International Journal of Processing and Post Harvest Technology

REVIEW PAPER

Fabricated foods: consumer demands for convenience

■ QURAAZAH A. AMIN[1], WANI TOWSEEF[1]* AND NUZHAT QUADIR[1]

[1]Division of Post Harvest Technology, Sher-e-Kashmir University of Agricultural Sciences and Technology, KASHMIR (J&K) INDIA (Email : towseef46@gmail.com; widaad57@gmail.com)

[2]P.G. Department of Food Technology, Institute of Home Science, University of Kashmir, KASHMIR (J&K) INDIA

*Author for Correspondence

Research chronicle : Received : 09.02.2013; **Accepted :** 15.05.2013

KEY WORDS : Fabricated food, Consumer

How to cite this paper : Amin, Quraazah A., Towseef, Wani and Quadir, Nuzhat (2013). Fabricated foods: consumer demands for convenience. *Internat. J. Proc. & Post Harvest Technol.*, **4** (1) : 49-56.

The process of adding micronutrients (essential trace elements and vitamins) to food is referred to as food fortification or enrichment. As defined by the World Health Organization (WHO) and the Food and Agricultural Organization of the United Nations (FAO), fortification refers to "the practice of deliberately increasing the content of an essential micronutrient, *i.e.*, vitamins and minerals (including trace elements) in a food irrespective of whether the nutrients were originally in the food before processing or not, so as to improve the nutritional quality of the food supply and to provide a public health benefit with minimal risk to health," whereas enrichment is defined as "synonymous with fortification and refers to the addition of micronutrients to a food which are lost during processing." In US, fabricated or designed foods are most often referred to as "convenience foods." Such foods are defined simply as those "to which services have been added to the basic ingredients to reduce the amount of preparation required in the home" (U.S.D.A., 1965). The "convenience foods" are essentially a single kind of fabricated or designed food. "Fabricated or designed foods" can be defined as foods built according to plan from individual components, natural or synthetic, to yield products having specified physical (textural), chemical and functional properties (Glicksmann, 1971). Food fortification was identified as the second strategy of four by the WHO and FAO to begin decreasing the incidence of nutrient deficiencies at the global level. The combination of animal proteins with the substitute or extender plant (vegetable) proteins very clearly fits into the definition of the fabricated or designed foods. Such foods then become convenience foods for the affluent nations and supplementary foods for the protein deficient developing countries.

Why fortification?:

Conceived for convenience and nurtured by necessity, substitutes and extenders for animal protein now stand at the threshold of their greatest growth. This growth will take place in two major areas each directed towards meeting the specific needs of the consumer – the leisure oriented citizen of the affluent nations and the protein-deficient inhabitant of the developing countries. Several surveys have repeatedly pointed out that most men and women do not ingest nutrients, they consume food. With this in mind the basic objective should be to make (fabricate or design) foods that will appeal to the consumer and will be accepted and consumed by him. The acceptance will vary from country to country and from region to region within a certain country depending on desires of needs of individuals. Fig. 1 shows the average daily consumption of protein for several countries (Stone, 1972). As a basis for high or low protein intake, Stone used the 1968 U.S. Recommended Allowance of 65 g of protein. The Recommended Daily Dietary Allowance for protein has been lowered to 56 g for a 70 kg male. This new dietary allowance is shown by a broken line in Fig. 1. Based on either the 56 or

65 g dietary allowance, there is an obvious relationship between protein intake and the average annual per capita income. The levels shown do not give any indication of the biological value or the proportion of animal and plant protein in the daily diet. Table 1 presents data from eight representative areas, seven are developing countries with the U.S. representing one of the affluent nations. One quickly recognizes two important differences - (a) the total daily protein intake varies from 51 to 92 g (b) the developing countries depend on vegetable protein as the major contribution to total daily protein intake. In many areas this will mean that the biological value of the protein in the daily diet will be lower than where larger amounts of animal protein are used. One may very quickly conclude that proteins are being wasted in our diet. Utilization of excess protein for energy may be wasteful and in certain instances may be an unhealthy practice. Today there is much concern over food additives. The importance and need for additives in many foods is well understood by the technologists and is essential in the fabrication of new products. Food additives are ingredients added to food products in order to provide a desired or beneficial result. The major functions of food additives are to provide the following attributes or properties: texture, flavor, nutrition, color, preservation and convenience. Additives, therefore, are a very important part of the fabricated or designed food. All who work with these foods recognizes one of the major building blocks of fabricated foods is protein. From the point of view of those who emphasize nutrition, there is no such thing as an imitation protein. Proteins used by the technologist may be a natural or fortified protein, or a combination (blending) of different proteins that complement each other nutritionally. As La Chance (1970) points out, the protein building blocks are proteins of whatever origin, optimized to guarantee better health and to conserve the most critical and expensive resource. Based on this latter statement the most important source of protein for fabricating food products are the vegetable proteins.

As food prices moved steadily upward during 1973 to 1974, more and more American homemakers examined several fabricated and substitute foods on their grocers' shelves. In the process they learned how to trim their meat bills with textured vegetable proteins (TVP). More specifically the rising meat prices, the U.S. school lunch program, and the world-wide protein shortage contributed to the growing acceptance of meat analogs and TVP meat extenders made from processed soybeans. It will soon be 100 years since vegetable protein meat analogs were first introduced on a commercial basis. Dr. John Kellogg developed and sold the first meat analog product in 1879 in Battle Creek Michigan. To many millions of people, however, they are brand new and are helping to produce a rapidly expanding market for these foods. One question that is often asked "do textured vegetable protein products fill a need for which the consumer will pay?" Examination of the average daily protein intake for the U.S. indicates that as a nation we are consuming about 95 g of protein. This is approximately 50% more than the recommended amount. With such per capita levels there is little demonstrated need for additional protein intake in the diet of the average American. However, rising prices for traditional protein foods make a protein extender or substitute a timely introduction. Where disposable incomes are increasing, the demand for better diets climbs too, and "better" means more protein (Spaeth, 1974). Not only has the per capita meat consumption reached an all time high in the U.S. but many other countries have shown a more rapid percentage increase. Engineered foods, fabricated foods, restructured foods, structured foods, designed foods, architecturally created foods, and food analogues are terms used to described foods prepared from individual ingredients or components according to predesigned plans to yield finished products having specified physical, chemical, and functional properties (Glicksman, 1985).

Diets that lack variety can be deficient in certain nutrients. Sometimes the staple foods of a region can lack particular nutrients, due to the soil of a region, or because of the inherent inadequacy of the normal diet. Addition of micronutrients to staples and condiments can prevent large-scale deficiency diseases in these cases. While it is true that both fortification and enrichment refer to the addition of nutrients to food, the true definitions do slightly vary. The terms also apply to food products prepared by any method

Table 1 : Conventional and new protein sources

Food	Source
Conventional foods	Meat, milk, fish, eggs, cereals, legumes
Extended milk products	Milk, oilseed protein, amino acids
New protein beverages	Oilseed protein, amino acids
Textured protein foods	Oilseed protein
Cereal-protein foods	Cereal, oilseed protein, fish protein concentrate, legumes, dry milk, amino acid
Fortified cereal products	Cereal, oilseed protein, fish protein concentrate, legumes, dry milk, amino acid, wheat fractions, cassava
Normal cereal foods	High-yielding varieties
Other new protein sources	Microbial protein, genetically improved cereals, protein from green plant tissue

Table 2 : Relative cost of various foods

Sr. No.	Food	Price of product/ kg	Protein content
1.	Chick-peas	70	20
2.	Wheat flour	30	11
3.	Beans	50	22
4.	Skim milk powder	100	36
5.	Fish, dried	200	31
6.	Cheese	150	25
7.	Chicken	100	19
8.	Beef	150	10

which reshape food pieces or particles into a larger and more appealing form (Anonymous, 1983). In nutshell fabricated foods offer the following:

- Consumer demand for convenience
- Nutritional composition improvement
- Undesirable components removing
- Food resource extending
- Costly food imitation
- New processing technology requirement
- New food resource utilization
- By-product or waste material utilization
- Cost and economy improvement
- New variety creation
- Preservation
- Functional utility improvement

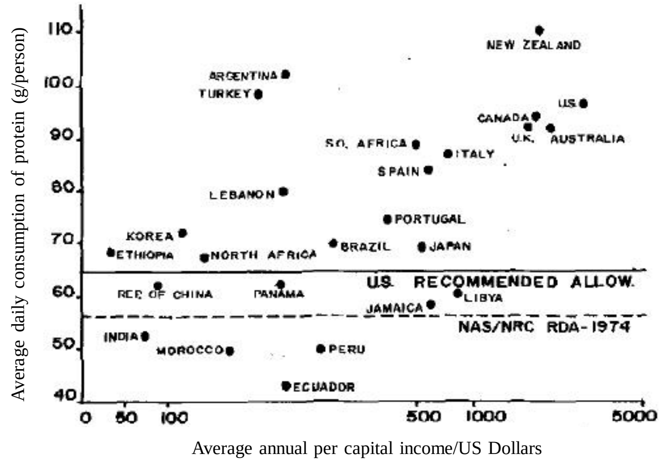

Fig. 1 : Average daily consumption of protein for several countries

History/Background:

The production of fabricated foods generally results from consumer demands for convenience, nutritional composition improvement, undesirable components removing, food resource extending, costly food imitation, new processing technology requirement, new food resource utilization, by-product or waste materials utilization, cost and economy improvement, new variety creation, preservation and functional utility improvement. Fabricated foods originated in the early 1940s during World War II. In the 1940s and 1950s, the lack of time for food preparation caused by war

Table 3 : Hydrocolloids used in foods

Exudates	Extracts	Flours	Biosynthetic	Semi-synthetic	Synthetic
Plant :	Seaweed :	Seed :	Dextrans	Cellulose derivatives:	Polyvinylpyrrolidone (PVP)
Arabic	Agar	Locust bean	Xanthan	Carboxymethylcellulose	
Ghatti	Alginates	Tara	Curdian	Methylcellulose	Polyethylene oxide
Karaya	Carragreenan	Tamarind	Polytran	Hydroxypropylcellulose	Polymers (Polyox)
Tragacanth	Furcellaran	Quince	Gellan	Hydroxyethylcellulose	
		Psyllium seed	Pullalan	Hydroxypropylmethylcellulose	Acrylic acid polymer
	Plant :	Flax seed			(Carbopol)
	Pectin			Starch derivatives :	
	Arabinogalactan	Cereal starches:		Hydroxypropyl starch	Methyl vinyl ether/maleic
		Corn			Anhydride
	Animal :	Wheat		Propylene glycol alginate	
	Gelatin	Rye			Polyvinyl alcohol
		Waxy maize		Low methoxy pectin	
	Cereal :				Polyethylene glycol
	Corn hull	Tuber :		Hydroxypropyl guar	polymers
	Oat	Potato starch			
		Konjacmannan			
	Vegetable :				
	Okra	Root :			
		Tapioca starch			

demands initiated the production of timesaving and convenience foods. The 1950s and 1960s contained high numbers of individuals consuming poor quality protein foods. Consequently, protein-based beverages, cereals, and pastas were fabricated throughout the world in an attempt to alleviate this problem. In the 1970s, a shortage of all types of food occurred. Many food innovations, such as high-yield grains, new food plants, and aquaculture, were developed to increase food quantity. Meat analogues and substitutes were developed to address the soaring price of meat as a result of high petroleum costs which were controlled by OPEC. However, meat analogue development was curtailed or stopped after new oil resources were found and petroleum prices were lowered. In the 1980s, meat analogues and fabricated meat chunks were first successfully developed by R.A. Boyer (Glicksman, 1985). Meat analogues were converted from vegetable proteins, such as soy proteins, by solubilizing the protein, unfolding the protein chains, reforming or simulating muscle protein fibers, and spinning fibers to the desirable meat-like structure. This process known as the Boyer process, was used to fabricated meat, fish and poultry-like products, such as chicken chunks (Glicksman, 1985). The concept of restructuring meat and poultry products had been developed since the last decade from lean trimmings and cuts. Restructured steak provided a low-cost, uniform product that imitated fresh muscle in flavor, color, and textural properties. Other types of restructured products, including roasts, chops, cutlets, strips, and cubes, were also produced through the same technology and were well received in the marketplace (Mandigo, 1986). The seafood industry imported surimi technology from Japan to produce restructured seafood closely resembling the flavor, appearance, texture, and shape of natural seafoods such as crab legs, scallops, and lobster tails (Glicksman, 1985). Recently, new technology in the binding process, such as the cold-set binder process, was introduced into the meat industry. Cold-set binders, which include alginate systems, Pearl Meat Binders and Fibrimex, are used in restructured meats to hold pieces together without the application of a thermal process (Esguerra, 1995).

Textured soy protein:

Soybeans and soy products have been used for centuries in Eastern Asia as a staple and highly nutritious food source. World wide, 155 million metric tonnes of soybeans are presently grown. The United States produced 46.34% of the total soybean production in the world. After the US, Brazil (19.97%), China (9.2%), Argentina (13.5%), Paraguay (1.6%), European Union (0.7%) and all other countries grow about 8.59% (Golbitz, 2001). On an average, there is 40% protein, which means 63.6 million tonnes of soy protein is available for consumption. Soy protein supplies all nine essential amino acids and provides many functional benefits to the food processors and for a healthy diet. Soy ingredients promote moisture and flavor retention, aid emulsification, and also enhances the texture of many foods from a variety of meats to peanut butter, frozen desserts and even cheese. For food manufacturers, soy protein contributes valuable functional characteristics in processing systems as well as offering full digestibility. Both isolated and concentrated soy proteins are easily digested by humans and equal the protein quality of milk, meat and eggs. Moreover, soy proteins are acceptable in almost all diets containing virtually no cholesterol and being lactose-free. The nutritional value of soy protein provides the consumer with a cholesterol free, lower fat alternative to animal protein.

What is texturized vegetable (soy) protein :

Soy protein, once associated with1970's "mystery meat," today is on the hot list of ingredients for its ability to contribute to two top food trends - the continued quest for high quality, low fat foods and the thriving field of functional and nutraceutical foods. The higher functionality of soy protein concentrates and soy protein isolates and their neutral flavor profile, account for their wide application in the food industry. There are several different definitions of texturized vegetable protein in the literature depending upon the sources. Texturized vegetable can be defined as "fabricated palatable food ingredients processed from edible protein source, including among others soy grits, soy protein isolates, and soy protein concentrates with or without suitable option ingredients added for nutritional or technological purposes. They are made up as fibers, shreds, chunks, bits, granules, slices or other forms. When prepared for consumption by hydration, cooking, retorting or other procedures, they retain their structural integrity and characteristic 'chewy' texture" (Anonymous, 1972). The USDA has defined textured vegetable protein products for use in the school lunch program as: "food products made from edible protein sources and characterized by having structural integrity and an identifiable structure such that each unit will withstand hydration and cooking, and other procedures used in preparing the food for consumption" (USDA, 1971). The Food Protein Council of the National Soybean Processors Association has defined textured vegetable protein as being: "derived from edible vegetable protein source, and mixtures thereof, by physical and/or chemical processes. These materials are converted into a structural form having definable textural properties similar to those of the food system for which its use is intended. Food ingredients and/or additives may be incorporated to enhance its nutritive value and organoleptic properties. Textured vegetable protein shall contain not less than 35% protein (N x 6.25) on a moisture free bases. The protein efficiency ratio (PER) shall be not less than 1.8 on the bases of PER of 2.5 for casein".

Meat extender:

Meat extenders produced from the extrusion processing of defatted soy flour or flakes and soy concentrates, and they represent the largest portion of textured protein. Meat extenders are rehydrated to 60-65% moisture, blended with the meats or meat emulsions, to food product to a level of 20-30% protein.

Meat Analog:

An extrusion process utilizing one or two extruders in a series can be employed to convert vegetable protein source directly into simplified varieties of meat analogs. These meat analogs have remarkable similarity in appearance, texture and mouth feel to meat. Extrusion technology can form a fibrous matrix (analog) almost indistinguishable from meat, and consumed as it is.

Uses of texturized soy protein:

Texturized soy protein has been a commercial success for many years because of the development of machinery that is capable of continuously producing textured vegetable product. The texturization of plant proteins has been a major development in the food industry. Processes, like extrusion, have been developed to impart a fibrous structure to amorphous plant proteins. Once texturized, these plant proteins can be dehydrated for use as an extender of fresh or processed meat. Consumers are becoming increasingly interested in healthy foods and open to soy protein ingredients. Texturization of soy flours into usable meat extenders and replacers is economically feasible for some time. Texturized vegetable foods provide an alternative to animal meat and falls under the Halal foods. Texturized vegetable protein from soy concentrate have the advantages of blander flavor and major reduction of non-digestible natural sugars (stachyose and raffinose) which can cause considerable flatulence, abdominal discomfort, and venting in some individuals. Modern texturized soy flours have milder flavors than in earlier years, which are easily masked in highly seasoned foods, like tomato sauces, pizza toppings, and canned chilli. Users of texturized vegetable protein includes the growing numbers of vegetarians, and people concerned with lowering cholesterol and total fat intake. In India, China, Japan and South Korea textured soy protein is eaten directly as a flavored or seasoned piece usually as a side or main portion of the meal. A good example of a completely meat-free meat analog is flavored bacon bits. Some of the textured protein consumption in different parts of the world is based on religious, cultural, or economic reasons. A good example is vegetarian diets for most Indians (Hindu). Textured soy protein widely used in child nutrition programs as well as for worldwide relief agencies to help feed famine plagued people in impoverished countries. Because of their low moisture and water activity, storage, shelf life and handling under poor conditions, do not become a problem. Vitamins and minerals can be fortified in textured soy protein to make it an ideal protein source. It is cholesterol free and can be processed as a low fat food. American consumer's acceptance of textured vegetable protein has prompted other countries' interest in this low-cost answer to the desire for more protein foods. U.K, South Africa, Japan, Korea, Mexico and India are among the nations that have joined the United States in commercial production.

Dairy-type products from soybean:

To lower costs, improve nutrition, reduce allergy response, and improve functionality, a number of dairy analog products have been developed with soy protein products. These include soy milk, soy cheese, nondairy frozen desserts, coffee whiteners, yogurt, and others. Although soy proteins offer considerable potential in the manufacture of dairy-type products, these products are not yet produced in the United States in significant volume. Isolates and functional concentrates are the most acceptable products in dairy applications because of their fine particle size, dispersibility, high protein content, and low flavor profile.

Beverages and toppings:

Isolates can be used in emulsified products such as coffee whiteners, liquid whipped toppings, prewhipped toppings, and toppings for other food items to replace sodium caseinate. The level of usage is from 0.5 per cent to 2.0 per cent of the finished formula. In addition, isolates are used in imitation sour cream dressings to emulsify fat, control viscosity, and provide textural characteristics. There is also developmental effort being devoted to utilizing soy protein products in products such as soy milks, convenience beverage powders, nondairy frozen desserts, sour cream dips, and related cheese-like products. Instant beverage mixes designed to be added to milk for use as meal replacements use both concentrates and isolates as protein sources. In cases where low viscosity beverages are fortified with soy protein and require good wetting and dispersion, sometimes even at low pH, isolates are used. Full-fat and defatted soy flours are major ingredients in low-cost replacements for milk solids. These replacements are used in beverages for human consumption in several developing countries. At present, many companies produce soy and milk protein blends which are sold as ingredients to food manufacturers. These blends often are combined to offer a protein content similar to that of cow's milk. The different blends are used as complete or partial replacements for NFDM in baked goods, sauces, meat products, and various fabricated foods.

Infant formulas and special nutritional products:

With the development of soy protein isolates, higher quality soy-based infant formulas became possible. These products have improved color, flavor, odor, and do not contain the flatus-producing carbohydrates found in soy flours. Since these formulas do not contain lactose, they can be used by people who are lactose intolerant. In addition to the milk-free or soy-based infant formulas, special formulas utilizing soy protein products are designed and manufactured for older infants and for geriatric, hospital, and postoperative feeding. Soy protein products also are used to increase the protein content of infant cereals and baby foods, especially in rice and wheat products used as the first solid foods for this age group.

Milk replacers for young animals:

Due to their economic advantages and nutritional quality, soy proteins are often used to replace milk protein used in feeding young animals, especially calves. Usually 30% or less of the milk protein is replaced by soy protein. Approximately 70% of the dairy herd replacement calves in the United States are being fed milk replacers. While soy flours once played a prominent role in milk replacers, many milk replacers now contain soy concentrates because of their higher protein content and low antigenicity. Some soy protein isolate goes into this market. In addition to calf feeding, both concentrates and isolates as well as soy flours are used in milk replacers for other baby animals, such as lambs, pigs, and companion animals.

Meat products:

Because of increasing acceptance on the part of consumers, processors, and regulatory agencies, the use of soy protein products is increasing in processed meat systems. Soy products contribute nutrition, flavor, and valuable functional properties when used as partial meat substitutes, binders, emulsifiers, meat flavor enhancers, brine ingredients, and meat analogs. Most of the current domestic meat applications for soy protein are in comminuted and coarsely ground meat products, with the latter being the largest area. Whole muscle meat products can be improved by using soy protein brine injection to tenderize and reduce cooking losses.

Emulsified meat products:

Levels of usage in emulsified meat products typically range from 1% to 4% on a prehydrated basis, depending on the protein ingredient used and the actual meat product. Emulsified meat formulations containing soy protein products have excellent eye appeal, texture and flavor. The result is substantial savings for the user without sacrifice of eating quality or nutrition. In finely chopped meats, such as frankfurters and bologna, soy protein isolates and neutralized soy protein concentrates are used for their moisture and fat binding, fat emulsifying, and stabilizing properties. These functional properties make them ideal ingredients for use in processed meat products, both coarse and fine emulsions (e.g., patties, loaves, and sausages).

Coarsely chopped (Ground) meats :

In coarsely chopped (ground) meats, texture contributing properties are particularly important. In coarsely chopped meats (meat patties, meat balls, chili, Salisbury steaks, pizza toppings, and meat sauces among others) textured soy proteins are the ingredients of choice. In some applications textured concentrates can be hydrated to a greater degree and used at higher levels than textured flours. In making patties it is necessary to add water at 2 to 3 times the weight of the soy protein. If too little water is used to hydrate the textured protein, the finished meat product will be dry. A good guide for hydrating soy products is to achieve a protein level of about 18% in the hydrated form. In patties, the primary functions of soy protein products are to give structure during cooking and to reduce cooking losses. When properly used, the patty will be more moist, will have a higher protein content and lower fat, and thus be better balanced nutritionally. Several studies with beef patties containing soy protein products indicate that up to 20% hydrated textured soy protein product would be acceptable to the consumer, based on various palatability characteristics. In supplementing ground meat in a patty-type product, up to about 20% substitutions can be made without flavor adjustment. Above this level, additional seasonings may be required to offset the dilution effect of the meat flavor. The flaked form in a textured soy product assures rapid hydration, which makes the ingredient well-suited for high volume applications. Its meat-like appearance and mouthfeel remain intact throughout strenuous retort and freezethaw conditions. It also contributes to overall fat stabilization. Soy protein products are also useful in making chili by aiding in flavor retention, increasing the protein content and providing a pleasing grainy texture.

Dairy products and margarine/edible spreads:

Soy flour is part of the FDA Standards of Identity for margarine, and it can be used in all types of edible spreads (e.g., replacement in peanut spreads and candy fillings). Present U.S. federal and state dairy laws greatly restrict competition by modified or imitation dairy products and retard new developments in this area.

Formulated foods:

No FDA standards inhibit the use of soy protein ingredients in the development of a wide variety of non-meat/poultry foods, including ready-to-eat cereals, side dishes, soups, cooking sauces and condiments, "add meat" meal entrees, cookies, snacks, non-standard breads, and other bakery products. In these cases, ingredient labeling applies universally, as well as in descriptive main panel labeling if the soy ingredient "characterizes" the food. This latter area also offers opportunities for highlighting the nutritional and health benefits associated with soy protein products.

Hydrocolloids are long-chain polymers, primarily carbohydrates, that are soluble or disperse in water (Table 3). Gum particles are suspended in solution as colloids, therefore, gums are also known as hydrocolloids. Gums are effective as binding and texturing agents and provide structure, functionality, and desirable properties to fabricated foods. The important functionality of gums is viscosity or thickening, gelling, and freeze-thaw stabilization properties (Lee *et al.*, 1997).

Meat analogues:

A meat analogue, also called meat substitute, mock meat, faux meat, or imitation meat, approximates the aesthetic qualities (primarily texture, flavor, and appearance) and/or chemical characteristics of specific types of meat. Many analogues are soy-based e.g., Tofu, tempeh. Generally, *meat analogue* is understood to mean a food made from non-meats, sometimes without other animal products such as dairy. The market for meat imitations includes vegetarians, vegans, non-vegetarians seeking to reduce their meat consumption for health or ethical reasons, and people following religious dietary laws, such as kashrur or halal. Hindu cuisine features the oldest known use of meat analogues. *Meat analogue* may also refer to a meat-based and/or less-expensive alternative to a particular meat product, such as surimi. Some vegetarian meat analogues are based on centuries-old recipes for seitan (wheat gluten), rice, mushrooms, legumes, tempeh, or pressed-tofu, with flavoring added to make the finished product taste like chicken, beef, lamb, ham, sausage, seafood, etc. yuba is another soy-based meat analogue, made by layering the thin skin which forms on top of boiled soy milk. Some more recent meat analogues include textured vegetable protein (TVP), which is a dry bulk commodity derived from soy, soy concentrate, mycoprotein-based quron which uses egg white as a binder making them unsuitable for vegans, and modified defatted peanut flour. Dairy analogues may be composed of processed rice, soy(tofu, soymilk, soy protein isolate), almond, cashew, gluten (such as with the first non-dairy creamers), nutritional yeast, or a combination of these, as well as flavoring to make it taste like milk, cheeses, yogurt, mayonnaise, ice cream, cream cheese, sour cream, whipped cream, buttermilk, rarebit, or butter. Many dairy analogues contain caesin, which is extracted dried milk proteins, making them unsuitable for vegans. Egg substitutes may be composed of tofu, tapoica starch, or similar products that recreate the leavening and binding effects of eggs in baked goods. Many people use fruit products such as banana paste or applesauce as egg analogues in baking. The extended meat or fabricated meat is popular in the world for economic reasons as well as utilization of other locally available agriculture produce. The extended products provide mixture of proteins and other nutrients to the consumer's, which are desirable from nutrition point of view, and it also satisfies the consumer's desire for meat particularly when they cannot afford the costly meat. This is also an effective way to utilize other agriculture produce. The number of extenders could be very large and it was felt necessary to find an effective method to select functionally compatible ones. Extended meats also in a way solve problems where a part of meat is replaced by other ingredients. Screening of ingredients, one at a time at arbitrary levels may take usually long time as well as the costly resources. In traditional methods of preparation, the difficulty in selecting levels at which to fix the ingredients is also a question to be answered by scientific workers.

Surimi:

Surimi (Japanese, literally "ground meat", Chinese: *yú jiâng*; literally "fish puree or slurry") is a Japanese word referring to a fish-based food product that has been pulverized to a thick paste and has the property of become a dense and rubbery food item when cooked. It is typically made from white-fleshed fish (such as pollock or hake), but the term is also commonly applied to food products made from lean meat prepared in a similar process.

Cheese analogues:

Cheese analogue is a substitute for milk cheese, which is similar in composition, appearance, characteristics and even in its intended use. In cheese analogues, the milk protein and milk fat are partly or wholly replaced by vegetable proteins (*i.e.* peanut protein, soybean protein) and vegetable fats and oils (*i.e.* partly hydrogenated vegetable fat like soybean, palm, etc). Cheese analogue are formulated and produced with desired nutritional, functional and storage properties as per the market and consumer needs. Cheese substitute can be suitably fabricated to have nutritional benefits. Analogue pizza cheese is manufactured in a manner similar to that for processed cheese manufacture, which finds application in baking as a topping on pizza and as slices in stuffed burgers. The degree of calcium sequestration and para-casein aggregation is controlled by using correct blend of emulsifying salts to give the desired degree of casein hydration/aggregation and fat emulsification in the analogue preparation. Casein-based analogue pizza cheeses were functionally more stable than natural Mozzarella cheese during refrigerated storage with respect to apparent viscosity and free oil. "Sufu" is an example of a soybean based cheese analogue with a spreadable creamy consistency. Cheese substitutes or imitation cheese may be generally defined as the products that are intended to partly or wholly substitute for or imitate cheese and in which milk fat, milk protein or both are partially or wholly replaced by non-milk based alternatives, principally of vegetable origin (Fox *et al*., 2000). A substitute cheese should not be nutritionally inferior to the cheese it is intended to mimic. Rather promoters of imitation cheese claim nutritional advantages compared with genuine cheese *i.e.*, higher unsaturated fatty acids, no cholesterol, less calorie, etc. (Mc Carthy, 1990).

Future of fabricated foods:

– Longevity; fabricated foods might prove helpful in reducing lipid peroxidation and thereby enhancing longevity.

– Mental activity; in future fabricated foods can be developed which will enhance the mental activity.

– Freedom from disease; fabricated foods might find application in pharmacy in the near future by encompassing drugs and antibiotics.

– Relief from genetic defects; by providing a phenylalanine free diet we might be able to prevent complicacies in case of genetic disorders like phenylketonuria.

– Addition of tranquilizers to food; fabricated foods can be developed to cure mentally challenged persons thereby taking away ate requirement to inject or administer tranquilizers orally.

– Optimally adjusted foods for different stages of life; we can develop formulated foods for infants, pregnant and lactating women, adolescents and children separately.

– Elimination of allergens; *Laythrin* from laythrus and saponin from peas and the like can be removed and foods can be tailor-made.

– Greater merging of preventive and therapeutic medicine with the technology of using synthetic substances in synthetic foods.

– Synthetic ingredients from bacteria and yeasts will be developed and used in foods.

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