EDITORIAL

TECHNOLOGIES TO IMPROVE WEANING FOODS IN DEVELOPING COUNTRIES

What is the Problem about Feeding Weaning-age Children?

The vast majority of older infants (7-12 mo) and the young toddlers (13-24 mo) in the developing world are chronically undernourished. Most of this undernutrition is associated with growth faltering that occurs in the so called weaning period (6-24 mo)(1). This condition is associated with a high-bulk, low energy diet(2), accompanied with bouts of diarrhea contributed in large part by the intake of contaminated left over foods(3). The most common and first complementary foods to breast milk, which is fortunately one of the most energy and nutrient dense foods(4), are small amounts of soft boiled rice or mashed chappati or breads or most commonly, viscous cereal gruels or preparations made from rice (Asia); sorghum, finger millet, maize, cassava and plantain (Africa); rice, wheat, millets, tapioca, potato (India); or sweet potato (Papua New Guinea)(5). The problem is that most poor mothers make a 50% gruel (5 g of a staple cereal flour cooked in 100 ml of water), which becomes thick and voluminous on cooking due to gelatinization and water binding capacity of the long chain carbohydrate component in the cereal flours. Such a gruel would contribute a mere 20 Kcal/100 g gruel or it would have an extremely poor nutrient density whilst having a high dietary bulk(6). Further, the weaning-age child has a poor swallowing reflex and can consume only small portions of semi-solid preparations. Hence, the dilemma is how to feed enough of the traditional gruel with a high energy density? How can one modify the form and texture of a solid or semi-solid weaning preparation to a pour batter consistency? In fact how can one literally 'thin' an extremely thick preparation and make it swallowable yet energy rich for the weaning child?

What are the Advantages of Indigenous Weaning Food Technologies Over Imported Ones?

Indigenous house-hold food processing technologies which are age-old and widely practised and which do not call for the use of too many ingredients, fuel, utensils or time are the ones most likely to be adopted on a regular basis. Well meant efforts to improve the nutritional status of the weaning child through advice such as 'balanced diets', 'frequent feeding', or 'freshly prepared food feeding', *etc.*, have met with little success. Advice which revolves round either simple modification of the home diet (mashing up rice and unspiced dal, or mashing up chappati soaked in milk, tea or even boiling water)(7); or better still on an ingredient that is *always* available in quantity in the house like whole cereal grains or their powders, is most likely to succeed(8). However, even the modification of the home diet does not adequately answer the real problems of (*i*) sufficient energy density as the child is only offered small amounts, or (*ii*) form and texture most suitable for easy, quick and possibly a one or two complementary feeds in addition to breast milk.

What is the Concept of Amylase-Rich-Food (ARF)?

The concept of Amylase-Rich-Food or ARF(8-12) directly addresses the twin problems of dietary bulk and poor energy density of most weaning gruels of the poor. ARF is nothing but *germinated cereal flours* which are extremely rich in the enzyme alpha-amylase. Just tiny or catalytic amounts of *any germinated cereal flour* can instantly liquify or reduce the dietary bulk of any viscous multi-mix gruel but where cereal flour is the main ingredient. The alpha-amylase cleaves the long carbohydrate chains in the cereal flour into shorter dextrins. However, for enzymatic action three conditions are required in the gruel of porridge, namely, it must be homogenous, it must be moist, and it must be hot (at least 70°C). Just half a flat teaspoon of any ARF can reduce even a very high solid concentration of 45 g of 25 g flour, 15 g sweetener and 5 g oil cooked in 100 ml of water to a soupy consistency. This remarkable property makes it possible to offer the weaning child a low viscosity yet high energy dense preparation from habitual ingredients that are used for young child feeding even in poor homes. ARF will act equally well on any gruel prepared from homogenised 'khichidi', or from 'chappati', biscuit or bread powder, or from donated foods such as Corn-Soya-Milk Powder, or Soya-Fortified-Bulger-Wheat powder. The single and unique contribution of ARF is that it can permit the mother to mix in *much more flour into the gruel* and consequently make it *high in energy density,* yet low in *viscosity* and *dietary bulk.*

How Does One Make ARF ?

Germination of pulses and cereals are part and parcel of the culinary culture of Asia and Africa. ARF preparation is relatively simple as it is broadly based on germination. A small amount of any whole cereal grain (100 g or so) is steeped overnight in 2-3 times its volume of water, the excess water drained, and the moist swollen seeds germinated in a moist dark environment for 24-48 h till the sprouts are evident. The further steps are sun-drying for 5 to 8 h and lightly toasting the grains on a flat skillet to remove any surface moisture. The sprouts are removed by hand abrasion and the grains are milled or powdered. This is stored in an air-tight bottle or plastic container. This small amount of ARF for a cost of 20-40 paise, will suffice for one child's gruel for one month. It need be made also only once a month(8-12). Summing up, the advantages of ARF preparation are: (*i*) cheap cost, (*ii*) widely known and practised household technology, (*iii*) small amounts to be made only intermittently, and (*iv*) adaptability of making at the household, the community level or even at the scaled-up commercial level. In fact a barely malt which sells from Rs. 6-10 per kg can be directly purchased from beer breweries, can be milled and packaged into 5 g packets which mothers can buy(13). Germinated sorghum flour has been used for the same purpose in Tanzania(14).

What about Fully Germinated or Malted Mixes ?

The Mysore group in 1980(15), the Swedish group in 1981(16), and the Baroda group in 1982(17) experimented with fully malted regionally acceptable cereal and pulse mixes. However, time, labor and cost constraints rule it out as a *house-hold technology* for poor mothers. Fully malted mixes do have low dietary bulk and high acceptability and could be taken up as a commercial enterprise.

What about Enrichment of Child Gruels ?

Depending on family resources, the gruel can be enriched with pulse flours (1 part pulse flour to 3 parts cereal flour), with some oil, and some sweetening agent such as jaggery or sugar. With addition of just 2.5 g ARF, a soupy gruel can be made with 22.5 g flours, 5 g oil and 15 g sweetner giving an energy density of 1.5 to 2.3 Kcal/100 ml(18). Just two feeds with such a gruel would adequately bridge the weanling child's energy gap.

What about Fermentation Technologies ?

Household level fermentation technologies have several advantages. It is low cost, does not need fuel, is simple, the soured products are antagonistic to pathogenic organisms, the product is flavoursome and palatable, many anti-nutritional factors are destroyed or minimised, viscosity is lowered, digestibility is improved and the fresh preparation can be kept without refrigeration for re-use for several hours even in hot and humid conditions. Classical examples of *Lactobacillus* fermentation are curd or dahi, lassi or butter milk, and sweet curd. Examples of auto-fermentation are 'iddili', 'dosai', 'dohokla', where microflora in the steep water ferment the wet batter(19). The mould fermented soyabean or tempeh of Indonesia is a widely consumed family food(20). Some examples of fermented weaning food porridges which may have some application in other developing countries are:

(*a*) The Nigerian Ogi which is a smooth textured porridge with a sour test reminisant of yogurt.

(*b*) The Mahewu of South Africa which is a sour non-alcoholic beverage quite often fed to babies.

(*c*) The Kenyan Uji a fermented porridge made from maize, millet or sorghum and is widely used as a food for infants and young children.

(*d*) The Ghaniyan Kenkey or fermented sour maize dough served in boiled dumpling form.

(*e*) In West Africa, Gari is a fermented cassava product.

(*f*) Nasha or the Sudanese porridge made from fermented sorghum and millet and is best known as a baby food.

(*g*) Njera of Ethiopia which is made from cold sorghum pancakes fermented in water and later fed in smooth paste form.

(*h*) The Obusera or fermented millet porridge of Uganda.

One thing that stands out is that through the ages, poor communities have demonstrated a strong instinct for survival and innovation. They have found ways to preserve food for longer periods through microbiological fermentations and have often used germinated materials as starters(5).

Conclusions

Most countries in the developing world have excellent and simple technologies available to be adapted only slightly to make traditional weaning gruels *much more* energy dense and yet of low viscosity or dietary bulk. In the ultimate analysis, weaning food technologies developed *by* the developing world *for* the developing world are most likely to succeed in poor communities.

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