Technical Bulletin-21

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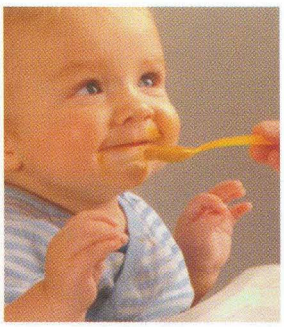

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Preface

Weaning period is very crucial phase in the child's development stage, which if not done properly, leads to malnutrition and other complications during early preschool age. The weaning foods prepared for children in the coastal rural Odisha were deficient in many nutrients especially in protein and vitamin A where as protein rich pulses and vitamin A rich sweet potato is abundant in the area. Further, it is also equally important that the appropriate proportions of food materials of known composition are added and proper methodology is followed. Roasting and powdering ingredients such as cereals, pulses, nuts and oil seeds makes premixes. They are reconstituted by the addition of water, milk, curd, fruit juice, oils and sugar or jaggery. Fresh weaning foods can be made using cereals pulses, vegetables, fruits, milk, curd, oil and other ingredients. Pulses are rich source of protein, cereals provide energy and sweet potato is rich in Vitamin A. Sweet potato is locally available in the area which can be used in a balance proportion to meet out the various nutrient requirement in general and vitamin A and energy in particular. The major reason of malnutrition among infants is ignorance of mothers/ rural women regarding food and nutritional requirement of the growing children, as well as lack of knowledge on available source of nutritionally rich food crops. Thus an attempt was made for creating awareness of food and nutritional requirement of the growing children, production of low cost hygienic and nutrition rich weaning mix from the food crops available locally and to increase access to protein and vitamin A rich food to the needy growing children of middle and low income group families of backward areas of coastal Odisha.

Authors

Contents

1. Introduction

Growth is the most sensitive and readily measured indicator of health and nutrition for the individual child. It is also a more general index of health in a community because it is dynamic and reflects positive change. However, because of the exclusive nature of a young infant's diet and the limited ability of the digestive tract to deal with excessive intakes of some nutrients, feedings for the young must closely match nutrient needs. In most developing countries with generally poor environmental conditions, average infant growth in weight and height is satisfactory until about three months of age, when it begins to fall off. Growth faltering at this age may occur as the child outgrows its mother's capacity to produce breast milk and to provide adequate supplementation. According to National Family Health Survey III (NFHS III), over 44 per cent infants were malnourished and infant morality rate in the state stands at 65 per 1000 live births. In rural areas of Odisha, women prefer mix of chura powder (rice flake power), milk and sugar and soft boiled rice and boiled potato. These weaning foods are deficient in protein, fat, Vitamin A and some other nutrients required for growing infants.

Despite general improvements in food availability and health and social services, hunger and malnutrition exist in some forms in nearly all countries. Between 1975 and 1990 the average prevalence of protein-energy malnutrition (PEM) in children in Africa, Asia, the Middle East, and the Americas combined, as estimated by FAD/WHO, was reduced from 47.5% to 40.8%. Nevertheless, there were 155 million underweight children in Asia in 1990, representing 44% of children fewer than five years of age (FAO/ WHO, 1992). Table 1 shows the prevalence of low-birth weight infants and underweight children (UNICEF, 1993). As of 1990, for instance, Japan and China had the lowest percentage of low birth weight and India had the highest. The prevalence of wasting and stunting among children in India and Pakistan was also higher than in other countries.

The poor are less likely to starve in urban centres than in the rural countryside. However, inadequate diets, harmful lifestyles, overcrowding, and unhygienic living conditions leave city dwellers prone to infection and various forms of malnutrition. In rural areas, under nutrition in various forms is a major peril, particularly among the

landless. Periodic starvation is common during the time before harvesting or when food is in short supply and prices rise. Within this context, two factors playing major roles in the pathogenesis of PEM and low birth weight are inadequate dietary intake and the combined effect of stress and infections, which may interfere with the intake, absorption, and assimilation of nutrients.

Societal changes (so-called development) are inducing changes in dietary practices. Increasing numbers of women in urban areas engaged in regular employment outside the home, the absence of facilities for breast-feeding at work sites, the break-up of families, maternal ill health, and the impact of high pressure commercial advertisements through the press and other media all contribute to early abandonment of breast-feeding and greater use of commercial baby foods. Studies that distinguish between exclusive and partial breast-feeding show that high percentages of infants in developing countries are breast-fed exclusively for very short periods (Fomon, MR, 1984 and Underwood, BA, *et al.*1981). Moreover, complementary foods are introduced much earlier than the recommended age of four months (Underwood, BA, *et al.*1982), often even in the first month of life. Such foods are usually bulky and thus low in energy density. Consumption of a large volume satiates an infant, reducing the frequency of suckling and consequently reducing breast-milk output. Early introduction of cereals and particularly vegetables can interfere with the absorption of breast-milk iron (Solomons, NV, et al 1989), thus potentially resulting in iron deficiency. In addition, weaning foods prepared under unhygienic conditions are frequently contaminated with pathogens and thus are a major factor causing diarrhoea and associated malnutrition (Motarjemi, Y.et al, 1993).

Weaning period is very crucial phase in the child's development stage, which if not done properly, leads to malnutrition and other complications during early preschool age. In introducing weaning foods, there may be diverse effects from timing, such as early or late weaning, and from the types of foods used. This process also has great geographic and cultural variations. Ready mix foods available in the market are costly and cannot be afforded by majority. Misperceptions about and the inappropriate use of commercial baby foods, which are increasingly available but which to date are not able to meet optimum nutrient requirements, may cause young children's health to deteriorate. On the other hand, prolonged exclusive breast-feeding and delayed weaning can also contribute to a high prevalence of growth faltering (Luwang, NC, 1985).

Table.1. Low-birth weight infants and moderately and severely underweight children (percentage) in selected Asian countries, 1990

Countries	Low birth-weight	Under weight (0-4 yrs)	Wasting (12-23 mo)	Stunting (24-50 mo)
China	9	21	8	41
India	33	63	27	65
Indonesia	14	40	-	-
Japan	6	-	-	-
Malaysia	10	-	6	-
Pakistan	25	40	11	60
Philippines	15	34	14	45
Sri Lanka	25	29	21	39
Vietnam	17	42	12	49
Thailand	13	26	10	28

Source: UNICEF, 1993

The weaning foods prepared for children in the coastal rural Odisha were deficient in many nutrients especially in protein and vitamin A where as protein rich pulses and vitamin A rich sweet potato is abundant in the area. Further, it is also equally important that the appropriate proportions of food materials of known composition are added and proper methodology is followed. Roasting and powdering ingredients such as cereals, pulses, nuts and oil seeds makes premixes. They are reconstituted by the addition of water, milk, curd, fruit juice, oils and sugar or jaggery. Fresh weaning foods can be made using cereals pulses, vegetables, fruits, milk, curd, oil and other ingredients. Pulses are rich source of protein, cereals provide energy and sweet potato is rich in Vitamin A. Sweet potato is locally available in the area which can be used in a balance proportion to meet out the various nutrient requirement in general and vitamin A and energy in particular. Sweet potato is one of the most nutritious foods in nature, and is relished by all ages for their sweet taste ad fibrous texture. The major reason of malnutrition among infants is ignorance of mothers/ rural women regarding

food and nutritional requirement of the growing children, as well as lack of knowledge on available source of nutritionally rich food crops. Thus an attempt was made for creating awareness of food and nutritional requirement of the growing children, production of low cost hygienic and nutrition rich weaning mix from the food crops available locally and to increase access to protein and vitamin A rich food to the needy growing children of middle and low income group families of backward areas with the following objectives.

Objectives

- To identify various feedings practices of children, traditional weaning mix in rural and backward areas of Odisha.
- To identify protein and vitamin A rich locally available food materials suitable for non-traditional weaning mixes, assessment of their nutritive value, palatability and acceptability.
- To standardize the methodology for the preparation of non-traditional protein and vitamin A rich weaning mix for children.
- Participatory evaluation of low cost weaning mix with mothers and infants
- Assessment of impact of weaning mix on the anthropometric measurements of infant.

2. Methodology

To know the common weaning (baby) foods and practices a study was conducted in rural coastal Odisha. Four blocks were selected randomly from Puri and Khurda district of Odisha for conducting survey and from each block one village was selected and from each village 25 households were selected randomly for the study. Finally 100 households were selected for the study to find out the common weaning food. Locally available nutritious foods suitable for infants were identified. Standardization of weaning mix was done adopting simple technique of roasting, boiling, blanching, drying and grinding and final mix was selected on the preference of mother and child, evaluation of the mix on nine point hedonic scale and also on the basis of nutritional composition of baby food mix. The impact of weaning mix was assessed with health and nutritional status of infants which was compared with control group of infants.

Methodology of the project head been divided into two different parts.

I. Weaning foods (baby food) and feeding practices in coastal Odisha

II. Standardization of sweet potato added weaning mix

I. Weaning foods and feeding practices in Odisha

A study in the coastal Odisha was conducted to know the common weaning foods given to the infants, weaning practices, weaning period and method of weaning mix preparation. Four blocks were selected randomly from Puri and Khurda district for conducting survey and from each block one village was selected and from each village 25 households were selected randomly for the study. Finally 100 households were selected for the interview.

General profile of the mother was taken and it was observed that majority 51 per cent of the mothers come under the age group of 25-30 and lowest in the age group of 35-40. Among 100 mothers 37 per cent had infants in the age group of 0-6 months and 63 per cent had infants in the age group of 6-24 months. Among the 100 respondents 14 per cent mothers were illiterate where as higher education of the studied mother was graduation (only 6 per cent)

Table.2. Distribution of infants as per their onset of weaning

Sl.no.	Age of onset of weaning	Frequency	Per cent
1.	Less than 4 months	18	18
2.	4-6 months	22	22
3.	6-8 months	26	26
4.	8-12 months	30	30
5.	More than one year	4	4
	Total	**100**	**100**

The onset of weaning was also studied and it was found that majority 30 per cent infants were weaned at the age of 8-12 months and lowest four per cent at the age of one year. 18 per cent infants were even weaned less that four mouths of age due to serval problems.

Table.3. Matrix ranking regarding common weaning foods given to the infants

Sl.no.	Common weaning foods	Matrix ranking
1.	Roasted chura power + milk + sugar	I
2.	Boiled sago with salt	X
3.	Lactogen(powered milk)	II
4.	Cow's milk	V
5.	Cerelac	IV
6.	Rice water +soft rice +boiled potato	III
7.	Soft boiled rice + dal	VII
8.	Boiled rice + boiled vegetable	VI
9.	Sattua	IX
10.	Biscuit + milk	VIII

Matrix ranking was done to know the common weaning foods given to the infants and it was found that roasted flakes(chura) power +milk+ sugar was the most preferred weaning food followed by rice water +soft boiled rice + dal and so on. It was also observed that studied families prefer Lactogen (powered milk) in relation to cow's milk with the belief that cow's milk causes cough and cold problem in infants. (Table-3)

Table.4. Distribution of infants as per food given to them up to the age of one year

Sl.no.	Category	Frequency	Per cent
1.	Up to 6 month only breast milk	60	60
2.	Up to 6 month breast milk + outside milk	10	10
3.	Up to 6 months breast milk + other solid foods	30	30
4.	Up to one year only milk (breast +Lactogen or cow's milk)	15	15
5.	Up to one year milk + solid food	85	85
	Total	**100**	-

The weaning pattern of the infants revealed that among 100 infants studied 60 per cent infants were exclusively breast fed for the period of 6 months where as 18 per cent were exclusively breastfed for less than 2 months only. Four per cent infants were exclusively breastfed up to one year. Up to 6 months only liquid food like cow's milk, powered milk, water and honey were given to the infants. It was also observed that exclusively breastfed infants were nutritionally normal in comparison to partial breastfed infants up to the age of 6 months. (Table-4)

Table.5. Distribution of infants as per the quantity of food given to them in one serving

Sl.no.	Quantity	Frequency	Per cent
1.	20-40g	7	7
2.	40-60g	47	47
3.	60-80g	13	13
4.	80-100g	33	33
	Total	**100**	**100**

After the age of 4-5 months mother's milk alone is not sufficient to sustain growth and development of infants due to increase demand of protein and calorie. Feeding pattern and quantity of food given to the infants was studied. It was found that up to the age of 6 months, only 30 per cent infants were getting some solid foods along with mother's milk and 15 per cent were getting only milk(mother's milk + Lactogen /cow's milk) up to one year which could not meet the requirement of protein, calorie and other

nutrients of the infants. Quantity wise majority of infants (47 per cent) were getting 40-60 gm in one serving. (Table 4-5).

Table.6. Distribution of infants according to the frequency of weaning foods given to them

Sl.no.	No. of times	Frequency	Per cent
1.	2 times in a day	3	3
2.	3 times in a day	33	33
3.	4 times in a day	39	39
4.	5 times in a day	20	20
5.	6 times in a day	5	5
	Total	**100**	**100**

Frequency of the weaning foods given to the infant was also studied and it was found that majority of the infants i.e. 39 per cent were getting outside food 4 times in a day and only two per cent were getting two times in a day where as outside food 3 times in a day along with mother's milk is sufficient for infant up to two years. (Table-6)

Table.7. Locally available foods which can be used in the preparation of weaning foods

Sl.no.	Food Group	Food Items	Rich in nutrients
1.	Cereal	Rice and rice products	Energy
2.	Pulse	Green gram, black gram, Bengal gram	Protein and energy
3.	Oil seeds	Til, groundnut	Protein, mineral and energy
4.	Millets	Ragi, bajra	Minerals
5.	Vegetable	Green leafy vegetable and almost all other vegetable	Vitamins and minerals
6.	Fruits	Banana, papaya (available throughout the year	Vitamins and minerals
7.	Tubers	Yam, sweet potato, potato	Energy and vitamin

Almost all the nutrients rich foods are available in the studied area like energy rich rice and tubers, protein rich pulses (green gram, black gram) oilseed (sesame seeds and

groundnut), vitamin and mineral rich vegetable and fruits which can be used in preparation of balanced food for the proper nourishment of the infants. (Table-7)

The survey conducted in Odisha on weaning practices adopted by mothers, common weaning foods, method of preparation of weaning food, locally available food materials indicated following findings

- The most preferred weaning food in the coastal Odisha was roasted chura (flakes) powder + milk +sugar and soft boiled rice +.boiled potato. These weaning foods are deficient in protein, fat, vitamin A and other nutrients which are very much required for growing infants.
- Muslim families did not give colostrums to the newborn infants. They give breast milk to the infants after three days before that they give water and honey to them. It was also observed that muslim mothers did not give flake power or other solid foods to their infants. They mostly give only milk up to one year.
- Most of the families prefer Lactogen (powered milk) to cow's milk with the belief that cow's milk due to cool in nature causes cough and cold problem in infants.
- Poor families due to financial problems give over diluted and contaminated milk to their infants which causes diarrhea and under nutrition among them.
- Preferred process of preparation of weaning foods was roasting, grinding and boiling.
- Main constraint regarding weaning foods was poverty, non-availability of foods and ignorance.
- In most of the families hygiene was not maintained during preparation and handling of foods which causes diarrhea among the infants.

II. Standardization of weaning mix

Almost all the nutrients rich foods are available in the Coastal Odisha like energy rich rice and tubers, protein rich dals (green gram, black gram) oilseed (Sesame seeds and groundnut), vitamin and mineral rich vegetable and fruits which can be used in preparation of balanced food for the proper nourishment of the infants.

Based on common weaning food used in this area and availability of locally food some combinations of mix were tried out. Standardization of weaning mix base and final weaning mix was done by various combinations of cereals/ pulses/ oil seed and sweet potato. Nutritive value (total energy, crude protein, fat, mineral, total ash, fibre etc.) of sweet potato based weaning mix was estimated.

For the preparation of mix sweet potato (Gourie variety, rich in vit A), green leaves (amaranths), and potato were dehydrated, kept for there storage quality in airtight containers and polythene bags. It was observed that sweet potato chips and potato chips can be kept in good condition up to one year in air tight containers and green leaves up to 6 months in polythene bags.

Roasted flake powder + Roasted Wheat power + Pulses (green gram dal+ bengal gram dal) + Sesame seeds powder were selected for the base of weaning mix in the ratio 2:1:1:0.25. This base was selected on the basis of the perception of the mothers of ten children to whom various bases were given to taste and acceptability regarding taste, flavour, texture and appearance. After standardization of base, weaning mix was tried out with various combinations of dehydrated sweet potato powder.

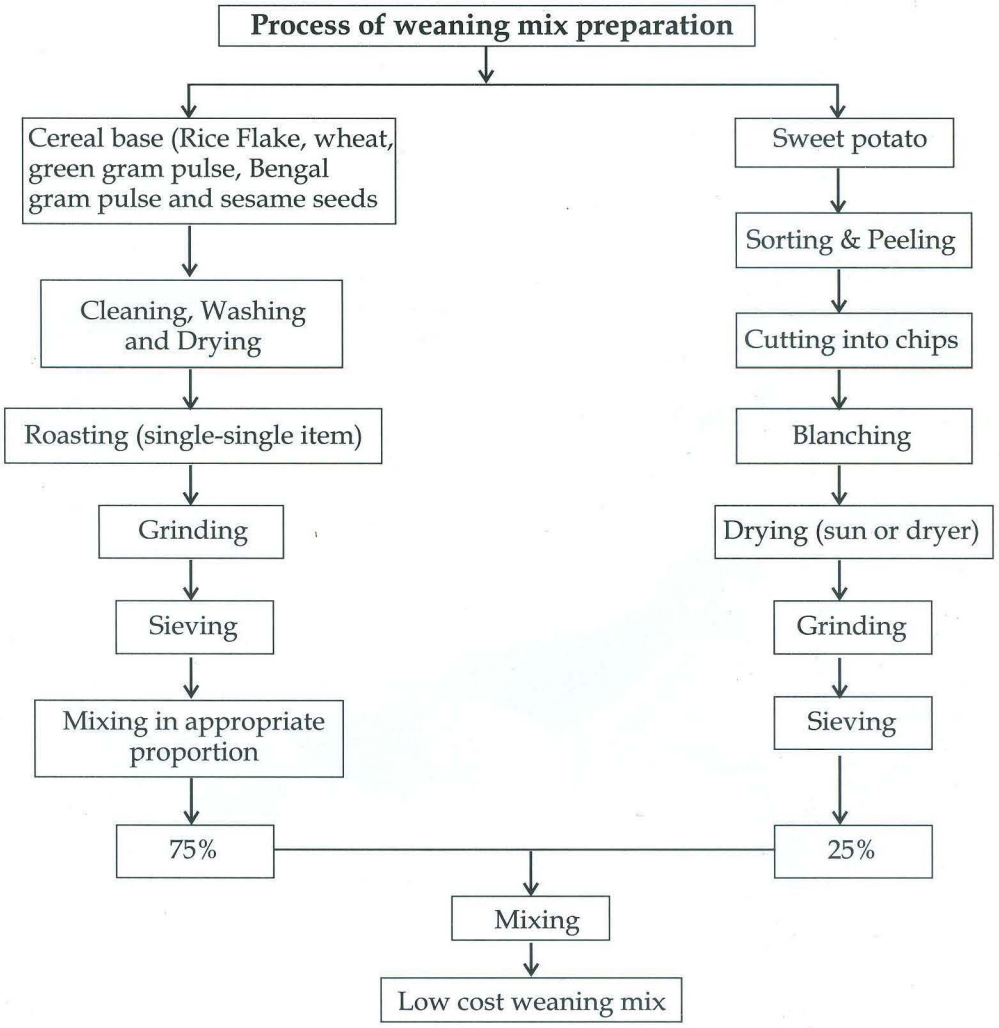
Standardization of weaning mix with sweet potato

1. Base + Dehydrated sweet potato power in the proportion of 90:10
2. Base + Dehydrated sweet potato power in the proportion of 85:15
3. Base + Dehydrated sweet potato power in the proportion of 80:20
4. Base + Dehydrated sweet potato power in the proportion of 75:25
5. Base + Dehydrated sweet potato power in the proportion of 50:50

Five combinations of sweet potato based weaning mix were prepared and tested for their acceptability by mothers on the basis of taste, flavour, texture and appearance and finally base + dehydrated sweet potato powder in the proportions of 75:25 was selected. The sensory evaluation of the weaning mix was also done on the nine point hedonic scale. Basis of the selection was taste preferred by children as perceived by mothers and nutritional composition of the weaning mix. Nutrient composition of sweet potato based weaning mix (total energy, crude protein, fat, mineral, vitamin A, total ash and fiber) was estimated and found suitable for infants..

Table.8. Sensory evaluation scores on nine point hedonic scale

Sensory quality characteristics	Sweet potato based weaning mix						
	5%	10%	15%	20%	25%	30%	50%
Appearance	7.8	7.8	7.9	7.8	8.0	8.1	7.4
Taste	8.1	7.6	7.5	7.8	8.2	7.3	7.9
Colour	7.7	7.6	7.9	7.4	7.8	7.7	7.5
Flavour	7.9	7.2	7.8	7.2	8.1	7.4	7.9
Texture	8.0	8.0	7.5	7.9	7.9	7.2	7.9
Over all acceptability	7.9	7.6	7.7	7.6	8.0	7.5	7.7



Proximate analysis was done to know the nutritional composition of weaning mix and it was found that this low cost weaning mix is nutritionally balanced for growing infants. **One thing which is very important in the preparation of weaning mix is its proper hygienic handling during preparation and proper storage after preparation. Weaning foods prepared under unhygienic conditions are frequently contaminated with pathogens and thus are a major factors causing diarrhoea, ill health and associated malnutrition.**

Table.9. Nutrient composition of weaning mix (per 100 gm.)

Nutrients	Percentage
Moisture (%)	5.81
Crude protein (%)	10.86
Crude fat (%)	5.89
Total ash (%)	1.95
Crude fibre (%)	2.78
Energy value (Kcal/100 g)	456
Beta carotene (mg on fresh wt. basis)	8.454
Dry matter (%)	94.19

Prepared weaning food

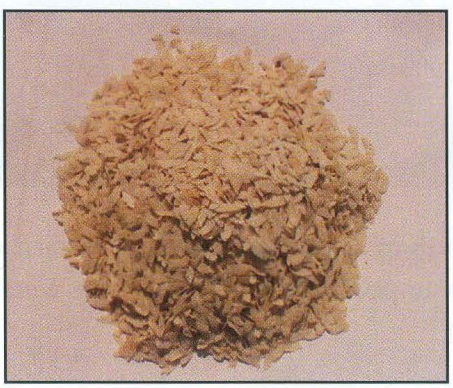
Raw Ingredients of weaning mix

SWEET POTATO

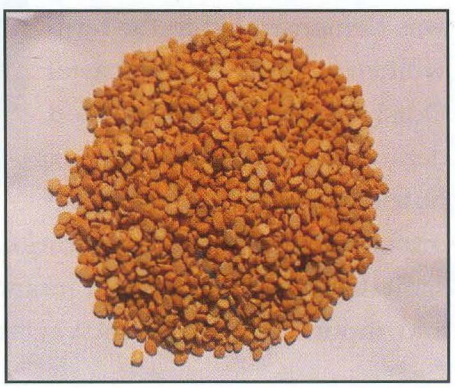
SESAME SEEDS

WHEAT

GREEN GRAM PULSE



FLAKE RICE



BENGAL GRAM PULSE

3. Dissemination of weaning mix technology among farmwomen

The sweet potato added weaning mix was developed with locally available food materials using very simple methodology and was tested in the laboratory. This technology of low cost and nutritionally balanced weaning mix for the infants was transferred to the farm women/ mothers through various training cum demonstration programmes.

Demonstration for dissemination of weaning mix technology

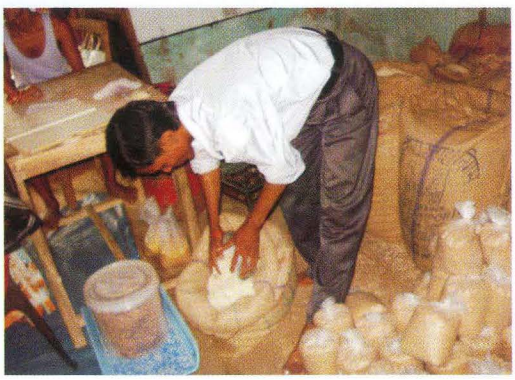
Thirteen training cum demonstration programmes were conducted in six villages of Khurda and Puri district involving 219 mothers/farm women. The process of preparation of low cost weaning mix and its handling was demonstrated to the farm women/ mothers in coastal Odisha. Along with method demonstration of weaning mix nutrition education was also imparted to farm women on various aspects like: infant feeding practices, hygiene and sanitation, balanced diet for infants and mothers, importance of safe drinking water, and importance of fruits and vegetables in the diet.

Table.10. Demonstrations cum training programme conducted in coastal Odisha for dissemination of technology

Sl. no.	Village	Date	No. of participants
1.	Mendhasal	29.09.07	32
2.	Kantamalim	15.10.07	18
3.	Italanga	16.10.07	31
4.	Italanga	08.04.08	22
5.	Bagalpur	11.06.08	12
6.	Balbhadrapur	21.08.08	23
7.	Italanga	05.11.08	32
8.	Jaipur	20.11.08	36
9.	Balapur	29.11.08	13
10.	Jaipur	16.07.09	36
11.	Jaipur	23.09.09	30
12.	Jaipur	06.01.10	30
13.	Jaipur	12.01.10	30
Total	**Six villages**	-	**345**

4. *Participatory evaluation of low cost weaning mix*

Participatory evaluation of low cost weaning mix was done with 138 mothers/farm women in different villages. To evaluate the mix with mothers firstly motivational/awareness training was conducted. After that demonstration cum training was conducted with same participants. Small quantity of weaning mix was provided to all the participants to evaluate the mix with their infants. After that participatory evaluation of low cost weaning was done on various aspects like; liking/motivation, disliking/rejection, reasons for liking and reasons for disliking. From all the 138 participants, technology was liked by ninety seven mothers. Forty one participants disliked



Participatory evaluation of weaning mix technology

the technology due to various reasons. Matrix ranking regarding reasons of liking and disliking of technology was also assessed with participants. Details of the matrix ranking are as follows;

Table.11. Ranking of reasons for adoption/liking of low cost weaning mix

Sl. no.	Reasons	Ranks
1	Good for child health	II
2	Cheap in relation to market food	I
3	Easy to prepare	V
4	Time saving	VI
5	Energy saving	VII
6	Liked by child	III
7	Hygienic	IV

Table.12. Ranking of reasons for rejection/disliking of low cost weaning mix

Sl. no.	Reasons	Ranks
1	Non availability of sweet potato through out the year	I
2	Proper storage problem	III
3	Preparation procedure is time taking	IV
4	Sweet potato processing is difficult	II

5. Assessment of weaning mix with infants

To assess the impact of low cost weaning mix on the health and nutritional status of infants, sixty infants were taken as an experimental group and forty five as a control group. Baseline survey of infants (Anthropometric measurements and Feeding practices) of both the experimental and control group was taken before starting the experiments. Weaning food was continued up to six months. Raw material of the weaning mix was supplied and the mothers of sixty infants were trained to prepare it at their own home. Instruction was given to give this weaning food two to three times in a day (75-100 gm/ day). Observations were taken at every one month interval. Final observation was taken up after six month. These observations were compared with the final observations of control group to whom weaning mix was not given. The control group infants were from the same locality and same category. Detail initial information about the infants of the experimental and control group is as follows;

Table.13. Age and sex wise distribution of experimental group of infants of infants

(N = 60)

Age (months)	No. of infants		Total
	Male	Female	
6 - 9	14	8	22
9 - 12	6	6	12
12 - 15	9	8	17
15 - 18	4	5	9
	33	27	60

A total of 60 infants were selected as an experimental group in which 33 were male and 27 were female infants between the age group of 6-18 months.

Table.14. Mean weight and height of infants of experimental group

(N=60)

Age (in months)	No. of Infants	Weight (kg)		Height (cm)	
		Male	Female	Male	Female
6 – 12	24	7.5 (8.4)	7.2 (7.8)	72 (73.9)	71.6 (72.5)
12 – 18	26	8.7 (10.1)	8.05 (9.6)	73.2 (81.6)	72.1 (80.1)

Table.15. Mean weight and height of infants of control group

Age in month	No. of infants	Weight (kg)		Height (cm)	
		Male	Female	Male	Female
6-12	25	**7.5 (8.4)**	**7.45 (7.8)**	**70.8 (73.9)**	**72.1 (72.5)**
12-18	20	**8.2 (9.7)**	**8.2 (9)**	**75.2 (73.9)**	**70.1 (72.5)**

Weight, height, head circumference, chest circumference and mid upper arm circumference of infants to the minimum error were taken and mean was calculated. Number in parenthesis indicates the national standard of mean of anthropometric measurements of same age group. It is observed from the table- 14, 15 16 &17 that mean value of all the anthropometric measurements of experimental as well as control group was less than the national standard indicating malnutrition among them.

Table.16. Mean head circumferences, chest circumferences and mid arm circumferences of experimental group infants

Age (in months)	Head circumferences (cm)		Chest Circumferences (cm)		Mid arm circumferences (cm)	
	Male	Female	Male	Female	Male	Female
6 – 12	44.1 (44.4)	42.4 (43.6)	42.2 (43.33)	42.2 (42.33)	14.0 (14.9)	14.0 (14.2)
12 – 18	44.2 (45.9)	42.4 (45.2)	43.5 (45.58)	43.5 (45.2)	14.0 (15.1)	14.2 (14.5)

Table.17. Mean head circumferences, chest circumferences and mid arm circumferences of control group infants

Age in months	Head circumferences		Chest circumferences		Mid upper arm circumferences	
	Male	Female	Male	Female	Male	Female
6-12	44.0 (44.4)	42.1 (43.6)	42.2 (43.33)	42.1 (43.3)	14.0 (14.9)	14.0 (14.9)
12-18	44.1 (45.9)	42.2 (45.2)	43.6 (45.5)	43.2 (45.2)	14.1 (15.1)	14.5 (14.5)

Table.18. Feeding practices of experimental group of infants

Sl. No.	Weaning food	Frequency	Percentage
1	Roasted flake powder with milk/ water and sugar	52	86.7
2	Powdered milk	14	23.3
3	Soft boiled rice with boiled potato	16	26.66
4	Others	7	11.67

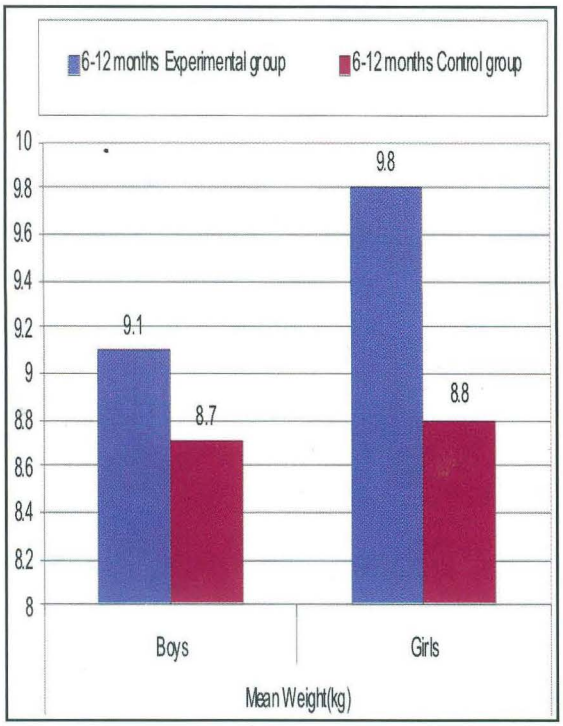
In rural coastal Odisha roasted flake (chura) power with milk/water and sugar is the most preferred weaning food in the majority of the families which was clearly observed from the table-18 which is the finding of the previous survey.

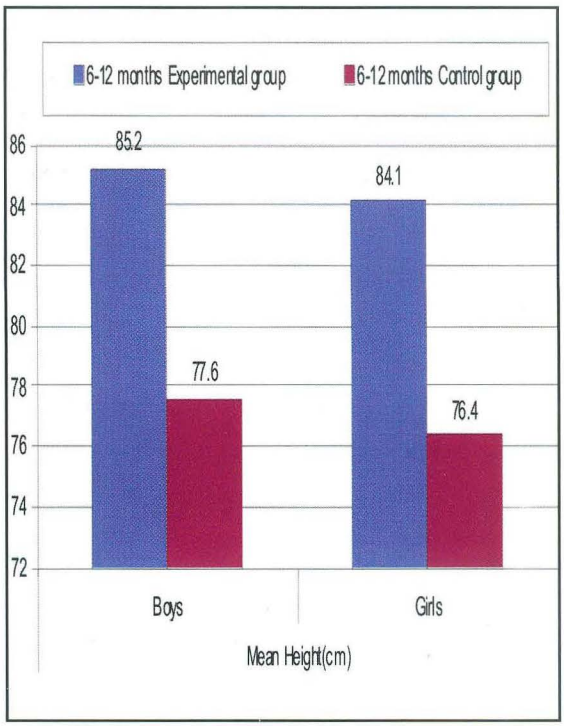
Table.19. Comparison in mean weight and height of infants of experimental and control group infants after six months

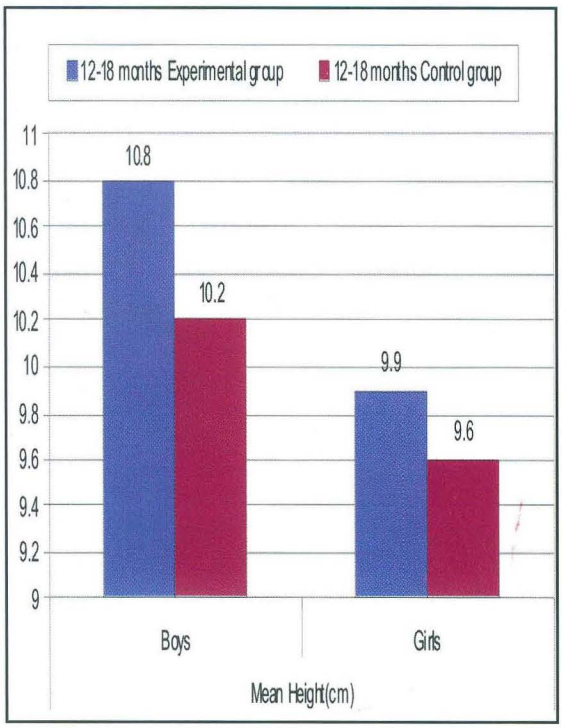
Age Group	Category	Mean Weight(kg)		Mean Height(cm)	
		Boys	Girls	Boys	Girls
6-12 months	Experimental group	9.1	9.8	85.2	84.1
	Control group	8.7	8.8	77.6	76.4
12-18 months	Experimental group	10.8	9.8	86.2	83.1
	Control group	10.2	9.6	85.1	83.9

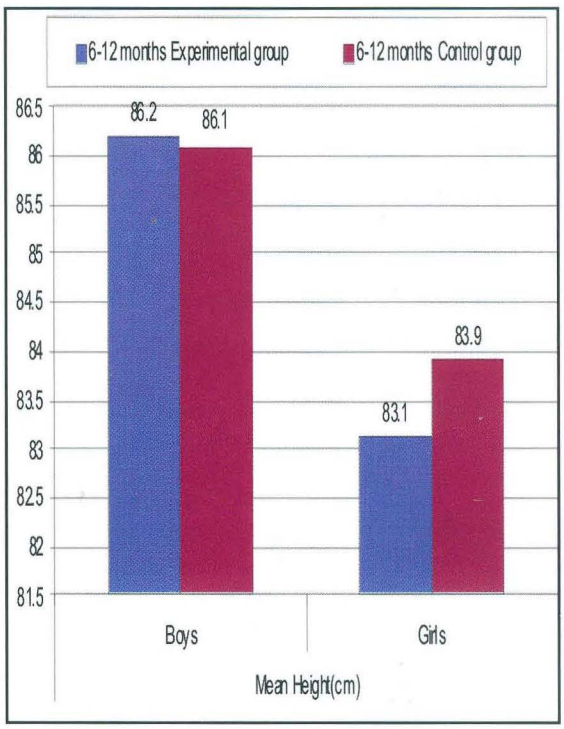
Table. 20. Comparison between mean head circumferences, chest circumferences and mid arm circumferences of experimental and control group infants after six months

Age (months)	Head circumferences (cm)		Chest Circumferences (cm)		Mid arm circumferences (cm)	
	Male	Female	Male	Female	Male	Female
6–12(Experiment)	44.4 (45.9)	42.4 (45.2)	42.2 (45.58)	42.5 (45.2)	14.0 (14.6)	14.2 (14.8)
6–12(Control)	44.2(45.9)	42.1(45.2)	42.2(45.58)	42.1(45.2)	14.0(14.6)	14.1(14.8)
12–18(Experiment)	46.8(48.5)	46.9(48.2)	46.1(46.5)	46.3 (46.5)	14.1 (15.1)	14.2(14.9)
12–18(Control)	46.4(48.5)	46.5(48.2)	46.1(46.5)	46.1(46.5)	14.0(15.1)	13.9(14.9)


6-12 months Experimental group
6-12 months Control group
10
9.8
9.6
9.4
9.2
9
8.8
8.6
8.4
8.2
8
9.1
8.7
9.8
8.8
Boys
Girls
Mean Weight(kg)


6-12 months Experimental group
6-12 months Control group
86
84
82
80
78
76
74
72
85.2
77.6
84.1
76.4
Boys
Girls
Mean Height(cm)


12-18 months Experimental group
12-18 months Control group
11
10.8
10.6
10.4
10.2
10
9.8
9.6
9.4
9.2
9
10.8
10.2
9.9
9.6
Boys
Girls
Mean Height(cm)


6-12 months Experimental group
6-12 months Control group
86.5
86
85.5
85
84.5
84
83.5
83
82.5
82
81.5
86.2
86.1
83.1
83.9
Boys
Girls
Mean Height(cm)

It is observed from the table that there is a difference between the mean weight and height of experimental and control group infants of 6-12 months age group. The difference in height is more than the difference in weight and the difference of weight and height is more in case of girls than in boys of 6-12 months age group. The difference in the mean weight and height of infants of 12-18 months age group of experimental and control group is less. The reason may be the infants of 12-18 months age group are taking almost all the food items so effect of this weaning mix is less in this age group. Mid arm circumference, chest circumference and head circumference are indicator of long term malnutrition and comparison between experimental and control group infants showed negligible difference between them. The evaluation of this weaning mix was based on participatory approach where our direct control was not there and the results were based on the assurance of the mothers that they had given the weaning food to the infants two times in the day up to six months. Raw materials for the weaning mix had been supplied from the institute. Two times monitoring in the month has been done.

It can be concluded that this weaning mix is good for the infants of less than one year.

If this technology can be disseminated in the rural area on large scale, it will be helpful to the rural farm women to feed their children a nutritionally balanced feed with low cost and simple technique.

6. Guidelines for better growth and development of infants

A. Promoting better maternal care and breast-feeding

It is crucial to mothers' physical and mental health, that they have ready access to health care services. Dietary guidelines for pregnancy and lactation should be widely disseminated through nutrition development programmes. Action also must be taken to promote maternal education and literacy. At a basic level, policies and programmes should empower mothers to breast-feed their infants exclusively from birth to 6 months of age and to continue breast-feeding with the addition of supplementary foods for up to two years or longer.

B. Improvement in feeding and weaning practices

It is necessary to consider the appropriate timing and quality of weaning foods. Depending on the physiological maturation of each infant, a general rule is that solid foods may be given at five to six months of age. A staple food that is calorically dense and adequate in protein is important, and high content of vitamins A and D, iron, and zinc should be emphasized. To prevent diarrhoea caused by bacterial contamination, freshly cooked or freshly peeled foods should be used. Approaching two years of age, the child should be consuming a variety from the family diet, with items from each of the basic food groups.

Guidelines for supplementary feeding based on the child's age:

6 months- begin feeding rice gruel/bananas

7 months- add egg yolk, liver, or legumes

8 months- add fish, green leafy vegetables, apple

9 months- begin one soft meal

10 months- add ground meat, begin whole egg

10-11months- give two complete meals

11-12 months- give three complete meals

Proper feeding and weaning practices have three focal levels: family, community, and commercial. At the family level, since breast milk is fully adequate for the first three months of life, supplementary food should not be started until after that time. At the

community level, nutrition programmes should become an active part of the primary health care and rural development systems. Communities must be given the tools and guidance to monitor children's growth and nutrition status and to produce and distribute appropriate supplementary foods to combat malnutrition and the means to secure resources (monetary and human) that can maintain innovative community nutrition activities.

C. Improvement of dietary bulk density with germinated cereal and legumes

Most of the traditional supplementary foods introduced in rural areas are prepared from cereal or starchy roots, commonly mixed with water. When they are cooked, starch granules become gelatinized, making the food mixture viscous and very difficult to feed to small children. Hence, the children's food intake becomes inadequate to satisfy their nutritional requirements.

One possible solution is to reduce the dietary bulk of the weaning foods without significantly changing their nutritional value. A traditional processing method, malting, reduces viscosity and hence bulk. During the germination of grains, amylolytic enzymes, or amylases, are developed and activated. When these enzymes are present in gruel, they rapidly break down the starch, resulting in a decrease in its water-holding capacity and thus causing the mixture to become more liquid.

Recent work in India showed that adding only a small amount of malted flour, or "amylase-rich food" (ARF), at a level of 3-4 per cent of total solids, to a cooked gruel resulted in thinning (Gopaldas, T, *et. al,* 1992). Higher intake of the ARF-treated gruel substantially improved child growth (John, C. *et al,* 1992). Similarly, ARF from wheat, maize, pearl millet, or sorghum could reduce the viscosity of thick gruel better than legumes.

The Institute of Nutrition developed ARF from local staple cereals as well as legumes. By adding ARF made with rice germinated for four days to 25 per cent cereal-legume gruel at 0.5 per cent-1 per cent of total solids, an optimum thinning effect was obtained. The enzyme activity of the rice ARF was significantly higher than that of moog-bean ARF according to the enzyme inhibitor content in the latter.

7. Conclusion

Under nutrition among young children have several aetiologies. A decline in breast-feeding practices due to ignorance and overburden is the main reason and calls for increased promotion of breast-feeding for at least 18 months, including support for maternal leave and the baby-friendly hospital initiative is very much required. During and after breast-feeding, appropriate supplementary feeding is crucial, but this needs developing weaning-food guidelines and practices at family, community, and commercial levels. Strategies must be plan realistically to address various constraints such as economics, social and cultural environments, and time. The production of low-cost supplementary foods from local ingredients using malting techniques in some Asian countries shows the advantage of decreasing the viscosity and hence the bulk of such foods. The success of supplementary feeding programmes relies on carefully articulated education messages about maternal and child nutrition requirements and involves maximum community participation. Intra-household food distribution also affects the nutrition status of children, as do hygiene and eating behaviours. This requires in-depth analysis and the implementation of comprehensive motivational programmes to modify food habits. Simple and meaningful growth-monitoring systems are also necessary for mothers and health care providers for the improvement in the growth and health status of infants and children.

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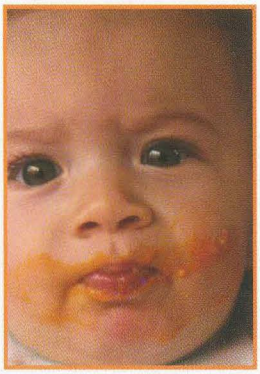
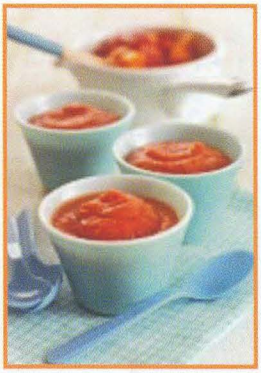
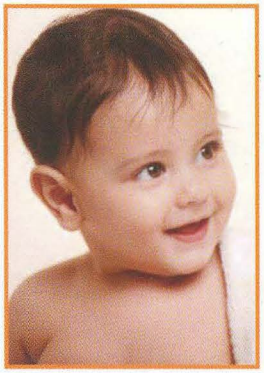
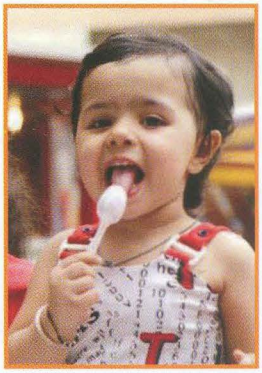

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