

HEATING TECHNIQUES IN DOMESTIC FOOD PROCESSING

A TEXT FOR ADULT EDUCATION

by

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ABSTRACT

The purpose of this study was to prepare curriculum materials for an avocational program in adult education on the heating and cooking techniques of domestic food processing. The material was developed as a teaching device (text) to be used in an adult education program or as a self study program for adults who had never cooked.

The text departed from the conventional development of food text materials. It is customary to proceed from the food to the method of preparation. This text began with the method and applied it, wherever possible, to each of six natural foods. These foods were meat, poultry, fish, vegetables, fruit and eggs. It was felt that this presentation would provide the adult learner with the means of achieving his immediate practical objectives more readily than the conventional presentation.

In addition to developing curriculum material for an avocational program on the heating and cooking techniques of domestic food processing the study served to examine the cooking repertoire of Canada and the United States. By means of deduction it became apparent that certain valuable areas of cookery have been neglected in Canadian and American cuisine. This was particularly evident in vegetable cookery. A method of preparing chicken by poaching was also found to have been largely overlooked in Canadian and American cook books.

The text was developed from a conceptual classification designed especially for this study. The classification depicts the whole field of food processing starting with food in its natural state and following it through the various processes to the stage at which it is ready for consumption. It begins by showing the six food processing techniques of preparation and preservation. These are; (1) Sub-division and

fractionization, (2) combining and mixing, (3) heating and cooking, (4) removal of heat and freezing, (5) use of chemical agents, (6) use of microorganisms. The heating and cooking technique is further classified according to media of heat transfer. These are; (1) water, (2) steam, (3) air, (4) fat, (5) combinations of these media. The media classification is sub-divided into methods of cooking. When water is the medium of heat transfer the cooking methods are boiling, simmering, poaching and stewing; when steam is the medium the methods are steaming, waterless-cooking and pressure-cooking, when air is the medium the methods are broiling and roasting or baking, when fat is the medium the methods are pan-frying, deep-fat frying, sautéing and pan-broiling; when a combination of media are used the methods are braising and pot-roasting. The methods may also be classified as moist heat methods, dry heat methods and combination methods.

The text was divided into five units as chapters, each chapter dealing with one medium of heat transfer. Each chapter gave definitions of each cooking method as well as description of its use with six natural foods. The foods chosen for this study were meat, poultry, fish, vegetables, fruits and eggs. If the method could be applied to these foods it was described in detail and a basic formula was developed. These basic formulae are steps of procedure which are used by experienced cooks to achieve predictable results. At the end of each chapter an appraisal of the method was made. Learning experiences were also suggested which would enable the adult learner to assess his own progress and achievement. Solutions to problems were given.

Every effort was made to familiarize the adult learner with the

basic principles of food preparation. It was felt that the intelligent performer of a skill is one who understands "why" as well as "how" a procedure is followed.

It was also felt that if the adult learner was given an understanding of basic methods, basic formulae and essential skills he would be equipped to use recipes intelligently.

This study was conceived as one unit in a broader curriculum which would embrace all six techniques of domestic food processing,

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CHAPTER I

INTRODUCTION

Although many courses dealing with food preparation are offered to adults by institutions providing adult education programs, there is a notable lack of appropriate teaching devices (texts) written especially for the adult learner. Instructional agents who teach these non-credit avocational courses usually select their own materials which have been developed for use in rigid credit courses in a formal curriculum. A text has not been designed to meet the immediate practical needs of the adult learner. Presently a text on basic food preparation written especially for adults is not available for public school adult education programs in British Columbia.

I. THE PROBLEM

Statement of the Problem.

A text designed for the adult learner in an adult education program must take into consideration the differences which exist between the pre-adult student following a prescribed course of study in the public school system, the adult receiving training in a professional institution and the adult student whose enrollment in a program is subsidiary and supplemental to his primary vocational role. The adult in the adult education program may be motivated by a feeling of inadequacy in his ability to perform tasks which are expected of him in a new social role. His interest may be motivated by special problems, responsibilities, needs, curiosities or ambitions. As a result he may be receptive to information which is directly related to the fulfilment of his particular goals. A text for

the adult must provide material for new learning which meets the immediate practical objectives of the learner.¹

A course on basic food preparation could be of interest and could conceivably meet the needs of adults assuming new societal roles. Selected examples might be:

1. The young adult who has just left home and is living by himself.
2. The retired man who has lost a spouse.
3. The professional person who wishes to engage in a hobby.
4. The young married person who has never cooked.

There should be recognition of the educational differences which exist between the adult learner in the formal academic institution and the adult in the adult education program. Some of the students who attend the adult education classes will have had little training in the sciences, whereas chemistry, biology and physics are prerequisites for food courses offered by colleges and technical schools. Although food preparation is firmly based on scientific principles allowances must be made for the probable disparity in educational background of a heterogeneous group subscribing to adult education courses. However, if the adult learner is given an understanding of basic principles of cooking, basic methods and essential skills he should have the foundation for making sound judgments and for applying appropriate skills whenever he is confronted with cooking tasks in his everyday life. He will also have acquired the basic knowledge on which to build more advanced and complex learning and skills.

Since learning is facilitated when the learner is aware of his progress some provision must be made for him to measure his knowledge and level of performance.

This study will endeavour to design a teaching device (text) which will meet the special requirements of the adult learner.

Need for the study.

In researching the literature the author has located excellent texts dealing with food preparation which have been written for the instruction of nutritionists, dietitians, food technicians, nurses, chefs, bakers and other commercial, industrial and hospital food-service personnel as well as many texts written for use of pre-adult students at the high-school level. However, for the adult whose interest in food preparation is avocational rather than vocational a text has not been designed for use in the non-credit formal instructional setting. There is no shortage of cook-books, recipe-books, magazines and pamphlets, as well as newspaper and magazine articles which furnish valuable resource material. However, these often tend to be collections of recipes with limited explanatory content and they do not provide the rationale for specified procedures. These resources are valuable to the experienced cook whereas the uninitiated may find them difficult to follow. The latter's difficulty arises from the fact that he does not have the necessary knowledge of basic principles, methods, skills and vocabulary.

The need exists for a text on the subject of food preparation which is designed especially for the adult who wishes to learn how to cook.

Purpose of the study.

The purpose of this study is to design an instructional device (text) especially for the use of the adult in an adult education program. It is intended for use in the following formal instructional settings:

1. A night school course under the direction of an instructional agent meeting for two hour sessions once a week for twenty weeks.

2. A similar course given by (a) A Home Demonstration Agent, (b) A Woman's Institute Agent, (c) An Agriculture Departmental Agent, (d) A University Extension Agent.

Although it is conceived as a device (text) to be used in a formal instructional setting under the direction of an educational agent using the seminar, demonstration, and laboratory techniques, it could also be used as a self-teaching device for adults who wish to gain some understanding of cooking theory and procedures on their own. It will therefore endeavour to incorporate some of the techniques peculiar to programmed learning and will offer ample opportunity for reinforcement of learning as well as feedback on achievement.

It could also serve as a manual to be used with recipes. It will not contain recipes but will supply formulae into which recipes fit. It will define the various cooking methods, provide basic formulae for using these methods with meat, poultry, fish, vegetables and, wherever practical, with eggs. The teaching device will include an appendix with tables of cooking temperatures and times, a glossary of cooking terms and supplemental material on heat exchange and transfer.

II. DEFINITION OF TERMS USED

As used in the context of this text the following terms are defined;

Food processing. This term will refer to all the techniques used in the alteration of natural foods.

Cooking. This term is used when "heating affects the entire mass of food. The changes produced in food by heat depend upon such factors as the method of heat transfer, the time of heating, and the temperature

TABLE I

FOOD PROCESSING PREPARATION AND PRESERVATION

Subdivision and Fractionization	Combining and Mixing	Heating and Cooking	Removal of Heat	Use of Chemical Agents	Use of Microorganisms
<hr/>					
Media:		Techniques of Heating and Cooking			
Water	Steam	Air	Fat	Combination of Media	
1. Boiling	1. Steaming	1. Broiling	1. Pan Frying	1. Braising	
2. Simmering	2. Waterless Cooking	2. Baking	2. Deep Fat Frying	2. Pot roasting	
3. Poaching	3. Pressure Cooking	of	3. Sauteing		
4. Stewing		Roasting	4. Pan broiling		
Moist Heat Methods			Dry Heat Methods		Combination Methods

Note: This outline represents the classification of food processing techniques¹, the classification of cooking techniques according to the media of heat exchange employed² and the classification of cooking methods within each medium group.³ Cooking methods may also be classified as dry heat methods, moist heat methods and combination methods.⁴

1. Marion Deyoe Sweetman, Ingeborg MacKellar, Food Selection and Preparation, N.Y., John Wiley & Sons, Inc., 1954, p. 138.

2. Ibid., p. 145.

3. Ibid., pp. 145-50.

4. Ibid., p. 405

Osee, Hughes, Introductory Foods, N.Y., The MacMillan Co., 1962, pp. 157, 192, 202.

Carl A. Rietz, Jeremiah J. Wanderstock, A Guide to the Selection, Combination and Cooking of Foods, Westport, Conn., 1965, pp. 14, 113-28.

reached on the surface and within the mass of food, as well as upon the nature of the food itself."²

Method. In general methods of cooking are divided into five classes according to the cooking medium employed for heat transfer. These media are (1) water, (2) steam, (3) air, (4) fat and (5) a combination of these media. They may also be classified as dry heat methods and moist heat methods.

Basic principles of cooking. This term refers to established cooking procedures which bring about predictable modifications in natural and processed food.

Formula. A procedure understood by practitioners in a field as stipulating certain routine steps. It is based on classic, academic, conventional procedures. A recipe derives from a formula.⁴

Recipe. A prescription, i.e., an order written by an individual. It is a specification as to type and amount of ingredients, manipulative procedures and cooking conditions.³

III. LIMITATIONS OF THE STUDY

This study will be limited to the heating techniques of food processing. It will not deal with the other five techniques shown on Table I. The text will not deal with nutrition, nor will it deal with selection and purchase of food and food-stuffs. It will not contain recipes but will give basic formulae from which recipes are derived.

IV. DESIGN OF THE STUDY

This study which is a text on basic food preparation will depart from the conventional presentation of material. It is customary for texts which are intended for use by professional and pre-adult students to deal with the different foods in turn and to indicate which cooking methods are applicable to each. This text will develop each cooking method and will

discuss the way in which it may be applied to the six types of natural food to be considered in the text. The methods to be developed are; boiling, simmering, poaching, stewing, steaming, waterless-cooking, pressure-cooking, broiling, baking or roasting, pan-frying, deep-fat frying, sauteing, pan-broiling, braising and pot-roasting. The foods which will be considered are meat, poultry, fish, vegetables, fruit and eggs.

This text will focus on basic cooking principles, basic methods of cooking, basic formulae, and essential skills. When these are mastered they can be used in an endless variety of ways. They are also the necessary prerequisites for more complex cooking knowledge and skills. The heating and cooking methods are applicable not only to natural foods, which are the concern of this text, but to many processed and combined foods e.g., when the student has learned to steam vegetables he has mastered the knowledge and skill which is essential to all steaming whether it be a processed food such as rice, or a mixture such as Christmas Plum Pudding.

The content of the text will be organized in a manner consistent with adult educational theory. It will be developed in sequential order proceeding from the known to the unknown, and from the simple to the complex. All methods using the same medium of heat transfer will be presented together e.g., those using steam -- steaming, waterless-cooking and pressure-cooking. There are four cooking media viz. water, steam, air and fat. Each will be presented in turn and applied to each of the foods under discussion. When these have been defined, discussed and presented in formula form the learner will be guided to a more complex cooking method viz. braising, which utilizes two of these cooking media.

The text will include suggested learning experiences after each chapter. It will supply the learner with an appropriate solution to each problem and

will refer him back for review if he has not mastered the content of the chapter.

The educational objectives will be clearly stated for the entire course as well as for each chapter. Owing to the design of the text these objectives will fall mainly into the Cognitive Domain and Psychomotor Domain. Using Popham's⁵ adaptation of Bloom's Taxonomy of Educational Objectives⁶, suggested learning objectives for this material are;

- | | |
|---|---|
| Cognitive Domain
Recall
Comprehension | (a) Learner will be able to define the various cooking methods, i.e., boiling, steaming, broiling, baking or roasting, frying, braising etc., |
| Cognitive Domain
Recall
Comprehension | (b) Learner will be able to tell what is meant by various cooking terms learned during the course, <u>e.g.</u> , sear, poach, par-boil, baste etc., |
| Cognitive Domain
Recall
Comprehension
Analysis
Psychometer Domain | (c) Given a main course recipe learner will be able to tell the formula from which it derives and to prepare it. |

ORGANIZATION OF THE STUDY

The study will be developed in the following chapters:

- | | |
|-------------|---|
| Chapter II | Cooking Methods using Water as
Medium of Heat Transfer |
| Chapter III | Cooking Methods Using Steam as
Medium of Heat Transfer |
| Chapter IV | Cooking Methods Using Air as
Medium of Heat Transfer |
| Chapter V | Cooking Methods Using Fat as
Medium of Heat Transfer |

Chapter VI

Cooking Methods Using a Combination

of Two or More Media of Heat Transfer

Chapter VII

Summary

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3. Carl A. Rietz, A Guide to the Selection, Combination and Cooking of Foods, Vol. II, Westport, Conn.: The Avi Publishing Co., 1965, p. 15.
Gladys T. Stevenson, Cora Miller, Introduction to Food and Nutrition, New York: John Wiley and Sons, Inc., 1960, p. 31.
4. Ibid., p. 5-6.
5. James W. Popham, Systematic Instructional Decision Making, Film-strip Tape Program, Los Angeles, California: Vimcet Association, 1967.
6. Bloom, Benjamin S., Taxonomy of Educational Objectives, New York: David McKay Company, Inc., 1956.

CHAPTER II

COOKING METHODS USING WATER AS THE MEDIUM OF HEAT TRANSFER

Introduction to Instructor.

As its learning objectives this chapter will require the adult learner to list and describe the four cooking methods which employ water as the means of heat transfer. He will be required to list and discuss the application of these methods in the preparation of food. He will be required to use these methods in the preparation of a meal.

Introduction to Learner.

The four cooking methods which employ water as the means of cooking food are boiling, simmering, poaching and stewing. This chapter will define and discuss each method as it may be applied to meat, poultry, fish, vegetables, fruit and eggs. The basic formula for each method will be developed.

Boiling. Boiling is a moist heat method of cooking in which water or another liquid is the medium of heat transfer. The food is cooked in a bath of boiling water or other liquid. The boiling point can be recognized by the presence of bubbles of steam which rise to the surface of the liquid and break. Boiling occurs in water at a temperature of 212°F .

Simmering. Simmering is a moist heat method of cooking in which water or another liquid is the medium of heat transfer. The food is cooked in a bath of simmering water or liquid. Simmering occurs at a lower temperature than boiling. It is recognized by the appearance of tiny bubbles of steam which form slowly and break before they reach the surface of the liquid. In

water simmering occurs between the temperatures of 180° and 210°F.

Poaching. Poaching is a moist heat method of cooking in which water or another liquid is the medium of heat transfer. The food is cooked in a bath of simmering water or liquid. The term 'poaching' implies that the food is basted with the hot liquid. This may be done by pouring some of the hot liquid over the food by means of a ladel or spoon, or it can be achieved by covering the cooking utensil with a tight-fitting lid and allowing the steam which rises and condenses on the lid to perform a self-basting action.

Stewing. Stewing is a moist heat method of cooking in which water or another liquid is the medium of heat transfer. The food is cooked in just enough simmering liquid to produce steam. The cooking utensil is covered with a tight-fitting lid which holds the steam in and prevents the escape of moisture. This is a slow cooking process and is used for foods which require long, slow, moist cooking.

Methods of Cooking Meat in Water.

Moist heat methods of cooking serve to soften the connective tissue of tough cuts of meat and thus render them more digestible and palatable. The moist heat methods of cooking meat which utilize water or another liquid as the medium of heat transfer are simmering and stewing. The boiling method does not apply to meat cookery.¹ At boiling temperature meat fibers separate and the meat loses juice, shrinks and becomes drier and harder.

Simmering Meat. Simmering is frequently used in the cooking of the tougher cuts of meat i.e., brisket, flank, etc. Another use of simmering is in the preparation of cured meats i.e., corned-beef, smoked or cured hams and tongue. In the simmering process the meat is generally left in a large

piece, placed in a large quantity of boiling water, seasoned and simmered until tender.²

Basic Formula for Simmering Meat.

1. Wipe meat with a clean, damp cloth.
2. Have large quantity of boiling water in a large container or kettle.
3. Add meat to the boiling water.
4. Season.
5. Simmer until tender.

Stewing Meat. Stewing is a method which is often used for less tender cuts of fresh meat i.e., round, flank, plate, brisket, etc. In stewing the meat is first cut into uniform pieces, generally 1 or 2 inch cubes. If a brown stew is desired the cubes are browned in a little hot fat. They are placed in a stewing kettle and covered with water or other liquid. The liquid may be either hot or cold. The liquid may be stock, wine, or water or a combination of two or more of these liquids. Seasoning is added and the liquid is brought to a boil. The pot is then covered and the heat is reduced to simmer. The meat is cooked until tender, usually from one to three hours. Vegetables may be added toward the end of the cooking if desired.³

Basic Formula for Stewing Meat.

1. Wipe meat with a clean damp cloth.
2. Cut into uniform pieces, generally 1 or 2 inch cubes.
3. If a brown stew is desired brown meat in a little hot fat.
4. Place meat in a stewing kettle.
5. Cover with water or other liquid. Water or liquid may be hot or cold.

6. Add seasoning.
7. Cover kettle and cook at simmer temperature.
8. Cook until tender, approximately one to three hours.

Making Soup or Soup Stock. Another application of this stewing method of cooking meat is the making of soup or soup stock. Meat stocks and soups are made by cooking meat and meat bones, vegetables and seasonings in water. Meat used for soup or stock is usually from the tougher cuts which are, of course, the cheapest. The meat is cut from the bone and cut into small cubes. The bones are also cut into short lengths. The object is to expose the maximum surface to the water in order to extract all the flavor. If a brown soup or stock is desired the meat and bones are first browned in hot fat. They are covered with cold water and salt is added. The important difference between simmering or stewing meat and making soup is that the water which is added is always cold water. Boiling water would seal in the juices and the purpose of making soup is to extract the juices from the meat. The water is brought to the simmer point and cooking is continued for several hours, usually three to four hours. Vegetables are added when the meat begins to become tender. The stock, meat and vegetables may be used for soup. For vegetable soup the meat and bones are removed leaving the stock and vegetables. If stock is wanted it is drawn off from the meat, bones and vegetables.⁴

Basic Formula for Meat Soup or Stock.

1. Cut meat from bones. Cut bones into short lengths and meat into 1 or 2 inch cubes.
2. If a brown soup or stock is desired brown the meat and bones in hot fat.

3. Cover with cold water.
4. Heat to simmer point.
5. Simmer for several hours, usually 3 to 4 hours.
6. Add chopped vegetables when meat begins to get tender.
7. The stock, meat and vegetables may all be used for soup,
or the stock and vegetables may be used for vegetable soup.
If stock alone is wanted it should be drawn off from the
bones, meat and vegetables.

Methods of Cooking Poultry in Water or Another Liquid.

Mature birds are likely to be tough and should therefore be cooked slowly in moist heat in order to soften the connective tissue. Stewing of poultry is a very common practice. Another method of cooking poultry in liquid is poaching and this is frequently overlooked in many cook books.

Stewing Poultry. The bird may be cooked whole but is usually disjointed. It may be browned in hot fat if a brown stew is desired. The pieces are placed in a stewing kettle and hot water or other liquid is added to cover them. Seasonings, including 1/2 teaspoon of salt per pound of fowl, are added and the liquid is brought to a boil. The kettle is tightly covered and the heat reduced to simmer. The bird is simmered until tender, about 2 hours. Vegetables may be added toward the end of the cooking period. The broth may be thickened if desired.⁵

Basic Formula for Stewing Poultry.

1. Prepare the bird for cooking.
2. Brown in hot fat for a brown stew if desired.
3. Place fowl in a stewing kettle.

4. Cover with boiling water or other liquid.
5. Add seasoning and 1/2 teaspoon of salt per pound of fowl.
6. Cover kettle tightly.
7. Bring liquid to a boil.
8. Reduce heat to simmer.
9. Cook until tender, usually 2 hours.
10. Add vegetables, if desired, toward the end of cooking time.
11. Thicken broth if desired.

Poaching Poultry. Very few American or Canadian Cook books provide recipes for this method of cooking poultry. However there are a number of Continental recipes from which to derive a formula. The bird may be cooked whole or may be disjointed. If whole, it is prepared for cooking by stuffing if desired and trussing. The bird is placed in a deep kettle and covered with boiling chicken stock or boiling water to which may be added onions, celery, carrot, bay leaf, thyme, parsley and peppercorns in various combinations. The kettle is covered tightly and the fowl is simmered until tender. Tenderness is judged by testing the dark meat with a fork. The chicken is removed from the kettle and the broth is strained through a fine sieve or cheesecloth. The chicken may be served with the broth in large soup bowls or the broth may be served first as a soup course and the chicken served separately, or the pieces may be served with a sauce. Another variation is to add vegetables such as onions and carrots during the last hour of cooking and to serve them with the chicken.⁶

Basic Formula for Poaching Poultry.

1. Prepare poultry for cooking.
2. Stuff if desired. Close cavity securely.

3. Truss whole bird firmly to ensure that it holds its shape during cooking.
4. Place in a deep kettle.
5. Cover with chicken stock or boiling water to which have been added vegetables, herbs and spices.
6. Cover kettle tightly.
7. Simmer bird until tender.
8. Remove from kettle and keep hot.
9. Strain broth.
10. Serve chicken and broth together or serve broth first and chicken separately.

Methods of Cooking Fish in Water or Another Liquid.

The best method of cooking fish in water or another liquid is by poaching. The liquid most frequently used is called a 'court bouillon.' This is a mixture of water, wine or vinegar, onion and other vegetables, herbs and spices.⁷

Poaching Fish. Whole fish, fillets and steaks may all be cooked by the poaching method. The fish is tied loosely in cheese-cloth and lowered into a bath of boiling water, other liquid or court bouillon. The heat is reduced to simmer and the kettle is kept tightly covered. The fish is cooked until tender. 10 minutes cooking time for each inch in thickness of fish should be allowed,⁸ or 8 to 10 minutes for each pound of fish.⁹

Basic Formula for Poaching Fish.

1. Tie the fish loosely in a cheese-cloth wrapping.
2. Lower it into boiling liquid. This may be boiling water, court bouillon, or other liquid.

3. Reduce the heat to simmer.
4. Cover kettle tightly.
5. Simmer until fish flakes readily when tested with a fork.

Allow 10 minutes cooking time for each inch in thickness of fish, or 8 to 10 minutes for each pound of fish.

6. Remove fish from water and from cheese-cloth very carefully to avoid breaking.

Methods of Cooking Vegetables in Water.

Boiling is one of the most common methods of cooking vegetables. Most vegetables should be cooked gently in a small amount of boiling water in a covered sauce-pan. Salting should be done at the beginning of the cooking period. There are some exceptions which are;

(1) Strong-flavored vegetables such as cabbage, brussels sprouts, broccoli, cauliflower, turnips and rutabagas should be cooked in water which covers them. They should be cooked in an uncovered sauce-pan to allow strong volatile flavors to escape in the steam. They should only be cooked until tender since the strong flavors increase with long cooking.¹⁰

(2) Green colored vegetables such as peas, green beans and the leafy vegetables such as spinach should be cooked in boiling water which just covers them. The pan is kept covered until the vegetable is heated through to allow some of the mild acids to escape in the steam, then the cover is removed for the remainder of the cooking.

(3) Yellow and white vegetables should be cooked in enough water to cover them since they require a longer period of cooking than other vegetables. The pan is kept covered throughout the cooking period.

Time charts for cooking vegetables are located in the appendix of

the text.

Basic Formula for Cooking Vegetables.

1. Have recommended amount of boiling salted water in sauce-pan.
2. Place the vegetables in the boiling water.
3. Cook strong flavored vegetables in an uncovered pan.
Cook yellow and white vegetables in a covered pan.
Cook green vegetables in a covered pan until heated, then
remove cover for remainder of cooking.
4. Keep the heat high until the boiling resumes.
5. Count the cooking time from when the water resumes boiling.
6. Turn heat down so the water boils gently.
7. Cook until tender. Drain well.

Methods of Cooking Fruit in Water or Another Liquid.

The methods of cooking fresh fruit in which water or another liquid is the medium of heat exchange are stewing and poaching. These methods are used for making fruit purées, sauces and compotes. A purée is a smooth soft sauce which has been pressed through a fine sieve or food mill or put through a blender. The word compote denotes a preparation of fresh or dried fruits cooked either whole or quartered in a thick or thin syrup. A minimum of water is used in each case and the fruit is simmered in a covered container. This preserves the valuable volatile flavors of the fruit. Fruits which are required to hold their shape after cooking are cooked in a sugar solution i.e., water to which sugar has been added. These fruits should not be stirred. Fruits which are not required to hold a definite shape when cooked should be cooked quickly in a small amount of water to soften the cellulose and the sugar should be added at the end of the cooking time. These fruits can be used as they are, or they may be

put through a sieve or an electric blender to make a purée.¹¹

Basic Formula for Cooking Fruit in Water.

1. Prepare fruit for cooking.
2. Peel and cut as directed in recipe.
3. Place in a shallow sauce-pan with a small amount of water, or water and sugar. If making a sauce or puree add sugar at the end of cooking. If making a compote add sugar at the beginning of cooking.
4. Cover sauce-pan.
5. Simmer until soft, or in the case of compote until fruit is clear and translucent.
6. Strain if a purée is desired.

Methods of Cooking Eggs in Water.

The methods by which eggs may be cooked in water are simmering and poaching. The boiling method does not apply to egg cookery. One basic principle which holds with all egg cookery is that eggs should always be cooked with low to moderate heat and for exactly the time specified in a given recipe. If this principle is ignored and eggs are cooked at a high temperature the result is that the protein coagulates to a degree which produces a firm, tough, often rubbery product rather than a tender one.¹²

Eggs which are to be served in the shell should be cooked to a stage in which the white is tender and the yolk is liquid or semi-liquid. There are two methods of soft-cooking eggs in the shell.

Method No.1 for Soft-Cooked Eggs in the Shell. Water should be boiling rapidly. The eggs are added to the boiling water and the heat is turned off. The saucepan is covered and the eggs are allowed to remain in the water for 4 to 6 minutes, depending upon the degree of firmness desired.¹³

Method No.II for Soft-Cooked Eggs in the Shell. The water should be at the simmering stage. The eggs are added and the water maintained at simmering temperature for 4 to 6 minutes.¹⁴

Basic Formula for Soft-Cooked Eggs.

1. Add eggs to boiling or simmering water.
2. Maintain water at simmering.
3. Allow eggs to remain in water for 4 to 6 minutes depending upon firmness desired.

There are three methods for hard cooking eggs in the shell. Method No.I and Method No.II follow the same methods as for soft-cooked eggs allowing the eggs in the case of Method No.I to stand in a warm place for 45 minutes to 1 hour, and in the case of Method No.II to remain in water over a double boiler for about 45 minutes. The water in the bottom of the double-boiler is kept simmering. Method No.III simmers the eggs in water over direct heat for 20 to 25 minutes.¹⁵

On removing hard-cooked eggs from the water they should be plunged immediately into ice-cold water. This stops the cooking process and aids in the prevention of the unsightly dark green deposit which tends to form on the outside of the cooked yolk.¹⁶

A properly hard-cooked egg should have a white which is firm, yet tender. The yolk should be dry and mealy. If the yolk appears waxy it is insufficiently cooked.¹⁷

Poaching Eggs in Water or other Liquid.

In poaching eggs a flat shallow pan should be used. Enough hot liquid to cover the eggs is poured into the pan. The liquid may be hot water, milk or cream. If the liquid is water it is necessary to add 1/2

or 1 teaspoon of salt to each pint of water. This tends to keep the egg white from dispersing and results in a more compact product. If milk or cream are used they should be heated in the top of a double-boiler. Eggs are broken gently into a saucer, one at a time, then slipped, one at a time, gently into the hot liquid. The heat is reduced to simmering and the eggs are basted with the hot liquid by means of a spoon or ladel. This ensures coagulation of the film of egg-white on top of the yolk and the result is more pleasing to the eye. The eggs are cooked until set. The egg white should be jelly-like and tender, the yolk will be liquid or semi-liquid. The eggs should be removed from the liquid with a slotted spoon.¹⁸

Basic Formula for Poaching Eggs.

1. Use a flat shallow utensil such as a frying-pan.
2. Add sufficient boiling liquid to the pan to cover the eggs.
3. Have the liquid at the boiling point.
4. Break eggs gently into a saucer, one at a time.
5. Slip, one at a time, gently into the hot liquid.
6. Reduce heat to simmer.
7. Baste eggs with the hot liquid to ensure coagulation of the film of egg-white on top of the egg-yolk.
8. Cook eggs until set.
9. Remove from liquid with a slotted spoon.

Appraisal of Cooking Methods Using Water as Medium of Heat Transfer.

The advantages of these methods to the cook are their ease of application, the relatively low cost of heating small quantities of water, and their practicality with all types of natural foods. It is comparatively

easy to cook food in water and the equipment required is minimal—a burner and a cooking utensil are all that are necessary. It is less expensive to heat a quantity of water sufficient to cook a food than to heat the average oven. Most natural foods and many processed foods may be cooked in water and the skill is not very difficult to acquire. Cooking in water is less time consuming for foods such as vegetables and fruits.

The changes which are desirable are the softening of tough connective tissue in meat and poultry, the coagulation of proteins in meat and fish and eggs, the softening of cellulose and the partial or complete gelatinization of starch involving swelling of starch grains in vegetables and fruits.

The disadvantage of using water as a cooking medium is that some water-soluble constituents tend to be lost. These are valuable minerals and vitamins, albumin and sugars. Flavor is also affected in various ways; an open kettle allows some of the volatile flavor substances of vegetables to escape; sugars, acids and some minerals which contribute to flavor in vegetables and fruit are water soluble and may be lost through cooking in water. Changes may also occur in color which make the cooked product unpleasing to the eye.¹⁹

The disadvantage of nutritive loss may be partially off-set by using the water or liquid in which the foods have been cooked for sauces or soups. Flavor losses may be reduced by cooking in covered containers.

The learner will have noted that the various formulae although similar in many respects, differ greatly in the time factor. It takes several hours to simmer a fowl whereas an egg requires a very few minutes.

In each case it is necessary for the adult learner to analyse the purpose of the particular method in its application to various foods. The

purpose in simmering or stewing tougher cuts of meat or poultry is to soften the tough connective tissue and make the meat more digestible and palatable. This requires long, slow, moist cooking. The purpose of cooking vegetables and fruit is to soften the cellulose, change the texture and reduce the bulk, as well as to retain the natural color and flavor. This process does not take as long and can usually be accomplished in 40 minutes at the most. The purpose of cooking eggs is to coagulate the protein and to change the texture. This requires very much less time. In cooking fish the purpose is similar to that of eggs, i.e., to coagulate the proteins and to change the texture as well as to retain the flavor. There is a negligible amount of connective tissue in fish which has to be broken down so the purpose is different from that for meat. The learner may have noticed similarities in the cooking of fish and eggs.

When the adult learner has acquired the skill and knowledge of the methods of simmering, poaching and stewing he will be able to use them in more complex procedures. Some more complex cooking processes require the cook to apply two or more methods. This is so in the case of braising which is usually a combination of frying and simmering.

SUMMARY

This chapter has discussed the four methods of cooking which employ water or other liquid as the medium of heat transfer. These methods are boiling, simmering, poaching and stewing. Each has been defined and the actual procedural steps involved have been given. Equipment used in these methods has also been described.

It has been pointed out that these moist heat methods serve a useful purpose in softening connective tissue in tough cuts of meat and poultry, in coagulating proteins in meat, fish and eggs, and in softening cellulose and swelling the starch in vegetables and fruits. The advantages and disadvantages of cooking food by these methods have been discussed with relation to texture, flavor, and color as well as with relation to retention of valuable food nutrients including vitamins and minerals. The disadvantages in many cases can be minimized by observing certain rules and these have been described.

Boiling is a method which has limited application in the cooking of most natural foods; simmering, poaching or stewing are usually preferable. The boiling method is used mainly for the preparation of vegetables. The method has been described as it applies to the various vegetables, i.e., strong and mild flavored, red, green, white and yellow. A basic formula for using this method with these vegetables has been given.

The simmering method has a wide application in the cooking of foods. It is used for meat, poultry, fish, fruit and eggs. Its application with each of these foods has been described and basic formulae developed.

The poaching method may be used with poultry, fish and eggs. The cooking procedures using this method with these foods have been described

and basic formulae given.

The stewing method may be applied to meat, poultry and fruit. The procedures have been discussed for each of these foods and basic formulae have been prescribed.

An appraisal of the value of these methods in the preparation of natural foods has been made. Their use in more complex methods of cooking has been indicated.

SUGGESTED LEARNING EXPERIENCES

1. What inexpensive main course dishes might you prepare using the simmering method of cooking?
2. Cabbage and brussel sprouts often taste unpleasantly strong when cooked. What can be done to minimize this?
3. You need some hard cooked eggs to garnish a salad. How would you cook them to avoid dark, greenish rings between the yolks and whites?
4. Using the Bantam edition of the Fannie Farmer Boston Cooking School Cookbook prepare the following meal;

Irish Lamb Stew	p. 186
Buttered peas	p. 263
Apple-sauce with cream	p. 366

SOLUTIONS TO PROBLEMS

1. Meat and poultry stews are economical. The cheaper cuts of meat, i.e., beef brisket, pig's knuckles, oxtails, poultry backs and many other unusual and inexpensive cuts are very flavorful when cooked by slow moist heat methods. Simmering and stewing are economical methods of cooking. Once the liquid has been brought to the boil it takes relatively little heat to keep it at the simmer point.
2. These strong flavored vegetables should not be overcooked because they develop strong flavor and odor with long cooking. They should be cooked just enough to render them tender in boiling salted water just covering them. They should not be cooked in a covered utensil.

3. Use whichever of the three methods for hard cooking eggs you prefer and immediately after cooking immerse the eggs in ice cold water. This stops the cooking process and helps to prevent the formation of the chemical compound that results in the greenish black ring between the egg yolk and egg white.
4. The apple-sauce can be cooked several hours in advance of serving time and chilled in the refrigerator. The lamb stew will take approximately $1\frac{1}{2}$ hours to cook. The green peas will take from 8 to 20 minutes. Preparation time before actual cooking should require about half an hour.

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CHAPTER III

COOKING METHODS USING STEAM AS

THE MEDIUM OF HEAT TRANSFER

Introduction to Instructor.

As its learning objectives this chapter will require the adult learner to list and describe the three cooking methods which employ steam as the means of cooking food and to list and discuss the application of these methods in food preparation. He will be required to use these methods in the preparation of a meal.

The three cooking methods which employ steam as the means of cooking food are steaming, waterless-cooking, and pressure-cooking. This chapter will define and discuss each method as it may be applied to meat, poultry, fish, vegetables and fruit. The basic formulae for these methods will be outlined.

Introduction to Learner.

The three cooking methods which employ steam as the means of cooking food are steaming, waterless-cooking and pressure-cooking. This chapter will define and discuss each method as it may be applied to meat, poultry, fish, vegetables and fruit. The basic formula for each method will be developed.

Steaming. Steaming is a moist heat method of cooking in which steam is the medium of heat transfer. The food being steamed does not come in contact with water but is bathed or surrounded by steam which is generated by boiling water. This is accomplished by placing the food in a special utensil known as a steamer. This piece of equipment has two parts which consist of a sauce-pan for boiling water and a perforated inset pan which

fits over the sauce-pan. The steam from boiling water in the sauce-pan rises and passes through the perforations in the inset pan and surrounds the food contained in it.¹ The steamer must have a tight-fitting lid to prevent the escape of the steam.

Waterless-cooking. In this method steam is generated by the moisture or juice which is contained in the food itself. A minimum of water is used. The utensil used in this method is called a waterless-cooker. It consists of a pan or other container made of heavy metal or glass such as in Corning Ware or ceramic which distributes heat evenly on all sides. Waterless-cooking may also be done in a heavy frying-pan or sauce-pan. The container must have a tight-fitting lid. Waterless-cooking must employ low temperatures.² It is sometimes done on the top of the range and sometimes in the oven.

Pressure-cooking. In this method the food is cooked in an atmosphere of steam which is held under pressure. The utensil used is called a pressure-cooker. There are various types of pressure-cookers. A pressure-cooker is a heavy metal pan which has a tight-fitting cover which locks on. The cover is equipped with a rubber washer, a safety-valve and a vent-pipe. A pressure-gauge comes with each pressure-cooker and it fits over the vent-pipe. When food is to be steamed in this utensil a small amount of boiling water is added which generates steam when heated to the boiling point. When the cover is locked on steam emerges from the vent-pipe. When a steady stream of steam is visible the pressure-gauge is placed over the vent-pipe and the steam is contained and may be held under pressures of 5, 10 or 15 pounds. Since heat is not lost through vaporization temperatures rise higher than the normal 212⁰F. of boiling water and cooking is rapid; e.g., meat and chicken require approximately

one-third the cooking time required by other methods.³

Since these three methods which employ steam for heat transfer are moist heat methods they have many useful applications. They are frequently used to soften tough connective tissue in meat and poultry, to coagulate the protein and soften any connective tissue in fish, and to soften the cellulose in vegetables and fruits. Not all methods are applicable to every type of food under discussion here but one or more may be used with each. Those methods which may be applied to meat, poultry, fish, vegetables and fruit will be described and the accepted procedures for each will be outlined.

Methods of Cooking Meat with Steam

Meat is seldom steamed in a steamer but may be cooked by the waterless-cooking method or the pressure-cooker method. These are moist heat methods and are very useful in cooking the tougher cuts of meat or meat of poor quality or grade. Such meat will be rendered tender and juicy since the moist heat softens the tough connective tissue.

Waterless-cooking Meat. The meat is prepared for cooking as directed in the recipe and is placed in a heavy pan or Dutch oven with a tight-fitting cover. A small amount of water is added to prevent burning before the juices in the meat start to produce steam. The cooking is done either on top of the range or in a slow oven, 300° to 325° F. The moisture and steam from the meat itself surround the meat and render it tender and flavorful. One authority has called the oven method of waterless cooking "steam-roasting."⁴

Basic Formula for Waterless-cooking Meat.

1. Wipe the meat with a clean, damp cloth.
2. Place in a heavy pan or Dutch oven.

3. Season.
4. Add a small quantity of hot liquid to the container.
5. Cover the container.
6. Cook on top of the range at simmer heat or in a slow oven,
300° to 325° F.
7. Cook until meat is tender.

Pressure-cooking Meat. The meat is prepared for cooking as directed.

The pressure-cooker is heated on top of the range. If the meat is to be browned a small amount of fat is added to the cooker and the meat is seared on all sides. The meat is placed on a rack, seasoning is added and a small quantity of hot liquid is poured in. The cooker is covered immediately to prevent the loss of steam. When steam emerges in a steady stream from the vent-pipe the pressure-gauge is placed over it. The indicator on the pressure-gauge is allowed to reach the "cook" position. The heat must be regulated to keep the pressure-gauge indicator at the required level. The time must also be carefully checked. The meat is cooked for the length of time specified in the recipe and when this time has elapsed the heat must be removed. If the recipe calls for immediate cooling this may be done by holding the cooker under cold running water, or by placing it in cold water. If the recipe does not indicate immediate cooling then the cooker may be allowed to cool of its own accord. When the pressure has been reduced the cover may be removed. It must never be removed while there is any pressure. Any juice which remains in the cooker should be saved and used for sauce or gravy.⁵

Basic Formula for Pressure-cooking Meat.

1. Wipe meat with a clean damp cloth.
2. Prepare meat as directed in the recipe.

3. Heat pressure cooker.
4. Add fat if meat is to be browned. Sear meat on all sides.
5. Place meat on a rack in the cooker.
6. Add a small quantity of hot liquid.
7. Close pressure cooker.
8. Heat until steam comes from vent-pipe.
9. Adjust pressure-gauge to vent-pipe.
10. Adjust heat to maintain the cook position on the gauge.
11. Cook for time specified in the recipe.
12. Remove from heat and cool under cold running water or in cold water if rapid cooling is indicated in the recipe.
13. When pressure has been reduced remove the lid from the pressure-cooker.
14. Use any juice which may remain in the pressure-cooker for sauce or gravy.

Methods of Cooking Poultry with Steam.

In cooking poultry as in cooking meat the same principle applies. Tough and older birds require long slow cooking in moist heat to soften the tough connective tissue and make the meat tender. The cooking methods which employ steam as the medium of heat exchange are very useful in tenderizing older birds. Steaming, waterless cooking, and pressure cooking are all employed.

Steaming Poultry. When a bird has reached its first or second year it no longer qualifies for the cooking procedures applied to younger birds. However, an older bird, or fowl, is often more flavorful than a young one but it will have developed tougher connective tissue which will have to be softened by the moist heat methods of cooking. Therefore, steaming is

an excellent method of preparation for fowl. The bird is prepared for cooking and is seasoned inside and out with salt and pepper. It is placed on the rack of the steamer. Water in the lower part of the steamer is kept boiling briskly and the steamer is tightly covered. The bird is allowed to steam for three to four hours, depending upon age and size. If desired it may be browned in the oven after steaming.⁶

Basic Formula for Steaming Poultry.

1. Prepare fowl for cooking.
2. Season inside and out.
3. Place on rack in steamer.
4. Have water in lower compartment boiling vigorously.
5. Cover steamer tightly.
6. Cook until bird is tender.
7. If desired brown bird in the oven after steaming.

Waterless Cooking Poultry. This is a method which may be used for young as well as for mature birds. The bird is prepared for cooking and placed in a roasting pan. If the bird is not young a small amount of water is added to the pan, if the bird is young water may not be required. Seasonings are added, the pan is covered and the bird is cooked in a moderate oven, 350⁰ F. until tender. The cover may be removed toward the end of cooking to brown the bird.⁷

Summary for Waterless Cooking Poultry.

1. Prepare bird for cooking.
2. Place in a roasting pan.
3. If bird is mature add a small amount of water to pan.
4. Cover the pan.

5. Place in a moderate oven, 350⁰ F.
6. Cook until tender.
7. Remove lid toward end of cooking to brown the bird if desired.

Pressure-cooking Poultry. Mature and young birds may be cooked by this method. The bird is prepared for cooking. If desired the bird may be browned in hot fat in the pressure cooker. One cup of boiling water is added to the cooker as well as seasonings. The cooker is covered and the bird is cooked under 15 pounds of pressure for about 35 minutes. The cooker is removed from the heat and allowed to cool. When the pressure is reduced the cover is removed.⁸

Basic Formula for Pressure-cooking Poultry.

1. Prepare bird for cooking.
2. If desired brown bird in hot fat in cooker.
3. Add 1 cup of boiling water.
4. Cover the pressure-cooker.
5. Heat until steam emerges from the vent-pipe.
6. Adjust the pressure-gauge.
7. Cook at 15 pounds pressure for about 35 minutes.
8. Remove from heat.
9. Allow pressure-cooker to cool of its own accord.
10. When pressure has been reduced remove cover.
11. Use any liquid which remains for sauce or gravy.

Methods of Cooking Fish with Steam.

The most common methods of cooking fish with steam is steaming. The steam serves to coagulate the fish proteins and render the fish tender and opaque.

Steaming Fish. Steaming is a method which gives very satisfactory results with most types of fish. Steamers are available which are especially designed for whole fish. They are usually long and oval in shape with a perforated inset rack and a tight-fitting cover. However, a suitable steamer can be improvised. Fish to be steamed is frequently tied loosely in cheese-cloth. The cheese-cloth allows the steam to surround the fish and it permits the fish to be lifted from the steamer without fear of breaking it.

The water in the steamer or other container must be kept boiling vigorously during the entire cooking period. The fish is tied loosely in a piece of cheese-cloth and placed on the perforated rack in the steamer. The steamer is covered tightly and the water kept boiling rapidly. The fish is cooked until it is opaque and flakes easily when tested with a fork. Cooking usually requires from 10 to 20 minutes per pound of fish,⁹ or 10 minutes cooking time per inch thickness of fish.¹⁰

Basic Formula for Steaming Fish.

1. Have water in lower part of steamer boiling vigorously.
2. Prepare fish for cooking.
3. Tie fish loosely in cheese-cloth.
4. Place on rack in the steamer.
5. Cover the steamer tightly.
6. Keep water boiling vigorously.
7. Cook until fish is opaque and flakes easily when tested with a fork. Allow 10 to 20 minutes per pound of fish, or 10 minutes for each inch in thickness.
8. Remove gently from the steamer.
9. Remove the cheese-cloth wrapping.

Pressure-cooking Fish. There are two ways of cooking fish in a pressure-cooker. In one the fish is wrapped in cheese-cloth as for steaming. In the other the fish may be browned in hot fat in the bottom of the cooker before cooking.¹¹ The time of cooking must be very carefully observed to prevent overcooking. If fish is overcooked it falls apart.

Method No.1 for Pressure-cooking Fish.

The fish is prepared for cooking and wrapped in a piece of cheese-cloth. The pressure-cooker is heated and hot water is added. The fish is placed on the rack in the cooker and the cover locked in place. Steam is allowed to come from the vent-pipe in a steady stream and then the pressure-gauge is placed on it. The indicator is brought to the "cook" position, and the fish is cooked for the time indicated in the recipe. The cooker is cooled by holding under cold running water or plunging into cold water. When the pressure has been reduced the cover may be removed.¹² The fish is removed from the cooker and from the cheese-cloth very carefully to avoid breaking.

Basic Formula for Method No.1 of Pressure-cooking.

1. Prepare fish for cooking.
2. Wrap lightly in cheese-cloth.
3. Heat pressure-cooker and add hot water.
4. Place fish on rack in the cooker.
5. Lock cover into place.
6. Heat and allow steam to come from vent-pipe.
7. Adjust pressure-gauge on vent-pipe.
8. Bring the indicator to "cook" position.
9. Cook for specified time.

10. Cool cooker immediately at end of cooking time.
11. Remove cover when pressure has been reduced.
12. Remove fish gently.

Method No.2 for Pressure-cooking Fish.

The fish is prepared for cooking and seasoned. If a crust is required fish is dredged with flour, crumbs or corn-meal and browned in hot fat in the bottom of the cooker. The fish is placed on a rack in the cooker, a small amount of water is added to the cooker and the cover is locked on. The cooker is heated, steam is allowed to come from the vent-pipe and the pressure-gauge is put in place. The indicator is brought to the "cook" position and the fish is cooked for the specified length of time. The cooker is cooled immediately and when the pressure has been reduced the cover is removed.¹³ The fish is removed carefully to avoid breaking.

Basic Formula for Method No.2 of Pressure-cooking Fish.

1. Prepare fish for cooking.
2. If a crust is desired dredge fish in flour, cornmeal or dry bread crumbs.
3. Season.
4. Melt a small amount of fat in the cooker and brown on both sides.
5. Place fish on a rack in the cooker.
6. Add a small amount of boiling water.
7. Cover and lock the cooker.
8. Heat until steam emerges from the vent-pipe.
9. Adjust the pressure-gauge over the vent-pipe.
10. Regulate the heat to keep the pressure-gauge indicator at "cook" position.

11. Cook for length of time specified in the recipe.
12. Remove from heat and cool immediately.
13. Remove cover when pressure has been reduced.
14. Remove fish very gently.

Methods of Cooking Vegetables with Steam.

All three methods may be used for cooking vegetables. Steam is considered one of the best heat exchange media because it does not rob the vegetables of valuable nutrients. It is not used with green vegetables because the steaming process is carried out in a covered container which holds in the volatile acids which rob the green vegetables of their color.

Steaming Vegetables. The vegetables are prepared for cooking. Water in the lower compartment of the steamer is brought to a vigorous boil. The vegetables are placed in the top inset pan and covered tightly. The vegetables are cooked until tender.¹⁴

Basic Formula for Steaming Vegetables.

1. Prepare vegetables for cooking.
2. Prepare steamer. Have water boiling rapidly in bottom compartment.
3. Place vegetables in top perforated inset pan.
4. Cover steamer.
5. Cook vegetables until tender.

Waterless-cooking.

This method has always been a great favorite with French and Chinese chefs. It is also highly thought of by nutritionists since few of the valuable nutrients are lost in water. The vegetables cook in steam which is generated by the moisture or juices of the vegetables themselves.

The vegetables are prepared for cooking by dicing, slicing or shredding. The heavy frying pan or sauce-pan is pre-heated and a very small amount of fat is added, just enough to keep the vegetables from sticking to the pan. The vegetables are added and if they are not very moist a small amount of boiling water is added, not usually more than one or two tablespoons. The pan is tightly covered and cooking is done over low heat. The vegetables are cooked until tender yet slightly crisp.¹⁵

Basic Formula for Waterless-cooking Vegetables.

1. Prepare vegetables for cooking by dicing, slicing or shredding.
2. Pre-heat the waterless cooker.
3. Add a small amount of fat to the cooker, - just enough to prevent the vegetables from sticking to the pan.
4. Add the vegetables and mix lightly.
5. If necessary a very small amount of boiling water may be added to initiate the steaming process.
6. Cover the cooker tightly.
7. Cook over low heat until vegetables are crisp - tender.¹⁶

Pressure-cooking Vegetables. The vegetables are prepared for cooking and the recommended quantity of boiling water is added to the cooker. The vegetables are placed in the cooker and the cover locked in place. The pressure-gauge is adjusted when steam emerges from the vent-pipe in a steady stream. The vegetables must only be cooked for the recommended length of time since there is a tendency to overcooking by this method. The pressure must be reduced immediately by subjecting the cooker to cold water.¹⁷

Basic Formula for Pressure-cooking Vegetables.

1. Prepare vegetables for cooking.
2. Heat pressure cooker.
3. Add recommended amount of boiling water.
4. Place vegetables in the cooker.
5. Cover tightly and adjust the pressure-gauge.
6. Cook for recommended length of time.
7. Remove the cooker from heat.
8. Cool rapidly by holding under cold running water or plunging into cold water.
9. When pressure has been reduced remove cover.

Methods of Cooking Fruit with Steam.

Fruit is frequently cooked by the waterless-cooking method and also by the pressure-cooking method. As in cooking fruit with water the time of adding sugar has an important effect on the finished product. If it is desirable that the fruit retain its original shape after cooking the sugar should be added at the beginning of cooking. If a sauce is desired the sugar is added after the fruit has been cooked.¹⁸

Waterless-cooking Fruit. This is a very good way of preserving the natural color of fruit. Fruits such as plums, soft type berries, rhubarb and cranberries retain their natural colors when cooked in this manner.

The fruit is prepared for cooking by cutting into small pieces. The container is heated and a very small amount of boiling water may be added if the fruit is not juicy. The fruit is placed in the cooker and covered tightly and cooking is done over low heat or in a moderate oven, 325° F., until the fruit is tender.¹⁹

Basic Formula for Waterless-cooking Fruit.

1. Prepare fruit for cooking by cutting into small pieces in the case of larger fruit.
2. Pre-heat the container.
3. If fruit is not juicy add a small amount of boiling water.
4. Place fruit in the cooker. Add sugar if fruit is required to hold its shape.
5. Cover tightly.
6. Cook over low heat or in a moderate oven, 325⁰ F. until fruit is tender.

Pressure-cooking Fruit. This method of cooking fruit prevents the loss of a good percentage of the valuable nutrients and flavor since very little water is used and steam is not allowed to escape.

The fruit is prepared for cooking. The recommended amount of boiling water is added to the heated pressure-cooker. The fruit is placed in the cooker. Sugar is added if it is desired that the fruit retain its original shape. The cooker is tightly covered and the pressure-gauge is adjusted. The fruit is cooked for the recommended length of time. If the recipe calls for immediate cooling the cooker is cooled under cold running water or by plunging into cold water. When the pressure has been reduced the cover is opened.²⁰

Basic Formula for Pressure-cooking Fruit.

1. Prepare fruit for cooking.
2. Add recommended amount of boiling water to the pre-heated cooker.
3. Place fruit in the cooker.

4. Add sugar if fruit is required to keep its original shape.
5. Lock the cover in place and adjust the pressure-gauge.
6. Cook for the recommended time.
7. Remove cooker from the heat.
8. If recipe calls for immediate cooling cool rapidly under cold running water, or plunge cooker into cold water.
9. When pressure has been reduced open cover.²¹

Appraisal of Cooking Methods Utilizing Steam as the Medium of Heat Transfer.

The advantages of steam as a cooking medium are its softening and tenderizing capabilities. The retention of food nutrients and flavor of foods are also important. The short time of cooking required in the pressure-cooker method is useful to the cook with limited time.

In all forms of steaming heat is conducted from the steam to the food. Since steaming is a moist heat method of cookery, it is a useful means of tenderizing tough or less tender cuts of meat and poultry, It is also useful as a means of preserving the natural flavors of fish. Steaming is rated second to baking as a method for cooking vegetables from the standpoint of retention of nutrients and flavor.⁷ The loss of soluble nutrients is less than in boiling and vegetables retain their original shape and color.

The methods of cooking which use steam as the means of heat exchange are steaming, waterless-cooking and pressure-cooking. Steaming usually refers to cooking in steam arising from added water; waterless-cooking refers to cooking in steam formed from the water or moisture inherent in the food itself; pressure-cooking is cooking with steam held under pressure.²²

In ordinary cooking utensils where the pressure is that of the atmosphere the temperature of steam is the same as of boiling water, 212° F.

The continuous formation of steam requires a high input of heat. One calorie is required to raise the temperature of 1 gram of water 1 degree centigrade. 540 calories are required to change 1 gram of water at 100⁰ C. into steam at the same temperature. When cooking is done in a pressure-cooker the steam is held under pressure and the heat of vaporization is not lost and the temperature rises. The high temperatures reached in cooking with steam under pressure shortens the cooking time very appreciably.²³ Although the temperatures of the cooking medium of steam under pressure are much higher than those of steaming, simmering, or boiling, the vitamin losses have not been found to be any greater when cooking is carried to the same stage.²⁴ The cooked product is of good texture and flavor.²⁵

The proper equipment is essential for satisfactory results in all three methods. For steaming vegetables, a special piece of equipment is available. It consists of a sauce-pan with a perforated inset-pan and a tight-fitting lid. When poultry or fish are to be steamed, they are placed on a rack in a container of suitable size and water is poured into the container to a depth which comes just below the rack. The container must be tightly covered during cooking. Waterless cooking requires a pan, or other container, made of some heavy material which conducts and distributes heat evenly from all sides. It must also have a tight-fitting lid. Pressure-cooking is done in a pressure-cooker. This is a heavy metal pan with a cover which locks on and is equipped with a rubber washer, a pressure-gauge and a safety-vent. It must be used as directed by the manufacturer. Since it is designed to hold steam under pressure and permits the steam to reach very high temperatures it must be handled with extreme care. A pressure-cooker must always be cooled before opening. If

used as directed it can be of great use to the cook who has limited time.

The great advantage of all three methods which utilize steam is the tenderizing effect they have on tough cuts of meat and poultry and the softening effect on vegetables and fruits.

These methods have a great many applications. Steaming and waterless cookery methods are utilized in more complex cooking procedures, such as braising, pot-roasting and casserole cookery.

SUMMARY

This chapter has discussed the three methods of cooking which employ steam as the medium of heat transfer. These methods are steaming, waterless-cooking and pressure-cooking. Each method has been defined and its application wherever practical has been described in the cooking of meat, poultry, fish, vegetables and fruits. Basic formula for the use of each method with these foods have been given. Equipment used in these methods has also been described.

It has been shown that these moist heat methods serve a useful function in softening connective tissue of meat and poultry, in coagulating proteins in meat, poultry and fish, and in softening cellulose and swelling starch in vegetables and fruits. The advantages of cooking food by these methods have been discussed with relation to texture and flavor as well as with relation to retention of valuable food nutrients including vitamins and minerals. The possibility of overcooking by the pressure-cooking method has been stressed. If properly applied it has been shown to have great advantages for the cook with limited time.

Steaming is a method which is applicable to poultry, fish and vegetables. This method has been described as it is used with these foods and basic formulae have been given.

Waterless-cooking is a method which may be used with meat, poultry, vegetables and fruit. The method has been described for each of these foods and basic formulae developed.

Pressure-cooking is applicable to all the foods under discussion, viz. meat, poultry, fish, vegetables and fruit. Its use with each of these foods has been described and basic formulae given.

An appraisal of these steaming methods has been made and their usefulness in more complex methods has been indicated. Their usefulness with processed and mixed foods has also been commented upon.

SUGGESTED LEARNING EXPERIENCES

1. You have purchased a 4 pound piece of beef of doubtful quality and tenderness. You would like to serve it whole as a roast. In the light of what you have learned in this chapter what method could you use which would ensure tenderness and flavor?
2. You have caught a 4 pound salmon and you would like to serve it to your friends in its entire size (by way of boast). How would you cook it?
3. Rhubarb is in season and consequently it is inexpensive. How would you cook it to retain its color? To retain its shape?
4. You have been held up at the office and you have to cook dinner. You had bought a roasting chicken the day before. How could you prepare it quickly?
5. Using the 1965 edition of the Bantam Fannie Farmer Boston Cooking School Cookbook, prepare the following meal.

Hungarian Chicken Paprika	p. 229
Steamed potatoes	p. 266
Panned green beans	p. 243
Baked rhubarb	p. 376

SOLUTIONS TO LEARNING EXPERIENCE PROBLEMS

1. If there is plenty of time the roast will develop good flavor and color if it is steam roasted. If time is short it could be cooked in the pressure-cooker. By this method it would be advisable to brown the roast well before cooking it under pressure. It will then have a more pleasing color.

2. The best method would be to wrap it in cheese-cloth and to steam it.
A smaller fish could be pressure-cooked.
3. The waterless-cooking method done in the oven is an excellent way to cook rhubarb. It may also be pressure-cooked. To retain shape sugar is added before cooking. Both methods will preserve the color.
4. The chicken could be cooked in the pressure-cooker. This would be the quickest way.
5. The oven should be used for the Hungarian Chicken Paprika and for the Baked rhubarb. The potatoes should be cooked in a steamer and the green beans in a heavy sauce-pan with a tight-fitting lid.
The chicken will require approximately 1 hour.
The rhubarb will also require approximately 1 hour.
The potatoes will take from 30 to 45 minutes.
The green beans will require about 30 minutes.
These are approximate cooking times after the necessary preparation.

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CHAPTER IV

COOKING METHODS IN WHICH AIR IS

THE MEDIUM OF HEAT EXCHANGE

Introduction to Instructor

As its learning objectives this chapter will require the learner to list and describe the two methods which employ air as the medium of heat transfer as well as to list and discuss the applications of these methods. He will also be required to use these methods in the preparation of a meal.

Introduction to Learner

The methods which employ air as the medium of heat exchange are broiling, roasting and baking. Roasting and baking are terms which are used synonymously. Roasting is generally used for meats whereas baking is used for fish, vegetables and fruit as well as for flour and other mixtures.

This chapter will define and discuss these methods as they may be applied to meat, poultry, fish, vegetables, fruit and eggs. Basic formulae for each method as it applies to these foods will be given.

Broiling. Broiling is a dry heat method of cooking in which air is the medium of heat transfer. The food is exposed to heat by radiation and convection at temperatures ranging from 250° to 900° F.¹ The heat may come from an open fire or the broiling element of a gas or electric range. The food is held in place by means of a rack or open grill or is secured to a revolving spit as in rotisserie cooking. When broiling is done out of doors on an open fire it is usually called "barbecuing." The food being barbecued is generally basted with a highly seasoned sauce. When food is to be broiled it is placed from 2 to 5 inches from the source of heat, the distance

depending upon the intensity of the heat and the size of the portions to be broiled. Larger pieces are placed farther from the heat than smaller ones because they require longer cooking and the surface will become overcooked if they are too close. When the cooking is done on a rack it is cooked first on one side and then turned and cooked on the other.

Since this type of cooking subjects the surface of the food to rapid evaporation of moisture it may result in a dry product if something is not done to counteract it. This may be done by brushing the food before and during cooking with melted butter, fat or oil.²

Broiling involves high temperatures and short cooking periods and produces a brown crust on the exterior of the food and a soft, moist interior. It is a suitable method for cooking tender cuts of meat, tender poultry, most fish and some vegetables and fruits.³

Baking and roasting. Baking and roasting are terms which are used synonymously. Roasting (baking) is a dry heat method of cooking which employs air as the medium of heat transfer. The cooking takes place in a heated oven where convection currents heat the air and equalize the oven temperatures. The heated air surrounds the food and cooks it. This method of cooking is suitable for tender cuts of meat, poultry, fish, some vegetables and fruits and eggs.

Methods of Cooking Meat Using Air as Medium of Heat Transfer.

Broiling Meat. Only tender cuts of meat such as steaks, chops, cutlets, ground meat patties, ham and bacon slices should be cooked in this manner. Since meat to be broiled should have some fat content, veal which is low in fat should not be cooked in this way. The exterior fat of the meat is generally scored at intervals, that is cut at right angles to the red muscle, to prevent it from curling during cooking. It is placed on a

pre-heated, greased broiling-rack and placed over or under the source of heat at a distance of 2 to 5 inches, depending upon the thickness of the cut. While cooking it should be brushed with melted butter, fat or oil from time to time. It is cooked first on one side and then turned and cooked on the other side. The length of cooking depends upon individual preference in the finished product.

There are four ways of determining when meat is cooked. (1) If the thickness of the meat permits a thermometer may be inserted into the middle edge of the meat. The temperature reading of the cooked meat should be the same as the reading for a roast of the same variety, i.e., a rare beef steak will have the same internal temperature as a rare roast of beef, - 130° to 140° F. (2) If the exterior surface of the meat is resistant to the touch it should be cooked. The meat will have become firm and the exterior surface will have developed a brown crust. (3) If drops of red liquid are seen on the surface of the meat it should be cooked to a state which is neither too rare nor too well done. The drops of liquid are juices from the interior which come to the surface when the meat is cooked. If the meat is allowed to reach a stage where no drops are visible it will be very well cooked or overcooked. (4) The most usual way of determining how well the meat is cooked is by making a small incision in the meat with a sharp knife near the bone or center of the meat. The color may be observed and a judgement made as to its readiness for serving.⁴

Basic Formula for Broiling Meat.

1. Wipe meat with a clean, damp cloth and prepare for cooking.
2. Place on a pre-heated, greased broiling rack.
3. Place meat 2 to 5 inches from the source of heat.
4. Brush meat with melted butter, fat or oil.

5. Brown first on one side.
6. Season with salt.
7. Turn and broil on other side.
8. Cook until the meat has reached the stage of individual preference.

Roasting Meat. The dry-heat methods of cooking are used only for tender cuts of meat, the tougher cuts being cooked by the moist-heat methods. Any tender cut of beef, veal, pork, or lamb may be roasted or baked.

Meat which is to be roasted is prepared for cooking by wiping with a clean damp cloth. It is then seasoned with salt and pepper if desired. It has been proven that salt does not penetrate to any appreciable extent so whether the meat is salted before or during cooking is not very important. The salt will be found at the end of cooking only to have penetrated to a depth of about one-half inch. The oven should be pre-heated. The meat is placed fat side up on a rack in a shallow roasting pan. If the fat is on top it will perform a self-basting action during cooking and will prevent the meat from drying out. The rack is used to keep the meat out of the drippings. A meat thermometer should be inserted into the center of the largest muscle, taking care that it does not touch fat or bone. The meat is roasted in an uncovered roasting pan in a slow oven, 325⁰ F. Experiments have shown that meat which is cooked at a low temperature tends to be juicier and to lose less through shrinkage than meat cooked at higher temperatures.⁵ A new method for roasting beef and lamb is called the "all day method." When this method is used the meat loses less through shrinkage and is more evenly cooked throughout. Meat cooked in this manner is subjected to oven temperatures of only 200⁰ F. As a result this method usually takes twice the conventional roasting time,

i.e., the time required to roast at 325° to 350° F.⁶ The meat should be cooked to individual preference. The use of a meat thermometer is the best way of insuring that the meat will be cooked to the desired degree.

Basic Formula for Roasting Meat.

1. Wipe meat with a clean damp cloth.
2. Pre-heat oven to 325° F.
3. Season roast with salt and pepper if desired.
4. Insert meat thermometer into center of largest muscle.
5. Place meat on rack in roaster. Leave uncovered.
6. Place in oven and cook until stage of preference.

Methods of Cooking Poultry Using Air as Medium of Heat Transfer.

Broiling Poultry. Broiling chickens, fryers, Rock Cornish hens, 4 to 8 pound turkeys or turkey parts, and ducklings, may be broiled or cooked on a rotisserie. If the birds are to be broiled on a rack or grill they should be split in half lengthwise. Those to be broiled on a rotisserie are left whole.

Half birds are prepared for broiling by fastening the wing to the back by means of a skewer. This exposes the breast to the heat.

If broiling is to be done on a rotisserie the body cavity of the bird is first rubbed with salt then the wings are tied close to the breast, the neck skin is fastened to the back with a skewer and the drumsticks crossed and tied with string to the tail. This process is called "trussing." When the bird has been trussed it is placed on the spit. The spit is passed through the bird lengthwise by inserting it between the branches of the wish-bone, running it parallel to the back-bone and bringing it out just above the tail. The bird is centered and securely fastened to the spit.

Both whole and half birds should be rubbed with melted butter, fat or oil, and sprinkled with salt. The half birds are placed on the grill about 3 inches from the source of heat. They are browned on the skin side for about 3 minutes, turned and browned on the under side for about 3 minutes. The grill is raised, or lowered, 4 to 6 inches from the heat and cooking is continued. The bird is turned frequently and is brushed occasionally with melted butter, fat or oil. Cooking time for a half chicken is approximately 50 to 55 minutes.⁷ Whole birds which are being broiled on a rotisserie should have a meat thermometer inserted into the heaviest part of a drumstick. When cooked the thermometer will register 190° F.⁸

Basic Formula for Broiling Poultry.

1. Prepare bird for broiling.
2. Rub with melted butter, fat or oil.
3. Sprinkle with salt.
4. Place bird 3 inches from source of heat.
5. Brown half birds on skin side for 3 minutes.
6. Turn and brown on other side for 3 minutes.
7. Move grill 4 to 6 inches from heat.
8. Continue cooking, turning frequently.
9. Brush occasionally with melted butter, fat or oil.
10. In whole birds use meat thermometer inserted in heavy part of drumstick.
11. Cook until thermometer registers 190° F.

Roasting Poultry. In cooking poultry as in cooking meat the same basic principle applies, i.e., moist heat methods are necessary to soften

the tough connective tissue found in older, mature birds. Young tender birds may be cooked by the dry heat methods. Roasting is a method which should only be used with tender poultry.

Large birds such as turkeys, geese, capons, and ducklings should be roasted in a slow oven, at 325⁰ F., in order that they be uniformly cooked throughout. Smaller birds such as chicken, Rock Cornish hens, and squab develop better color and do not dry out as much if roasted in a hotter oven at 375⁰ to 400⁰ F.

If the bird is to be stuffed the cavity should be well washed, drained and patted dry with paper towels. The cavity should be rubbed lightly with salt and the stuffing packed in loosely to allow for expansion during cooking. The cavity is tightly closed with skewers and string.

The bird should next be trussed. Trussing holds the bird in a compact shape and aids in even cooking. It also makes the bird more attractive for serving. The neck skin is fastened to the back with a skewer, the wings are brought to the back and fastened. The drumsticks are tied to the tail except in the case of ducklings and geese. In these birds the drumsticks are tied together but not attached to the tail. The skin of the bird is rubbed with softened butter, fat or oil. It is placed in a roasting pan and roasted breast-side down for the first two-thirds of the cooking time. It is then turned breast-side up for the remainder of the cooking time. It is basted occasionally during roasting with pan drippings and roasted until tender. The best way to determine when the bird is cooked is to use a meat thermometer which should be inserted into the heavy muscle of a drumstick. When the chicken is cooked the thermometer will register 190⁰ F. A bird is considered cooked when the thickest part of the drumstick feels soft when pressed with the fingers. Small birds are cooked

when the drumstick turns easily out of the thigh-joint.⁹

Basic Formula for Roasting Poultry.

1. Prepare the bird for cooking.
2. Rub body cavity lightly with salt.
3. If bird is to be stuffed pack stuffing in loosely.
4. Close cavity securely.
5. Truss the bird.
6. Rub bird with softened butter, fat or oil.
7. Place, breast-side down in roasting pan.
8. Roast for two-third of cooking time.
9. Turn and roast breast-side up.
10. Roast until tender. Meat thermometer will register 190⁰ F.

Methods of Cooking Fish Using Air as Medium of Heat Transfer.

Broiling Fish. Broiling is a very suitable method for cooking most types of fish. It is especially good for fatty varieties since it allows fat to drip off during the cooking process. Small whole fish, fish fillets and steaks may be cooked in this way. Large fish should be cut into smaller pieces before broiling. The fish is brushed with melted butter, fat or oil before broiling. The pieces are placed 3 to 5 inches from the source of heat on a pre-heated and greased broiling-rack and are broiled until golden brown on one side then turned and the cooking is completed on the other side. Time for broiling may be estimated by allowing 10 minutes for each inch of thickness of the fish.¹⁰ Most fish will broil in 10 to 20 minutes.¹¹

Basic Formula for Broiling Fish.

1. Prepare fish for broiling.

2. Pre-heat and grease broiling rack.
3. Sprinkle fish with salt and pepper.
4. Brush with melted butter, fat or oil.
5. Place on rack with skin 3 to 5 inches from heat.
6. Broil until golden brown.
7. Turn and broil on other side.
8. Brush occasionally with melted butter, fat or oil.
9. Cook until golden brown and fish flakes readily when tested with a fork. Allow 10 minutes for each inch of thickness of fish.

Baking Fish. Baking is a method suitable for cooking whole fish, steaks or fillets. Any fish may be baked. Temperatures used are very high, 450⁰ to 500⁰ F.

Baking Whole Fish (3-4 lbs.) To bake whole fish which have been dressed (scaled, gutted and trimmed) the fish should be rubbed inside and out with salt and pepper. The fish is placed on a buttered baking-pan and brushed with melted butter, fat or oil. It is baked in a pre-heated oven at 450⁰ to 500⁰ F., allowing 10 minutes cooking time for each inch of thickness of fish. It should flake easily when tested with a fork.¹²

Basic Formula for Baking Whole Fish. (3-4 lbs)

1. Prepare fish for cooking.
2. Pre-heat oven to 450⁰ to 500⁰ F.
3. Rub fish inside and out with salt and pepper.
4. Place on a buttered baking pan.
5. Brush with melted butter, fat or oil.
6. Bake at 450⁰ to 500⁰ F., allowing 10 minutes cooking time per inch thickness of fish.

Baking Fish Fillets or Steaks. Pieces of fish such as fillets and steaks should be dipped in salted milk, allowing 1 tablespoon salt per cup of milk. The fish is then rolled in fine bread or cracker-crumbs and placed on a buttered baking-pan.¹³ It is baked in a very hot oven, 450° - 500° F., allowing 10 minutes cooking time for each inch thickness of fish.¹⁴

Basic Formula for Baking Fish Fillets or Steaks.

1. Pre-heat oven to 450° to 500° F.
2. Dip pieces of fish in salted milk, using 1 tablespoon salt per cup of milk.
3. Roll fish in fine bread or cracker crumbs.
4. Bake in very hot oven, 450° to 500° F., allowing 10 minutes per inch thickness of fish.

Methods of Cooking Vegetables and Fruits Using Air as Medium of Heat Transfer.

Broiling Vegetables and Fruits. Very few cook-books devote much attention to broiling as a method of cooking vegetables and fruits. Since this is a dry heat method of cooking it is very useful in preserving natural flavors which might be lost in water or steam in the moist heat methods. The fruit is first oiled with melted butter, fat or oil and then arranged on a baking-pan and placed on the broiling-rack about 4 inches from the source of heat. The vegetable or fruit is broiled under full heat for four minutes. It is then turned and the cooking is continued at low heat, for 20 to 30 minutes, or until tender. The subjection of the vegetable or fruit to a lower temperature may be achieved by moving the broiling rack farther away from the source of heat. Vegetables which may be cooked in this manner are unpeeled beets, new spring potatoes, corn on the cob, green peppers, tomatoes, mushrooms and onions.¹⁵ Fruits which lend themselves to this type of cooking

are bananas, pears, apples, plums, peaches, sliced pineapple and half grapefruit.

Basic Formula for Broiling Vegetables and Fruits.

1. Rub vegetables or fruit with melted butter, fat or oil.
2. Place on baking pan about 4 inches from source of heat.
3. Broil at high heat for 4 minutes.
4. Reduce heat to low.
5. Turn fruit or vegetable and cook until tender, about 20 to 30 minutes. Root vegetables will require longer cooking than the fruit type vegetables such as tomatoes and green peppers.

Baking Vegetables. Baking is an excellent way of cooking root vegetables such as potatoes, carrots, beets, and onions, as well as vegetables which have heavy skins such as squash, cucumbers, and tomatoes. This method serves to retain valuable nutrients and to protect flavor since there is no loss by solution.¹⁶ The vegetables are first washed and if a crusty skin is not desired in the finished product, such as baked potatoes, the skin is oiled with melted butter, fat or oil. The vegetables are baked in a moderate oven, 350° F. for 35 to 45 minutes. Baked starchy vegetables such as potatoes and squash should be opened when baking is finished to allow steam to escape. Otherwise the vegetables will become soggy.¹⁷

Basic Formula for Baking Vegetables.

1. Wash vegetables.
2. Oil if desired.
3. Place in a shallow baking pan.
4. Bake in a pre-heated oven, 350° F. for 30 to 45 minutes. Root vegetables will require longer cooking than the fruit types such as tomatoes, cucumbers, etc.

Baking Sliced, Diced or Shredded Vegetables. Another way of baking vegetables is to slice, dice or shred them, add seasonings and a very small amount of liquid and bake them at 350⁰ F. in a covered casserole.¹⁸ A casserole is a heat-proof baking dish. It may be made of ceramic, glass as in Pyrex or Corning Ware, enamelled metal etc.

Basic Formula for Baking Sliced, Diced or Shredded Vegetables.

1. Peel vegetables.
2. Slice, dice or shred vegetables.
3. Place in a buttered casserole.
4. Season with salt and pepper.
5. Add a very small amount of liquid if the vegetable is dry.
6. Bake at 350⁰ F. until tender.

Baking Fruit. Fruits are very high in volatile flavors (evaporating rapidly) and since it is desirable to retain these delicate flavors baking is a very satisfactory method of cooking. It is especially useful for cooking those fruits which have a heavy skin or peel, such as apples or pears. The skin serves to hold the volatile flavors and the steam which results from heating the juices helps to soften the cellulose.¹⁹ The oven should be pre-heated to 350⁰ F. The fruit is washed and placed in a shallow baking dish and a minimal amount of water is added to prevent burning. The fruit is placed in the oven and baked until tender.²⁰

Basic Formula for Baking Fruit.

1. Pre-heat oven to 350⁰ F.
2. Wash fruit.
3. Place in a shallow baking dish.

4. Add a very small amount of water.
5. Bake at 350° F. until tender.

Methods of Cooking Eggs Using Air as Medium of Heat Transfer.

Eggs may be baked in individual ramekins or casseroles (these are individual heat-proof dishes). The french call these little dishes "cocottes" and there are many recipes for "Eggs en Cocottes." They are also called shirred eggs. These combine eggs with other foods such as ground chicken or other meat, cheese, spinach, mushrooms etc. The ramekin should be warmed and buttered generously. An egg is broken into each ramekin and is sprinkled lightly with salt and pepper. The ramekin is placed on a cookie-sheet and baked in a slow oven, 300° to 325° F., for 8 to 10 minutes, or until the eggs are set. The eggs may be served in the ramekins or may be turned out onto a piece of toast. They are often served with a sauce.²¹

Basic Formula for Baking Eggs.

1. Warm the ramekins.
2. Butter generously.
3. Break a fresh egg into each ramekin.
4. Sprinkle lightly with salt and pepper.
5. Place ramekins on a cookie-sheet.
6. Place in a slow oven, 300° to 325° F., and bake for 8 to 10 minutes, or until eggs are set.

Appraisal of Cooking Methods Employing Air as the Medium of Heat Exchange.

The advantages of cooking methods which use air as the medium heat exchange are that color is changed, flavor is improved and in the case of meat, fish, and poultry, the plasma proteins are coagulated, i.e. made

firm or set.

The two methods which employ air as the medium of heat exchange are broiling and roasting (baking). These are both dry heat methods of cooking and are suitable for tender cuts of meat, poultry, fish and some vegetables and fruit.

In broiling the food is subjected to intense direct heat and the outer surface is cooked faster than the interior and a crust is formed which has an agreeable color and flavor. The time required for broiling a food depends upon the temperature employed, the size and shape of the food and the degree of doneness preferred.²⁵

In roasting (baking) in an oven, temperatures and time of cooking are very important in controlling the changes that take place. In roasting meat and poultry the lower the temperatures the lower the cooking losses will be. When temperatures are low there is less loss through shrinkage and less loss of juices which contain valuable vitamins, minerals and flavors.²⁶ In baking vegetables and fruits practically all the vitamins, minerals and flavor are retained since there is no loss by solution.²⁷

These methods are relatively easy to employ with modern cooking equipment, although broiling requires considerably more skill than roasting (baking). Modern ovens are usually thermostatically controlled and if times and temperatures are carefully checked the cook should have little difficulty with the roasting (baking) method. In roasting meat and poultry, it is advisable to use a meat thermometer to prevent over or under-cooking. In broiling meat, poultry or fish, the broiling rack should be pre-heated and greased before the food is placed on it. This prevents initial sticking. It is also important to brush food with melted fat or oil before and during broiling to prevent it from drying out. The distance

from the source of heat is important in broiling and the inexperienced cook may require some practice with this method before mastering the skill.

Since broiling and roasting (baking) are dry heat methods of cooking their application is limited to tender cuts of meat and poultry, i.e. those cuts which do not have appreciable connective tissue to be broken down. They may also be used with fish and to a more limited degree with vegetables and eggs. If cost is a consideration it must be borne in mind that the cuts of meat which lend themselves to this type of dry cooking are the most expensive.

The learner will find that the roasting (baking) method has many applications. It may be used with a wide variety of foods both natural and processed. It is also one of the most frequently used methods with flour mixtures such as cake, pastries, bread, etc., as well as with egg mixtures such as custards, souffles, etc.

SUMMARY

This chapter has discussed the two methods of cooking which employ air as the medium of heat transfer. These methods are broiling and roasting (baking). Each has been defined and the actual procedural steps involved have been described. Equipment used in these methods has also been described.

It has been pointed out that these are dry heat methods of cooking and that their application is limited to tender cuts of meat and poultry and they should not be used with tough cuts of meat or poultry. They may also be used with fish, vegetables and fruit. Eggs also may be baked. The purpose of these methods is to develop flavor in foods as well as to coagulate the plasma proteins in meat, poultry and fish. The baking method is particularly useful in conserving vitamins and minerals and other nutrients in vegetables.

Broiling is a method which may be applied to meat, poultry, fish and vegetables. Its application to each of these foods has been described and basic formulae have been given.

Roasting (baking) is a method which may be applied to meat, poultry, fish, vegetables, fruit and eggs. Its application with each of these foods has been described and basic formulae developed.

An appraisal of the value of these methods in the preparation of the foods under discussion in this text has been made. Their use with processed foods and mixtures has been indicated as well as their usefulness in more complex cooking procedures.

SUGGESTED LEARNING EXPERIENCES

1. Choose two identical roasts of beef i.e. the same cut, weight and conformation. Weigh them before roasting. Roast one in the conventional manner at 325° F. Roast the other by the "all day method" at 200° F. Weigh each when roasted and compare the loss of weight. Slice and compare the juiciness and color. This could be a class project with one group cooking one roast another the other.
2. You are planning the menu for a supper party on the patio or in the back-yard. You would like to barbecue the main course so you have decided to prepare shish-kabobs. Which meats and which vegetables might you use?
3. You are planning to bake a whole fish. Could you use the same oven to bake the vegetables which might accompany it on the menu?
4. Using the 1965 edition of the Bantam Fannie Farmer Cooking School Cookbook prepare the following meal;

Roast Loin of Pork	p. 196
Baked Potatoes	p. 265
Baked Tomatoes	p. 276
Baked Fruit Compote	p. 365

SOLUTIONS TO PROBLEMS

1. You have performed a typical laboratory experiment. It would be presumptuous to predict the exact result. Other experimenters have found the shrinkage in the "all-day method" roast to be considerably less than in the conventional method roast.
2. The meats could be, - lamb, beef, pork, ham and the variety meats. The vegetables could be onions, green peppers, mushrooms, sliced zucchini or summer squash.

3. The fish and vegetables cannot be baked at the same temperature since the fish requires a high heat and the vegetables a moderate heat.

It might be possible to bake the vegetables first and remove them to a place where they can be kept warm, and then increase the temperature and bake the fish.

4. The entire meal can be baked in the oven. The pork will take approximately 3 hours to roast so it should be put in the oven 3 hours before dinner. The baked potatoes will need approximately 1 hour so they must go in 2 hours after the pork. The baked tomatoes and the fruit compote each require approximately 30 minutes to bake so they will go in last; $\frac{1}{2}$ hour after the potatoes.

It is always wise to allow some extra time at the end of cooking. This time is needed for seasoning if necessary, garnishing and serving.

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CHAPTER V

COOKING METHODS IN WHICH FAT IS THE MEDIUM OF HEAT TRANSFER

Introduction to Instructor.

As its learning objectives this chapter will require the adult learner to list and describe the four cooking methods which employ fat as the medium of heat transfer as well as to discuss their application in food preparation. He will also be required to use these methods in the preparation of a meal.

Introduction to Learner.

The methods which employ fat as the medium of heat transfer are pan-frying, sautéing, pan-broiling, and deep-fat frying. This chapter will define and describe each method as it may be applied to the cooking of meat, poultry, fish, vegetables, fruit and eggs. The basic formula for each method will be developed.

Pan-Frying. Pan-frying is cooking in a small amount of fat in an uncovered frying-pan over direct heat. Food cooked in this manner may be fried in its natural state or it may first be floured or egg-and-crumbed to give a brown crisp crust. The flouring process involves coating the food in seasoned flour. If food is to be egg and crumbed it is first floured then dipped in slightly beaten egg and finally covered with fine bread or cracker crumbs.¹

Sautéing. Sautéing is frying lightly and quickly in a little hot fat. If any excess fat accumulates during cooking it should be poured off. The food is turned or flipped constantly.

Pan-Broiling. Pan-broiling is frying on a hot surface, usually a metal

pot or pan, without adding fat, or by oiling slightly with a piece of fat meat,² or by sprinkling salt on the hot pan. Any fat which accumulates from the food itself must be poured off. The food cooks in its own fat.

Deep-Fat Frying. The deep-fat frying method is frying in a deep kettle with enough fat to cover or float the food being cooked. To prevent absorption of fat by the food the fat must be hot enough to seal the surface as soon as the food is immersed in it. The fat is never sufficiently hot until it stops bubbling. It is wise to use a deep-fat thermometer for deep-fat frying but if one is not readily available it is possible to test the temperature by means of an inch cube of bread. If the fat is hot enough for deep-fat frying the bread cube will turn golden brown in 40 seconds after being immersed.³

Methods of Frying Meat with Fat.

Methods which employ fat as the medium of heat exchange are dry-heat methods and can be used only for tender cuts of meat. The tough cuts of meat must always be cooked by the moist heat methods. Any thin tender cut of beef, veal, pork or lamb may be fried. All four methods may be used with meat i.e., pan-frying, sauteing, pan-broiling and deep-fat frying.

Pan-Frying Meat. The meat should be wiped with a clean damp cloth. It should be seasoned with salt and pepper. If a golden crust is desired the meat should be floured or egg-and-crumbed. The flouring process is the covering of the meat with seasoned flour. This may be accomplished by the following means; (a) the food is shaken in a paper bag containing the seasoned flour; (b) the food is dipped or rolled in the seasoned flour. The fat is melted in a frying-pan but not allowed to reach the smoke point. The meat is added to the pan and browned first on one side then turned and browned on the other side. Cooking should be done at moderate temperatures

and the food should be turned occasionally to cook both sides evenly.⁴

Basic Formula for Pan-Frying Meat.

1. Wipe meat with a clean, damp cloth.
2. Season with salt and pepper.
3. If a crust is desired flour the meat or egg-and-crumb it.
4. Melt fat in a hot frying-pan to a stage just before smoking.

Use a pan with a heavy bottom.

5. Add meat and brown first on one side.
6. Turn and brown on other side.
7. Cook meat in uncovered pan at moderate temperatures, turning occasionally to cook both sides evenly.
8. Cook until tender.

Sautéing Meat. The meat should be wiped with a clean damp cloth. It is seasoned with salt and pepper. The pan is heated and a little fat is added, about 2 tablespoons is generally sufficient for four servings. The meat is browned quickly on both sides. If more cooking is necessary the heat should be lowered and the cooking and turning continued.⁵

Basic Formula for Sautéing Meat.

1. Wipe meat with a clean, damp cloth.
2. Season with salt and pepper.
3. Heat frying-pan over high heat.
4. Add a little fat to the frying-pan, about 2 tablespoons are usually enough for meat for four.
5. Brown meat quickly on both sides.
6. If more cooking is necessary reduce the heat and continue cooking and turning.
7. Cook until tender.

Pan-Broiling Meat. The meat should be wiped with a clean damp cloth. This type of cooking should only be attempted in a heavy thick frying-pan. The pan should sit squarely on the stove and the heat should be evenly distributed. The pan is heated and used in an ungreased state or it may be rubbed with a piece of fat meat, to keep meat from sticking to the pan. Usually a piece of the fat trimmed from the outside of the steak or chop itself is used. When the pan is hot, but not smoking, the meat is added. It is browned first on one side then turned and browned on the other. The cooking and turning are continued until the meat is sufficiently cooked. Any fat which accumulates during cooking should be poured off - the meat must not pan-fry.¹⁶

Pan-broiling of bacon is different from other pan-broiling in that the bacon is placed in a cold pan and heated slowly with frequent turning. Accumulated fat is poured off. Bacon is cooked until crisp.¹⁷

Basic Formula for Pan-Broiling Meat.

1. Wipe meat with a clean damp cloth.
2. Heat pan.
3. Rub pan with fat from the meat if necessary.
4. Add meat.
5. Brown first on one side then on the other.
6. Pour off any fat which accumulates in the pan.
7. Cook and continue turning until done.

Deep-Fat Frying Meat. The meat should be wiped with a clean, damp cloth and prepared for cooking. It is usually floured or crumbed. The fat is heated to frying temperature, 360° to 375° F.¹⁸ It is advisable to use a thermometer to determine the correct temperature. The meat is placed, a few pieces at a time, in the wire basket and lowered into the hot fat. The

meat is browned and cooked through. It is not necessary to turn the meat because it is exposed to the fat on all sides. When cooked the meat is lifted out of the fat by means of the raising the wire basket. Fat should be allowed to drain off before removing from the basket and then the food is placed on absorbent paper towels to remove any excess fat.⁹⁷

Basic Formula for Deep-Fat Frying Meat.

1. Wipe meat with a clean, damp cloth and prepare for cooking by flouring or crumbing.
2. Heat fat in kettle to 360° - 375° F.
3. Place meat, a few pieces at a time, in wire basket and lower into hot fat.
4. Brown and cook meat until tender.
5. Drain off all excess fat before removing from wire basket.
6. Place cooked meat on absorbent paper towels to remove any remaining fat.¹⁰

Methods of Frying Poultry with Fat.

Young birds of any size may be fried. The usual size for chickens is 2½ to 3½ pounds. Small birds may be cut into fourths or halves while larger birds are usually disjointed. Two methods are used for frying poultry.

Pan-Frying Poultry. The poultry should be prepared for cooking by cutting bird in half or quarters or by disjointing. The pieces are wiped dry, seasoned with salt and pepper and sometimes floured or crumbed. Fat is melted in a heavy pan to a depth of 1/4 inch for chicken to 1/2 inch for turkey. The larger pieces are added to the pan first and allowed to brown, then the smaller pieces are added and browned. The pieces are turned occasionally to brown and cook evenly. When pieces are brown the

heat is reduced and the poultry cooked until tender, the thickest pieces of a $2\frac{1}{2}$ pound bird require approximately 25 minutes to cook.

Basic Formula for Pan-Broiling Poultry.

1. Cut bird into parts or disjoint.
2. Dredge with flour or egg-and-crumb if directed to do so.
3. Heat fat in frying pan. Allow $\frac{1}{4}$ inch of fat for chicken, $\frac{1}{2}$ inch for turkey.
4. Add large pieces to pan and brown.
5. Add smaller pieces.
6. Brown on all sides.
7. Keep turning to brown and cook evenly.
8. Cook until tender, a $2\frac{1}{2}$ pound bird will require approximately 25 minutes.

Deep-Frying Poultry. The bird should be cut into serving pieces. The pieces are egg-and-crumbed or dipped in a batter. (1 cup flour, 1 cup milk, 1 egg and $\frac{1}{2}$ teaspoon salt) The fat should be heated in a deep kettle to 300° - 325° F. The pieces are placed in the wire basket and lowered, a few at a time, into the hot fat. The bird should be cooked until tender. It is drained in the wire basket and then placed on absorbent paper towels. ¹¹

Basic Formula for Deep-Fat Frying Poultry.

1. Cut bird into serving pieces. Pat dry.
2. Prepare by egg-and-crumbing or by dipping in batter.
3. Heat the fat to a temperature of 350° F.
4. Lower the pieces, a few at a time, into the hot fat.
5. Regulate the heat to maintain a constant temperature of between 300° and 325° F.

6. Cook until tender.

7. Drain in wire basket and then on absorbent paper towels.

Methods of Cooking Fish in Fat.

Any small fish, fillets or steaks may be fried. The two methods used are pan-frying and deep-fat frying.

Pan-Frying Fish. The fish is prepared for cooking. It is seasoned with salt or floured or rolled in fine bread crumbs. Fat is melted in a frying-pan to a depth of $\frac{1}{8}$ inch to $\frac{1}{4}$ inch. The fish is placed in the pan, skin side up and cooked at moderate heat until brown. It is carefully turned and browned on the other side. It is cooked until it flakes easily when tested with a fork.¹² The complete cooking time will be about 10 minutes per inch thickness of fish.¹³

Basic Formula for Pan-Frying Fish.

1. Prepare fish for cooking.
2. Season, flour or egg-and-crumb.
3. Melt fat in a heated frying-pan allowing $\frac{1}{8}$ to $\frac{1}{4}$ inch of fat.
4. Place fish in pan, skin side up.
5. Cook slowly at moderate heat.
6. When browned, turn carefully.
7. Cook on other side until golden brown and fish flakes easily.

The approximate cooking time is 10 minutes for each inch of thickness of fish.

Deep-Fat Frying Fish. This method is suitable only for small lean fish or steaks cut into serving pieces of not more than $1\frac{1}{2}$ inch thickness. The fish should be thoroughly dried. It is floured, crumbed or dipped in

batter. It is fried until golden brown at a temperature of 375⁰ F. It will require approximately 3 or 4 minutes. The fish should be well drained.¹⁴

Basic Formula for Deep-Fat Frying Fish.

1. Cut fish into serving pieces.
2. Dry fish thoroughly.
3. Prepare fish for frying by flouring, egg-and-crumbing, or dipping in batter.
4. Lower into hot fat a few pieces at a time.
5. Fry until golden brown at 375⁰ F. for approximately 3 to 4 minutes.

Methods of Cooking Vegetables in Fat.

Frying is a method which may be used with many vegetables. The finished product contains all the soluble nutrients and flavor of the vegetable. Vegetables which are frequently cooked in this manner are cabbage, celery, carrots, beets, parsnips, turnips, potatoes, onions, green beans, spinach, and other greens.

Pan-Frying Vegetables. French and Chinese cooks are world famous for this method of preparing vegetables. The result is crisp, tender vegetables with delicious flavor. The vegetables are prepared by shredding, slicing or dicing. One or two tablespoons of fat are added to a heavy frying-pan. The vegetables are added and mixed lightly to develop flavor. The pan is covered and the vegetables are cooked, stirring once or twice, until they sizzle. They are cooked only until crisp - tender. The water that cooks out of the vegetables evaporates, so there is no excess liquid.¹⁵

Basic Formula for Pan-Frying Vegetables.

1. Shred, slice or dice vegetables.

2. Melt 1 or 2 tablespoons of fat in a heavy frying-pan.
3. Add vegetables.
4. Mix lightly.
5. Cook in covered pan until vegetables sizzle.
6. Reduce heat.
7. Cook only until crisp - tender, stirring once or twice.

Sautéing Vegetables. Shredded, chilled vegetables may be cooked by this method, e.g. they are cooked in an uncovered pan in a small amount of fat. They are stirred frequently until cooked.¹⁶

Basic Formula for Sautéing Vegetables.

1. Shred chilled vegetables.
2. Melt a very small quantity of fat in a heavy frying pan.
3. Add vegetables.
4. Cook un-covered over moderate heat.
5. Stir frequently and cook until tender.

Deep-Fat Frying Vegetables. This method is used for cooking some vegetables, notably potatoes and onion rings. The vegetables should be peeled and cut into slices or strips. Potatoes should be washed in cold water, drained and dried thoroughly between clean towels. Onion rings should be dipped in milk and then in seasoned flour. The vegetables are placed in the wire basket, a few pieces at a time, and lowered into deep fat at a temperature of 375° F. They are fried until golden brown. They are removed from the fat, drained and turned onto paper towels.¹⁷

Basic Formula for Deep-Fat Frying Vegetables.

1. Prepare vegetables by peeling and cutting.
2. Prepare each vegetable as instructed in recipe.

3. Place vegetables, a few at a time, in the wire basket.
4. Lower vegetables into hot fat at 375° F.
5. Cook until golden brown.
6. Drain off fat and turn onto paper towels.

Methods of Cooking Fruits in Fat.

A few fruits may be fried although this is not a common way of preparing fruit. Those fruits which may be cooked in this manner are apples, bananas and pineapple slices. The method commonly used in sauteing.¹⁸

Sautéing Fruit. The fruit should be peeled and cut. Apples and pineapple are usually sliced, bananas are usually cut lengthwise. Apples and pineapple are sauteed in a small amount of flavorful fat such as butter or bacon fat. Bananas are usually dredged with flour, browned in butter and sprinkled with powdered sugar.

Basic Formula for Sautéing Fruit.

1. Prepare fruit as directed in recipe.
2. Melt butter or flavorful fat in frying-pan.
3. Add fruit.
4. Brown and cook on both sides.

Methods of Cooking Eggs Using Fat as a Cooking Medium.

Eggs may be cooked by pan-frying. Just enough fat should be used to prevent eggs from sticking to the frying-pan. The fat is heated to moderately hot, not allowed to smoke. The eggs are broken, one at a time, into a saucer, then slipped, one at a time, into the frying pan. They are seasoned with salt and pepper. The pan should be covered if the eggs are not to be turned. The eggs are cooked until the white is opaque and of a jelly-like consistency. If eggs are to be turned they are cooked in an

un-covered pan. The egg is cooked on one side then turned with an egg-turner or a broad spatula. The eggs should be removed from the pan carefully with an egg-turner or spatula.¹⁹

Basic Formula for Frying Eggs.

1. Melt only enough fat in pan to prevent sticking.
2. Heat pan to moderate temperature. Fat should not smoke.
3. Break the eggs, one at a time, into a saucer.
4. Slip, one at a time, into the frying-pan.
5. Season with salt and pepper.
6. Cover pan, or leave un-covered and turn eggs when cooked on one side.
7. Cook until white is opaque and of a jelly-like consistency.
8. Remove from pan carefully with an egg-turner or a broad spatula.

Appraisal of Cooking Methods Using Fat as the Medium of Heat Transfer.

The advantages of using fat as the cooking medium are that practically no food nutrients are lost and that flavor is developed in browning. Frying is also a fast method of cooking and is therefore useful to the cook who has limited time. It is an important method for preparing food from left-overs. Such left-over food as meat, poultry, fish and vegetables may all be prepared in some appetizing way by means of these methods. Recipes which utilize these methods in the preparation of left-over food are: fish cakes, potato cakes, hash and croquettes.

The object of cooking with fat is to cook the food through and brown the outside with the minimum absorption of fat. Fat absorption must be kept to a minimum to insure palatability and digestibility. Fat absorption is affected by (1) the length of time of heating, (2) the temperature of the

fat, (3) the amount of surface exposed to the fat, and (4) the character and composition of the food. The longer the food remains in the fat the greater the absorption. The higher the temperature of the fat, the lower the absorption. The larger the proportion of surface of food, the greater the absorption. No difference in fat absorption has been found to exist due to the kinds of fat used.²⁰

Of great importance to flavor and digestability is the "smoke point" of fat used for frying, i.e. the amount of heat the fat can stand before it smokes. When fat smokes it is breaking down chemically and when this happens it becomes irritating to the digestive tract as well as smelling and tasting badly.²¹ Therefore fat used for frying should never be allowed to reach the smoke stage.²² For deep-fat frying the temperatures should not exceed 385° F. and most foods may be fried at lower temperatures. Pan-frying and sauteing are done at much lower temperatures.

The fats suitable for deep-fat frying are the hydrogenated fats, compounds, high quality lard, and vegetable oils with the exception of olive oil. Olive oil, butter and margarine are not suitable for deep-fat frying since they smoke at too low a temperature.

The fats which may be used successfully in pan-frying and sauteing include butter, lard, hydrogenated fats, margarine, vegetable oils and meat drippings.

Deep-fat frying can be greatly facilitated by the use of the proper equipment. A deep kettle with a wire inset-basket and a deep-fat thermometer are very important. For pan-frying or sautéing it is necessary to have a frying-pan with a bottom of uniform thickness which sits squarely on the stove, otherwise there will be areas which are hotter than others and frying will be uneven.

Frying requires somewhat more skill on the part of the cook than some other cooking methods. Attention must be given to selection of the fat most suitable for the particular method, preparation of the food, temperature of the fat, and the length of time required for frying. However, when the skills have been learned, the food prepared by these methods will be palatable, nutritive and pleasing to look at.

SUMMARY

This chapter has dealt with the four methods of cooking which employ fat as the medium of heat transfer. Each method has been defined and its application has been described in the cooking of meat, poultry, fish, vegetables, fruit and eggs. Basic formulae have been developed for each method as it applies to the different foods. Equipment used for the various methods has been described.

The pan-frying method of cooking may be used with meat, poultry, fish, vegetables and eggs. The method has been described as it applies to each of these foods and basic formulae have been developed.

The sautéing method of cooking may be applied to meat, vegetables and fruit. The method has been described as it applies to each of these foods and basic formulae have been given.

The pan-broiling method is applicable to meat. The method has been described and a basic formula given.

Deep-fat frying may be applied to meat, poultry, fish, and vegetables. Its application has been described with each of these foods and basic formulae developed.

An analysis of the methods which use fat as the medium of heat transfer has been made. Ways in which these methods may be used in more complex cooking procedures have been indicated.

SUGGESTED LEARNING EXPERIENCES

1. You wish to prepare a breakfast of bacon and fried eggs. Would you begin the frying process in the same way for each?
2. Fried chicken may be prepared by two different methods. What are these?
3. You find that you have some left-over cooked food in the refrigerator. If these foods are boiled potatoes, cooked corn beef how might you use them?
4. Using the Bantam edition of the All New Fannie Farmer Boston Cooking School Cookbook prepare the following recipes:

1. Fillet of Sole a la Meuniere	p. 128
2. French-fried potatoes	p. 269
3. Panned green beans	p. 243
4. Sautéed bananas	p. 368

SOLUTIONS TO PROBLEMS

1. Bacon is an exception to the rule for pan-frying. It is always placed in a cool frying pan and heated. The bacon should be fried first and then removed from the pan and drained on paper towels. The eggs may be fried in the remaining bacon fat. They should be cooked at a moderate temperature.
2. Chicken can be deep fat-fried or pan-fried.
3. These left-overs would make an excellent hash with the addition of some chopped onion. The three ingredients should be chopped, seasoned with salt and pepper and pan-fried in a small quantity of melted fat.
4. The equipment necessary for this menu is a deep-frying kettle and in-set basket for the french-fried potatoes and two frying pans, one each

for the sole and the green beans. Since the green beans will require the longest cooking time they should be started first. The sole and the french-fried potatoes will require approximately the same cooking time. The temperature of the fat for french-frying must be carefully checked. The bananas might be sautéed at the table in a chaffing dish or an electric frying-pan.

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CHAPTER VI

COOKING METHODS USING A COMBINATION OF MEDIA OF HEAT TRANSFER

Introduction to Instructor.

As its learning objectives this chapter will require the learner to name and describe the cooking methods which employ two media of heat transfer and to discuss the applications of these methods. He will also be required to use these methods in the preparation of a meal.

Introduction to Learner.

The two cooking methods which utilize two different media of heat transfer are braising and pot-roasting. These methods also utilize a dry heat method and a moist heat method of cooking. This chapter will define and discuss these methods as they may be applied to meat, poultry, fish, and vegetables. Basic formulae for these methods as they apply to each food will be given.

Braising. Braising utilizes two different media of heat transfer. It also combines a dry heat method and a moist heat method of cooking. Dry heat is used for browning and adding flavor and may be applied by sauteing, pan-frying or baking. Moist heat is used to soften tough connective tissue in meat and poultry and to soften cellulose in vegetables.¹ It may be applied by simmering, steaming, or waterless cooking.

There are two important variations of this method. Most frequently used is the one in which the food is first sauteed or fried in a small quantity of hot fat until it is nicely browned on all sides and then subjected to moist-heat cooking in a tightly covered container. The other method

first subjects the food to the moist heat method in a tightly covered container and then applies the dry heat method by removing the cover and either baking the food in an oven or frying it in a small quantity of fat.²

The container used for braising may be a casserole for oven cookery or a heavy frying-pan or kettle for surface cooking. A Dutch Oven which is made of cast iron or other metal and has a close-fitting lid is suitable for both oven and surface cooking. The close fitting lid is essential for this method of cooking since the food is partially cooked in the steam from its own juices or from added liquid.

Pot-Roasting. A variation of braising is pot-roasting which also uses a combination of cooking media and a combination of cooking methods. Braising is the term used for cooking smaller cuts of meat such as steaks, chops, slices and cubes whereas pot-roasting is used for large less tender pieces of meat such as roasts.³

Although braising and pot-roasting are used for less tender cuts of meat and poultry as well as some vegetables braising may also be used to cook tender cuts of meat and fish.

Braising Meat. Meat to be braised may be prepared in a number of ways. It should first be wiped with a clean, damp cloth. It may be cooked in its natural state or it may be rubbed with seasoned flour or it may be pounded with a wooden mallet to break down some of the connective tissue, e.g. Swiss steak, wiener schnitzel. It is sauteed in hot fat until it is evenly browned on all sides. It is then placed in a casserole or kettle which is just large enough to hold it,⁴ and enough liquid to cover the bottom of the container is added. The container must be covered tightly and the meat cooked slowly either in an oven at 300° to 325° F. or on top of the stove at simmer. During the cooking extra liquid is added if necessary to keep the

meat moist and steaming. It is cooked until tender. The pan juices should be saved for sauce or gravy.⁵

Basic Formula for Braising Meat.

1. Wipe meat with a clean damp cloth.
2. Prepare meat as directed in the recipe.
3. Heat a heavy frying-pan or kettle.
4. Add a small amount of fat.
5. Add meat and brown on all sides. Beef should be allowed to take on a real dark brown color.
6. Transfer meat to a casserole if a frying-pan has been used for browning.
7. Add a small quantity of hot liquid. This may be wine, stock or water.
8. Cover the container tightly.
9. Cook in an oven at 300⁰ to 325⁰ F., or on top of the stove at simmer heat.
10. Add more liquid during cooking if it is necessary to keep meat moist and steaming.
11. Cook until tender.
12. Reserve pan juices for making sauce or gravy.

Pot-Roasting Meat. Large, less tender pieces of meat are used. The meat is wiped with a clean, damp cloth. Meat which is to be cooked by this method is frequently marinated in a mixture of herbs and spices and wine or vinegar. If marinated it should be drained and dried with paper towels before cooking. It is sauteed in a small amount of hot fat or oil then placed in a kettle and a small amount of liquid is added. The liquid may

be some of the marinade, or wine, stock or hot water. It is tightly covered and cooked slowly in a slow oven at 300⁰ to 325⁰ F., or on top of the stove at simmer heat. Vegetables may be added toward the end of the cooking period. The juices should be saved for making sauce or gravy.⁶

Basic Formula for Pot-Roasting Meat.

1. Prepare the meat by wiping with a clean, damp cloth.
Marinate if recipe calls for it.
2. Heat a frying-pan or heavy kettle and add a small amount of fat or oil.
3. Add meat and brown on all sides in the hot fat.
4. Transfer meat to a heavy kettle if a frying-pan has been used.
5. Add a small quantity of hot liquid to cover the bottom of the container.
6. Cover the container tightly.
7. Cook in a slow oven at 300⁰ to 325⁰ F., or on top of the stove at simmer heat.
8. Cook until tender.
9. Vegetables may be added toward the end of cooking.
10. Reserve pan juices for sauce or gravy.

Braising Poultry. Any mature bird may be cooked in this manner.

Poultry cooked by this method is often called a fricassee. The bird is wiped with a clean, damp cloth. It is seasoned with salt and pepper and browned on all sides in a little hot fat or oil. It is placed in a casserole or heavy kettle and hot liquid is added to cover the bottom of the container. Liquid may be chicken stock, wine or water. The container

is covered tightly and the poultry cooked in a slow oven at 300⁰ to 325⁰ F., or on top of the stove at simmer heat. It is cooked until tender. The cooking liquid should be saved for sauce or gravy.⁷

Basic Formula for Braising Poultry.

1. Prepare bird by wiping with a clean, damp cloth.
2. Disjoint if the recipe calls for it.
3. Heat a heavy frying-pan or kettle and add a small amount of fat or oil.
4. Add poultry and brown on all sides.
5. Transfer poultry to a casserole if a frying-pan has been used.
6. Add a small amount of hot liquid.
7. Cover the container tightly.
8. Cook in a slow oven at 300⁰ fo 325⁰ F., or on top of the stove at simmer heat.
9. Cook until tender.

Braised Fish. Although braising is not a very common method of preparing fish it may be used to lend variety to fish cookery. Small pieces of fish such as fillets or steaks may be used. The fish is sauteed in a small amount of melted butter then placed in an oven-proof dish to which may be added fish stock, dry white wine, cream or other liquid. The dish is covered and the fish placed in an oven at 350⁰ F. It is cooked until it flakes readily when tested with a fork. It takes approximately 15 minutes, or 10 minutes per inch thickness of fish.⁸

Basic Formula for Braising Fish.

1. Prepare fish by cutting into fillets or steaks.
2. Heat a heavy frying-pan and add a small amount of butter.

3. Brown the fish lightly on all sides.
4. Transfer to an oven-proof dish.
5. Add dry, white wine or cream to cover bottom of container.
6. Cover tightly.
7. Cook in a moderate oven at 350⁰ F. until fish flakes readily when tested with a fork. Fillets will require approximately 15 minutes.

Braised Vegetables. Certain vegetables lend themselves to this method of cooking. Some of these are celery, leeks, lettuce, okra, endive, cucumbers, squash and carrots.

The vegetable is first prepared by peeling or removing the outer leaves. It is sliced or cut into fairly small pieces. Frequently vegetables to be braised are cut in half lengthwise, e.g., carrots, parsnips, leeks. It is sauteed in a small amount of butter then enough liquid to cover the bottom of the container is added. The container is covered tightly and the vegetable is cooked in a moderate oven at 350⁰ F., until most of the liquid has been absorbed.⁹

Basic Formula for Braising Vegetables.

1. Prepare vegetables as directed in the recipe.
2. Saute in a small amount of butter in a heavy frying-pan.
3. Transfer to an oven-proof dish.
4. Add enough liquid to cover bottom of container.
5. Cook in a moderate oven at 325⁰ F., until tender and most of the liquid has been absorbed.

Appraisal of the Braising Method of Cookery.

The advantage of braising is that it combines the good features of both a dry and a moist heat method of cooking. Through the dry heat cooking the food being cooked develops color and flavor and through the moist heat cooking it is softened and tenderized.

Braising is a two step process involving preliminary browning followed by moist cooking, or moist cooking followed by browning. The dry heat method employed for browning may be either frying, sauteing or roasting. The moist heat method may be steaming or cooking with water. The steam may come entirely from the food itself or partly from liquids added in small amounts. The steaming may be done on top of the stove or in the oven in an oven-proof container such as a casserole. The general aim is to produce a well-browned product which is both tender and juicy.¹⁰

Since the foods which are cooked in this way usually contain large amounts of connective tissue the time for cooking must allow for conversion to gelatin to ensure tenderness. Meat cooked in this way to the well-done stage will have lost much of its juice, however since the pan juices are flavorful they are seldom discarded and the dissolved minerals and vitamins are consumed as gravy or sauce.¹¹

In the preparation of foods by this method care must be taken during the moist heat cooking that they are not allowed to reach the point where bundles of fibres fall apart. In the case of the meats this makes carving difficult. In general, shrinkage of meat cooked by moist heat is greater than in meat cooked by dry heat methods. This is partly the result of the need to reach a more advanced stage of doneness to dissolve the connective tissue.¹²

In using this method the cook must analyse the purpose of its application. It may be used if a tough cut of meat or poultry is to be cooked

in a flavorful way. It may also be used to develop flavor and juiciness in tender cuts of meat such as pork chops, veal, chicken and fish.

Since braising is a method which allows the cook to produce tender, flavorful dishes from the tougher cuts of meat and poultry and since the tougher cuts are always the least expensive it provides a means of exercising economy.

SUMMARY

This chapter has dealt with the two methods of cooking which employ two media of heat transfer as well as two methods of cooking viz. a dry-heat method and a moist-heat method. These methods are braising and pot-roasting. The methods have been described as they may be applied to meat, poultry, fish and vegetables. Basic formulae have been developed for these methods with each of these foods. Equipment which is used for cooking by these methods has been described and an appraisal has been made of the methods.

Braising is a method which may be used to cook meat, poultry, fish and vegetables. The method has been described as it applies to each of these foods and basic formulae have been developed.

Pot-roasting is a method which may be used with large less tender or tough cuts of meat. Its application has been described and a basic formula given.

SUGGESTED LEARNING EXPERIENCES

1. While shopping for meat you observed that pork was reasonable in price. How could you cook pork chops to ensure tenderness and flavor?
2. You plan to entertain friends who like chicken. You would prefer to do most of the cooking before they arrive. What could you prepare?
3. Using the Bantam edition of the Fannie Farmer Boston Cooking School Cookbook prepare the following meal.

Braised Beef	p. 173
Braised Red Cabbage and Apples	p. 249
Lyonnaise Potatoes	p. 271
Sauteed Pears	p. 374

SOLUTIONS TO PROBLEMS

1. The pork chops could be braised. Long slow moist heat destroys roundworms called trichinellae. The recipe for Braised Pork Chops on page 197 of the Bantam edition of the Fannie Farmer Cookbook would produce a good result.
2. There are many ways of preparing chicken in advance. Smothered Chicken is an excellent way. A recipe can be found on page 223 of the Fannie Farmer Cookbook. Other excellent braised chicken dishes are Chicken Casserole, Chicken a la Cacciatore, Coq au Vin, and Hungarian Chicken Paprika. These recipes may all be found in the Fannie Farmer Cookbook.
3. The potatoes should be boiled in advance of frying. After initial

preparation the Braised Beef will require approximately $3\frac{1}{2}$ hours of cooking, the Red Cabbage and Apples will require $1\frac{1}{2}$ to $3\frac{3}{4}$ hour, the Lyonnaise Potatoes approximately 20 minutes. The pears will require 10 to 15 minutes.

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CHAPTER VII

SUMMARY

The purpose of this study was to design an instructional device (text) on basic food preparation to meet the needs of the adult learner in either an adult education program or a program of self study. It has been recognized that the adult learner who participates in an avocational adult education program has different practical objectives than the adult in the professional school or college. His reasons for participating in such a program may be motivated by inadequacies in a new social role or by special problems, responsibilities, needs, interest, curiosities or ambitions. Whatever his reasons for participation in such a program the new learning must be made meaningful for him and applicable in his daily life.

In this study the educational objectives and goals were outlined for the entire course as well as for each unit of the course. Material was presented in sequential order proceeding from the known to the unknown and from the simple to the complex.

The text departed from conventional design of food text material. It is customary to proceed from the food to the method of preparation. This text began with the method and applied it, wherever possible, to each of six natural foods viz. meat, poultry, fish, vegetables, fruits and eggs. It was felt that this presentation would provide the adult learner with the means for achieving his immediate practical objectives more readily than the conventional presentation.

Every effort was made to familiarize the adult learner with the basic principles of food preparation. It was felt that the intelligent performer of a skill is one who understands "why" as well as "how" a procedure is

followed. These basic principles are the keystone of all cookery. They form the basis for sound decisions in the application of cooking methods.

The text was developed from a conceptual classification designed especially for this study. The classification depicts the whole field of food processing starting with food in its natural state and following it through the various processes to the stage at which it is ready for consumption. It begins by showing the six food processing techniques of preparation and preservation. These are; (1) subdivision and fractionization, (2) combining and mixing, (3) heating and cooking, (4) removal of heat, (5) use of chemical agents, (6) use of microorganisms. The heating and cooking technique is further classified according to media of heat transfer. These are; (1) water, (2) steam (3) air, (4) fat, (5) combinations of these media. The media classification is subdivided into methods of cooking. When water is the medium of heat transfer the cooking methods are boiling, simmering, poaching and stewing; when steam is the medium the methods are steaming, waterless-cooking and pressure-cooking; when air is the medium the methods are broiling and roasting or baking; when fat is the medium the methods are pan-frying, deep-fat frying, sauteing and pan-broiling; when a combination of media are used the methods are braising and pot-roasting. The methods may also be classified as moist heat methods, dry heat methods and combination methods. The moist heat methods employ as the media of heat transfer water and steam. The dry heat methods employ as the media of heat exchange air and fat. The combination methods employed two or more methods. The text was organized into five units or chapters, each chapter dealing with one medium of heat transfer. Each chapter gave definitions of the cooking methods utilizing the medium of heat transfer as well as descriptions of their use with the six natural foods. If a method could be applied to a food its application was discussed in detail

and a basic formula was developed. These basic formulae are steps of procedure which are followed by experienced cooks to achieve predictable results. At the end of each chapter an appraisal of each method was made. Learning experiences were also suggested which would enable the adult learner to assess his own progress and achievement. Solutions to problems were given.

It was necessary to refine the objectives and to limit them to what could be encompassed in a limited time. In cases where there were several acceptable ways of performing the same task it was found expedient to choose one way giving preference to the simplest.

The study also served to examine the cooking repertoire of Canada and the United States of America. By means of deduction it became apparent that certain valuable cooking procedures have been neglected in Canadian and American cuisine. This was particularly evident in vegetable cookery. In the search for evidence of the use and practicality of certain methods with the various vegetables it was found that French and Chinese vegetable cookery was much more varied. The formulae were tested and the results were found to be very pleasing. A method of preparing chicken by poaching was also found to have been neglected in most American and Canadian cook books. This is a method which is very popular in most European countries.

An appendix to the text included tables of cooking times and temperatures, a glossary of cooking terms, and supplemental material on heat exchange and on the purposes of cooking.

This study has been conceived as one unit in a broader curriculum which would embrace all six techniques of domestic food processing.

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TABLE II TIME TABLE FOR COOKING MEATS IN LIQUID

Kind of Cut	Approximate Weight	Approximate Total Cooking Time
	Pounds	Hours
<u>Beef</u>		
Corned beef brisket (piece)	3	3 to 3.3/4
Beef shanks	4	3 to 4
Beef tongue	3 to 4	3 to 3½
For Stew (1 to 2 pieces)		2½ to 3
<u>Chicken</u>		
	3 to 4	2½ to 3
<u>Lamb</u>		
For Stew (1 to 2 pieces)		1½ to 2
<u>Pork</u>		
Smoked ham (whole country style)	16	4
Smoked ham (country style)	5	2½
Smoked picnic shoulder (country style)	7 to 8	3½ to 4
Smoked pork shoulder butt, boneless	2 to 3	1½ to 2
Pork hocks	¾ to 1 ea.	2½ to 3
<u>Veal</u>		
For Stew (1 to 2 pieces)		2 to 3

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TABLE III

TIME TABLE FOR BROILING MEAT

Kind and Cut	Approximate Thickness Inches	Approximate Total Ckng. Time		
		Rare	Medium	Well Done
		M I N U T E S		
Bacon				4 to 5
Beef Steaks	3/4 - 1	10	14	18
Rib, Club, Tenderloin				
T-Bone, Sirloin	1½	16	20	26
Ground Meat				
Patties	3/4	8	12	14
Ham, Cured and Smoked, Slice	1			20
Lamb chops, rib	3/4		12	14
loin, shoulder	1½		18	22
Ground Lamb Patties	3/4		12	14
Liver Calf, Young beef, lamb	1/2			12

TABLE IV

TIME TABLE FOR ROASTING MEATS

Kind and Cut of Meat	Ready to cook Weight	Approximate Roasting Time at 325 F.	Internal Temp. of Meat When Done
<u>Beef.</u>	Pounds	Hours	F.
Standing Ribs			
Rare	6 - 8	2 to $2\frac{1}{2}$	140
Medium	6 - 8	$2\frac{1}{2}$ to 3	160
well done	6 - 8	$3\frac{1}{2}$ to $4\frac{1}{2}$	170
Rolled Rib			
Rare	4 - 6	2 to 3	140
Medium	4 - 6	$2\frac{1}{2}$ to $3\frac{1}{4}$	160
Well done	4 - 6	3 to 4	170
Rolled rump	5	3 to $3\frac{1}{2}$	160-170
Sirloin tip	3	2 to $2\frac{1}{4}$	160-170
<u>Veal</u>			
Leg	5 - 8	$2\frac{1}{2}$ to $3\frac{1}{2}$	170-180
Loin	5	3	170-180
Rolled shoulder	3 - 5	3 to $3\frac{1}{2}$	170-180
<u>Lamb</u>			
Leg	6 - 7	$3\frac{1}{4}$ - 4	180
Shoulder	3 - 6	$2\frac{1}{4}$ to $3\frac{1}{4}$	180
Rolled Shoulder	3 - 5	$2\frac{1}{2}$ to 3	180
<u>Pork Fresh</u>			
Loin	3 - 5	3 to 4	185
Shoulder	5 - 8	$3\frac{1}{2}$ to 5	185
Ham, whole	10-14	$5\frac{1}{2}$ to 6	185
Ham, half	6	4	185
Spare ribs	3	2	185
<u>Pork Cured</u>			
Cook before eating			
Ham, whole	12-16	$3\frac{1}{2}$ to $4\frac{1}{4}$	160
Ham, half	6	$2\frac{1}{2}$	160
Picnic Shoulder	6	$3\frac{1}{2}$	170
Fully cooked			
Ham, whole	12-16	2 to 3	130
Ham, half	6	About $1\frac{1}{2}$	130

TABLE V

TIME TABLE FOR BRAISING MEATS

Kind and Cut	Approximate Weight or Thickness	Approximate Total Cooking Time
Beef		
Pot roast	3 - 5 lbs	3½ - 4 hrs.
Round or Chuck Steak	1 - 1½ in.	2 - 2½ hrs.
Flank Steak	1½ - 2 lbs.	2 hrs.
Short ribs		2 - 2½ hrs.
Cubed beef for stew	1½ in. cubes	2½ - 3 hrs.
Oxtails		3 - 3½ hrs.
Lamb		
Shoulder, rolled	3 lb.	2 - 2½ hrs.
Shoulder chops	¾ in.	40 min.
Shanks	1 lb.	1½ - 2 hrs.
Cubed lamb for stew	1½ in. cubes	1½ - 2 hrs.
Pork		
Rib and loin chops	¾ in. - 1 in.	50 - 60 min.
Shoulder steaks	¾ in.	45 min.
Spareribs		1½ - 2½ hr.
Tenderloin patties	½ in.	30 min.
Veal		
Shoulder, rolled	3 lb.	2½ hr.
Round Steak (cutlets)	½ in.	45 min.
Loin or rib chops	¾ in.	45 min.
Cubed veal for stew	1 in. cubes	1½ - 2 hrs.

TABLE VI

ROASTING GUIDE FOR POULTRY

Kind of Bird	Ready to cook weight (pounds)	Amount of Stuffing (quarts)	Approximate Roasting time at 325° F. for stuffed chilled birds (Hrs)
<u>Chicken</u>			
Broilers or Fryers	1½ to 2½	¼ to ½	1¼ to 2
Roasters	2½ to 4½	½ to 1¼	2 to 3½
Capons	4 to 8	1¼-1.3/4	3 to 5
<u>Duck</u>	3 to 5	½ to 1	2½ to 3
<u>Goose</u>	4 to 8	¾ -1½	2.3/4-3½
	8 to 14	1½ to 2½	3½ to 5
<u>Turkey</u>			
Fryers or Roasters			
(very young birds)	4 to 8	1 to 2	3 to 4½
Roasters (fully			
grown young birds)	6 to 12	2 to 3	3½ to 5
	12 - 16	3 to 4	5 to 6
	16 - 20	4 to 5	6 to 7½
	20 - 24	5 to 6	7½ to 9

TABLE VII

TIME TABLE FOR COOKING FISH IN LIQUID

Product	Market Form	Approx. Weight	Cooking Temp.	Approx. Total Cooking Time
		pounds		minutes
Fish	Pan-dressed	1/2 to 1	Simmer	10
	Steaks	1/2 to 1	Simmer	10
	Filletts		Simmer	10
Crabs	Live		Simmer	15
Lobster	Live	3/4 to 1	Simmer	10-15
		1 to 1 1/2	Simmer	15-20
Scallops	Shucked		Simmer	4-5
Shrimp	Headless		Simmer	5
Spiny Lobster	Headless	4.oz	Simmer	10
Tail		8.oz	Simmer	15

TABLE VIII

TIME TABLE FOR BROILING FISH

Product	Market form	Approx. Weight or Thickness	Cooking Temp.	Approx. Total Cooking Time
		pounds or ins.		minutes
Fish	Pan-dressed	1/2 to 1.1b		10-15
	Steaks	1/2 to 1"		10-15
	Fillets			10-15
Clams	Live			5-8
Lobster	Live	3/4 to 1.1b		10-12
Oysters	Live			5
	Shucked			8-10
Scallops	Shucked			8-10
Shrimp				8-10
Lobster		8.oz		10-12
Tails				

TABLE IX

TIME TABLE FOR BAKING FISH AND SHELL FISH

Product	Market Form	Approx. Weight pounds and inches	Cooking Temp. deg. F.	Approx. Total Cooking Time Minutes
Baking				
Fish	Dressed	3 to 4	350	40-60
	Pan-dressed	$\frac{1}{2}$ to 1	350	25-30
	Steaks	$\frac{1}{2}$ to 1"	350	25-35
	Filletts		350	25-35
Clams	Live		450	15
Lobster	Live	$\frac{3}{4}$ to 1	400	15-20
		1 to $1\frac{1}{2}$	400	20-25
Oysters	Live		450	15
	Shucked		400	10
Scallops	Shucked		350	25-30
Shrimp	Headless		350	20-25
Spiny Lobster	Headless	4.oz	450	20-25
Tails		8.oz	450	25-30

TABLE X TIME TABLE FOR COOKING FRESH VEGETABLES

Vegetable	Boiling Minutes	Steaming Minutes	Pressure Cooking 15-lb.press. Minutes	Baking Minutes
Artichokes, French or Globe, whole	35 - 45		10 - 12	
Artichokes, Jerusalem, whole	25 - 35	35		30 - 60
Asparagus, whole	10 - 20	12 - 30	$\frac{1}{2}$ - $1\frac{1}{2}$	
tips	5 - 15	7 - 15	$\frac{1}{2}$ - 2	
Beans, Lima, green	20 - 25	25 - 35	1 - 2	
Beans, Soy, green	20 - 30	25 - 35	1 - 2	
Beans, green whole or 1-inch pcs.	15 - 20	20 - 35	$1\frac{1}{2}$ - 3	
shredded	10 - 20	15 - 25	1 - 2	
Beet greens	5 - 15			
Beets, new, whole	30 - 45	40 - 60	5 - 10	40 - 60
old, whole	45 - 90	50 - 90	10- 18	40 - 60
Broccoli, heavy stalks, split	10 - 15	15 - 20	$1\frac{1}{2}$ - 3	
Brussels sprouts, whole	10 - 20	10 - 20	1 - 2	
Cabbage, green quartered	10 - 15	15	2 - 3	
shredded	3 - 10	8 - 12	$\frac{1}{2}$ - $1\frac{1}{2}$	
Cabbage, red, shredded	8 - 12	10 - 15	$\frac{1}{2}$ - $1\frac{1}{2}$	
Carrots, young, whole	15 - 25	20 - 30	3 - 5	35 - 40
sliced	10 - 20	15 - 25	$1\frac{1}{2}$ - 3	30- 40
mature, whole	20 - 30	40 - 50	10- 15	60
sliced	15 - 25	25 - 30	3	

TABLE X CONTD.

Vagetable	Boiling Minutes	Steaming Minutes	Pressure Cooking	
			15-lb.press. Minutes	Baking Minutes
Cauliflower, whole	15 - 20	25 - 30	10	
flowerets	8 - 15	10 - 20	1½ - 3	
Celery, diced	15 - 18	25 - 30	2 - 3	
Chard, Swiss	10 - 20	15 - 25	1½ - 3	
Collards	10 - 20			
Corn, on cob	5 - 15	10 - 15	0 - 1½	
Eggplant, sliced	10 - 20	15 - 20		
Kale	10 - 25			
Kohlrabi, sliced	20 - 25	30		
Okra, sliced	10 - 15	20	3 - 4	
Onions, small, whole	15 - 25	25 - 35	3 - 4	50 - 60
large, whole	20 - 40	35 - 40	5 - 8	30 - 45
Parsnips, whole	20 - 40	30 - 45	9 - 10	
quartered	10 - 20	30 - 40	4 - 8	
Peas, green	8 - 20	10 - 20	0 - 1	
Potatoes, white, medium, whole	25 - 40	30 - 45	8 - 11	45 - 60
quartered	20 - 25	20 - 30	3 - 5	
Rutabagas, diced	20 - 30	35 - 40	5 - 8	
Spinach	3 - 10	5 - 12	0 - 1½	
Squash, Hubbard, 2-inch pcs.	15 - 20	25 - 40	6 - 12	40 - 60
Squash, Summer, sliced	10 - 20	15 - 20	1½ - 3	30

TABLE X CONTD.

Vegetable	Boiling Minutes	Steaming Minutes	Pressure Cooking	
			15-lb press. Minutes	Baking Minutes
Sweet potatoes, whole	25 - 35	30 - 35	5 - 8	30 - 45
quartered	15 - 25	25 - 30	6	
Tomatoes	7 - 15		$\frac{1}{2}$ - 1	15 - 30
Turnips, whole	20 - 30		8 - 12	
sliced	15 - 20	20 - 25	$\frac{1}{2}$	

TABLE XI

TEMPERATURES FOR DEEP-FAT FRYING

Food	° F.
Chicken	350
Fish	350
Fritters	350
Shell Fish	350 - 375
Cauliflower	375 - 385
Croquettes	375 - 385
Egg-plant	375 - 385
Onions	375 - 385
French-fried potatoes	385 - 395

American Home Economics Association, Handbook of Food Preparation,
Washington, 1964, p. 29.

TABLE XII

OVEN TEMPERATURE

Temperatures in ° F.	Description
250 - 275	Very slow oven
300 - 325	Slow oven
350 - 375	Moderate oven
400 - 425	Hot oven
450 - 475	Very hot oven
500 - 525	Extremely hot oven.

American Home Economics Association, Handbook of Food Preparation,
Washington, 1964, p. 29.

GLOSSARY OF COOKING TERMS

Acidulate - to add vinegar or lemon juice to water, usually 1 tablespoon to each quart of water.

Barbecue - to cook meat, poultry or fish over an open fire. The term also denotes dishes which are served with a pungent sauce.

Baste - to pour fat or liquid over food while cooking to moisten, glaze or flavor it.

Bind - to hold foods together with a sauce so that they form a cohesive mass.

Blanch - to immerse foods briefly in boiling water to loosen skins or to whiten. This process is generally used with vegetables, fruit and nuts.

Bone - to remove the bones from meat, fish or poultry.

Bread - to roll in or coat with crumbs before cooking.

Bouquet-garni - bunch of aromatic herbs used to flavor soups, stews, braised dishes and sauces. Usually it is made of parsley, thyme, and bay leaf tied together in cheese cloth.

Casserole - a special earthenware or other oven-proof dish in which food is cooked and from which it may be served at the table.

Chop - to cut into small pieces with a sharp knife on a board.

Clarify - to clear a liquid such as soup by adding slightly beaten egg-white and broken egg shells. These coagulate when the liquid is heated and the particles of food adhere to them. The liquid is then strained.

Court Bouillon - a liquid in which fish, poultry or meat is cooked to give added flavor. A simple court bouillon consists of water, wine, vinegar or

stock, either used alone or in combination, to which have been added onion, celery, carrots, bay leaf, salt and pepper.

Crisp - to place in ice-water until crisp; a process used with vegetables.

Croquettes - a mixture of chopped or ground cooked food—vegetables, cereals, cheese, meat, fish, etc., bound together by eggs or a thick sauce, shaped into small balls, rolls, or pyramids, and fried in deep fat.

Croutons - cubes of bread toasted or fried. Usually served in salads, soups or over various dishes.

Cube - to cut into even-sided pieces.

Dice - to cut into very small cubes.

Disjoint - to cut poultry into pieces at the joints.

Dredge - to cover food completely with a dry ingredient such as flour or crumbs.

Dress - to remove the internal organs and to trim off unedible portions of meat, poultry, or fish.

Dutch Oven - a large heavy iron casserole with a close-fitting lid. May be used on top of the range or in the oven.

Eviscerate - to remove the internal organs.

Fillet - to cut meat or fish into desired shape removing all bones.

Flake - to break up into flat pieces, usually with a fork.

Forcemeat - pastes of meat, fish or shell fish bound with egg white, butter or cream for use as stuffings or soup garnishes.

Fricassee - to stew meats, usually poultry or veal. Meat may or may not be browned before subjecting to long slow moist cooking.

Grate - to reduce to small particles by rubbing against a grater.

Grind - to reduce to small particles or powder with rotary cutters or a mortar and pestle.

Lard - to insert pieces of fat meat into larger pieces of lean meat for flavor and juiciness. Fat may be inserted into small deep gashes made in the meat, or run through with a special butcher's tool called a larding needle.

Marinate - to allow food to stand in a marinade, usually a mixture of oil, vinegar or wine, spice and herbs, to flavor or tenderize.

Mince - to chop or cut very fine.

Par-boil - to pre-cook or partly cook in liquid.

Plank - to broil or roast and serve on a board similar to a small wooden bread board.

Poach - to cook gently in liquid kept below the boiling point.

Ragout - a French term for a well seasoned stew.

Ramekin - an individual oven-proof baking dish.

Reduce - to boil a liquid to lessen the quantity and to concentrate the flavor.

Render - to melt fat meat such as salt-pork or bacon so that the connective tissue may be removed leaving the liquid fat.

Roux - a mixture of fat and flour blended together over low heat. This is the first step in making sauces and gravies which are thickened with flour.

Scald - to heat to just below the boiling point.

Scallop - to bake food in layers covered with sauce and crumbs in an oven-proof dish.

Score - to make light cuts in a surface, usually in lines.

Sear - to apply heat, usually to meat, quickly so as to harden the outside and thus prevent juices from escaping.

Skewer - a metal or wooden pin used to hold meat in shape or to close an opening.

Sliver - to cut or to shred into long thin pieces.

Steep - to extract the essence from a food by applying hot liquid. This term usually applies to tea making but is also applicable to other leaves such as herbs.

Strain - to separate a liquid from solid pieces of food by pouring through a sieve.

Try-out - to remove fat from such meats as salt-pork and bacon. The liquid fat is often used for frying.

Purposes of Cooking Foods

The purposes of cooking food are to render it more digestible, to develop, improve and alter its flavor, to make it more palatable through changes in color and texture and to destroy harmful organisms which might make it injurious to health.¹

Purposes of Cooking Meat, Poultry and Fish

Meat is the lean portion or muscle tissue and surrounding connective tissue of edible animals. The muscle is made up of thousands of muscle fibres, or cells, which are surrounded by connective tissue. The proteins in the muscle fibres, or cells, are delicate and soft, like the protein in a raw egg. Meat juices contain extractives or flavoring substances, vitamins and minerals. Connective tissue together with interior muscle fat serves to hold in the plasma proteins and the meat juices. The amount and concentration of connective tissue determines whether the cut of meat will be tough or tender. Those cuts of meat with the least connective tissue are apt to be tender, those with the most are apt to be tough.²

There are two general methods of cooking meat. These are the moist heat methods and the dry heat methods. Moist heat increases tenderness by softening some connective tissue and converting it to gelatin. Dry heat does not increase tenderness and may often reduce it. The moist heat methods are used for cooking tough or less tender cuts of meat. The dry heat methods are used for cooking tender cuts.³

The methods of cooking poultry are based on the same principles as apply to meat cookery. Tender poultry is cooked by dry heat methods, less tender or tough poultry by moist heat methods.⁴

Since fish does not contain any appreciable amount of connective tissue there is no need to use methods of cooking to make it tender. It is usually cooked by dry heat methods but is also frequently cooked by

moist heat methods.⁵ Care must be exercised in cooking fish that it does not become overcooked and fall apart.⁶

Purposes of Cooking Vegetables and Fruits

The general purposes of cooking vegetables are to improve the digestibility, to change the texture, to reduce the bulk, to conserve the color, to retain or change the flavor, and to destroy microorganisms.⁷

All vegetable and fruit tissues contain nutritive material (such as sugars, starches, vitamins and minerals), pectins, and cellulose. The cellulose is in the form of a fibrous supporting wall surrounding the plant cells which contain the nutritive materials. The pectins serve to hold the cells to-gether.⁸

Heating plant material in a moist atmosphere softens the tissues. This is the result of a breakdown and dissolving of pectins and a softening of cellulose as well as the swelling of starch grains which results in partial or complete gelatinization.⁹

Purposes of Cooking Eggs

The purposes of cooking eggs are to coagulate the protein, to change the texture and to change the flavor.

Eggs if soft-cooked in a way to prevent toughening are easily and rapidly digested. Hard-cooked eggs are not as rapidly digested as soft-cooked. Both egg-white and egg-yolk coagulate when heated however egg-yolk requires a slightly higher temperature for coagulation than egg-white. The toughness and greater shrinkage of the protein coagulated at high temperature is the basis for the recommendation of low or moderate temperatures for egg cooking.¹⁰

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8. Hughes, op. cit., p. 29.
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Heat Exchange in Cooking

Cooking is actually the subjection of food to heat exchange. There are three methods of exchanging or transferring heat to a food. These are (1) by conduction, (2) by convection and (3) by radiation.

Direct transfer of heat by contact is called conduction i.e. heat is conducted to the food through contact with a hotter substance. The hotter substance may be a cooking utensil and/or the cooking medium (water, steam, air, fat). The best conductor used in domestic cooking utensils is copper but many other materials perform the same function more or less effectively. As cooking media water and steam are better conductors of heat than air. (2)

Convection is the movement caused by changes of temperature within a fluid or gas. The fluid or gas nearest the source of heat is the first to become warm and consequently less dense; this causes it to rise and to be replaced by colder denser portions. This is apparent in boiling liquids. It also takes place within an oven but is not visible. Convection takes place in the heating medium as well as within the fluid of the food being heated. (3)

Radiation is the transfer of heat from one substance to another through space when the two are not in contact. In broiling, food receives heat by radiation from the open flame or glowing metallic broiler. The food is not in contact with the broiler. (4)

The various methods of cooking employ these three means of altering temperature. In broiling much of the heat is derived through radiation. In roasting (baking) the transfer of heat is by convection and by some conduction from the cooking utensil. In liquid cooking the transfer of heat

is by conduction and convection currents. In steaming the transfer is by conduction from the steam to the food. In deep-fat frying the heat is received by the fat through conduction from the pan and is transferred to the food by convection currents.

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