 months. Rasulabad already had intervention of 16 months at the time of benchmark, and therefore, the decline in anemia in this block is over an already improved anemia level resulting from the intervention before the benchmark. This perhaps indicates that prolonged interventions may not be cost effective and interventions of 10-12 months duration may be sufficient.

Table 1: Anemia level (%) in children by age

Maitha	**Baseline**					**End-line**				
Age (yrs)	N	Normal	Mild	Moderate	Severe	N	Normal	Mild	Moderate	Severe
1-2	22	13.6	13.6	68.2	4.5	-	-	-	-	-
2-3	49	12.2	18.4	63.3	6.1	31	25.8	45.2	29.0	0.0
3-4	37	10.8	10.8	78.4	0.0	56	33.9	37.5	25.0	0.0
4-5	42	16.7	9.5	66.7	7.1	74	35.1	43.2	16.2	0.0
5-6	-	-	-	-	-	80	36.2	37.5	23.7	0.0
Rajpur	**Baseline**					**End-line**				
Age (yrs)	N	Normal	Mild	Moderate	Severe	N	Normal	Mild	Moderate	Severe
1-2	23	0.0	8.7	78.3	13.0	-	-	-	-	-
2-3	28	3.6	3.6	89.3	3.6	15	60.0	20.0	20.0	0.0
3-4	49	0.0	6.1	89.8	4.1	62	43.5	41.9	14.5	0.0
4-5	51	2.0	11.8	76.5	9.8	87	49.4	34.5	16.1	0.0
5-6	-	-	-	-	-	98	49.0	37.8	13.3	0.0
Rasulabad	**Benchmark**					**End-line**				
Age (yrs)	N	Normal	Mild	Moderate	Severe	N	Normal	Mild	Moderate	Severe
1-2	-	-	-	-	-	-	-	-	-	-
2-3	42	4.8	28.8	61.9	4.8	31	35.5	29.0	19.4	0.0
3-4	80	26.8	24.4	48.8	0.0	54	40.7	22.2	18.5	0.0
4-5	96	18.8	22.8	58.4	0.0	78	41.0	26.9	12.8	0.0
5-6	65	9.4	31.3	59.4	0.0	91	38.5	34.1	15.4	0.0

Table 2: Anemia level (%) in children by sex

Maitha	Baseline					End-line				
Sex	N	Normal	Mild	Moderate	Severe	N	Normal	Mild	Moderate	Severe
Male	83	12.0	21.7	62.7	3.6	119	36.1	39.5	21.8	0.0
Female	67	14.9	3.0	76.1	6.0	122	32.0	50.0	22.9	0.0
Total	150	13.3	13.3	68.7	4.7	241	34.0	40.2	22.4	0.0
Rajpur										
Male	78	2.6	14.1	80.8	2.6	150	47.3	39.3	13.3	0.0
Female	73	0.0	1.4	86.3	12.3	112	50.0	74.7	16.9	0.0
Total	151	1.3	7.9	83.4	7.3	262	48.5	36.6	15.0	0.0
Rasulabad										
Male	149	24.9	29.5	45.6	0.0	126	43.6	27.0	12.7	0.0
Female	134	9.7	24.6	54.9	0.7	128	35.2	30.5	18.7	0.0
Total	283	17.7	27.2	54.8	0.4	254	39.4	28.7	15.7	0.0

NFHS-2:Any anemia:76% (12-35 month), 70% (36-71 month), IASDS/KGMC: Any anemia:78%(12-35month,69.9%(36-71month) Normal (>=11), Any Anemia (<11), Mild (10-10.9), Moderate (7-9.9) and Severe (<7)

Most research indicates that there is an inverse relationship between the amount of iron absorbed and total iron stored of the individual. Deficient individuals more readily absorb iron. This was also the case in this study.

Vitamin-A Deficiency among children

As per the WHO, the children having serum retinol levels between 10 mcg/dl and 19.9 mcg/dl are classified as having vitamin A deficiency. It has been observed that there is significant improvement in serum retinol levels of children at the end line stage in both the blocks. It has been observed that there is significant improvement in Serum levels of children at the benchmark stage. The percentage of children below the cut-off 19.9 has gone down from 37.3 at the baseline stage to 13.3 at end line in Maitha, and from 57 to14.9 in Rajpur. In Rasulabad, this decline, from benchmark to end line was from 24.9% to 10.2% (Table 3). These results confirm the observations on anemia.

Table 3: Level of Vitamin A deficiency in children

Age (Yrs)	Maitha		Rajpur		Rasulabad	
	Serum level <19.9					
	Baseline	Endline	Baseline	Endline	Benchmark	Endline
1-2	40.9	-	43.5	-	-	-
2-3	42.8	3.2	50.0	1.8	27.3	6.5
3-4	24.3	8.9	63.3	11.3	20.5	11.1
4-5	40.5	13.5	60.8	19.5	27.4	6.4
5-6	-	20.0	-	14.3	22.2	14.3
Sex						
Male	33.7	10.9	65.4	8.4	23.1	9.5
Female	41.8	15.6	47.9	6.9	25.9	10.9
Total	37.3	13.3	57.0	15.3	24.9	10.2

Nutritional status of pre-school children

Standard Deviation (SD) classification has been used to determine the extent of malnutrition using weight-for-age as an indicator. Children who fall below –3sd median weight are classified as having severe malnutrition (severely underweight), and those below –2sd but –3sd and above median weight are termed moderately underweight (Table 4).

Table 4: Nutritional status of children (%) (based on SD Classification)

Nutritional Status Maitha	Baseline			End-line		
	Male	Female	Overall	Male	Female	Overall
Severe	11.9	13.8	12.7	9.2	6.8	8.0
Moderate	44.2	44.4	44.3	39.8	47.4	43.5
Normal to mild	43.9	41.9	43.0	51.0	45.8	48.5
Rajpur	Baseline			End-line		
	Male	Female	Overall	Male	Female	Overall
Severe	10.8	14.4	12.5	2.1	3.0	2.5
Moderate	41.0	36.0	38.6	32.1	27.8	30.0
Normal to mild	48.2	49.6	48.9	65.8	69.2	67.5
	Benchmark			End-line		
Rasulabad	Male	Female	Overall	Male	Female	Overall
Severe	10.4	15.5	12.9	12.6	12.4	12.5
Moderate	38.7	42.0	40.4	39.6	38.5	39.0
Normal to mild	50.9	42.5	46.7	47.9	49.1	48.5

Severe (<- 3sd), Moderate (>=- 3sd to <-2sd) and Normal to mild (<-1sd to >-2sd and >-1sd)

Prevalence of severe malnutrition declined considerably in Maitha and Rajpur though it remained almost static in Rasulabad, giving further support to earlier observations on anemia. The *severe* and *moderate* grade of malnutrition was 57% in baseline and reduced to 52% in the endline in Maitha. Similar decline in *severe* and *moderate* grades of malnutrition taken together was noted in Rajpur also, from 51% to 33%. However, there was hardly any change Rasulabad. Clearly, this indicates that it is the initial few months' intervention, which is crucial in controlling malnutrition. The subsequent follow-up does not seem to be consequential in this regard.

Consumption of ICDS food by children

Information on the food consumption pattern, consumption of fortified supplementary food provided through ICDS and its acceptability, the perception of mother and children about the goodness of this food and its sharing amongst the family members and sibling was gathered by direct observation as well as by focus group discussions (FGD). The mothers for the FGDs were selected from different socio-economic groups, taking special care to include those from scheduled castes/ tribes.

Children were specifically observed in the control as well as the intervention blocks during supplementary feeding activity at the several Aangan Wadi Centres (AWCs) at the time of endline evaluation as well as during the periodic nutrition surveillance to assess the extent to which they were eating Panjiri / regular ICDS supplementary food.

Only few (about 15%) children were taking supplementary food to home and rest beneficiaries were consuming food at the AWCs. The supplementary food was being shared with others in the case of more than two thirds of the children. This was common in both the intervention as well as the control block.

It has been observed that about 15% of children were consuming more than 75% of the fortified food, while about half of children were consuming between 50 - 75% of the fortified food provided at the AWCs. Only few (below 10%) child beneficiaries consumed less than 25% of the fortified supplementary food in the intervention block.

In the control block, 18% children consumed more than 75% of the ICDS supplementary food provided to them and 65% consumed between 50-75% of the fortified supplementary

food provided at the AWCs. In this block, only 3% children consumed less than 25% of their share of ICDS supplementary food.

This indicates under utilization of the fortified food by the ICDS beneficiary children. However, it is noteworthy that there was regular, almost un-interrupted, supply and distribution of the fortified food (Panjiri) throughout the intervention period and its consumption by the children was equally regular (with some level of sharing). Field

observations, FGDs with the mothers of beneficiary children during the surveillance and endline evaluation show that the practice of sharing of supplementary food provided through the AWCs under the ICDS programme, was universal and the extent of sharing was similar in the control as well as in the intervention block.

Perception of mothers about the fortified supplementary food provided at AWCs

Majority (90-96%) of the mothers stated that food distribution was regular and almost all children were also taking usual meals at home. On an average, children were getting 70-80 gm of fortified supplementary food per day from AWC. The average quantity consumed by children, as reported by mothers, was 50-70g in case of children above 3 years and about 50-60g by those below three years. The gap in consumption was apparently because of sharing of Panjiri by others. About 70% mothers preferred Panjiri for their children. About 25% expressed the view that different types of food should be supplied (even fruits), and some stated that Panjiri should be sweeter. A few Aangan Wadi Worker (AWWs) and mothers suggested that supplementary food should have a variety and include foods like biscuits and puffed snacks.

Most children and mothers (almost 70%) liked it. Those mothers who did not prefer (about 27%) this food for their children stated that it was not of good quality, as it did not have oil in it as in the traditional Panjiri. A few (about 16%) gave less sweetness as the reason for not liking it.

Association between consumption of fortified food and levels of Anaemia, Vitamin A deficiency and severe malnutrition

The paper show significant decline in the levels of anemia, vitamin A deficiency and malnutrition levels, an attempt was made to correlate these with the extent of food consumed. It is important to mention here that the information on the quantity consumed was collected on the perceptions of the mothers/children and not using any measurement. In such community based studies, there is always a likelihood of considerable recall bias, which is difficult to avoid. The analysis may therefore have limitation of reporting bias, as it is not easy to quantify the amount of food consumed, yet an attempt is made to correlate (Table 5).

Table 5: Association between consumption of fortified food and levels of Anaemia, Vitamin A deficiency and severe malnutrition

Indicator	Food consumed (Per cent) *					
	Rasulabad		Maitha		Rajpur	
	>75%	< 50%	>75%	< 50%	>75%	< 50%
Severe malnutrition	8.1	18.1	11.8	27.1	10.4	11.0
Any Anemia	71.4	52.4	70.6	89.7	34.1	52.8
Vitamin-A deficiency	19.0	7.1	14.7	7.7	18.9	13.9

* Children consuming less than 25% of fortified food were not included because of inadequate sample size.

Higher levels of anemia, vitamin A deficiency and severe malnutrition are found in children who consumed only up to 50% of fortified food as compared to those children who consumed 75% or more of fortified blended food provided through the AWCs.

Dietary habits and food consumption patterns of children

With respect to the dietary habits and food consumption patterns of children (12-59), data was collected through questioning the mothers and the care providers about the food consumed also there was no discernable difference at the endline vis-à-vis baseline. Also there were no perceptible differences in the food consumption patterns/dietary habits in the control *vs* intervention block. (Annexure 3)

Conclusion:

The findings reveal that fortified food has been effective in improving anemia, serum retinol and nutritional status. It is also revealed that short duration of intervention is as effective as prolonged interventions. There are other studies also indicating that fortification of foods with iron has produced improvements in iron status: Chile, where nationally distributed dry milk, fortified with ferrous sulphate and vitamin C, lowered the prevalence of anemia in infants from about 27% to close to zero; Ghana, where electrolytic iron, added to a complementary food, reduced anemia and iron deficiency; India, where double fortification of salt, with iodine and iron, has the potential to prevent both iron and iodine deficiencies and has been effective for improved haemoglobin concentrations; and Venezuela, with fortification of maize and wheat.

Fortification is a preventive measure for micronutrient malnutrition. The goal is not to provide 100% daily of micronutrients but rather "fill the gap" between intake from other sources and daily micronutrients needs. Costs of micronutrients are clearly negligible on a per person per year basis. Success requires active collaboration among several sectors: the scientific community, the government, private industry, consumer groups and international agencies.

Acknowledgement

Authors thank World food Programme, Delhi for identifying this Institute to undertake this study. Authors are also thankful to Indian Council of Medical Research, New Delhi for granting permission to undertake the study and thank Dr Godbole, SGPGIMS, Lucknow for supervising the examination of blood. Authors are thankful to districts administration for full cooperation in collecting the data. Authors are thankful to Dr Tulsi, Scientist "C" of NIMS for analysis of data and Mr Mathur, Mr Badolia,Mr Bara, Mr Rajendra Singh, Ms Sunita, Ms Madhu, Mr Jeentendra Yadav for data management.

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