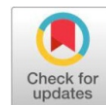


Research Article

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Assessment and development of nutrient-rich complementary food for unprivileged families in Vaishali district of Bihar



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ABSTRACT

Malnutrition is responsible, directly, or indirectly, for over half of all childhood deaths. Infants and young children are at increased risk of malnutrition from six months of age onwards, when breast milk alone is no longer sufficient to meet all nutritional requirements and complementary feeding needs to be started. Appropriate complementary feeding should start from the age of six months with continued breastfeeding up to two years or beyond. Complementary foods were developed with appropriate proportions of wheat, maize, ragi and moong after processing to reduce the anti-nutritional factors and increased digestibility with enhanced shelf life. Children from 6 months to 23 months were selected, their weight and height were measured, and a list of malnourished children was prepared on the basis of the growth monitoring scale of WHO guidelines. The anthropometric measurements such as weight and height of all the children's age group has increased after all feeding trials with a weight gain of 23.75 percent, 23.07 percent 23.74 percent and height increase 4.46 percent, 3.6 percent, 5.61 percent after completion of all four-feeding trial in the age group of 6- 11-month, 12-17 month and 18-24 months which is a marked increased/changes in weight and height. Thus, this complementary food is the most affordable and nutrient- rich food that is suitable for parents and children. It is concluded that ready-to- mix complementary food will be extremely rich in nutrients, which will be helpful to improve the health of children.

Keywords: Malnutrition, complementary food, ready to mix, nutrient-rich, anthropometric.

Introduction

Weaning is a period of transition for the infant during which its diet changes in terms of consistency and source. From a liquid milk-based diet, the child has gradually introduced to semi-solid food. Such semi-solid or generally called weaning food should be easily digestible, have a high energy density and low bulk. The World Health Organization recommends exclusive breastfeeding until 6 months of age and continued breastfeeding for at least 2 years, along with the timely introduction of adequate amounts of complementary foods of suitable nutritional and microbiological quality. Recently World Health Organization opined that malnutrition is responsible for about 60% of all deaths, occurring among children aged less than five years (under 5 years) in developing countries. Globally, more than two-thirds of childhood deaths associated with undernutrition happen in the first year of life and are usually associated with poor infant and young child feeding (IYCF) practices (Jones, Steketee, Black, Bhutta and Morris, 2003). While breast milk provides adequate nourishment and protection to children from infection for the first six months, children need nutritious and adequate complementary foods thereafter for good health, growth and development [2]. Complementary feeding refers to a process that starts after the

sixth month of life when breast milk alone can no longer be sufficient to meet the nutritional requirements of infants and therefore other foods and liquids are needed in addition to breast milk [7]. The period of complementary feeding is generally taken to be 6 to 24 months of age though breastfeeding may continue beyond two years [6]. Save the Children identifies this period as the peak for malnutrition when foods of low nutrient density are used to replace breast milk and incidences of diarrhea become more common. Conversely, when complementary foods are not introduced appropriately growths in children are likely to falter [8]. Appropriate complementary feeding practices should aim to provide sufficient energy, protein and micronutrients to cover the child's energy and nutrient requirements [3]. The World Health Organization emphasizes the importance of continued breastfeeding during this period as breast milk continues to constitute a significant source of nutrients contributing half of the infant's energy requirement during the first year and a third in the second year. In addition, successful complementary feeding requires use of good quality, locally available and affordable foods with adequate nutrients that are supported by supplementation and nutrition education to the mothers. The transition from exclusive breast feeding to complementary feeding is associated with the greatest challenge and has high impact on child nutritional status increasing the prevalence of malnutrition.

Although breastfeeding is one of the excellent choices for feeding practice in the human infant, it provides nutrients required for growing infants for only up to six months. Thereafter it is inadequate to sustain optimal growth and

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development and there is a need to be complemented with other nutrients, such as weaning foods [1].

Most infants are developmentally ready for other foods at about 6 months. In settings where environmental sanitation is very poor, waiting until even later than 6 months to introduce complementary foods might reduce exposure to foodborne diseases. However, because infants are beginning to actively explore their environment at this age, they will be exposed to microbial contaminants through soil and objects even if they are not given complementary foods. Thus, 6 months is the recommended appropriate age at which to introduce complementary foods.

During the period of complementary feeding, children are at high risk of undernutrition. Complementary foods are often of inadequate nutritional quality, or they are given too early or too late, in too small amounts, or not frequently enough. Premature cessation or low frequency of breastfeeding also contributes to insufficient nutrient and energy intake in infants beyond 6 months of age.

According to a UNICEF report in 2014, the prevalence of underweight, stunting, and wasting in the world was 15%, 25%, and 8%, respectively. The statistics for Iran, according to the latest national study (Demographic and Health Survey, 2010), were 4.08%, 6.83%, and 4%, respectively.

Malnutrition is responsible, directly or indirectly, for over half of all childhood deaths. Infants and young children are at increased risk of malnutrition from six months of age onwards, when breast milk alone is no longer sufficient to meet all nutritional requirements and complementary feeding needs to be started. Complementary foods are often of lesser nutritional quality than breast milk. In addition, they are often given in insufficient amounts and, if given too early or too frequently, they displace breast milk. Gastric capacity limits the amount of food that a young child can consume during each meal. Repeated infections reduce appetite and increase the risk of inadequate intake. Appropriate complementary feeding should start from the age of six months with continued breastfeeding up to two years or beyond.

Methods and Materials

Two Panchayats of Hajipur Block of Vaishali District were selected for this study. In this study, the nutritional, health and socio-economic status of children were surveyed in collaboration with Anganwadi worker, Lady Supervisor and ASHA. Malnourished children were identified and developed nutritionally enriched complementary foods from homemade cooked foods, and processed and powdered complementary mix. Complementary foods were developed after appropriate processing so as to reduce the anti-nutritional factors, increased digestibility with enhanced shelf life (for ready-to-cook mixes). Children from 6 months to 23 months were selected, their weight and height were measured and list of malnourished children were prepared based on the growth monitoring scale of WHO guidelines.

Data analysis

Socio-economic characteristics were analyzed by the developed questionnaire on the basis of survey.

Independent Variable

Independent variables were identified on the basis of UNICEF's conceptual framework of malnutrition and nutrition can be classified into immediate (poor diet, disease); underlying

(household food insecurity, inadequate care, unhygienic living conditions and inadequate health service); and basic (socio-economic factors such as poverty, type of family, education level of family etc.).

Table 1. Socio-economic characteristics of beneficiaries

Categories	N=100
Gender	Male Female
Age Group	< 1 year 1-1.5 year 1.5-2 year
Caste	Gen OBC SC
Literacy	Illiterate Primary education Secondary education Above
Occupation-	Labour Businessman Farmer
Family type-	Joint Nuclear

Dependent variables

The dependent variables for this study are the anthropometric indices namely: height for age, which indicates the level of stunting; weight for age, which indicates the level of underweight; and weight for height which indicates the level of wasting. The nutritional status of children were classified as per their Z score when compared with the WHO Growth Standards.

Preparation of low-cost complementary food

The complementary food was developed with locally available food materials such as Wheat, Maize, Ragi and Moong. All the food grain materials were washed separately and soaked in potable water for overnight. The unsoaked water was drained out and soaked grains were tied in wet muslin cloth separately and allowed for 24 hours for germination at room temperature. After 24 hours, the germinated Wheat, Maize, Ragi and Moong were rinsed with potable water and then dried at 55-60°C. The dried samples of sprouted Wheat, Maize, Ragi and Moong were roasted separately under low flame (70-80°C) for a pleasant flavor and the roasted samples of Wheat, Maize, Ragi and Moong were ground into fine powder in an electric grinder to make fine flour and sieved by 80-100 mesh and then stored in plastic containers for further use. The above complementary food can be prepared by adding either water/milk or sugar and cooking by 2-3 minutes.

Feeding trial in selected villages & Anthropometric assessment of children before and after feeding trial-

A four-month feeding trial was given to identify malnourished children in the selected villages at an interval of one month. Multigrain complementary food was given as a feeding trial. Firstly, initial weight of children was measured before the feeding trial after one month of the feeding trial weight gain of malnourished children was measured and Complementary food helps in eliminating malnutrition. The rest of the months, growth was monitored in every fifteen days.

Results and Discussion

Socio-economic and personal characteristics of selected children

The criteria for selecting malnourished children is socioeconomic status and personal characteristics of beneficiaries such as sex, age, caste, education, occupation and family type.

The socio economic and personal profile of children's family is shown in graph (fig.1)

Sex is also a social and legal status as girls and boys, men and women. The majority of respondents belonged to the Men (47%) and women (53%). Age is an important constituent for complementary feeding in poor families. These selected children were categorized into three groups i.e., >1 year, 1-1.5 year and 1.5 -2 year. The respondents have belonged to the first group (47%), second group (28%) and the third group (25%). It is revealed that majority (39 %) of the respondents belonged to SC/ST category followed by beneficiaries from BC category (28 %) respectively and None of the respondents were from UR (Unreserved) category. According to Trivedi scale (1963), education level was assessed into four groups. The majority of the respondents were illiterate (48 %), primary education (37 %), secondary education (8 %), higher secondary and above (7%) of the respondents. The family type was included to know whether it is a joint family or a nuclear family. It was measured with the help of scale developed by Trivedi and Pareek (1963). The majority of the respondents belonged to joint family 68 per cent and only 32 per cent respondent were nuclear family. The occupation of respondents was 64 percent labour, 18 percent businessman and 18 percent farmer.

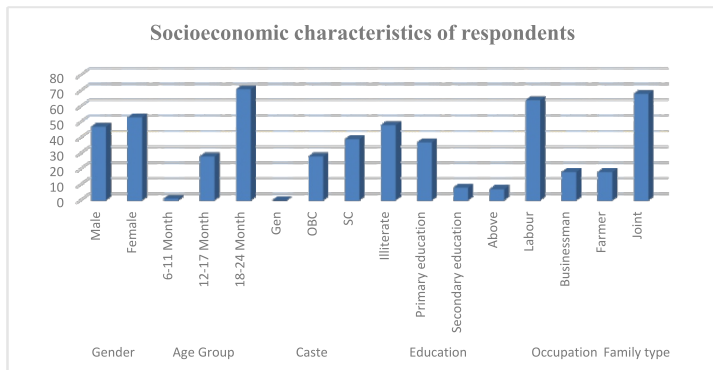


Fig.1 Socioeconomic characteristics of respondents

Nutritional composition of the developed complementary mix

The nutritional composition of developed complementary food is shown in table (1). The proximate analysis and nutritional composition of developed complementary food was evaluated. The energy (277.08 Kcal) and protein content (16.65 g) of developed Complementary food is high which is helpful for minimizing in malnutrition of children. The results showed that germinated weaning mixes could be used as good nutritional supplements for infants. According to recommended dietary allowances (RDA,2011), the calorie requirement and protein requirement under the age of 6-12 months is 672 Kcal and 14.19 g, and for the 1-3 years is 1060 Kcal and 16.7g respectively. The developed complementary mix contributes 41.23 percent of calorie requirement and 117.33 % of protein requirement of recommended dietary allowances for 6 to 12 months children and 26.13 percent of calorie and 99.7 percent of protein requirement of RDA,2011 contributes. for the age group of 1-3 years.

Table.2 Nutritional composition of developed complementary food per 100 gm.

Energy (Kcal)	277.08
Carbohydrate(g)	66.74
Protein(g)	16.65
Fat(g)	1.92
Calcium(mg)	144.6
Phosphorus (mg)	334.4

Anthropometric assessment after Feeding trials

The developed complementary food was provided to 100 selected samples for a period of four months. The initial weight and height was recorded and the packaged complementary food along with all directions of feeding was also provided. Again the data of growth indicators was recorded to after every feeding trial to see the changes in the growth parameters. It is evident that weight among all the children's age group has increased after all feeding trials with a weight gain of 23.75 percent, 23.07 percent 23.74 percent and height increase 4.46 percent, 3.6 percent, 5.61 percent after completion of all four feeding trial in the age group of 6- 11 month, 12-17 month and 18-24 months which is a marked increased/changes in weight and height.

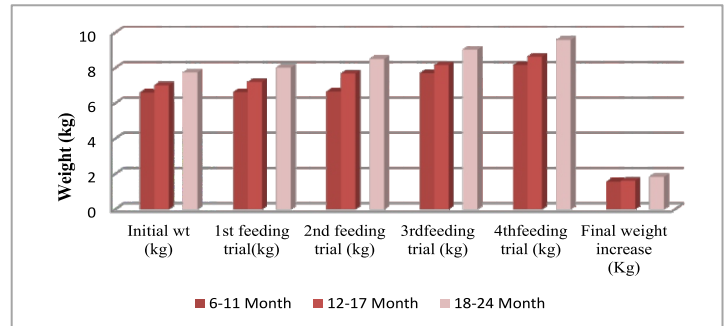


Fig.2 Change in weight of children after 4 months of feeding trials.

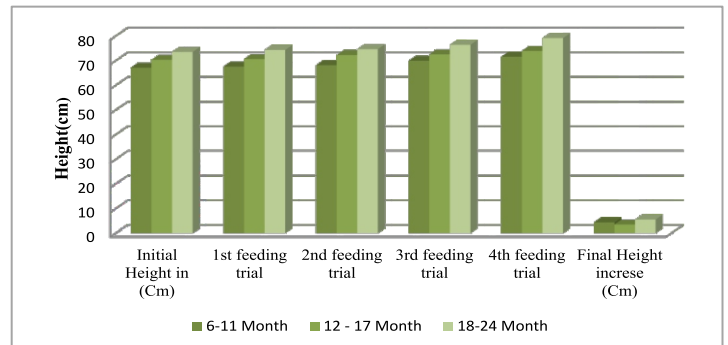


Fig.3 Changes in height of children after 4 months feeding trial

Conclusion

The first two years of a child's life are a critical window during which the foundations for healthy growth and development are built. Complementary foods can be prepared at home or purchased as commercial items that are ready to eat. Enough complementary foods must be available in order to improve the feeding of infants and young children. These foods must be promoted in Anganwadi Centre of government and commercial sector through governmental programs to reach the desired target beneficiaries. Thus, this complementary food is most affordable and nutrient-rich food that is suitable for parents and children. It concluded that ready-to- mix complementary food will be extremely rich in nutrients, which will helpful to improve the health of children.

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