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Emerging Dietary Patterns from Daily Food Intake Pattrens of Young Children under Five

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Abstract: Modern lifestyle extends the umbrella of social responsibility for provision of appropriate nutritionally balanced foods to children of all age groups in particular the children under 5 years of age of all socio-economic groups of civil society which starts from home leads to the health professionals at all health outlets, Nutritionists, Dieticians, schools and the food industry. Dietary pattern established in early childhood significantly influence the probability of having less tendency towards junk food which certainly result into mal nutrition whether under/over weight or obesity. This review paper will open an avenue of understanding of how children's food preferences are acquired during infancy and early childhood, which are helpful in developing strategies to improve the quality of children's food based dietary pattern and nutritional status. This study shall also be useful for those food companies engaged in manufacturing/ producing ready to serve diets for infants and children. Moreover, it will contribute in developing food-based dietary guidelines for children (under 5 years of age).

Key words: Childhood, dietary patterns, food neophobia, nutritionist, nutritional status, meal patterns, food preferences

INTRODUCTION

Like many other domains of development, young children's eating patterns are largely influenced by learning about what is edible and non-edible and what is acceptable within a family and the culture.

A carefully timed development exists between children's early physiological and their increasing nutrition needs. The literature regarding early childhood nutrition has focused upon children's changing nutrient requirements for growth and health and has neglected the social developmental framework from which children's eating behaviours and intake patterns emerge. The purpose of this paper is to review the research and identify research gaps in the development of children eating behaviour, with a focus on how children develop early experiences, particularly within family eating environments and to shape food consumption patterns belonging to different socio economic groups.

Appropriate nutrition during the childhood is essential for the maintenance of normal growth and good health (Ministry of health, 1997). Before we review and discuss matters related to the children nutritional needs and their emerging dietary patterns, let us understand what dietary pattern stands for?

Dietary patterns versus food intake patterns: In recent years, dietary pattern, vaguely defined as multiple dietary attributes as a single exposure, have emerged as an alternative or adjunct to traditional approaches for the study of the association of diet and health (Kant, 1996, 2004; Hoffman *et al*., 2002). Daily eating pattern emerges from daily eating practices broadly refer to daily food in-take during the proper meals or between the meals or on any particular eating occasion. Eating patterns influence nutrient intake; for example, Dwyer found that as the number of eating occasions increased, so did the overall energy intake (Dwyer, 1995). Dietary patterns are the outcome of meal patterns of the individuals that are determined from short term intake of an individual food or composite food or combination of foods on any particular time.

Many dietary studies attempts to explain the relationship between a single dietary component and health outcomes or antecedents influencing consumption. Although these studies are valuable but they do not represent the interplay of all the individual food choices that describe a complete food pattern (Popkin *et al*., 1999; Messina *et al*., 2001; (Kant, 2004). Over all diet quality depends on the time. An analysis featuring a total diet approach may explain how foods substitute for (e.g. skim milk for whole milk) or complement each other (e.g., milk and cereal). It provides a complete assessment of the combinations of foods consumed and may be useful in identifying emerging dietary patterns in a population, dietary pattern inconsistent with dietary recommendations or dietary patterns related to specific health outcomes (Tucker *et al*., 1992; Wirfalt and Jaffery, 1997; Green-wood *et al*., 2000; Millen *et al*., 2001; Wirfalt *et al*., 2001; Tucker *et al*., 2002; Quatromoni *et al*., 2002; Rasanen *et al*., 2002; Newby *et al*., 2003).

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The dietary patterns of infants influence their health during infancy and later in childhood and adulthood (Davis, 2001).

Stages of early childhood: Young children are one of the most vulnerable groups in any society. They have many special dietary needs, which are quite different from those of healthy adults. Childhood is a time of change between the infant diet and adult diet. Hilton (2004) has classified childhood as follow:

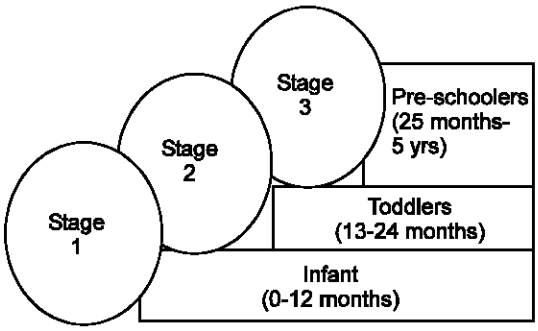

Fig. 1: Stages of early childhood (Adapted from Hilton, 2004)

Infants grow most rapidly, with an average rate of weight gain of about 9% per month, but once the first birthday is reached this rate drops to about 1% per month. Many parents become concerned at about this time, because they are unaware of the different weight gain rates of different ages. The infant lays down more body fat as compared with the high proportion of lean tissues accumulated by the preschool child. This body fat gain by infants requires more energy per gram of body weight. Hence, the 2-5 years old child requires only half as much energy to gain per gram of body weight as compared with infant (Forbes, 1991).

Inborn abilities and preferences: The feeding interaction is perhaps the most important experience for infants as it supplies nutrients for growth, establishes the mother-infant bond, provides a sense of security and pleasure for the infant and presents repeated opportunities for learning and social exchange.

Transition to complementary foods: The developmental period during which the transition to solid foods is initiated is a dynamic period of growth and learning. Dietary pattern change more during this period than any other time of life. This transition necessitates rapid learning about flavours, foods, etiquette and social exchange. An infant's first experience with flavours may, in fact, occur before birth as flavours from a pregnant woman's diet are transmitted to amniotic fluid (Mennella *et al*., 1995). Human milk also conveys flavours from the maternal diet to the breast fed infant; in contrast, the formula fed infant has a very different feeding experience with respect to exposure to flavour from food.

Current findings in the area of gustatory research suggest that an infant's early experience with flavours in human milk may positively influence the transition to, and acceptance of, solid foods (Sullivan and Birch, 1994; Mennella and Beauchamp, 1997). Figure 2 shows that breast-fed infants consumed greater amount of novel food than formula-fed infants at three points during an experimental study on food acceptance of the first transition foods offered and consume greater quantities of cereals prepared with human milk.

Therefore, the learning associated with repeated exposure to flavours from human milk may predispose the infant to accept solid foods more readily.

An unnoticed development in young children's eating behaviour is food neo phobia that refers to the fear of new foods. As infants enter toddler-hood, the types and amounts of foods offered to them also change, they begin to indicate, verbally and behaviourally, likes and dislikes for certain foods (Carruth *et al*., 1998). Their food dislikes may result in avoidance of particular foods or groups of foods, thus limiting dietary variety (Falciglia *et al*., 2000) and potentially, the major sources of essential nutrients. Moreover, consistent avoidance of foods may result in lifelong unhealthy food habits.

Toddlers are predisposed to neophobia, which typically presents between 13-24 months of age. Children previously judged as "good eaters" in infancy often begin to reject new foods and exhibit refusals of formerly accepted, familiar items. This is a particularly confusing and worrisome time for parents who fear that the child will suffer growth or health problems that stem from a less than balanced diet. Escalating parents-child power struggles during mealtime can perpetuate the problem. Parental confusion and anxiety developed by children's noephobic tendencies get worse by the lack of clear nutrition guidelines for this period of rapid development and growth. There is growing recognition for the construction of practice guidelines to be used by health care professionals to support parents in helping their established healthy eating behaviours (Picciano *et al*., 2000). Children's acceptance of new foods is not instantaneous and it requires repeated exposure and experience with new foods to overcome neophobia and enhance acceptance (Birch and Marlin, 1982). Research indicates, that children may require 5-10 exposures to a new food before changes in liking are expressed.

After repeated experience with one version of a novel food, children show clear preferences for the version to which they have been repeatedly exposed over an unfamiliar version (Sullivan and Birch, 1990).

Mothers and care givers at home who struggle with their children's picky eating may not be aware that neophobia is a normal stage of development and the consistency,

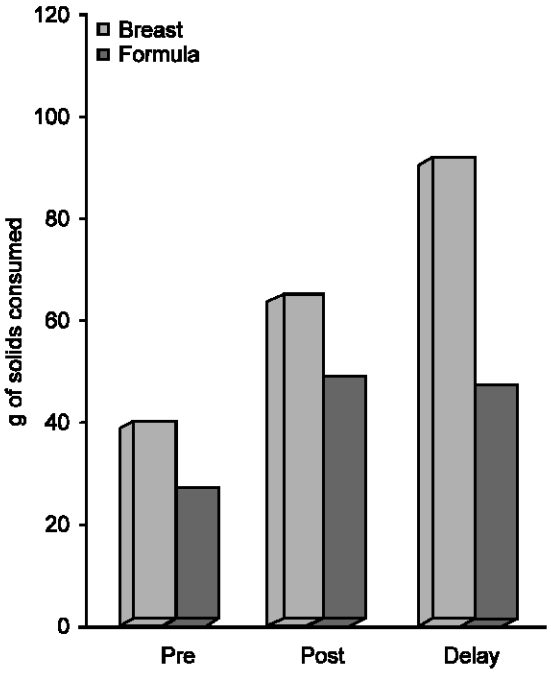

Fig. 2: Comparison of breast-fed and bottle-fed infant's consumption before and after repeated experience with first solid food. Source: Sullivan and Birch (1994)

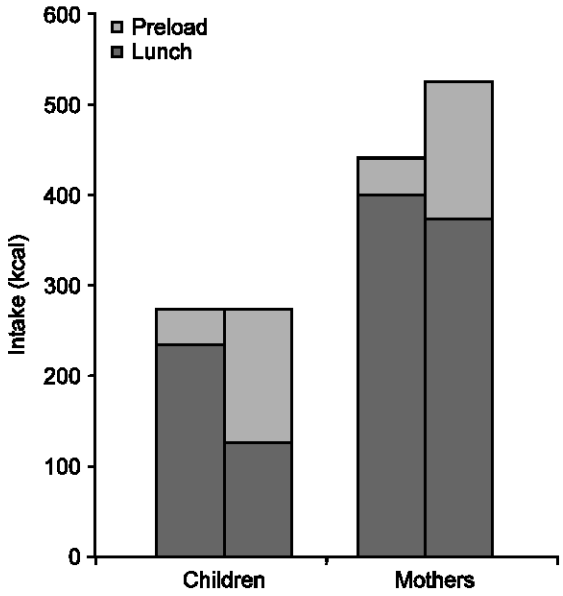

Fig. 3: Children's and mother's energy intake at lunch (after the ingestion of high and low calorie "preloads" or snacks). Children adjust energy intake to reflect the energy content of the preload. In contrast, adult mothers showed little evidence of compensation. Source: Birch and Deysher, 1986

patience and endurance are the keys to helping children increase the variety in their diets. Research findings stress the importance of early experience and opportunities for learning. The most consistent findings reveal that children like what they know and come to accept new foods if provided repeatedly, in a non-coercive manner.

Self-regulation of energy intake in children: Conventional wisdom holds that natural patterns of intake among young children are erratic, where children eat "like birds" one day and "like horses" the next. Research provides evidence to the contrary. Fomon and colleagues demonstrated that infants could self-regulate energy intake-consuming consistent energy from formula over the course of a 24-h period when formula energy density and/or energy source (carbohydrate or fat) were modified (Fomon *et al*., 1969, 1975).

Subsequent research has indicated that preschoolers also have the ability to respond to energy dense cues within a meal and to adjust their food intake in relation to energy density. Using single meal protocols in which a preload and a main course are offered (Birch and Deysher, 1986) have consistently demonstrated that children consume less during a meal after ingesting high energy preloads than after low energy preloads. As shown in Fig. 3 children exhibited a greater responsiveness to the energy content of the foods consumed than did their mothers as adults who consumed roughly the same amount of food at lunch whether given a low or high energy preload.

Children need enough energy to sustain optimal growth. Young children need to consume energy-dense foods in order to meet their energy requirements.

Reinforce children's ability to self-regulate energy intake: Individual differences in the extent to which children self-regulate energy intake clearly exist and are systematically related to differences in children's weight and adiposity; preschool-aged children who show less evidence of self-regulating energy intake tend to be heavier (Fisher and Birch, 1999).

Factors affecting dietary patterns of children (under 5 years): There are many factors that influence on "Dietary Patterns" of children. Dietary patterns of children are shaped by some of the endogenous factors and others are environmental factors (see Fig. 4).

As Katherine describes children's food choices are shaped by individual, societal and cultural factors. Some are endogenous to the individual child; but others are environmental. These include the foods made available to children inside and outside the home and the modelling of food behaviours by parents or the caregivers (Katharine *et al*., 2001).

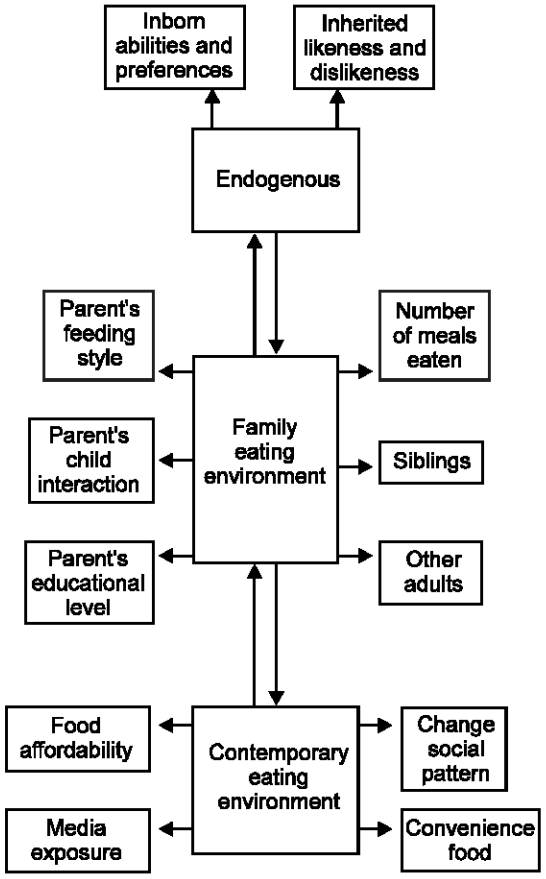

Fig. 4: Factors affecting dietary patterns of young children (under 5 years of age). Adapted from Katherine *et al.* (2001)

Parents provide their children with both genes and the environment where eating occurs. Genetic influences on eating are apparent at birth, in the observation that infant possess an unlearned preference for the taste of Sweet (Desor *et al.*, 1975).

The family eating environment: Parents and other influential care givers like grandparents, Aunts, Uncles living with the family and siblings profoundly influence the eating environment in which children's preferences and intake regulation patterns develop they determine the availability and composition of the child's diet, provide a model eating behaviour and guide the child's eating through feeding practices (Birch and Fisher, 1998).

Many health authorities, therefore, recommend that parents, grand parents, teachers and other influential adults such as day-care staff should guide children in developing healthy eating patterns and acquiring information on nutrition and diet-health relationships. Some studies have explored the affects of parent's nutritional knowledge on their children's knowledge and dietary practices. Contento found that Latin mother's nutritional knowledge and attitudes toward nutrition were positively correlated with nutrient intakes of their 4-5 years old children (Contento *et al.*, 1993). An association was also found between complementary feeding practices and mother's education by Liaqat *et al.* (2007). Parents have a major influence on their children's eating patterns. Oliveria found nutrient intakes in aggregation families with the strongest associations between mothers and their children (Oliveria *et al.*, 1992).

Composition of the family diet: By selecting the foods that come into home, parents have direct control over the foods to which children are repeatedly exposed. This point is particularly important as familiarity and repeated exposure to foods facilitate the acquisition of food preferences. This is true in case of Pakistani meals where mixed/composite foods are frequently used in daily meals (Liaqat *et al.*, 2009).

Stanek found a positive correlation between the qualities of the home environment and the nutrient adequacy of the children's diets. Children who ate with parents, siblings, or both at mealtime also had better diets, defined as taking more servings from the five basic food groups (Stanek *et al.*, 1990).

Family eating behaviour as model for young children: The second role that parents play in the development of children's eating behaviour is serving as models, both in terms of what and how much is consumed.

A recent study provides evidence that modelling effects may be most significant for high energy containing foods (Jansen and Tenney, 2001).

Children's eating patterns is influenced by routine with the family Unit, such as number of meals eaten together (Vauthier *et al.*, 1996). Young children who eat meals with other family members eat more healthy, nutrient-dense foods. Further, children who have companionship at meal times tend to eat more serving of foods from the basic five food groups (Stanek *et al.*, 1990).

Finally, children learn manners and adopt cuisine rules from observing their parents, such as whether foods are eaten with a spoon or with their hands and at what occasions foods are normally consumed. For instance, children tend to prefer particular foods at the times of the day when those foods are most commonly consumed within a given culture (Birch *et al.*, 1984).

Child feeding practices: The social contacts in which foods are presented also influences whether they are accepted; young children who observe adults eating a certain food is more likely to eat it, like wise, using a food as a reward are presenting it with some attention from the adults also enhances a child's acceptance of it (Birch *et al.*, 1995).

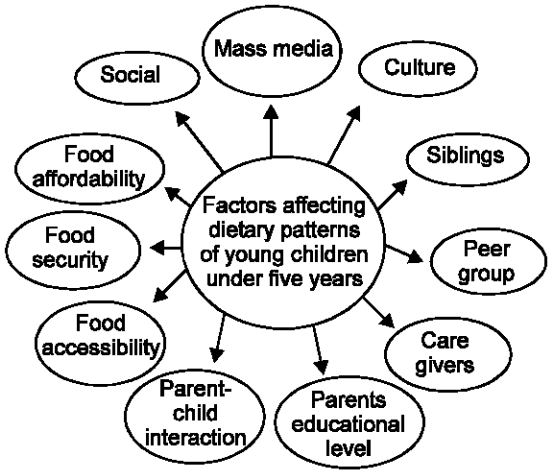

Fig. 5: Factors affecting on dietary pattern of young children (under 5 years) in Pakistan

Horne describes the relationship between using reward contingencies to encourage intake, however, is not straightforward. A series of experiments has shown that reward can promote the consumption of foods and vegetables when paired with modelling and praise (Horne *et al*., 1995).

Parent's feeding styles are also associated with children's food habits. Feeding styles represent parent's approaches to maintain or modify children's behaviours with respect to choosing and/or eating foods.

Permissive feeding: It is characterized by a lack of structure in child feeding, the child is simply allowed to eat choice foods of any quantities however these choices are limited only by what is available. Permissive feeding has been associated with drinking less milk and lower consumption of all nutrients except fat (Cullen *et al*., 2000).

Authoritarian feeding: Authoritarian feeding including behaviours such as restricting the child from eating certain foods and forcing the child to eat other foods. In the long-term, authoritarian feeding has been associated with lower intake of fruit, juices and vegetables (Cullen *et al*., 2000). According to Birch and Fisher parents employing stringent controls during mealtimes may influence their child's preference for high fat, energy dense foods and inhibit their preference for a variety of healthy foods (Birch and Fisher, 1998).

Authoritative: It represents a balance of authoritarian and permissive feeding and sets the stage for children to make healthful eating choices in the future. Adults determine which foods are offered and children determine which foods (and how much) are eaten. Authoritative feeding practices include: asking the child to make decisions about the type of food eaten, giving small portions when introducing a new food, involving the child in decisions about new foods, explaining the health benefits of foods perceived as healthy and praising the child for eating healthy foods. Authoritative feeding is associated with greater fruit and vegetable availability, higher intake of fruits and vegetables and lower intake of foods with less nutritive value (Gable and Lutz, 2000).

Trendy eating environment: While the family is undoubtedly the first and the most central environment in which children's eating develops, families do not parent there in isolation of the larger societal and physical environment in which they live. Environmental constraints on parent's ability to promote healthful patterns of eating include food availability, accessibility, affordability, time demands in family life, loss of the family meal, television, dinning out and child care.

The dietary patterns of young children from families in which television viewing is a normal part of meal routines include fewer fruits, vegetables, more pizzas, snack foods and sodas than the dietary patterns of children from families in which television viewing and eating are separate activities (Katharine *et al*., 2001).

Increasing reliance on convenience foods and meals consumed outside the home is associated with higher intake of dietary fat and calories and with lower intake of fruits and vegetables. This could result in lower intakes of fibre, calcium, iron and other nutrients that are important for children's growth and development. (French *et al*., 2001).

These children consume fewer fruits and vegetables, more fried food and soda, more saturated and trans fat, higher glycemic load and less fibre and micronutrients (Stanek *et al*., 1990) may preclude preparation of healthful dinners at home.

Dietary pattern that result in high intakes of fats and saturated fats and low intakes of fruits and vegetables are linked to increase risks of coronary heart disease, certain cancers, diabetes, hypertension and obesity. (Frazao, 1998). Although these diseases `typically manifest themselves in midlife or later, diet-influenced physiologic variables associated with chronic disease track from childhood into adulthood and evidence suggests a positive association between obesity in adolescence and morbidity in later life (Freedman *et al*., 1987). For these reasons there is considerable interest in deeping our understanding of the influences on children's diet (Must and Strauss, 1999).

Changing social patterns and socio economic factors influence whether meals are cooked and served at home and how frequently these have been prepared. Today's parents are working longer hours and many children have either single-parent families or two parents working outside the home. Thus parents increasingly rely on convenience foods or home meal replacements, including those from restaurants (NPD, 2000).

Table 1: Indicators of child malnutrition

Indicators	(NNS 2001-02)	(NNS 1985-87)
Malnourished (low weight-for-age)	37.8%	47%
Stunting: (low height-for-age)	37%	46%
Wasting: low weight-for-height	13.2%	15%

Pakistani perspective on dietary pattern of children (under 5 years): Nutrition Survey of West Pakistan (1965-66) and National Micro-Nutrient Survey (1976-77) had focused on important nutritional problems, particularly Protein-Energy Malnutrition (PEM) and hidden hunger among children of all ages. Similarly National Health Survey of Pakistan 1985-87 highlighted the nutritional status of the various population groups with particular emphasis on at risk groups National Nutrition Survey 2001-02 however focus on the children under five and their indexed mothers, highly vulnerable segment of the society, who could be prevented in coming decades.

During 2001-02 survey, the food intake was obtained using food frequency method for a given period of time in combination with the 24-h recall method for the previous day. Frequencies indicate that the food consumption pattern and use of selective food groups over a given period of time.

Pakistan being developing country have diversified scenario of Nutritional problems e.g. according to various nutritional surveys conducted from time to time at national level indicate that the prevalence of malnutrition among Pakistani children remains high. In spite of sustained food supply Pakistan is one of the few Asian Countries that has shown little evidence of improvement in nutritional status of young children under five over the last two decades. This has been documented in the past twenty years (Table 1). The information is drawn from two major national nutritional surveys I-e the National Nutrition Survey (NNS) conducted in 1985-87, the National Nutrition Survey Conducted in 2001-2002 and UNICEF report at a glance 2003.

Persistently high malnutrition indicators are responsible for hidden retardation among its population and as well as the country's development. Poor nutritional status of children can lead to poor education performance, poverty and consequently affect the country's overall potential economic growth.

Factors affecting dietary pattern of Pakistani children under five years: Despite the environmental and technological constraints, total food availability in the country has been sufficient to meet the overall national requirement of the whole country's population. On the other hand, poor health and poor nutritional status continues to be a major public health concerns among children and their mothers. This indicates general food availability issues leading to food affordability at the household level as one of the major cause of poor nutritional status in Pakistan. The factors affecting the dietary pattern of young children in the long run are summarized in Fig. 5 About 18.86 million children under five fall in age group of which 42% are underweight, representing an alarming condition of food insecurity.

Conclusion: It can be concluded that dietary habits are the resulting affect of broad spectrum dietary patterns emerging from the daily food consumption patterns and meal patterns over a longer period of time and are developed due to availability, accessibility and affordability and effected geographical, cultural, psychological and religious and media influences.

There is a dire need to design and conduct research studies with an entire dietary pattern approach including daily intake of mixed/composite foods prepare with different recipes and their meal patterns to identify and assess the overall dietary pattern of young children under 5 years of age and to study the various combinations of foods consumed along with the assessment of their nutritive values. A dietary pattern also covers the routine or timings at which child takes a meal, number of meals, frequency of meals and snacks (eating between main meals) intake patterns or profiles of intake of multiple or single nutrient in the form of foods. Thus research studies need to be planned and conducted with the objectives of exploring target areas to establish relationship between dietary patterns and nutritional status of young children living in different socio-economic situations with an aim to contribute in developing food base dietary guidelines for children's under 5 years at national level.

The association need to be established among different dietary patterns with socio economic groups of the regions thereby finding an opportunity to assess and evaluate the prevailing dietary standards and to recommend measures for improving dietary pattern of young children (under five years of age) in all socio economic groups.

These studies are highly effective in getting an understanding of children's food preferences, which are essential in developing strategies to improve the quality of children's dietary intake and will contribute, in developing dietary guidelines for children (under 5 years), as research in nutritional deficiencies and food availability issues in order to modify and promote healthy eating habits of vulnerable groups is the key to convince and generate consciousness not only among policy makers at national and provincial levels but also among the consumers families and communities at large.

To combat with the existing malnutrition mixed/ composite foods for toddlers based on indigenous foods need to be processed and manufactured locally to compete the cost of the imported complementary food products. Such complementary foods locally processed and manufactured from indigenous foods could be highly cost effective. The Government, food factory owners multinational food industries would want to undergo the manufacturing and marketing these composite complementary food products.

Local private food industry might find some studies interesting to become active and more productive to meet the demand of ready to eat or ready to cook complementary composite foods. As the overall food availability in accordance with desired dietary pattern on an affordable price is the ultimate solution to the malnutrition problem among children under five.

Indigenous food items for young children would be convenient for improving dietary status of children of low economic groups if these could be prepare and manufactured under hygienic conditions. This method will control the diarrhoea/ cholera and food borne diseases which are caused by the unhygienic food items and contaminated water.

In addition the proposed studies could be highly useful in designing intervention programs to promote, protect and support optimal breast-feeding and complementary feeding practices and discourage/minimize bottle-feeding.

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