

DEVELOPMENTS IN FOOD SCIENCE 16

# **FUNDAMENTALS OF NEW FOOD PRODUCT DEVELOPMENT**

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## PREFACE

This book is written for people who are involved in the commercial processing of food and food products and who are active in the field of new product development or those who may be considering a venture into this complex activity. It is also intended for college and university food science or food technology students, a large percentage of whom will become involved with product development in their professional careers.

Much thought was given to the possible content of this book. Product development is an extremely broad area involving chemistry, biochemistry, nutrition, microbiology, marketing, law, economics, food science and business. The intent of the authors is to give the reader a good background in food product development by introducing the elements that must be understood to bring a successful food product to the market. These diverse elements include food constituents and functionality, ingredient functions and selection, organoleptic principles and evaluation, quality control and quality assurance, preservation, packaging, marketing, trademarks, patents and labels, regulatory aspects of food processing, and nutrition. In addition, examples of new products developed at Cornell University are discussed and formulas and procedures are described. Finally, future trends in the food industry are considered.

The authors of this book bring to it a combination of long experience in the field and recent training. As senior author, I have had 27 years of experience in product development in the university setting as well as the enriching opportunity of consulting with many commercial companies both in the United States and abroad. Dr. Kelly Robbins and Dr. Patricia Wong Hahn represent the younger generation of scientist, both well trained to handle the complexities of product development. Dr. Robbins, whose research has focused on food processing effects on nutrient availability, and factors which affect the yield and composition of poultrymeat, is on the faculty at the University of Tennessee. Dr. Hahn, who completed her M.S. and Ph.D. programs under my direction, is Senior Scientist for The Pillsbury Company where she has been involved with product feasibility, formulation, development and commercialization. Her strength is in the area of food chemistry. This blend of experience, technical training, research, and teaching has served us well in the preparation of this book.

Robert C. Baker

Ithaca, New York  
September, 1987

## IN APPRECIATION

The authors wish to sincerely thank Charlotte Bruce, Research Support Specialist at Cornell University, whose efforts have contributed to the accuracy and readability of this book. Her background as a foods person and a free-lance writer served well in the evolution from early draft to camera-ready copy. We also wish to thank her husband, Dr. Robert Bruce, Professor of Education at Cornell University, whose enthusiasm and expertise in editing and word processing and whose gift of time also contributed to the publication of this book.

We also wish to thank Dean David Call and Associate Dean Kenneth Wing of the Cornell College of Agriculture and Life Sciences for their encouragement and for allowing time to be spent in the preparation of this book.

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## TABLE OF CONTENTS

CHAPTER 1	INTRODUCTION	1
	The new food product	1
	Convenience foods	2
	Snack foods	3
	The institutional and fast-food trade	4
	The role of the food scientist	8
	The food processor and the new product	9
	Criteria for new products	10
	The market	11
	The consumer	12
	Eating patterns	12
	The psychology of buying	13
	Reaching the consumer	13
	Consumer priorities	14
	Population and food consumption	15
	Demographic shifts	16
	Changing corporate policies	18
	The world market	19
	Conclusion	20
	References	23
CHAPTER 2	BASICS OF NEW FOOD PRODUCT DEVELOPMENT	25
	Introduction	25
	Idea stage	26
	Where do the ideas come from?	26
	Sources of new food product ideas	27
	Improving the success ratio in new products	28
	Poor product performance	29
	Wrong market for company	29
	Development stage	30
	Taste-paneling stage	31
	Consumer sampling stage	31
	Shelf life stage	32
	Packaging stage	33
	Production stage	34
	Market-testing stage	34
	Commercialization stage	35
	References	36

## TABLE OF CONTENTS, continued

CHAPTER 3	FOOD CONSTITUENTS AND FUNCTIONALITY	37
Introduction		37
Proteins		37
Definition and structure		37
Physical and functional properties of proteins in foods		41
Isoelectric point		41
Denaturation		41
Gelation		41
Water-holding capacity		42
Emulsification		42
Structure		42
Foam formation		42
Fat adsorption		42
Nutritive value		42
Sources of protein		43
Effect of processing and heat treatment		44
Carbohydrates		45
Definition and structure		45
Physical and functional properties		45
Sugars		45
Starch		48
Celluloses and hemicelluloses		48
Pectins and gums		48
Sources of carbohydrates		50
Lipids		50
Definition and structure		50
Physical and functional properties of lipids		51
Melting point		51
Emulsifiers		52
Emulsions		52
Autoxidation		52
Lipolysis		52
Sources of lipids		52
Water		54
Importance of water in foods		54
References		55

## TABLE OF CONTENTS, continued

CHAPTER 4	INGREDIENT FUNCTIONS AND SELECTION	57
Introduction		57
What is a food additive?		57
Acidulants		57
Antioxidants		60
Preservatives		61
Colors		64
Certified colors		64
Uncertified colors		65
Flavors		70
Flavorings		70
Flavor enhancers and potentiators		72
Enzymes		72
Stabilizers and thickeners		74
Nutritive agents		77
Surface-active agents		78
Miscellaneous additives		79
Final note		79
References		80
CHAPTER 5	ORGANOLEPTIC PRINCIPLES AND EVALUATION	83
Introduction		83
Appearance		83
Size and shape		83
Consistency		84
Color		84
Flavor		85
The role of sensory analysis in product development		86
Sensory tests (taste panels)		86
Analytical-discriminative tests		86
Analytical-descriptive tests		88
Affective tests		88
Statistical analysis of taste panel data		90
Texture		95
Final note		98
References		98



## TABLE OF CONTENTS, continued

CHAPTER 6	QUALITY CONTROL AND QUALITY ASSURANCE . . . . .	101
Introduction . . . . .		101
Parameters of quality . . . . .		104
Food safety . . . . .		105
Samples and sampling frequencies . . . . .		108
Testing procedures . . . . .		109
Control charts . . . . .		111
Sanitation . . . . .		112
Consumer satisfaction . . . . .		113
Product withdrawal or recall . . . . .		113
Quality motivation . . . . .		115
References . . . . .		116
CHAPTER 7	FOOD PRESERVATION . . . . .	119
Introduction . . . . .		119
Refrigeration . . . . .		119
Mechanical refrigeration . . . . .		119
Circulation of air and humidity . . . . .		119
Modified or controlled atmospheres . . . . .		120
Freezing . . . . .		120
Methods of freezing foods . . . . .		120
Air freezing . . . . .		120
Indirect contact freezing . . . . .		121
Immersion freezing . . . . .		121
Heat preservation . . . . .		122
Blanching . . . . .		122
Pasteurization . . . . .		122
Batch pasteurization . . . . .		122
High temperature-short time pasteurization . . . . .		122
Canning . . . . .		123
Still retort . . . . .		123
Agitating retort . . . . .		123
Hydrostatic cooker and cooler . . . . .		123
Aseptic canning . . . . .		124
Dehydration . . . . .		124
Dehydration methods . . . . .		124
Drum driers . . . . .		125
Vacuum driers . . . . .		125
Freeze-drying . . . . .		125
Air-convection driers . . . . .		125

# TABLE OF CONTENTS, continued

## FOOD PRESERVATION, continued

Food concentration . . . . .	126
Concentration methods . . . . .	126
Intermediate moisture foods . . . . .	126
Food fermentations . . . . .	127
Food irradiation . . . . .	127
References . . . . .	128

## CHAPTER 8 PACKAGING . . . . . 129

Introduction . . . . .	129
Packaging materials and forms . . . . .	130
Rigid materials and forms . . . . .	130
Metal cans . . . . .	130
Glass containers . . . . .	133
Composite containers . . . . .	135
Semirigid materials and forms . . . . .	135
Flexible packaging materials . . . . .	136
Films . . . . .	136
Paper . . . . .	140
Aluminum foil . . . . .	141
Controlled- and modified-atmosphere packaging . . . . .	141
Aseptic packaging . . . . .	144
Retort pouch . . . . .	146
Packaging regulations . . . . .	147
References . . . . .	148

## CHAPTER 9 MARKETING . . . . . 151

Introduction . . . . .	151
Defining the consumer . . . . .	152
Defining the marketplace . . . . .	153
Defining corporate objectives . . . . .	154
What constitutes a new product . . . . .	155
New product concept testing . . . . .	156
New product market-testing . . . . .	157
Pretest market tests . . . . .	159
Market tests . . . . .	161
New product pricing . . . . .	163
Distribution . . . . .	165
Advertising and promotion . . . . .	167
References . . . . .	169

## TABLE OF CONTENTS, continued

CHAPTER 10	TRADEMARKS, PATENTS AND LABELS . . . . .	171
Introduction . . . . .		171
Trademarks . . . . .		171
Patents . . . . .		175
Labels . . . . .		177
Statement of identity . . . . .		178
Net quantity of food contents . . . . .		179
Name and address of manufacturer . . . . .		181
Ingredients . . . . .		181
Manufacturing code . . . . .		181
Nutrition labeling . . . . .		182
Grades . . . . .		182
Labeling for special dietary use . . . . .		182
Savings representations . . . . .		183
Universal Product Code (UPC) . . . . .		183
Dates . . . . .		183
Symbols . . . . .		184
References . . . . .		184
CHAPTER 11	REGULATORY ASPECTS OF FOOD PROCESSING . . . . .	187
Introduction . . . . .		187
United States Department of Agriculture . . . . .		188
Food and Drug Administration . . . . .		192
Food standards . . . . .		193
Food additives . . . . .		194
Color additives . . . . .		197
Pesticides and unavoidable contaminants . . . . .		199
Sanitation and wholesomeness in food manufacturing . . . . .		199
References . . . . .		201
CHAPTER 12	NUTRITION . . . . .	203
Introduction . . . . .		203
Nutritional quality . . . . .		205
Recommended daily allowances . . . . .		206
A balanced diet . . . . .		207
Food nutrient levels . . . . .		208
Nutrient fortification . . . . .		212
Nutrition labeling . . . . .		214
Determining nutrient content . . . . .		216

## TABLE OF CONTENTS, continued

## NUTRITION, continued

Labeling low-calorie foods . . . . .	217
Sodium labeling . . . . .	218
References . . . . .	219

## CHAPTER 13 NEW PRODUCTS FROM CORNELL: EGGS, POULTRY, AND SEAFOOD . . . 223

Introduction . . . . .	223
Egg products . . . . .	223
Frozen omelets . . . . .	224
Apple egg drink . . . . .	224
High-Pro cookies . . . . .	226
Hard-cooked egg roll . . . . .	228
Casing . . . . .	228
Production procedure . . . . .	229
Precautions in preparation . . . . .	229
Egg-crust pizza . . . . .	231
Observations on trial formulations . . . . .	231
Reheating methods . . . . .	231
Taste paneling . . . . .	234
Poultrymeat products . . . . .	235
Smoked chicken . . . . .	235
Observations on laboratory trials . . . . .	235
Chicken hash . . . . .	237
Chicken chunkalona, chicken chunk roll, and poulet supreme . . . . .	238
Chicken sticks . . . . .	242
Chicken steaks . . . . .	243
Seafood products . . . . .	245
The evolution of formulas for seafood chowders . . . . .	245
Materials and methods . . . . .	245
Starting formula for New England seafood chowder . . . . .	246
Examining clam and fat content . . . . .	246
Type and level of starch . . . . .	247
Fish and clam levels . . . . .	247
Type and level of seasonings . . . . .	247
Starting formula for Manhattan seafood chowder . . . . .	248
Tomato and tomato paste levels . . . . .	248
Fish and clam levels . . . . .	250
Further changes . . . . .	251
Final formulas . . . . .	252

## TABLE OF CONTENTS, continued

## NEW PRODUCTS FROM CORNELL, continued

Frozen minced fish . . . . .	253
Deboning machines . . . . .	253
Effect of species used . . . . .	253
Effect of phosphating . . . . .	254
The package . . . . .	254
Conclusions . . . . .	254
Seafood crispies . . . . .	254
Starting formulation . . . . .	254
Effect of species of fish . . . . .	255
Effect of type and level of texturizers and addition of clams . . . . .	255
Breeding evaluations . . . . .	255
Final formulations . . . . .	257
Canned minced fish . . . . .	257
Objectives in canning minced fish . . . . .	257
General procedures . . . . .	257
Choosing a precook method . . . . .	258
Effect of degree of cook, phosphate, and time of oil addition . . . . .	259
Optimization of amount of precook drip . . . . .	259
Addition of vegetable broth . . . . .	260
Canned red hake and pollock . . . . .	260
Treatment of fish before cooking . . . . .	260
Precooking methods . . . . .	262
Canning methods . . . . .	262
Effect of precooking method and phosphate treatment of red hake . . . . .	262
Effect of freezing red hake before canning . . . . .	264
Additional findings . . . . .	265
Recommendations for canning red hake . . . . .	265
Effect of precooking method and freezing on pollock . . . . .	266
Effect of phosphate treatment on pollock . . . . .	266
Recommendations for canning pollock . . . . .	266
References . . . . .	267

CHAPTER 14 FUTURE TRENDS . . . . .	271
Introduction . . . . .	271
Facts and trends affecting the food industry . . . . .	271
References . . . . .	

## Chapter 1

### INTRODUCTION

#### 1.1 THE NEW FOOD PRODUCT

The shelves in today's supermarkets are stocked with a variety and abundance America has never seen before. The supermarket is a consumer's paradise, offering a bewildering maze of products, each with a claim to superiority over other similar products. And each month "new" products are introduced, every one of which is designed to add variety to the average American diet or to improve its quality.

What are these new products? For the purpose of this book, Litchfield's (1967) definition will be used. A "new" product may be (a) an already existing product that has been repacked and given a new name and image, (b) an improved version of an old product that may have new packaging and/or brand name; or (c) a completely new product that serves an unmet need of the consumer.

Most new products today are variations and combinations of these classifications. Because consumers like foods to seem as "homemade" as possible, food processors may take an existing product and modify it. For example, to achieve a light, flaky pie crust, the crust may be packed separately from the filling so that all the consumer needs to do is assemble the pie and warm it.

Development of new products is a formidable task. Research to derive a suitable recipe is followed by tests, which have to consider shelf life as well as the cost of the product. Quality has to be balanced against profits, and the final decision is likely to be based on the market for which a food item is to be produced. Is it a snack food for children or a basic convenience food? Is it an entree that is meant for service in an institution or is it to be marketed as a TV dinner? Both these categories are convenience foods, though the term "convenience" is generally used to refer to the food product that the public buys for consumption at home. This is the meaning we shall use in this book except when otherwise specified. It is necessary to remember that institutions and businesses such as schools, colleges, and restaurants also use convenience foods. The only difference is that they purchase food items in different packages and in large quantities; where a homemaker may buy a bottle of ketchup a month, a restaurant may typically purchase a couple of gallons. In either case the ketchup is a convenience food.

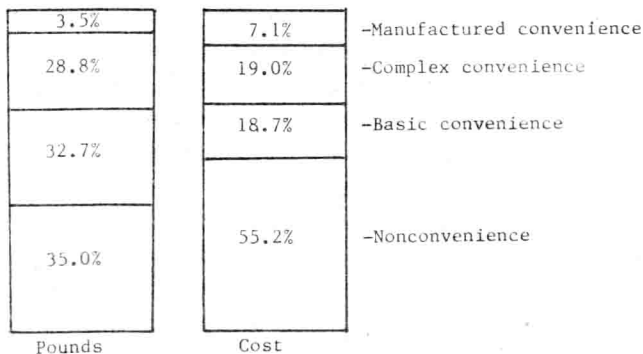
## 1.2 CONVENIENCE FOODS

As America moved from an agriculture-based society to a complex conglomeration of specialized institutions, its progress has been paralleled by the evolution of convenience foods. One of the earliest food processing techniques to create a convenience food was that of canning. This was invented by the Frenchman, Nicholas Appert, whose writings, published in 1810, described his thermal process of preserving food in glass jars. Because of the value of this method of preservation in feeding Napoleon's army, he was awarded a prize by the French government. It is a long way from the first jar of canned food to the present when approximately 45 percent of a household's food bill is spent on a vast array of convenience foods (Fig. 1.1).

The term "convenience food" has been defined in the United States Department of Agriculture Handbook (1983) as "fully or partially prepared foods which transfer significant time, culinary skill or energy from the homemaker's kitchen to commercial food processors and distributors."

The range of convenience foods, therefore, includes those that are fully prepared and have only to be warmed before being served, as well as partially prepared products such as the cake mix to which the cook has only to add milk and an egg or two. A convenience food may also be the packet of frozen peas that eliminates the tedium of growing, gathering, shelling and freezing the peas. Also included is the snack food, or food that one eats between meals.

The working mother, the traditional cook in the nuclear family, would be a very tired woman if after working outside the home she still had to prepare the family meal the way it was prepared in 1940. In the 1940s the homemaker could



Manufactured: commercially-processed foods having no home counterpart (such as ready-to-eat cereal). Complex: commercially-processed multi-ingredient mixtures. Basic: commercially-processed single-ingredient foods. Nonconvenience: fresh foods or basic processed foods used as ingredients (such as flour). Source: USDA

Fig. 1.1 Share of weight and cost of food used at home by convenience category.

buy a chicken dressed, but she probably grew the herbs she might use to season the prepared product. The dinner rolls would have to be mixed, shaped, and baked in her own kitchen. A meal would require two hours to prepare. Yet initially there was resistance to the use of convenience foods, and the feeling still persists that the home-cooked meal is superior in taste, nutrition, and visual appeal to a meal out of a box or can.

Habits are difficult to change; one is inclined to do things the way they have always been done, and the food we eat and the way we prepare it are no exceptions. Yet the pressure of time on the career person who has to shop for and prepare meals is relentless and necessitate compromises. Small inroads into the eating habits of Americans began after World War II and gained momentum as more and more women joined the work force. Skepticism over the quality of convenience foods dissipated as food items were constantly improved in response to aggressive competition.

Today the family cook spends less than half the time in the kitchen that his or her counterpart did twenty years ago. No longer is the cook embarrassed because the chicken served at dinner was prepared in a factory, the mashed potatoes were reconstituted from a box of flakes, and the dessert was similarly "prepared." The current generation is growing up accepting as normal the variety and quality of today's convenience foods.

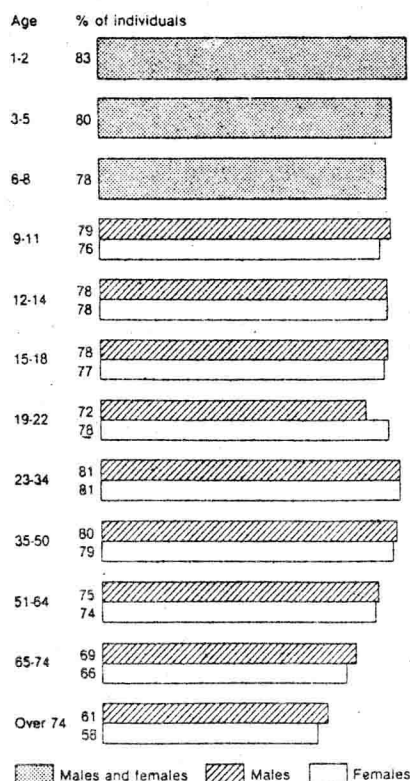
#### 1.2.1 Snack foods

This current generation is also the biggest consumer of a convenience food that has very specific characteristics of its own. This is the snack food, the success of which is probably the direct result of rising incomes. A snack used to be fruit, nuts, or homemade cookies, items bought with the week's groceries or made at home. Today, the market for snack foods is estimated to be \$9 billion, and it is growing. The major buyer of snack foods, according to studies by the Point of Purchase Advertising Institute (POPPI), is the woman visiting the market with a child. Working women buy more snacks than nonworking women, just as working women buy more convenience foods in all categories. There seems to have been less resistance to snacks than to other convenience foods, probably because they are not part of a main meal. Whatever the reason, the snack food is very much a part of the American diet.

Who eats the snacks in the family? According to the 1977-78 USDA Nationwide Food Consumption Survey (USDA, 1983), the age of snackers ranges from one to over seventy (Fig. 1.2).

Teenagers are not the primary consumers of snack foods, as one would expect; rather, that group is toddlers between the ages of 1 and 2. In the three days reported in the POPPI studies, 83 percent of these little persons snacked at least once. The next most frequent snacker is aged between 23 and 34, which is





Individuals reporting at least one snack in three days. Source: USDA Nationwide Food Consumption Survey, 1977-78, Individual Phase, 48 States, spring.

Fig. 1.2 Individuals consuming snacks.

also the group most likely to have young children. These figures correlate with the finding of POPAI that the woman visiting a store with a young child is the major buyer of snack food. Among young men and women the number of snackers remains at an average of 77 percent. Among older adults, the proportion decreases with age, the smallest being women over 74.

### 1.3 THE INSTITUTIONAL AND FAST-FOOD TRADE

Today the food-service industry ranks fourth in the amount of retail sales generated in the United States. Because of the nature of the business, it is labor-intensive, forming the largest single group in the United States work force. Its growth represents an amazing change, considering that in the 1920s