Role of Imitation Milk in the Feeding of Tomorrow's Population

FRANK V. KOSIKOWSKI
Department of Food Science, Cornell University, Ithaca, New York 14850

Anyone who has been reading his newspaper lately must realize that a dynamic change is occurring in the world population. It is presently increasing by 70 million each year. Furthermore, by the time your child now in kindergarten is appointed an associate professor in some university, the world population will have doubled to 7 billion souls. But, what has not been so well appreciated is that the increase will be distributed unequally in a geographic pattern.

Unfortunately, the regions destined for peak population are either already overcrowded or lack sufficient food or both. In Asia there are about 1.8 billion people now and in one generation another billion will be added. Contrast this to the USSR or to North America where, in each area, only about 220 million people live. In Latin America the total number of people is relatively low, but the annual population rate increase is 3%, while the annual food production rate increase at only 2.5% is not keeping up.

The type of staple foods consumed most generally in the critical areas of Asia and Latin America includes grains, beans or pulses, fish and rice, and not much milk, although the demand for milk is increasing. In the Near East and in Africa, where food production also lags seriously, a long-established pattern exists for milk and milk product consumption, though amounts are insufficient for good nutrition.

If one were to suggest the fate of the new individuals being born in the developing world areas, a most honest assessment would elicit gloom. The individual will earn pittance wages, if he is fortunate enough to find work, and will be exposed to unattractive, improperly balanced foods. He and the community in which he lives will lack capital to improve their lot, and if they were fortunate to attract capital, the low productivity likely to prevail when people are malnourished will curtail additional inflow.

Having established a brief background, it is well to indicate the types of products under consideration. They are filled milks, synthetic-like imitation milks, and protein concentrate beverages. The terminology of the first two is not acceptable under major international conventions, but because nationally such terms are used, they are repeated here.

The definition and terminology of filled milks have been discussed extensively by the Joint FAO/WHO Committee of Government Experts on the Code of Principles Concerning Milk and Milk Products (4). Many participating governments have accepted the interpretation that the name filled milk is a misleading one for the consumer and, accordingly, use of this name is incompatible with the Code. A majority of government delegations recommend that the suffix "...rine" be used in general for imitation milk and milk products, like Mellorine or Vegerine.

Present State of Filled Milk Evolution in Developing Countries

Five years ago about ten countries were producing and utilizing filled milk to some extent, a number which undoubtedly has increased since. The amount of filled milk produced outside the United States, in any case, is small compared to the total amount of milk.

But as the population has increased rapidly in recent years, it has been assumed that filled milk could follow a similar pattern. Two classic examples of filled milk development in foreign lands are found in the Philippines and in Mexico.

In the Philippines, starting in 1957, evaporated filled milk from cocoanut fat and imported skimmilk powder was processed and distributed with much advertising and fanfare. One of the first two companies formed there manufactured this product under license and supervision of the marketing organization of a dairy farmers' cooperative located in the northwest United States. The other was an affiliate of a large Los Angeles dairy. Later, a third evaporated filled milk company was started by a Dutch dairy cooperative. By 1961 the filled product had taken over more than 50%, or 70,000 tons annually, of the canned liquid milk business. Inasmuch as evaporated milk is the standard form of milk consumed and largely imported, the Philippine government saved annually an estimated 32 million dollars in foreign exchange. Also, the filled milk sold mainly to low income groups is 33% cheaper than evaporated milk.

The major reason for the entry of filled milk

was that of economics (5). Imported evaporated milk prices were high, and cocoanut oil, a domestic product, was plentiful. However, as sales of evaporated filled milk increased, the medical profession became concerned about the possible detrimental nutritional effect on infants consuming large amounts of cocoanut fat in their diets. As a precautionary move to allay this concern, the fat was changed to 90% cocoanut and 10% corn oil. Some concern is still expressed for those infants up to nine months of age. The government of the Philippines stipulated that the corn oil used must be domestically produced. Evaporated filled milk production is a successful venture in the Philippines which helps feed over 27 million people. It has not stifled the small domestic fluid milk industry, whose product is sold mainly to wealthy consumers, but it has not helped it either.

Illustrating another development example, it was my pleasure recently to visit the oldest and largest filled milk plant in the world, the Consuma, a 15-year-old government-operated plant in Mexico City. Daily production is about 250,000 liters. Skimmilk powder imported from France is reconstituted with cocoanut fat produced domestically and the filled whole milk is standardized to 3.3% fat, 12.5% total solids, and 200 IU of vitamin D per liter. Homogenization and pasteurization at 161F for 15 sec follow, and the filled milk is bottled in glass.

The unique aspect of the Consuma plant was that none of the product was offered to the general public. It was sold only to the poor people of Mexico City, of which there are many, at 8 cents per liter in exchange for a validated coupon. Because the operational and distribution costs continue to increase, the individual liter glass bottles are to be dispensed with soon, and all filled milk from the Consuma will be bulked into large drums at the plant and dispensed in the poor districts.

Driving to the outskirts of Mexico City to view the filled milk plant provided an opportunity en route to observe conditions of extreme poverty, where poor people were living in substandard houses and where, obviously, proper food and nutrition were lacking. Among the many thousands in these districts some, at one time, must have been milk producers whose flight to the city had forced them into accepting subsidized filled milk for their families rather than producing natural milk under an equally poor, but perhaps healthier, environment in the countryside. One is startled at this paradox of the present century.

Synthetic-like Imitation Milks

Synthetic-like imitation milks containing no milk-derived ingredients except sodium caseinate are slowly entering the United States market. Consumption analysis shows they contain cocoanut fat, sodium caseinate, or soy protein, corn syrup solids, polysorbates, potassium phosphate, salt, gums, vitamins, artificial color, and artificial flavor. As yet, no significant commercial distribution of synthetic-like imitation milks has occurred overseas, so no impact is evident. These imitations are bound to improve with time and it is likely that soybean isolates will replace sodium caseinate as the protein source. Such improvement will be welcomed because analyses of the limited brands available generally show a shocking inattention to principles of good nutrition (1, 2). One brand sold at supermarkets in the northeastern United States was analyzed in our Cornell laboratory (7). This synthetic-like imitation milk possessed about one-fifth of the protein found in cow's milk, almost one-sixtieth of the calcium, a coliform count of 120,000 per milliliter and an inability to form cheese or buttermilk. At a price of 20 cents per liter for this imitation milk, compared to 25.5 cents for cow's milk, one wonders what kind of a bargain the consumer was getting in terms of nutrients. In developing countries where such foods would be a greater portion of the staple food of the diet, the use of imitations with inadequate nutrients would be even more tragic.

Growth of Protein Concentrate Beverages

Though not strictly considered imitation milks because no obvious attempt is made to simulate milk, protein concentrate beverages are being formulated in increasing numbers, using ingredients native to the developing country of origin. These beverages are intended to fill a nutritional void in countries where protein foods like milk are scarce and to replace milk if necessary in areas where prices are considered too high. They generally are superior to our present synthetic-like imitation milks when their nutritional qualities are compared, and their development initially resulted from a high degree of motivation to improve the nutrition of youngsters in developing countries.

A wide array of protein concentrates is available for these beverages. They include soybean, cottonseed, fish powder, and ground nut. In many instances, and for a variety of reasons, protein concentrates as foods or beverages have not lived up to the rosy predictions claimed

for them by their developers, although progress is discernible. The soybean, either as a concentrate or isolate, presently possesses the greatest potential, followed by supplemented wheat flour. Unfortunately, relatively few soybeans are grown in developing countries except for China, a condition which may be partly rectified in the future, particularly in Latin America.

Examples of protein concentrate beverages now available commercially or in pilot plant stage include "Saci," a sterilized, noncarbonated, chocolate-flavored, 3% soy protein nutrient beverage distributed by the Coca Cola Company in Brazil. In Chile another nutrient beverage containing a wheat protein fraction and sesame is being developed. A third is Lactone, being produced experimentally in India with UNICEF participation.

Lactone is a pasteurized vegetable and animal protein beverage in which standardized or toned buffalo milk is reduced to 2.0% fat with a water mixture containing ground-nut or peanut isolate mixtures, glucose syrup, minerals, vitamins, and salts (3). Reasons for mixing ground-nut isolate with the buffalo milk are to avoid the problem of undependability of supplies of imported dried milk and to utilize ground nuts grown in India. The product is slightly more costly than toned buffalo milk and suffers from a grayish color defect and a slight ground nut flavor, but research may reduce or eliminate the latter two problems. Aflatoxin arising from the use of mold-contaminated ground nuts is said to be eliminated by the application of hydrogen peroxide–catalase in the preparation of the nut isolate.

Acceptance, Usage, Costs, and Safety of Imitation Beverages

Achieving acceptance of new food products in developing areas by natives is more difficult than first considered. One protein concentrate food failed in Peru because consumers could not accustom themselves to the "wet dog" flavor of the product. People's personal choice, rather than the nutritional value of a strange beverage or food, often decides the issue. On this point, filled milk would have a decided advantage over concentrated protein beverages because even in the poorest countries people recognize milk and probably would have no great hesitancy in accepting this product.

Use of filled milk by governments is influenced by the predominating fats produced domestically, such as butter, cocoanut, cottonseed oil, corn oil, the availability of inexpensive skimmilk powder, and the foreign exchange position. Governments who find all three factors in their favor will more likely resort to filled milk production, despite the fact that they subscribe to the Code of Principles. They will then accept the Code only in part, i.e., that part which does not affect them. On the other hand, the Code of Principles may minimize trade in filled milks between countries. In the Philippines an attempt was made to export evaporated filled milk to Hong Kong, but the effort never materialized because the Hong Kong municipality required it to be labeled evaporated skimmed milk. Whether rightly or wrongly, trade between countries in filled milks will not be as easy as trade in milk products.

The price of a food in a developing country does not necessarily accurately reflect the cost of production. This is due to indirect or complicated developing government subsidies or to dumping policies of developed food-producing countries possessing surpluses. In the case of filled milks both policies are usually in force. For example, whether it be in India, Mexico, or the Philippines, the continuation of filled milk production is highly dependent upon the availability of skimmilk powder from overseas sold at a low world market price or obtained through donations. It would not be practical for the developing country to turn to producing its own skimmilk powder sources, usually because the size of the domestic milk supply is not large enough, and if the milk supply is large, then the marketing of the surplus milk fat may be difficult.

For this reason, those in developed and developing countries fool themselves if they think that a permanent filled milk industry can be developed to care for all the millions of new people expected to arrive on this earth by 1990. Some of these will be born in developed countries like the United States, where the population is expected to rise to 400 million. With dwindling dairy herds, our supplies of skimmilk powder will be used in feeding these new American citizens. So at a time when the need for filled milk in the most densely populated areas of the world will be at its greatest, there may be insufficient milk powder available for use in these areas.

Furthermore, in spite of early assurances that protein concentrates were to be inexpensive sources of nutrients, it is plain in some cases this is not to be so. For example, the well-publicized inexpensive fish protein concentrate presently sells at over 40 cents per pound, as does sodium caseinate. Using a realistic cost appraisal suggests that a number of concentrated protein beverages will not provide large amounts

of foods for tomorrow's population because they will be too expensive.

On this point a highly respected scientist in the Nutrition Division of the United Nations (6) states: "Many a time reference has been made to cheap protein-rich foods. This is proving to be wishful thinking rather than reality. The protein-rich foods, being processed products, cannot be as cheap as one might think, based on the low prices of the feed grade meals and cakes."

In the past filled milk and protein concentrate beverages appear not to have been subjected to the same hard scrutiny by public health officials as has milk. Now it is becoming recognized that microbes can grow well in these products, a point personally observed in some filled milk plants, and that toxin substances like aflatoxin in peanut protein, or gossypol in cottonseed meal, can develop or be present if production of raw materials and processing of these alternative foods are not properly conducted and supervised. Such awakening undoubtedly will help to protect the health of the consumer but also will increase costs. To developing governments with inadequate financing this increased vigilance required will be considered with mixed emotions, but they cannot avoid the responsibility of protecting their people.

Attitudes

An important factor as to whether foods like imitation milk can be utilized successfully in developing countries is the attitude of government, private industry, scientists, and individuals. Governments' attitudes decide the amount of economic protection deemed necessary to protect its staple foods, be it cow's milk, cocoanuts, or soybeans, and these may be dictated by its foreign exchange condition or by simple political expediency. Private industry may assume attitudes leading to nonparticipation in the development of new protein foods and beverages because of the heavy economic risks involved. Scientists may become so involved with the development of one protein concentrate food that they may adopt attitudes which prejudice them against natural foods or other protein concentrates and thus fail to see the forest because of the trees.

For individuals of developing countries, experiences gained by years of unique family living, by the use of food indigenous to the area, and by low income fix their attitudes about food selection and development.

As much as anything then, attitudes will determine the future role of filled and imitation milks and protein concentrate beverages, perhaps even more than technological advances.

Role of Imitations

Summarizing the role of imitation milk in feeding tomorrow's population, there is no great future for the synthetic-like imitation milk described earlier where calcium and protein are low, unless the nutrient base is improved. On the other hand, filled milk can play an important short-term role but, because of its dependence upon low-priced skimmilk powder, this importance will be limited.

Protein concentrate beverages have a long-range place in the feeding of tomorrow's population, particularly in those areas where mammalian milk production cannot be effectively increased. But protein concentrate beverage technology is beset with many problems now just beginning to show. These include high costs, hygiene, toxin production, variability of nutrient composition, intervention of governments, and dissension between those supporting free distribution and those supporting private enterprise practices.

It is still difficult to visualize that in about 30 years enough inexpensive protein beverages can be produced to fill the protein needs of our expanding population, but one dreads the consequences if the goal is not reached. As we consider the influence of filled and imitation milks and other beverages, we must not overlook the equal long-term need for natural milk in developing countries where potentials exist. One great danger is that so much emphasis is being given to protein concentrate beverages that, by contrast, new plans to initiate milk development and distribution projects might be nullified, either through inadequate funding, inattention, or by pressure from groups interested in other nutrient beverages.

Milk development in Asia, Africa, and Latin America is progressing. Where successful milk development occurs, whole areas benefit economically, and people engaged in production also are economically and physically benefited and the health of children drinking the natural milk improves dramatically. But we Americans know relatively little of these activities by the Food and Agriculture Organization and her sister agencies and, partly because of this, the programs for milk development do not receive the full support they deserve.

As a dairy group, you might expect me to say some nice things about natural milk and its value to mankind. One hopes you have not

been disappointed, but having said them, it is necessary to point out that there definitely is a place for filled milks and protein concentrate beverages in developing countries if these products are reasonably priced, of good hygienic quality, and adequately labeled.

By the year 1990 we will need all the protein and calories that can be obtained through natural and unconventional food sources, and we should not now play games as to whether plant foods are more desirable than animal foods, or vice versa. Both are needed, but what is needed more are clear thinking, careful planning, and cooperative efforts in development activities. Time will show that natural milk, protein concentrate beverages, and filled milk all will be playing important roles in feeding tomorrow's population, even if the roles are dissimilar and with filled milk perhaps relatively limited.

The future of the dairy industry is inalterably interwoven with food development in general. If proper development of food fails in needy countries outside the United States, then our dairy industry will suffer, too, in the long run because the movements are interdependent. We must strive to see that they succeed.

References

(1) Brink, M. F. 1968. Comparing nutritional values of filled and imitation milk. Amer. Milk Rev., 30: 32.

(2) Coulter, S. T., and P. B. Manning. 1968. Comparison of dairy, filled and non-dairy products nutritionally speaking. Milk Dealer, 57: 24.

(3) Davelaar, H. 1968. Report on Lactone. Proc. Food Conservation Conference, UNICEF, United Nations, New York.

(4) Food and Agriculture Organization of the United Nations and World Health Organization. 1964. Report of the 7th session of the joint FAO/WHO Committee of Government Experts on the Code of Principles Concerning Milk and Milk Products. Rome, Italy. pp. 1–27.

(5) Food and Agriculture Organization of the United Nations. 1962. The Economics of Filled Milk. Rome, Italy. pp. 1–33.

(6) Kapsiotis, G. D. 1968. Potentials for supplementing staple foods with proteins, amino acids and other nutrients. Proc. Food Conservation Conf. UNICEF, United Nations, New York.

(7) Kosikowski, F. V. 1968. The problems of milk and imitation milk. J. Milk Food Technol., 31: 171.