FOOD AND NUTRITION NEWS

Acharya N.G. Ranga Agricultural University

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FOOD ADDITIVES

as macromolecule replacers in food formulation

The relationship of diet to development of cardiovascular disease and cancer has resulted in guidelines that recommended reducing calories and fat consumption to 30% of total caloric consumption. A combination of sugar and fat is highly appealing for consumers and obese persons are more inclined to have a "fat tooth" than a "sweet tooth". In fact, many fat-rich foods such as ice cream, french fries, chocolate, and pizza are among the most popular. The consumer has a choice: decrease his liking of the high calorie, high fat foods and beverages or find alternatives that are low in calories and fats and also taste good. A few decades ago "light" foods were unknown, but now increasing numbers of those products are found on grocers' shelves and in freezer cases as choices for consumers searching for alternatives to satisfy their desires, yet maintain their health. Formulation of these foods of choice have been made possible by use of food additives. Manufacturers are scrambling to develop new technologies and expand the uses of low calorie ingredients, and consumers are feeling increasingly comfortable with the concepts of fat and sugar replacers.

New materials-both natural and synthetic-have been introduced as replacement ingredients for producing low-calorie and reduced fat products. Some materials are traditional macromolecules with new uses, but others are synthesized materials that have been introduced to replace sugar and / or fat components of food products. The broad categories of macromolecular replacements, some of which are also considered as bulking agents, include carbohydrate based, protein based, lipid based, and mixed blend replacers. The carbohydrate-based replacements can be classified as

1. glucose polymers and starch derivatives (polydextrose, maltodextrins, dextrins and modified starches) or modified sugars (isomalt, inulin and perhaps even sucrose esters, although they usually are regarded as emulsifiers)
2. mixed hydrocolloids, including fibers and gums.

Proteins that are used for fat replacement include micro-particulated egg albumens, caseins, whey albumins, and whey globulins. The lipids are either emulsifiers or fat analogs that have been modified or synthesized such that they are no longer metabolized completely. Replacements can reduce fats or carbohydrates, but that is not necessarily synonymous with low calorie. Caloric contribution is considered in selecting replacement ingredients, but obviously it is not the only factor. Even if little energy reduction is achieved, replacements for fats and sugars will likely continue to be used to provide individuals with more freedom in their food choices for achieving long-term diet and health goals.

Some replacement agents function as both fat and sugar, but the unique properties of each agent limit its applications. Frequently, combinations of replacement agents are needed. The functional attributes that must be provided by the sweetener system to be used as a sugar replacer have been outlined in relation to both sensory and processing requirements. Solubility (usually in water), retention (and release) of water, reduction of water activity, retardation of bacterial

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growth, air incorporation and coagulation temperatures in bakery products, ability to depress freezing point in frozen products and control of crystal formation in confectionery products are critical functions, not withstanding providing sweetness, which is performed by the sugars. The volume lost when sugar is removed must be replaced, generally by compounds that bind water through molecular attraction, capillary action, or slowing water molecule movement through the matrix. The combination of water with binding agents provides the necessary bulk lost with the sugar.

Similarly, the roles of fat in food products are numerous and give a food unique identifiable characteristics. In some products, part of the fat can be removed without a noticeable change in the original sensory characteristics. However, total removal of fat often alters the flavour, texture, tenderness, body and smoothness of a product. Fats also contribute moistness and a rich mouth feel. Fats produce emulsions and aid in the incorporation of air in batters. Some of the functional aspects of fat have been identified, but not all the facts that need to be considered for fat replacement are known. A fat replacer that works in one application can fail totally in another.

In order to create sensory textural perceptions of high fat levels, factors suggested for macromolecule substitutes include:

1. The size of the particles i.e.small, uniform microparticles from 0.1 to 3µm that promote textural creaminess in dairy products, frozen desserts and salad dressings and particles in the size range of fat crystals (20 to 30 µm) that produce deformable gels with a short texture, and
2. water binding or water structuring to promote the perception of moistness associated with high fat in bakery products.

It is suggested that a three ingredient system is necessary for a good fat mimetic:

1. a thickening agent for lubricity and flow control
2. a soluble bulking agent for control of adsorption/absorption of the food onto the taste receptors of the tongue, and
3. a microparticulate, generally insoluble, agent that acts like a ball bearing to create smoothness.

SALATRIM, a family of low calorie fats, containing mixture of long chain saturated fatty acids, has physical properties of fats, but only about half the calories of an ordinary edible oil and is a safe and versatile fat substitute. CAPRENIN, a randomized triglyceride containing caprylin, (C 8:0), capric (C 10:0) and behenic (C22:0) acids has functional and organoleptic properties similar to cocoa butter and thus can be used as a confectionary fat. It provides fewer usable fat calories than ordinary fats because behenic acid is not completely absorbed.

A universal fat or sugar substitute simply does not exist. All of the macromolecular replacers contribute distinct properties suitable for replicating a limited number of functions in particular food products. Healthful and nutritional attributes are not the sole determinants of the success of a food product. With the continuing development of links between diet and health, consumers want healthier products, but marketing studies indicate they are unwilling to compromise on taste. Without good flavour, texture, mouthfeel and appearance, the product will be deemed unacceptable by the consumer. Hence, any search for ingredients for use in low calorie or reduced calorie foods must also provide good sensory quality, which increasingly will be the major challenge.

FOOD ADDITIVES IN PRODUCT DEVELOPMENT

Low fat/calorie pound cake developed

Cakes usually have a high fat content compared to other bakery products and hence are rated as calorie dense. With increasing market for reduced fat / calorie bakery goods, an attempt was made to formulate cake recipes which provide the eating satisfaction of full fat product yet have low calorie content. Recipes were formulated using food additives which function as partial fat replacers in the product such as cellulose, gums, maltodextrins, emulsifiers and bulking agents. Using a standard pound cake recipe containing 20% fat (as butter) as control, test products were prepared in which 50 - 75% of the butter was replaced with a single or a combination of additives. Quality of product with each treatment was evaluated by subjective assessment by a trained panel. Response Surface Methodology (RSM) design was used to arrive at the best combination of variables that would yield an acceptable product. The study revealed that polydextrose used alone had a volume depressing effect and resulted in gumminess. Addition of emulsifiers at 15% level along with 50% polydectrose negated the undesirable effects yielding a product in which fat quantity could be cut down by more than 50% without affecting volume, texture and eating quality. **(Kamini* Devi & Fadi M. Aramouni, 1999)**

Development of low calorie food products

With the increased health problems associated with high fat intake such as obesity, cardiovascular diseases and diabetes, there is an urgent need to develop low calorie products. Fat and sugar substitutes were used in development of low calorie products without altering taste and texture. In fried snacks, cellulose was incorporated at 5 and 10 per cent level to reduce the absorption of oil during frying. In dairy and other sweetened products, fat was substituted by maltodextrin and sugar with aspartame.

All the prepared products were subjected to sensory and objective evaluation. Fried products with 5 per cent cellulose were equally acceptable to control with an overall acceptability of 4.1 and 4.0 respectively. Icecreams with 15 and 30 percent fat substituted with maltodextrin were rated almost similar to control in flavour, taste and body texture. In yoghurt samples, products with 15 and 30 per cent fat substitution were well accepted. Products with 100 percent fat substitution were scored lower. Jelly

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Table 1 : Nutritive value of low calorie products

Product	calories		Fat		Protein	
	Control	Low Calorie products	Control	Low Calorie products	Control	Low Calorie products
I. Fried snacks						
1. Chakkalu	513	-	22.2	-	10.2	-
a) 5% Cellulose	-	435	-	13.6	-	8.8
b) 10% Cellulose	-	397	-	11.7	-	7.0
2. Muruku	592	-	30	-	11.1	-
a) 5% Cellulose	-	496	-	18	-	9.1
b) 10% Cellulose	-	444	-	15	-	8.1
II Dairy Products						
1. Icecream 211	-	11.5	-	5.1	-	
a) 15% fat substitution	-	187	-	9.8	-	4.8
b) 30% fat substitution	-	176	-	7.6	-	4.5
c) 50% fat substitution	-	160	-	5.6	-	4.3
d) 50% fat + 5% sugar substitution	-	135	-	5.6	-	4.1
2. Yoghurt	91	-	6.1	-	4.6	-
a) 15% fat substitution	-	86	-	5.1	-	4.2
b) 30% fat substitution	-	81	-	4.7	-	4.0
c) 50% fat substitution	-	72	-	3.3	-	3.9
d) 50% fat + 5% sugar substitution	-	53	-	6.1	-	3.7

Table 2 : Energy value of low calorie aspartame sweetened products

Products	Calories (K.cal/100g)
I. Jelly	
a) Control	120
b) 50% sugar substitution	72
c) 75% sugar substitution	52
d) 100% sugar substitution	24
II. Lemonade (dry mix)	
a) Control	313
b) 100% sugar substitution	136
Reconstituted drink	
Control	125
Modified	7

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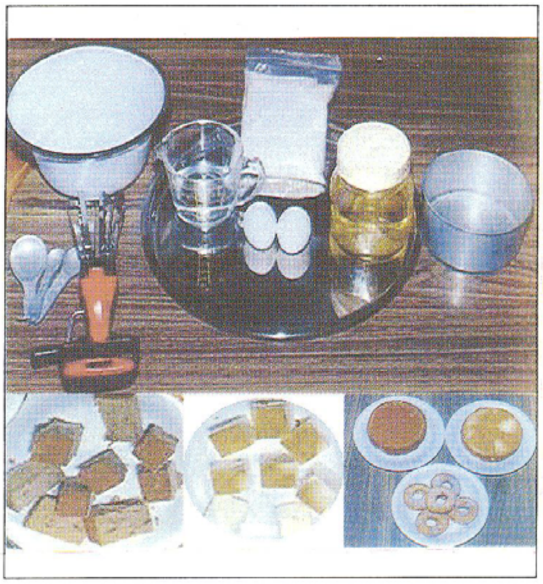
and lemonade sweetened with aspartame in place of sugar substituted at 50 percent level were highly acceptable. In all the products significant reduction in fat and caloric values were observed (Table 1,2) Reduction of fat in fried products ranged from 15-20 percent. In dairy products, reduction of calories ranged from 5-40 per cent while in jelly and lemonade the reduction in calories ranged from 30-80 per cent (Sujatha and Uma Reddy, 1999)

Formulation of ready to make cake and doughnut mixes



In recent years processed food products especially ready to cook convenience foods are gaining popularity. In view of the need for developing instant mixes a study was designed to formulate cake and doughnut mixes and to study the acceptability and shelf life of the mixes. Two cake mixtures (vanilla and chocolate flavours) and one doughnut mix were developed. The basic ingradients included in the mixture were refined flour, sugar and fat. Food additives used in the formulations were flavours, leavening agents, soya lecithin, Glycerol Mono Stearate (GMS), Carboxy Methyl Cellulose (CMC) and sorbic acid.

The formulated mixes were made into products and subjected to sensory evaluation. The products were well accepted both at laboratory and consumer level in all the sensory attributes. The most preferred flavour was vanilla and the dry mixes could be stored upto six months without affecting sensory parameters. **(Vijaya Khader, G. Sarojini and N. Laxmi Devi 2000).**

"BIO" - FOOD ADDITIVES - New Generation Additives for Food

Modern food processing preserves food quality, controls food spoilage and disease causing micro organisms, preserves desirable sensory qualities such as flavour, odour, texture and appearance, preserves nutrient content and in many cases enhances the nutrient value as well. These multifarious functions are made possible by use of food additives. Food additives broadly comprise of the categories of preservatives, nutrients, flavouring agents, colouring agents, texturising agents and others. The list is regularly renewed and revised by the Joing Expert (WHO/FAO) Committee on Food Additives.

Additives may be synthetic compounds, naturally occurring compounds extracted from natural sources or synthesized to resemble natural products in all respects (nature identical). For centuries, additives of different chemical nature have been used in foods in order to enhance or maintain certain qualities. These have been based primarily on empiricism and experience. The unprecedented growth of the industry commensurate with the present demand for processed foods of desired structural and functional attributes has brought about changes in the choice and use of food additives. Scientific understanding of their role in terms of functional and interactive properties has opened up new vistas in this area.

There has always been an increased consumer response towards natural ingredients in food systems which are used for the manufacture of clean label products, containing no artificial additives. This caused a renewed interest among food scientists which directed their attention towards compounds of biological orgin. In view of this, focus is now being drawn towards utilization of biotechnological applications such as microbial genetics, fermentations, enzymatic processes etc.

Biocolours

Colouring of foods has been an age old practice since the invention of synthetic colourants and petrochemical based synthetic colours have found great acceptability. Now, consumer awareness and concern for healthful and perfectly balanced food has resulted in increasing interest for food colourants of natural origin. Natural colours are generally extracted from fruits, vegetables, seeds, roots and micro organisms and they are often called 'biocolours' due to their biological origin. Algae, bacteria and plants are the three important sources of biocolours. The commonly available commercial natural colourants of plant origin are carotenoids (extracted from citrus peel/pulp), oleoresin (extracted from Bixa orellana), carrot extracts, chlorophylls and heterocyclic pigments like flavones and anthocyanins-oenocyanin and betanin. Common plants, whose extracts are reported to have some role as natural food colourants are curcuma root, citrus oils, gardenia, saffron, carrot, paprika, hibiscus, beetroot, purple corn, sandal wood and spinach. Some natural colourants include beta carotene, (butter, cheese, margarine, oils, fats, fillings, instant soup powders) canthaxanthine (salad dressings, meat products, meat substitutes, products based on soy or other cereal proteins, SCP or fish proteins, shrimps, lobsters).

Increasing preference for natural food colours has led to the need for finding alternative biotechnological means of augmenting production of natural pigments. The Plant Cell Biotechnological Department at CFTRI, Mysore is engaged in production of natural food colourants through plant cell cultures and algal cultures.

Saffron (Crocus sativus) which is an important food additive both for its colour and aroma is restricted to certain geographical locations in the world. Moreover, the plant produces only one or two trifed stigmas per year, thereby rendering it difficult to produce in very large amounts. To obtain 1 kg of dry stigma, one needs to harvest 1,50,000 flowers of saffron. Biotechnology has made the production of stigma in culture possible.

Production of root derived compounds in controlled environment has been made possible using hairy root culture technology, an important biotechnological method independent of agroclimatic conditions. Using this technology, CFTRI has developed hairy root cultures of Beta vulgaris producing betalaines. The betalaine content in this in vitro system is marginally higher than in vivo grown plants of beet root. Phycocyanin which is a blue pigment has been developed by processing of cyanobacterial biomass such as spirulina. Safety analysis of phycocyanin finds its use as colourant in icecreams, toffees, beverages and in cosmetics.

Bioflavours

Flavour can be described as the combined perception of taste, smell and mouthfeel. Flavours play an important role in the food, cosmetic, feed and pharmaceutical industries. Among the food systems, flavour is a unique attribute which determines its acceptability. Food products containing synthetic flavours are often avoided, because consumers consider these compounds as toxic or harmful to their health. Microbiological processes are considered to be a better option for the production of flavours. The production of flavours may involve any of the two routes

- biosynthesis of a specific compound by metabolising cells
- biotransformation or bio-conversion which involve modification of chemical substrate by microbial cells.

The major microbial flavour sources include bacteria, yeasts, and filamentous fungi. Each has its own significance in the production of flavour. Some of the most common flavour compounds produced from microbial sources are terpenes, alkyl pyrazines, carbonyls, aldehydes, lactones etc.

Plant tissue culture(PTC) technique has been exploited for the production of food flavours from straw berry plant, apple, grape, pineapple and raspberry. Vanillin flavours have also been produced by culturing callus cells derived from vegetative vanilla tissue. However, because of some inherent difficulties like slow growth rate, low yield as compared to microbial sources, use of PTC as an economically viable source for production of flavours in food industry is questionable.

The development of novel and cheap production processes such as solid state fermentation may help to overcome some of the current limitations of microbial flavour production and also widen the spectrum of bioproduction of such compounds.

Biosurfactants

Among the recommended food additives, surfactants in general and emulsifiers in particular, play a very significant role and are virtually indispensable in fabricated or texturized foods. Except for the naturally occurring lecithin, all other food surfactants are derived by chemical synthesis from oils and fats of plant and animal origin by processes involving esterification,

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transesterification, enzymatic modification, all in conjunction with high grade up and down stream processing. These processes result in much higher unit price for the surfactants. This has led to the search for a biological route. A wide variety of microorganisms have been identified that are capable of producing numerous kinds of extracellular and cell associated surface active agents when grown on specific substrates in submerged fermentation. These microbial surface active agents or biosurfactants are claimed to have a broad spectrum and, in some cases, specific functionality, rapid biodegradability i.e., environmental acceptability and possible low toxicity. A great deal of research work has been undertaken during the last decade in developing microbial surface active products, through biotechnological processes, Some of the most thoroughly characterized microbial surface active agents are the glycolipids containing hydroxy fatty acids covalently bonded to carbohydrate trehalose, rhamnose and sophorose. The production of

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World Food Day Celebrated

World Food Day (16-10-200) was celebrated at Peddashapur village, Shamshabad Mandal, Ranga Reddy District, A.P. A debate on Food for Health and quiz competition were conducted for school children. Dr. Vijaya Khader, Associate Dean, College of Home Science, ANGRAU explained the importance of World Food Day. A talk was given by Dr. G. Sarojini, Unit Coordinator, AICRP, Home Science, ANGRAU. Other staff of Department of Food and Nutrition, the MEO, village sarpanch,teachers and school children actively participated in the programme. On this occasion, an exhibition depicting the sources of various nutrients, nutritional deficiency disorders, health and hygiene was organized for the benefit of the participants.

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food biosurfactants should, therefore, be recognized as a challenging job. Thus, there is a real need for intensive investigation on selection of microbes that can utilize cheaper feed stocks and produce large quantum of broad spectrum surfactants and on developing technology for product recovery in a high state of purity. With an optimum combination of all these factors, it may be possible, in not too distant future, to switch over to food biosurfactants from the traditional synthetic surfactants.

Natural antioxidants have been extracted from plants of labiatae family out of which rosemary and sage were found to be most effective in stabilizing soybean and vegetable oils.

With, increased consumer response towards 'natural' ingredients in food systems, which are required for manufacture of 'clean label products' containing no artificial additives, more and more newer biotechnological processes will have to be employed for the production of natural food additives which are the new generation additives for foods.

Short course on "Current Concepts on Obesity and Health" 2nd - 31st August, 2000

A short course entitled "Current Concepts on Obesity and Health" was conducted from 2nd to 31st August, 2000, under the Centre of Advanced Studies, at Department of Foods and Nutrition, P.G. & Research Centre, A.N.G.R. Agricultural University, Rajendranagar, Hyderabad. The course was planned by the coordinators of the short course Dr. K. Uma Maheshwari, Assistant Professor and Dr. P. Rajya Lakshmi, Associate Professor, under the overall supervision of Dr.(Mrs.) Vijaya Khader, the Director, Centre of Advanced Studies.

The participants in the cadre of Assistant and Associate Professors from Faculty of Home Science, Department of Foods and Nutrition from UAS, Hebbal, Karnataka; Tamilnadu Agricultural University, Madurai, Marathwada Agricultural University, Parbhani; Jawaharlal Nehru Krishi Viswa Vidyalaya, Jabalpur; Acharya N.G. Ranga Agricultural University, Rajendranagar, Hyderabad, and Koti Women's College, Hyderabad attended the short course.

Topics related to different dimensions of obesity i.e., physical, physiological, metabolic, biochemical, and nutritional aspects of obesity, the health risks associated with obesity and management of obesity such as prevention, control, and therapeutic aspects were covered during the training period.

Participants were given practical exposure by arranging visits to Nature Cure Hospital; Energy Metabolism Unit at National Institute of Nutrition; Gandhi Gyan Mandir Yoga Kendra, Nutrifit - Diet and Nutrition Counselling and Fitness Clinic at Hyderabad. Further a demonstration was arranged using body composition analyzer i.e., Bodystat - 1500 at College of Home Science, Hyderabad.

The concluding session of the course was arranged on 31st August, 2000. Dr. (Mrs.) Vijaya Khader, Director, Centre of Advanced Studies, welcomed the dignitaries and the guests and also presented CAS activities. Dr. P. Rajyalakshmi, Course Coordinator, presented a brief report about the short course. Dr. K. Vijaya Raghavan, Deputy Director, National Institute of Nutrition, Hyderabad delivered the keynote address. Dr. (Mrs.) R. Vatsala, Dean, Faculty of Home Science, gave the presidential address. Dr. (Mrs.) K. Uma Maheshwari, Course Coordinator proposed the vote of thanks.

Thaumatin - a powerful natural sweetening agent

A natural protein extracted from the berry of a West African plant called the Katemfe (Thaumatococcus daniellii) plant, thaumatin is listed in the Guinness Book of World Records as the sweetest substance known, being 2000-2500 times sweeter than an 8-10% solution of sucrose. Thaumatin has four primary functions which are flavour enhancement, masking bitterness, providing better mouthfeel and providing synergy with sweeteners and other ingredients. Thaumatin, as a protein is completely digested by man and animals, which accounts for its acceptance by regulatory authorities throughout the world as a safe, natural substance; and is listed in the Generally Regarded as Safe (GRAS) list. Hence, thaumatin being a natural product, may find use in natural label products.

State Best Teacher award to Dr. Uma Reddy

Dr. (Mrs.) M. Uma Reddy, Professor, Department of Foods and Nutrition, College of Home Science, Hyderabad has received State Level best teacher award for the year 2000-2001 on September 5, 2000.

She has been teaching Foods and Nutrition courses at undergraduate and postgraduate level for the last 32 years. She has guided over 36 postgraduate students and published 40 original research papers in national and international journals. She has completed 6 research projects as principal investigator. She has developed technologies related to detoxification of aflatoxins in grains.

Earlier, she has received APAU Meritorious Teacher's award 1990, G.S. Nevetia national level award for best research publication in Journal of Oil Technologists Association of India 1995, and nominated for Women of the year 2000 by American biographical Institute for her significant contribution in the field of Foods and Nutrition.

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For any correspondence

Address to

Editor :

Dr (Mrs) Vijaya Khader

Director
Centre of Advanced Studies
Post graduate and Research Centre
ANGR Agricultural University
Rajendranagar, Hyderabad 500 030.

Issue Editor :

Dr (Mrs) Kamini Devi

Assistant Professor
Dept. of Foods & Nutrition
College of Home Science,
ANGR Agricultural University,
Hyderabad - 500 004