



## **TARGET FOOD SOURCES FOR FORMULATING COMPLEMENTARY/ SUPPLEMENTARY FOODS FOR WEANING PURPOSES – A REVIEW**

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### **ABSTRACT**

*The paper focuses on complementary and supplementary foods for weaning purposes. While advocating that breast-feeding be sustained during weaning periods, it also articulates the decision, which guides when to introduce semi-solid foods to infants. It considers the process of formulating complementary and supplementary foods and identifies staple foods as the target sources used for the purpose. It views the issues of relative local availability as a function of certain rather compelling determinants that facilitate both inter- and intra- zonal transfer substitution of target food sources. Conclusively, complementary and supplementary foods are as important as weaning period is critical to the survival of infants. Therefore, weaning must not be done inappropriately but implemented as a smooth transitional dietary experience of infants, which takes them successfully through breast-feeding to the family's diet.*

**Keywords:** *Target foods, Complimentary, Weaning, Supplementary*

### **INTRODUCTION**

For quite some time now, interest has focused on complementary / supplementary foods for weaning purposes by all and sundry. This interest is not intended to detract from the gains of the "Baby Friendly Hospitals Initiative (BFHI)" launched in 1991 by UNICEF with the support of WHO (NU, 1994), which reiterates that breast milk is the best food for babies as it provides sufficient nutrients for their growth, energy and prevention of diseases (Okungbowa, 1986; AHRTAG, 1989).

Complementary foods are those that complement breast milk or any other foods. Similarly, supplementary foods could supplement many other foods, if not breast milk that is considered to be a complete food. Whereas, the relationship of some foods to breast milk is mainly complementary, that of breast milk to some of those foods may indeed be supplementary during weaning. Further still, the relationship of those foods to themselves is both complementary and supplementary during and after weaning period. In these contexts, the term "complementary foods" or "complementary feeding" alone is grossly inadequate, without the use of "supplementary foods" or "supplementary feeding" in combination, to describe what is actually happening of the relationships. Therefore, in so far as the foods that are used during weaning periods can be either complementary and / or supplementary, to that extent must we be cautious about the current dogma to use "complementary foods" instead of "weaning foods" - that have both complementary and supplementary effects - to describe the foods that are applicable during this critical period of weaning. To this author, the term "complementary foods" alone can only be used in a limited sense to describe the

type of feeding that is undertaken during the weaning period. The most important consideration is to ascertain whether or not the foods achieve desired overall energy and nutrient densities for the particular infants. It is more useful to do so rather than engage in some futile semantic, if not teleological, arguments about whether or not "complementary foods" should replace "weaning foods". Also, see WHO (1998) for further clarification of this line of reasoning. However, the question of what comes next after exclusive breast milk is as topical as ever. Ordinarily, it is mere common sense that the subsequent weaning period should introduce the child to a full diet via substances that bridge the gap biochemically and rheologically between breast milk and solid foods as gently and naturally as possible (Wynne-Tyson, 1979). But, this is a critical phase that must be addressed carefully and not to be left to common sense alone, because doing so is tantamount to a form of violence against children (Wynne-Tyson, 1979). Literature reports confirm that malnutrition is prevalent in areas where infants are put off breast-feeding and given improper diets (Cameron and Hofvander, 1983; UNESCO / NES, 1983; IFPRI – ACC / SCN, 2000). Although, Ojofeitimi and Igah (1978) had articulated the need to improve the diet used during weaning period, child malnutrition has not abated in many communities in Nigeria. Consequently, "baby friendliness" should no longer be restricted to the promotion of exclusive breast-feeding in hospitals. Rather, it should be extended to include a phased approach to weaning period, to neighborhoods and communities where majority of mothers and their children who may never attend hospitals reside.

It is by so doing that the enigma that the weaning period has constituted to developing countries over the years, will be properly tackled and resolved. Therefore, specific research questions were addressed as follows:

- (i) What is meant by formulating "complementary and / or supplementary foods" for weaning purposes?
- (ii) When should semi-solid foods be introduced?
- (iii) What are the constituents of complementary and / or supplementary foods for weaning purposes?
- (iv) What is meant by formulating the food?
- (v) What are the target food sources?
- (vi) What is the relative local availability of the foods?
- (vii) What is the conclusion?
- (viii) What is the recommendation?

### **Formulating Complementary/Supplementary Foods for Weaning Purposes**

A comprehensive explanation of the principles of complementation and supplementation had been articulated elsewhere by Igah *et al.* (1998). However, for convenience in understanding this section, inherent concepts are highlighted as follows: To Wean - The term "to wear" means "to accustom" and it describes the process by which the infant gradually becomes accustomed to the full adult diet (Cameron and Hofvander, 1983). Weaning period - This is the period which baby is gradually introduced to foods other than milk and is recommended for between the 4<sup>th</sup> and 6<sup>th</sup> months (Okungbowa, 1986). Complementary food and / or supplementary food—refer to the food that is used to complement breast milk or the food that complements and / or supplements other foods used during weaning period. However, weaning age – the age at which the child is actually weaned (or put off breast milk), varies from mother to mother and may be influenced by any or a combination of factor(s), such as:

- (i) Mother's physiologic state or willingness to breast feed,
- (ii) Mother's exposure or level of awareness (i.e. modernization),
- (iii) Mother's economic status (i.e. relative empowerment, poverty),
- (iv) Socio-cultural influences, and
- (v) Child's willingness to give up breast-feeding.

Thus, Alakija and Ukoli (1979) examined the infant feeding patterns of Benin mothers and reported that solid foods were introduced between 5 – 6 months, but mainly at 6 months. Cherian (1981), on the other hand, reported that the age of introduction of solid foods among the uneducated mothers in Zaria depended on the child's ability to sit. Prior to this developmental achievement, foods given were

considered unnecessary and unsuitable for upbringing of the child.

However, a study of the pattern of infant feeding in Nigeria showed that the age of introduction of foods other than breast milk depends on what was used in the preparation of the foods. Where cereal pap was used as complementary food, it might be given as from the first month of life. Root crops and tubers were given generally as from the 6<sup>th</sup> month of life (Orwell, 1984). But, Uwaegbute (1988), in a comparative study of weaning pattern of the 3 major ethnic groups in Nigeria observed that the Yoruba and Igbo mothers introduced solid foods earlier than their Hausa counterparts. Whereas, the former did so from the first month of their babies' lives, the latter introduced solid foods from 4 – 5 months only.

### **When to Introduce Semi-Solid Foods**

The question of what decision guides when semi-solid foods should be fed to infants is relevant here. In critically examining the decision, Pipes (1977) had reported that a number of criteria had been used as a basis for recommending the addition of semi-solid foods to the infant's diet such as chronological age, volume of the milk infant consumes, the need for iron-containing foods (which is why the foods used for weaning should be complementary, as well as, supplementary in regard to specific energy and nutrient densities) and developmental readiness. It was noted that some criteria (e.g. chronological age alone, etc) were quite arbitrary and ignored individual differences among infants and their patterns of physical growth. That individual differences, which should not be ignored actually exist among infants, particularly in terms of nutrition and their patterns of physical growth, had been amply demonstrated by Widdowson's (1962) concept of nutritional individuality. Thus, Pipes (1977) suggested that developmental readiness, rather than chronological age, was the important criterion, which guides the decision as to when semi-solid foods should be fed to infants. Therefore, the most likely period to start weaning is from 4 to 6 months and end at 2 years (AHRTAG, 1988; Jonah, 1999), a period that coincides with attainment of the desired developmental readiness of many healthy infants.

### **The Constituents of Complementary and /or Supplementary Foods for Weaning Purposes**

This is any food item besides breast milk given to an infant during the process of weaning (Brown, 1978). According to Dearden (1980), common complementary and / or supplementary diets used for weaning in developing countries consists of gruel (pap or porridge) made from cereals or starchy tubers. When cooked the cereals or starchy tubers absorb different amounts of water. This change in volume must be taken into account because a small child is not able to eat more than about 200 –300 cm<sup>3</sup> (1 – 12 cupfuls).

Fresh tuber and roots already contain water and their volume changes little when boiled or steamed. Therefore, AHRTAG (1988) recommended that foods used for weaning should meet the following criteria:

- (i) High in energy (i.e. energy dense),
- (ii) Easy to digest,
- (iii) Low in bulk and viscosity (i.e. not too thick in flow),
- (iv) Fresh and clean (i.e. must be wholesome),
- (v) Inexpensive and easy to prepare,
- (vi) Not too highly seasoned.

Therefore, a thick creamy porridge made from the basic foods of the community is a good complementary food for babies (or a good food used for weaning of babies).

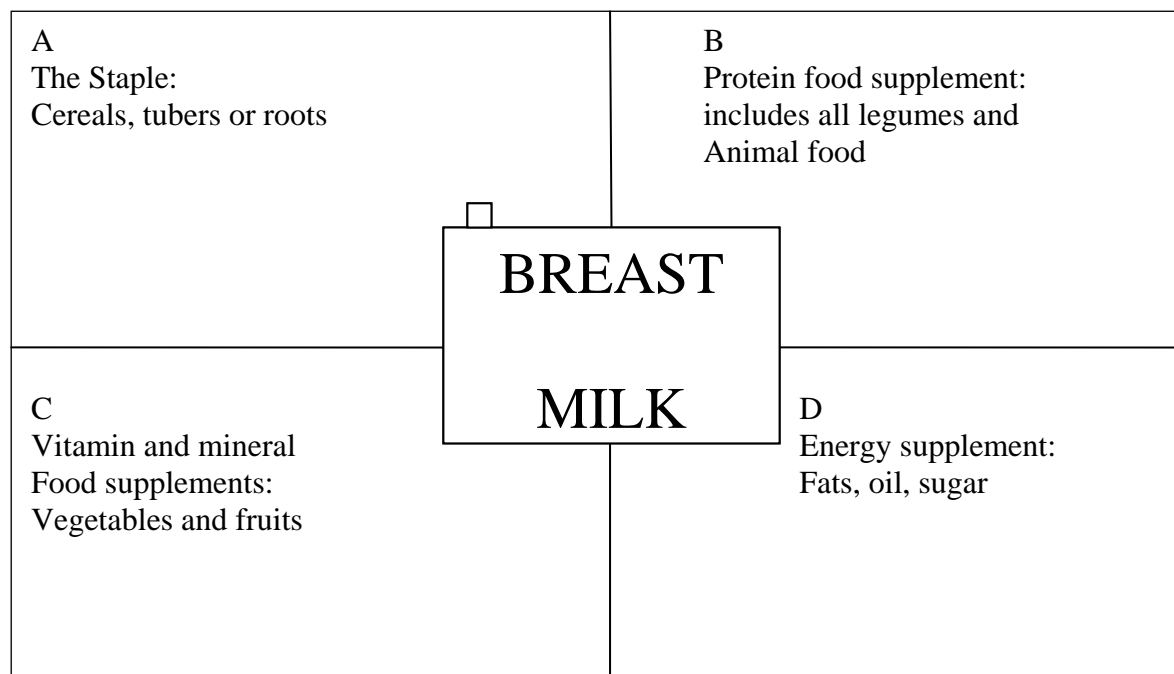
**Formulating the Food**

Briend and Darmon (2000) had determined limiting nutrients by linear programming, with a new approach to predict insufficient intakes from complementary foods. However, caution should be exercised concerning complementary foods and the development of food allergy (Koletzko, 2000), because allergic reactions to food components are of particular concern in infants and young children (ESPGHAN Committee on Nutrition, 1998). Despite the foregoing, formulating of complementary and / or supplementary foods for weaning purposes can be done through either linear programming, whereby certain important variables iterate to give the optimization factor for the components (i.e.  $Z = Y_1 + Y_2 \dots\dots\dots$ ); or by using quartering method in a food square format. In either of the methods, the nutrient

content of the food material is targeted, especially protein content of which the amount required by the infant's body must be supplied in combination with other nutrients in conformity with the principles of complementation and supplementation in the formulated diet. To this end, Cameron and Hofvander (1983) had suggested that the simplest recipe of complementary foods used for weaning infants is one that has only two ingredients. One example is a cereal or root mixed with a legume. This is called a *basic* mix. However, other foods must be added to make a complete meal. Therefore, recipes that are more suitable for the weaning period and for feeding much later are called *multi-mixes*. They best conform to the principles of complementation and supplementation. Such a multi-mix has four basic ingredients as follows:

- (i) A staple as the main ingredient (i.e. preferably a cereal),
- (ii) A protein supplement from a plant or animal food source (e.g. beans, groundnut, milk, meat, chicken, fish, eggs, etc),
- (iii) A vitamin and mineral supplement (e.g. a vegetable and / or fruit),
- (iv) An energy supplement to increase the energy density of the mix (e.g. fat, oil or sugar, etc).

When these four ingredients are used together in suitable proportions, they form a complete meal. The food square that can be a useful concept when teaching how to choose ingredients for weaning recipes is given as follows:



**Figure 1: The Conceptual Food Square (Cameron and Hofvander, 1983).**

In the food square, breast milk is in the middle because it is a complete food in itself. It is an important food during the weaning period and, although after sometime, the daily amount may not be large, it is a very valuable source of energy and nutrients.

The square has four parts, one for the staple and one each for protein food supplements, vitamin and mineral food supplements and for energy supplements. Some important tabulation provide veritable evidence of the complementary and supplementary effects of multi-mix diets that can be used as guide to planning of foods for weaning purposes (see Cameron and Hofvander, 1983; UNESCO / NES, 1983).

### **Target Food Sources**

Staple foods are the first target food sources for formulating complementary and / or supplementary foods for weaning purposes. Samson (1993) defined staple foods as those that are needed and used in the kitchen all the time. They can also be said to be foods that are eaten on a regular basis by individuals, families, groups and communities, etc. Therefore, the staple food is also the basic. It is relatively cheaper than most other foods and is usually eaten by the family at most meals. Examples include:

- (i) Cereals and products (e.g. maize, wheat, sorghum, millet, oats, barley, bread - soaked in gravy or milk or tea, rice, etc).
- (ii) Roots, tubers and products (e.g. cassava, yam, coco yam, Irish potatoes, sweet potatoes, etc).
- (iii) Starchy fruits (e.g. plantain, breadfruit, banana, etc).

However, on their own, especially when cooked in water, most cereals, grains and roots are too low in energy density. Therefore, some oil or fat (or sugar used with discretion) should be added to the porridge to make it creamier, easier to swallow and digest. Adding oil not only makes the porridge more energy dense but also impacts its viscosity positively. This type of porridge, freshly and hygienically prepared each time, could be given in addition to breast milk for about two weeks. Thereafter, babies need other complementary and supplementary foods, as well as, breast milk and the porridge to meet their energy and nutrient requirements. Thus, the best types of complementary and supplementary foods for weaning purposes should contain at least a target food source from each of the four food groups; whilst breast-feeding should be continued regularly between meals. Examples of other types of target food sources include:

- (i) Peas and beans:  
These are good foods for providing protein. They, also, have the added value of being relatively cheaper. However, they need to be cooked thoroughly and mashed in order to make them easily

digestible for babies. Examples include chickpeas, cowpeas, groundnuts, soybeans, split peas, lentils, black-eye beans, peanuts, red beans, navy beans, etc.

- (ii) Animal and fish:

These are good for babies but are usually more expensive than peas and beans. Examples include meat, fish, offal, eggs, milk and food made from milk such as cheese and yoghurt, curd, cottage cheese. Termites, crayfish and edible locusts are also very useful in many parts of Nigeria.

- (iii) Dark Green Leafy Vegetables (DGLV's),  
Yellow Vegetables and Fruits (YV&F's):

Babies need these foods to prevent eye damage and possibly nutritional blindness from shortage of vitamin A. Examples include spinach, kale, tomatoes, carrots, amaranth, sweet cassava, pumpkin leaves, pumpkin fruit, paw paw, etc.

- (iv) Oils, Fats or Sugars:

These add extra energy, by way of complementation and / or supplementation, to the porridge or cereal used for weaning purposes. It should be noted that sugars are not as good to use as oils or fats and will also damage teeth. Examples include corn, palm, groundnut, coconut and sunflower oils, ghee, butter, margarine, lard, and any animal fat.

- (v) Fruits:

Before giving these to babies, they should be peeled carefully or washed in clean water, then mashed or the juice squeezed out. If water is added to the juice it must be clean, otherwise babies may get infected and have diarrhea, etc. Examples include oranges, pumpkin, tomatoes, banana, plantain, papaya, mango, pineapple, etc. It is important to bear in mind that food from the family pot, (*that is, the food that the rest of the family normally eats*); can give a baby all the nourishment required without additional cost. Therefore, there is no need to buy expensive commercially manufactured complementary and / or supplementary foods. To this end, it is important to talk to mothers about what the family usually eats and help them to decide which foods would be suitable in terms of complementary and / or supplementary effects to give to a young baby, particularly during the critical period of weaning.

### **Relative Local Availability**

The determinants of local availability of a food material include geography, ecology, cultural traditions and dietary habits. On the basis of these determinants, Igah (1991) pointed out that Nigeria could be loosely categorized into four dietary zones. These are as follows: (i) Northern dietary zone, (ii) Central dietary zone, (iii) South – Eastern dietary zone, (iv) South – Western dietary zone.

The target food sources, therefore, can be said to be relatively available in each of the zones; but with some overlapping such that some of the foods may feature in more than one zone.

Furthermore, it must be noted that the type of indigenous technology which is culturally available to the zones enables different culinary practices to be undertaken in not only processing food materials into various acceptable ready-to-eat foods / meals; but more importantly, in determining the ways by which individual foods are available, acquired and handled. Thus, relative local availability has been enhanced by inter – and intra – zonal transfer substitution. This concept follows the dictates of supply and demand and enables food materials to be moved from zones of relative surplus to others of relative lack and vice versa. Fortunately, with advances in food production, post – harvest handling technology, marketing and distribution, the problem of relative local availability is being tackled, progressively.

### CONCLUSION

Weaning is a very critical period in the survival of infants. The *timing* of introduction of semi-solid foods is still of the essence. Therefore, any efforts directed

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at appropriate feeding of infants during this period must take cognizance of the complementary and supplementary effects of the target food sources to be used, their wholesomeness, as well as their relative local availability.

### Recommendation

The current fad of using the terms “*complementary food*” or “*complementary feeding*” in place of “*weaning food*” or “*weaning*” appear to be rather straight-jacketed, restrictive and should only be applied with discretion. This is because complementation *per se* fails to take into account the supplementary roles of the target food sources that are not only *nutritionally*, but also, *biochemically* and *rheologically* very important during the critical period of weaning.

Therefore, weaning must not be done inappropriately but implemented as a smooth transitional dietary experience of infants, which takes them successfully through breast-feeding to the family's diet.

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