DEVELOPMENTS IN FOOD SCIENCE 16

FUNDAMENTALS OF NEW FOOD PRODUCT DEVELOPMENT

ROBERT C. BAKER

PATRICIA WONG HAHN

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ROBERT C. BAKER
Department of Poultry and Avian Sciences, Cornell University, Ithaca, New York, U.S.A.

PATRICIA WONG HAHN
The Pillsbury Company, Minneapolis, Minnesota, U.S.A.

KELLY R. ROBBINS
Department of Animal Science, University of Tennessee, Knoxville, Tennessee, U.S.A.

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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.

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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.

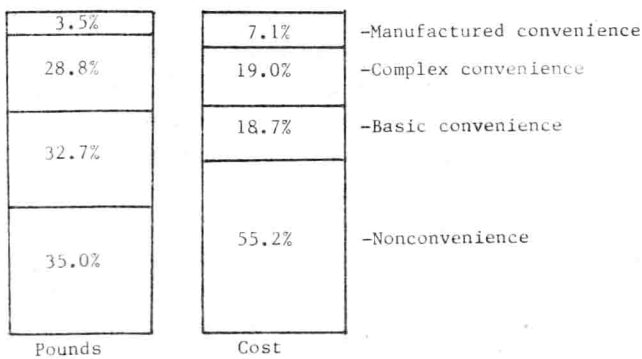
1.2 CONVENIENCE FOODS

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.

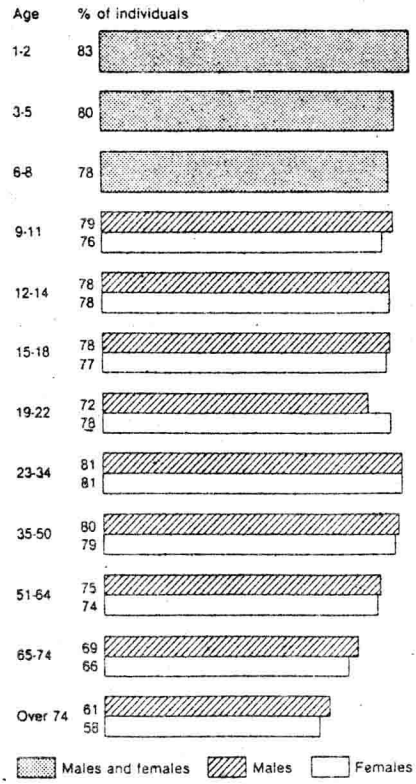
Today the family cook spends less than half the time in the kitchen that his or her counterpart did twenty years ago. No longer is the cook embarrassed because the chicken served at dinner was prepared in a factory, the mashed potatoes were reconstituted from a box of flakes, and the dessert was similarly "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 (POPAI), 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 POPAI 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