

AN ABSTRACT OF THE THESIS OF

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Title: Home Preservation Practices and Knowledge of Alberta

Homemakers

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Margy J. Woodburn

The rationale for this study lies in the upsurge of home food preservation which has occurred as a result of the unprecedented rise in food prices and, concomitantly, the danger and economic loss entailed in the use of faulty methods. A sample of 200 non-urban homemakers in the province of Alberta who do food preservation were examined on their practices and knowledge with regard to canning, drying, making sauerkraut, pickling, smoking and root cellar storage.

The demographic characteristics of the sample population were delineated as to age, education, income, and size of family still living at home. These general demographic differences were not reflected in the food preservation methods used, in general.

Cookbooks, some of which may have been government bulletins, were the most important source of information followed by family and district home economists.

Unsafe practices followed by these homemakers were the use by 12% of the open kettle method for processing foods other than jams and jellies and the use by 76% of the boiling water bath rather than pressure processing for the low acid foods. These unsafe practices were made more serious by incorrectly evaluating the safety of food and the inability of the respondents to relate acidity classification of the food with its safety.

The recommendation is made that canning publications provide the rationale for approved methods. More effective communication methods to reach homemakers are needed.

Home Preservation Practices and Knowledge
of Alberta Homemakers

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Home Preservation Practices and Knowledge of Alberta Homemakers

STATEMENT OF THE PROBLEM AND OBJECTIVES OF THE STUDY

Home food preservation would seem to be experiencing a resurgence in the province of Alberta due to the pressure to reduce food expenditures by preserving food in season for later use and the increased interest in household self-sufficiency. Home gardens have increased. In some areas, fishing and hunting also contribute food for preservation. Spoilage of any of this food could result in economic loss, illness and, possibly, death.

Modern science has contributed to food preservation technology which has resulted in increased nutrient retention, increased shelf life, and increased food safety. Government and commercial bulletins outline currently acceptable home preservation methods, but these frequently do not include the principles or reasons behind the advantages and disadvantages of the recommended procedures. Many of the earlier food preservation practices such as drying or open-kettle canning were simpler and less expensive than the currently approved methods. A homemaker who does not perceive the newer methods as an advantage in her value system may not accept them. Homemakers who use obsolete equipment and methods often rely on their memory or on procedures described by an older homemaker. Knowledge transmitted in this way is sometimes misunderstood or inaccurate (1).

Therefore, it is necessary to learn the practices and beliefs of homemakers if education is to be effective. No such information is

available for Canadian homemakers although a survey related to canning and freezing practices was conducted in the United States in 1974. Since the author is Provincial Food and Nutrition Specialist in the Home Economics and 4H Branch, Alberta Agriculture, this study of homemakers' practices in food preservation was conducted in the province to provide guidance in program development. It is anticipated that it may be of value in other provinces.

The information collected was focused on preparation practices for canning, drying, making sauerkraut, pickling, root cellar storage, and smoking. Freezing was not included as a method of preserving foods since it has an excellent safety record and householders' knowledge of good practices and treatment of thawed products is adequate (2). Also excluded was preservation with sugar, because the concentration of sugar results in a confection type of food as well as aiding in its preservation. Spoilage problems are largely limited to molds.

This study examined the food preservation practices of a sample of Alberta homemakers who live on farms or in towns under 3,000 with respect to kinds of food preserved, methods and equipment used, knowledge of food preservation principles, and demographic characteristics. The study group was selected from six Alberta Agriculture districts near Edmonton. These areas were chosen because of the high amount of food reported to be preserved and to minimize interview costs.

The objectives of the study with respect to the sample group were as follows: to identify methods of food preservation used; to ascertain the amount of canning, drying, sauerkraut making, pickling, root cellar storage, and smoking being done; and to determine changes in the amount

of home food preservation during the past five years. Understanding of the biological principles of food preservation was assessed to determine if increased understanding resulted in decreased food spoilage thereby resulting in decreased economic loss and greater safety. The awareness of safe food preservation procedures was examined as well as the adequacy of the homemaker's test to determine the safety of home preserved food. The demographic characteristics of the homemakers who preserve foods were examined and the source of their preserving instructions determined.

The results from the study should aid in the development of strategies for home economics extension programs, as well as for the preparation of publications and radio and television materials designed to aid rural Alberta homemakers in the safe preservation of food.

LITERATURE REVIEW

Since prehistoric times, man has been developing food preservation methods to increase the security of his food supply. All food begins as a living plant or animal, which starts to deteriorate immediately after harvest or slaughter. Cellular respiration and enzyme activity continue, and various chemicals in the food react with the oxygen in the air and other chemicals. Microorganisms such as yeasts, molds and bacteria begin to grow on and within the raw foodstuff. Depending on the nature of the microorganism, this growth will spoil the food or make it unsafe unless it is stopped or drastically slowed down. This is the primary objective of food preservation; to allow food to be preserved so that it can be safely eaten at a later date (3).

Food may be preserved by canning, refrigeration or freezing, drying, salting, sugaring, pickling with acids such as vinegar and other chemical treatments (4). Since theories of food preservation have been adequately reviewed elsewhere these are not repeated here. The practices of homemakers in food preservation which have been reported will be summarized since knowledge of the practices of homemakers provides the basis for planning educational strategies. The most recent comprehensive study is one conducted in 1974 for the United States Department of Agriculture (5); however, only canning and freezing were included.

Canning

In 1946, the United States Department of Agriculture (U.S.D.A.) published the results of extensive heat penetration and bacteriological studies on home canned food, and a scientific basis became available for home canning of low-acid foods (6). These findings have recently been affirmed as safe and alternate shorter times under increased pressure have been recommended for many foods (7, 8).

The importance of time-temperature schedules used in commercial canning and the adverse effects of excessive processing on food quality have not been communicated effectively to the general public, nor has their importance been taken into account in home canning (3); many homemakers follow directions from old cookbooks or procedures handed down from one generation to another. These instructions were frequently developed through hit-or-miss techniques (3).

In spite of the availability of a valid scientific basis for processing home-canned food, there are still outbreaks of botulism, largely traceable to improperly home-canned foods. From 1970-73 there were 21 botulism outbreaks from home-canned compared to two from commercially-preserved items (9). More serious are the deaths which frequently occur during these outbreaks. In the period 1974-76 there were 43 outbreaks involving 69 cases or an average of 14 outbreaks per year (10, 11, 12). More recently, 17 outbreaks occurred in 1977 and 12 in 1978 (13). This is an alarming increase considering that in the period 1950-1973 outbreaks of botulism caused by home-canned food averaged only four per year (9). The largest number of outbreaks in any one year from 1950-1973 was 13.

Between the years 1964-1973, three outbreaks involving five cases of botulism were reported in Canada due to home preserved food. Two of these were from home-canned vegetables (green beans and green peppers) and one from home salted pork. Those due to native fish and seal products have been excluded since those practices are followed in only a limited part of Canada (14). Since 1973 the only outbreaks have been among the Inuit and Indian populations and have implicated game foods. This is a problem that does need attention (15, 16, 17, 18, 19).

As previously stated, recommended processing procedures during home processing have been confirmed as safe (7); human error is the problem. Of the botulism outbreaks traced to low-acid home-canned foods in the United States, only one was from a pressure-processed product and in that one, the air had not been exhausted (Center for Disease Control, personal communication with M. Woodburn).

Thompson et al. (20) investigated sources of error in home canning and concluded that the most important sources of variability in the home were inaccurate pressure regulation in the pressure vessel, variations in process timing, and human error. The latter cannot be analyzed and effectively compensated for by increasing processing times, but is justification for additional education about the importance of adhering to the recommended processes.

A microbiological analysis of home-canned tomatoes by Fields et al. (21) showed that the predominate species in tomatoes was bacilli, some of which are known to form heat resistant spores. Three jars contained molds, indicating faulty processes and/or containers

failed to seal. Further investigation revealed that 34% of the samples had been processed using the open-kettle method which is not recommended. These samples had the highest incidence of viable microorganisms (58%). However, 33% had been processed in a boiling-water-bath and some of the same groups of organisms, spore forming bacilli, were found, and one of these jars contained yeasts and molds. The processing times ranged from five minutes to three hours. This is unmistakable evidence that not all of the homemakers were following recommended procedures. Powers and Godwin (22) also reported examining microbiologically jars of home-canned tomatoes that had been hot-packed but had not been processed for the approved length of time. The United States Department of Agriculture (1971) recommends the following times in boiling water for raw packed tomatoes; pint jars, 35 minutes; quarts, 45 minutes; for hot pack, 10 minutes in either pints or quarts in boiling water (23).

When Fields et al. (21) examined home-canned green beans microbiologically; 14% of the samples contained viable microorganisms which included spore-forming bacilli: B. licheniformis, B. subtilis, B. coagulans, B. megaterium and B. stearothermophilus. However, it should be recognized that spores of some bacilli are more heat resistant than those of C. botulinum. In addition, from eight jars, molds, yeasts and/or cocci were isolated. The presence of molds, yeasts and non-heat resistant genera is indicative of underprocessing and/or faulty seal and such jars constitute a potential risk. The open-kettle method and the boiling-water-bath were used for home canning green beans by 24% of the homemakers Fields et al. (21) sampled. These methods are

antiquated and not recommended for vegetables such as green beans which have a higher pH necessitating the use of proper processing methods with pressure to prevent botulism (23).

The National Survey on Home Canning conducted by the U.S.D.A. (5) also found that homemakers are using the open-kettle method for canning fruits (44%) and low acid vegetables (14%), which results in inadequate processing. Other non-recommended practices followed by those surveyed by the U.S.D.A. included packing or filling jars too tightly (3%) and reusing flat metal disks from the two-piece metal lid with band, 9%.

Most of the home canners, 94%, used jars designed especially for canning when processing foods other than jams and jellies. However, 33% used other jars, such as those for peanut butter, coffee, and salad dressing. Therefore, some canners used both standard home canning and nonstandard jars.

Fields et al. (21) in a study to determine how closely home canners followed recommended procedures found that 46% of the jars used for tomatoes and 34% of the jars used for green beans were of non-recommended types for home canning, suggesting a need for the distribution of more information on types of containers and reasons for their use.

Knowledge of the signs of spoilage is important for the home food preserver. The home canners surveyed by the U.S.D.A. (5) recognized spoilage by a bulging lid, leakage, mold and off-odor in descending order. Almost one-third of those interviewed thought floating fruits or vegetables in a jar would be an indication of spoilage; however, it is not. Fruits or vegetables may float because the pack is too loose,

because some air remains in the tissues of the product after heating and processing, or, in the case of fruits, because the syrup is too heavy. Three out of four canners thought spoilage was due to lids that failed to seal properly (5). Jones and Weimer (24) reported that homemakers they surveyed identified unsafe foods by dents and bulges. Thirty percent of their sample used taste to determine the safety of canned food, which is disconcerting in view of potential botulism poisoning.

Drying

Drying of food as a preservation method dates back to prehistoric times. In recent years, drying at home has increased in popularity due to the back to the earth movement and because, if properly done, the food can be stored at room temperature. Drying is a simple process resulting in moisture evaporation and under ideal conditions creates a lightweight and concentrated food (25).

However, drying has been associated with loss of ascorbic acid (26, 27) which is probably the most labile vitamin found in foods (26). Calloway (28) reported that the retention of beta-carotene in dehydrated vegetables was 70 to 100%. Heat and light convert the all-trans configuration to its isomer, the cis form which is less potent (29, 30). This would explain why Holmes et al. found negligible beta-carotene retention in green beans and tomato puree dried under household conditions. Moyer (32) reported that a preliminary study of the carotene, thiamin, and ascorbic acid content of selected vegetables made prior to dehydration, during dehydration, after storage, and after cooking

resulted in little loss of carotene during processing, but that its loss was rapid at all storage temperatures above -40°C . Some of the thiamin was leached out during the blanching process prior to dehydration, as it could be prior to freezing, but there was no further loss of this vitamin during drying or in storage.

Niacin and riboflavin, two other water-soluble vitamins, are fairly stable to heat and oxidation, and so are not lost to any extent during normal hot air dehydration (26).

Dried foods appeared to be a good source of free folacin in the work done by Holmes et al. (31). The retention of free folacin was higher than total folacin in dried tomato puree, zucchini squash, raspberries and boysenberries but not in green beans. From 60 to 96% of vitamin B_6 was retained during drying.

Labuza (26) has reported that when several meats, legumes and vegetables were air dried on tray dryers there was very little change in digestability or net protein utilization.

Thus, home dried foods may contribute to the dietary intake of most vitamins, minerals, protein and calories. The extent to which food is dried at home has not been reported in the literature.

Pickling

Pickling foods is their preservation and subsequent retention in an acidic preserving liquid. Brine made of common salt (sodium chloride) is used to control fermentation and the use of vinegar or its major constituent, acetic acid, either added or produced by fermentation, is

based on ancient tradition. More recently a last step of processing in a boiling water bath has been recommended by the U.S.D.A. (33).

Controversy over whether subsequent processing would result in a bacteriologically safe product without harm to quality has taken place since 1965. The U.S.D.A. reported that values for pH and acid changed very little as the result of processing or storage of the pickled product. The processed, fermented dill pickles stored for six months were superior in color and texture to the unprocessed pickles, but the color and texture of the other pickled products did not appear to be greatly influenced by processing (33).

Recent Canadian studies have shown that processed products were generally paler in color, less crisp in texture, and less sharp and poorer in flavor. Agriculture Canada does not recommend processing pickles, because there does not appear to be an advantage from the microbiological stand point or from the sensory point of view (34). Homemakers' practices in this area have not been reported.

Making Sauerkraut

Sauerkraut is obtained by utilizing the bacteria normally present in raw cabbage to ferment sugar in the cabbage in the presence of salt to produce lactic acid. Other vegetables preserved by a similar fermentation are Chinese cabbage, and rutabagas or white turnips (25).

Traditionally, this is a popular food in Canada; however, the current use of the method is not known.

Root Cellar Storage

Root cellar storage is the winter storage of fresh, raw, whole fruits and vegetables for later use. They are held for several months after harvest in a cold 0° to 4.4° C moisture atmosphere. Fresh whole fruits and vegetables respire or breathe after they are harvested, and for some fruits and vegetables this is reduced by layering them with dry leaves, sand, moss, or earth, or by individually wrapping them in paper. Thus the natural cycle to decomposition is retarded because the growth of microorganisms and the rate of enzymatic action, which leads to overripening and eventually to rotting, are slowed down.

Since root-cellar storage deals with whole fruits and vegetables, it is easy to ascertain if it is successful by looking, touching, and smelling.

This means of preservation requires space of suitable temperature but otherwise is convenient and inexpensive. It has been used extensively by many households.

Smoking

Smoking as a means of food preservation is quite different from "hot smoking" which is cooking slowly in a barbecue for several hours to make the food partially or wholly table-ready. "Cold smoking" for food preservation flavors the meat after it has been held in a mild smoke at 21°C - 49°C for several days. This also colors the tissues, helps retard rancidity, and, in many cases, increases dryness. The food is then stored in a cool, dry place, or is frozen, to await

future preparation for the table (25). Light smoking results in a high a_w (available water) so the food must be refrigerated or frozen for preservation.

In areas of Canada with wild game or fish, smoking has appeared to be a currently popular method to preserve the extra supply. However, no data to support this observation are available nor was it known if recommended storage practices were being followed.

METHODOLOGY

The Study Area

The geographical area selected for this study is located in Alberta Agriculture Regions 3, 4 and 5. There are six regions throughout the province designed to facilitate the administration of extension functions. These regions are subdivided into districts. In each district the district office provides the administrative unit for the district home economist of the area who, in turn, is responsible to the regional home economist. The sample for study was selected from home economist district offices in Morinville, Stony Plain, Lamont, Smoky Lake, Vegreville and Wetaskiwin. (Figure 1).

Design of the Study

Practices of homemakers doing home food preservation were studied by way of an ex post facto observation. Kerlinger (35) defines ex post facto research as follows:

a systematic empirical inquiry in which the scientist does not have direct control of independent variables because their manifestations have already occurred or they are inherently not manipulable. Inferences about the relationships among variables are made without intervention, from concomitant variation of independent and dependent variables.¹

¹Fred N. Kerlinger, Foundations of Behavioral Research, Second Edition. (New York: Holt, Reinhart and Windsor, Inc., 1973), p. 379.

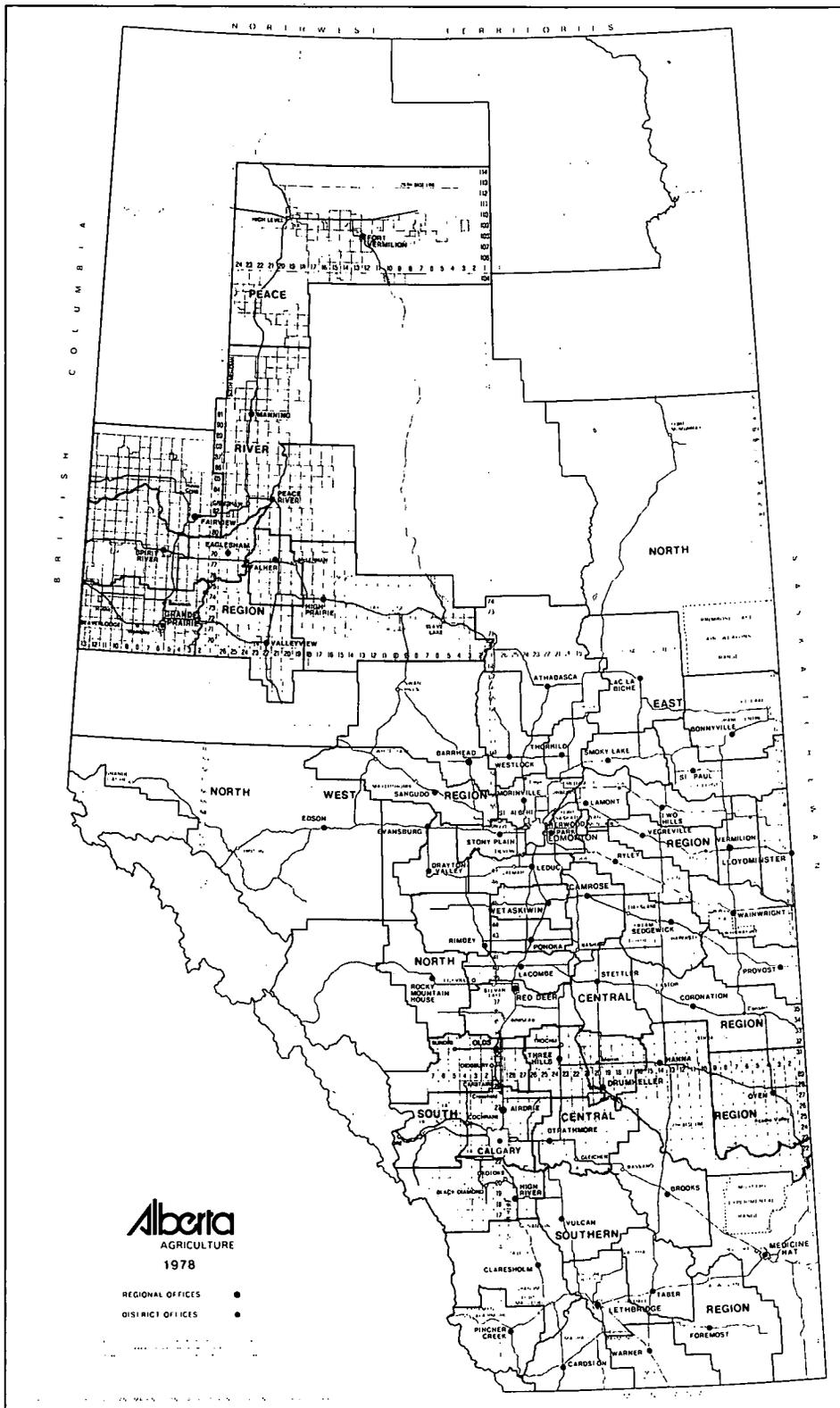


Figure 1. Map of Alberta with District and Regional Alberta Agriculture Extension Offices.

This definition suggests various inherent weaknesses in this study, which are common to other types of ex post facto research. There is no control over time and the study variables. However, for knowledge of practices and beliefs of people, survey research yields useful data if carefully controlled.

Sampling Procedures

The homemaker sample was drawn from county maps of the survey area. All homemakers on selected roadways were personally contacted and asked if they did any home food preservation, i.e. canning, drying, making sauerkraut, pickling, root cellar storage, or smoking. The areas were not known by the investigator who designated roadways distributed across the counties.

Two hundred and seventy-five homemakers were contacted, and the complete interview was conducted with 200. Of the 75 not interviewed, 43 did not do any food preservation and the remainder were unavailable for interviewing.

The interviews were done in person and required approximately 35 minutes. Periodic checks were made with the district home economist in each office involved to ascertain the validity of the information being collected.

Construction of Survey Instrument

In developing the survey instrument, the National Survey of Home Canning questionnaire (5) was used as a basis for four of the questions

related to canning so that the results could be compared. These questions involved the following: equipment used, methods and procedures used; food safety awareness; and sources of canning instructions. Demographic questions which were included in the National Survey on Home Canning were also used for this study. Additional items were added to determine the amount of drying, sauerkraut making, pickling, root cellar storage, and smoking being done at home.

In addition, specific questions were asked about knowledge of preservation techniques to ascertain the homemaker's understanding of the principles involved. To further explore their understanding, respondents were asked to determine the correctness of food preservation vignettes and statements on food safety principles (36). The items were based on the investigator's experience with questions homemakers asked and correct responses were verified by consulting reputable references. The total number was limited to enable the interview to be conducted in approximately 30 minutes.

The questionnaire was pretested with ten homemakers for clarity and understanding, and subsequently minor changes in format were made. The questionnaire is in the Appendix. The interviewer was trained in September 1978 and the interviews were completed by November 1978.

Key punching and verification, data summary and statistical analysis were done by the University of Alberta Computing Services. Chi square was the statistic chosen to compare expected distributions with those found (37).

Limitations of the Study

As previously indicated, this study was subject to the general weaknesses of ex post facto design. Kerlinger summarized the problems associated with this type of design as being: (1) the inability to manipulate independent variables, and (2) the risk of improper interpretation. Improper interpretation in ex post facto research results from the possibility of a variety of alternative explanations in a given situation. Relationships found among certain variables may be interpreted in a causal manner when they could merely be spurious in nature. Although there is no ultimate safeguard from this problem, the validity of interpretation increases if analyses are guided by logical hypotheses (35).

Another limitation of this study is that while it examined the demographic profile of the home preserver, it did not provide a comparative study of non-preservers in an attempt to detect demographic differences between those who preserve and those who do not.

RESULTS AND DISCUSSION

Demographic Characteristics of Home Preservers

The profile of the home preserver that emerged from the survey indicates that the greatest number of home preservers sampled were between the ages of 35 and 49 (48%)(Table 1). It was evident that for all except those 65 and over canning was the most popular with pickling also being done by most.

Table 1. Age of Selected Homemakers in Alberta and Number Using Each Food Preservation Method.

food preservation method	under 35 yr. n ¹ =35		35-49 yr. n ¹ =97		50-64 yr. n ¹ =58		65 yr. and over n ¹ =10	
	no.	%	no.	%	no.	%	no.	%
canning	35	100	97	100	58	100	8	20
drying	14	40	37	38	16	28	1	10
making sauerkraut	16	46	76	78	43	74	2	20
pickling	32	91	92	95	54	93	2	20
storing (root cellar)	23	66	74	76	48	82	3	30
smoking	3	8	11	12	5	8	0	0

¹Number of respondents in each age group

Age of homemaker was related to the size of family living at home as expected from the normal life cycle. Homemakers under 50 years of age generally came from households with three or more members, while those 50 years and older lived in one or two member households.

number of types of food preservation used however differed little with the size of family living at home (Table 2).

Table 2. Size of Family of Selected Homemakers in Alberta and Number Using Each Food Preservation Method

method of food preservation	family size					
	2-4 n ¹ =121		5-6 n ¹ =62		more than 6 n ¹ =17	
	no.	%	no.	%	no.	%
canning	120	99	61	98	17	100
drying	32	26	28	45	8	47
making sauerkraut	85	70	47	76	11	64
pickling	110	91	59	95	17	100
storing (root cellar)	91	75	47	76	13	76
smoking	12	10	6	10	1	6

¹Number of respondents in each family size group.

Interviewees who lived on farms did more food preservation than their non-farm counterparts who lived in towns or villages with a population of under 3,000 (Table 3). The statistical analysis showed a significant relationship ($P \leq .05$) between the number who dried food and their residence.

The responses appeared to illustrate that the amount of education was not related to the kinds of home food preservation (Table 4), except for a significantly greater ($P \leq .01$) use of sauerkraut as a method by those respondents with fewer years of schooling.

Table 3. Method of Home Food Preservation Used by Selected Farm and Non-farm Homemakers in Alberta

food preservation method	<u>residence</u>			
	farm n=153		non-farm ¹ n=47	
	no.	%	no.	%
canning	153	100	47	100
drying	61	40	7	14
making sauerkraut	75	49	28	60
pickling	143	93	42	90
storing (root cellar)	120	78	31	66
smoking	13	8	3	6

¹town under 3,000

Table 4. Years of School of Selected Homemakers in Alberta and Number Using Each Food Preservation Method

method of food preservation	eighth grade or less n ¹ =42		two years high school n ¹ =63		four years high school n ¹ =45		one year college n ¹ =23		further training n ¹ =27	
	no.	%	no.	%	no.	%	no.	%	no.	%
canning	42	100	62	98	44	97	23	100	27	100
drying	12	28	18	28	21	46	8	34	9	33
making sauerkraut	34	80	47	74	29	64	16	70	18	66
pickling	36	86	61	96	44	98	20	86	25	92
storing (root cellar)	34	81	48	76	32	71	15	65	22	82
smoking	3	7	5	8	4	8	1	4	6	22

¹Number of respondents in each education category

Information concerning income was provided by only 96 of the interviewees (Table 5). Of these, 77% came from households where the income was between \$5,000 and \$20,000. Similarly, about six out of ten canners came from households with a total income between \$5,000 and \$20,000 in the National Survey of Home Canning (5).

Table 5. Selected Alberta Homemakers Classified by Age and Family Income Level

age years	income ¹						not reported
	<5,000	5,000- 12,499	12,500- 19,999	20,000- 24,999	25,000- 29,999	>30,000	
under 35	2	2	11	5	0	0	16
35-49	2	8	25	4	2	8	48
50-64	6	6	7	1	0	0	37
65 and over	2	4	1	0	0	0	3
Total	12	20	44	10	2	8	104

¹Annual gross income

Sources of Food Preservation Information

Most homemakers in the sample used cookbooks (Table 6). These ranged from instruction booklets which are included with canners and preserving jars to books written on home canning. Some respondents did not appear to differentiate between government bulletins and cookbooks. The next most important sources in order appeared to be family, government bulletins, district home economists, popular periodicals and friends.

Table 6. Sources of Food Preservation Information Used by Selected Alberta Homemakers

sources of information	frequency
neighbours, friends	90
family	121
club or organized association contacts	0
newspaper, magazines	83
cookbooks	162
government bulletins	106
district home economists	98

The results in Table 7 indicated that a greater percentage of home preservers who had education beyond high school used government bulletins and the services of the district home economist; those homemakers who were only educated to the high school level seemed to rely more on cookbooks, popular periodicals, family and friends.

More canners under 49 years of age than those over 49 used the various information sources (Table 8). This is possibly an indication of the older respondents having learned through past experience. As family size increased (Table 9), the family became increasingly important as an information source. Homemakers whose incomes were above \$12,500 seemed to use government bulletins and the services of the district home economist more than those who had incomes below \$12,500. Government bulletins and cookbooks are available from the local district home economist (Table 10).

Table 7. Number Reporting Sources of Food Preservation Information Classified by Last Year of School Completed by the Selected Alberta Homemakers

information sources	eighth grade or less n ¹ =42		two years high school n ¹ =63		four years high school n ¹ =45		one year college n ¹ =23		further training n ¹ =27		<u>percent</u> high school n ¹ =150		beyond high school n ¹ =50
	no.	%	no.	%	no.	%	no.	%	no.	%			
friends	21	50	25	40	25	56	11	48	8	30	47		38
family	27	64	39	62	31	69	10	43	14	52	5		48
club contacts	0	0	0	0	0	0	0	0	0	0	0		0
popular periodicals	20	48	26	41	18	40	9	39	10	37	1		38
cookbooks	34	81	53	84	37	82	21	91	17	63	82		76
government bulletins	15	36	36	57	23	51	10	43	22	81	49		64
district home economists	17	40	31	49	17	38	14	61	19	70	43		66

¹Number of respondents in each education category

Table 8. Sources of Food Preservation Information Classified by Age of Selected Alberta Homemakers¹

information sources	under 35 n ¹ =35		35-49 n ¹ =97		50-64 n ¹ =58		65 and over n ¹ =10		<u>percent</u> 49 and younger n ¹ =132		50 and older n ¹ =68
	no.	%	no.	%	no.	%	no.	%			
friends	14	40	50	52	24	41	2	20	48		38
family	26	74	62	64	27	46	6	60	66		48
club or organized association contacts	0	0	0	0	0	0	0	0	0		0
popular periodicals	11	31	44	45	23	40	5	50	42		42
cookbooks	28	80	83	86	45	78	6	60	84		75
government bulletins	18	51	56	58	29	50	3	30	56		44
district home economists	18	51	50	52	26	45	4	40	52		44

¹Number of respondents in each age group

Table 9. Sources of Food Preservation Information Classified by Family Size of Selected Alberta Homemakers

information source	2-4 persons n ¹ =121		4-6 persons n ¹ =62		more than 6 persons n ¹ =17		mean %
	no.	%		%	no.	%	
friends	53	44	27	44	10	58	48
family	70	58	38	61	13	76	65
club or organized association contacts	0	0	0	0	0	0	0
popular periodicals	42	34	31	50	10	58	48
cookbooks	97	80	52	84	13	76	80
government bulletins	60	50	34	54	12	70	58
district home economists	55	45	35	56	8	47	50

¹Number of respondents in each family size (members living at home)

Table 10. Sources of Food Preservation Information Classified by Income Level of Selected Alberta Homemakers^{1,2}

information source	under \$5,000 n ¹ =11		\$5,000-12,499 n ¹ =20		\$12,500-19,999 n ¹ =44		\$20,000-24,999 n ¹ =10		\$25,000 and more n ¹ =11	
	no.	%	no.	%	no.	%	no.	%	no.	%
friends	6	54	8	40	22	50	4	40	7	64
family	7	64	10	50	27	61	5	50	7	64
club contacts	0	0	0	0	0	0	0	0	0	0
popular periodicals	6	54	10	50	20	45	3	30	6	54
cookbooks	9	82	16	80	34	77	6	60	7	64
government bulletins	4	36	9	45	21	48	7	70	5	46
district home economists	2	18	9	45	21	48	7	70	6	54

¹Number of respondents in each income category.

²Number of respondents who did not report income level was 104.

Home Canning Equipment Used

Most canners, 98% (Table 11), used jars designed especially for canning vegetables and fruits other than jams or jellies. However, more than one-third used other jars, such as peanut butter, coffee, and salad dressing containers; therefore some canners used both home-canning jars and non-standard jars. Tin cans were used by two percent of the sample. These results compare closely with the National Home Canning Survey (5) which showed that 94% of the respondents used home canning jars and one-third used other jars. Fields et al. found that 46% of the jars used for tomatoes and 34% of the jars used for green beans were of the non-recommended type for home canning (21). One percent of the canners in the U.S.D.A. survey (5) used tin cans.

Authorities recommend the use of jars designed especially for home canning so that jars will be heat tempered, resistant to mechanical shock, of the right size for the established processing time and temperature, and the proper size to fit standard home-canning closures.

Table 11. Kinds of Jars or Cans Used for Home Canning Fruits and Vegetables by Selected Alberta Homemakers

	no.	%
tin cans	4	2
home canning jars	197	98
other jars	75	38

All family sizes used the standard home canning jars but as family size increased so did the percentage of other jars slightly (Table 12).

Table 12. Kinds of Jars and Cans Used for Home Canning Fruits and Vegetables According to Family Size of Selected Alberta Homemakers

	2-4 persons n ¹ =121		5-6 persons n ¹ =62		more than 6 persons n ¹ =17	
	no.	%	no.	%	no.	%
tin cans	4	3	0	0	0	0
home canning jars	118	98	62	100	17	100
other jars	44	36	24	38	7	41

¹Number of respondents in each family size

Income level (Table 13) did not seem to affect the use of one kind of jar over another, as about the same percentage of households, regardless of income, used standard home-canning jars. The upper income group used other jars just as frequently as the lower income group.

The glass lid, rubber ring and metal combination band was used by 87% of home canners interviewed when canning fruits and vegetables other than jams and jellies (Table 14). The new flat metal lids with metal bands were used by 72% of the interviewees these lids, however, were the most popular among the respondents to the U.S.D.A. National Survey of Home Canning (5). The glass lids, rubber rings and wire bail combination as well as the plastic flat lid and plastic film were not used by any of the home canners interviewed. The reuse of the flat metal lid was a non-recommended practice followed by 8%.

Younger home canners appeared to use the new flat metal lids, whereas the older, canners tended to use the glass lid, rubber ring and metal band combination (Table 15). This may reflect the availability and/or the popularity of the respective types when the homemakers began their canning careers.

Table 13. Kinds of Jars and Cans Used by Selected Alberta Homemakers for Home Canning Fruits and Vegetables Classified According to Income^{1,2}

	under \$5,000		\$5,000-12,499		\$12,500-19,999		\$20,000-24,999		\$25,000 and more	
	no.	%	no.	%	no.	%	no.	%	no.	%
tin cans	1	9	0	0	1	2	0	0	1	9
home canning jars	10	91	20	100	43	98	10	100	11	100
other jars	6	55	8	40	18	41	2	20	6	54

¹Number of respondents in each income group.

²One hundred and four of the interviewees did not state their income.

Table 14. Kinds of Jar Lids or Tops Used by Selected Alberta Home-makers for Canning Fruits and Vegetables

	no.	%
new flat metal lid	145	72
reused flat metal lid	15	8
porcelain-lined zinc cap	1	1
glass: rubber ring: wire bail	0	0
glass: rubber ring: metal band	174	87
plastic flat lid	0	0
plastic film	0	0
paraffin	3	2
other kinds of jar lids	4	2

Of those who used the two-piece flat metal lid with metal band, only 48% used them correctly and only 26% of them did so for the correct reason. The lids seal because of a sealing compound around the sealing edge, which softens when the jar gets hot. Therefore, it is necessary to tighten them only until firm so that the air in the jar may be vented during processing. The venting of the air cannot take place if they are turned until tight; similarly, trouble arises if the screw band is loosened before the jar is placed in hot water and tightened after processing, because this could result in breaking the seal. Removal of the air from the jar is necessary to prevent limited mold growth and reduce oxidative changes.

Table 15. Kinds of Jar Lids or Tops Used for Canning Fruits and Vegetables Classified by Age of Selected Alberta Homemakers

type of lid	under 35 yr. n ¹ =35		35-49 yr. n ¹ =97		50-64 yr. n ¹ =58		65 yr. and over n ¹ =10	
	no.	%	no.	%	no.	%	no.	%
new flat metal lid	33	94	67	70	38	66	7	70
reused flat metal lid	6	17	3	4	6	10	0	0
porcelain-lined zinc cap	1	3	0	0	0	0	0	0
glass, rubber ring, metal band	25	72	84	86	55	94	10	100
paraffin	1	3	2	2	0	0	0	0
other kinds of jar lids	1	3	1	1	2	2	0	0

¹Number of respondents in each age group

Home Canning Practices

Three-quarters of the home canners canned fruit using the boiling-water-bath; 80% of those who canned low acid vegetables, 72% of those who canned meats and 14% of those who canned mixed foods also used the boiling-water-bath (Table 16). Authorities approve this method for processing fruits, tomatoes, pickles, and jams, but recommend only the use of a pressure canner or pressure saucepan for all low acid vegetables, meats and mixed products containing low acid foods. The National Home Canning Survey (5) results showed that the boiling-water-bath was used by 53% of those who canned fruit; 40% of those who canned low acid vegetables; and 34% of those who canned vegetable mixtures.

The open-kettle method was used by 8% of the home canners who canned fruits and by 8% of those who canned vegetables. In this method the food is cooked, then packed into hot jars, lids put on and is processed no further. Open-kettle canning is not a safe practice because temperatures obtained are not high enough to destroy all the spoilage organisms that may be present in low acid foods such as vegetables other than tomatoes. Spoilage bacteria may also enter the food when it is transferred from kettle to jar, making it undesirable to can other foods, such as fruits, pickles, and tomatoes by this method. Fields et al. (21) found that in interviewing homemakers who had canned tomatoes and green beans 34% and 24% had been processed in a boiling-water-bath; and 34% and 2% had been canned using the open-kettle method. Open-kettle processing was used by U.S.D.A. (5) respondents for 44% of the fruits; 14% of the low acid vegetables; and 26% of the vegetable mixtures.

Table 16. Kind of Food Canned and Method Used by Selected Alberta Homemakers

	boiling water bath		pressure canner or cooker		open kettle		other		total	percent ³ of sample
	no.	%	no.	%	no.	%	no.	%		
fruits	150	87	7	4	13	8	1 ¹	1	172	86
vegetables (excluding tomatoes)	114	80	15	10	11	8	1 ¹	1	141	70
meats	38	72	13	24	1	2	1 ²	2	53	26
mixed foods	1	14	5	72	0	0	0	0	7	4

¹waterless cooking method

²one inch of water

³percentage of total sample canning food in that category

Oven canning was used by only two of the two hundred Alberta homemakers interviewed. Oven canning is not safe because jars may explode, causing personal injury or damage to the oven. Also, temperatures obtained in the food in jars during oven processing do not get high enough to ensure destruction of spoilage bacteria in low-acid foods. Processing times are not applicable to oven processing since the rate of heat penetration is slower in the oven.

Seventeen percent of home canners had pressure canners, but of those only 18% ensured that the dial gauges or pressure indicators were registering accurately (Table 17). Pressure sauce pans may be safely

Table 17. Pressure Canners and Saucepans and Their Use by Selected Alberta Homemakers

	n ¹ =200	
	no.	%
pressure canner owned	34	17
dial or pressure indicator gauge checked	6	
pressure saucepan owned	39	20
used for canning	6	
canners who canned vegetables (excluding tomatoes)	141	70
canners who canned meats	53	70
canners who canned mixed foods	7	4

¹Total number of respondents

used for canning low acid foods, however only 15% of the householders who had them used them for canning. Interviewees who should have made use of either a pressure canner or saucepan include the 70% of the

sample who canned low acid vegetable, 26% of the sample who canned meats and 3% of the sample who canned mixed products containing low acid foods. Thus, more than the 40 who were using recommended equipment were canning products for which such equipment was needed. This reinforces the need for education which was apparent in the preceding section.

Because tomatoes are the most often canned food in the home, respondents were asked about leaving processed jars of tomatoes in a canner to cool. About three-quarters, 74%, of the respondents knew that it was not recommended. The problem, of course, would be that such practices result in thermophilic spoilage.

Practices in Making Home Sauerkraut.

Sauerkraut was made by 72% of the sample population. Significantly ($p < .05$) fewer homemakers 34 years of age and younger made sauerkraut compared to their older counterparts.

Only 3% (4 of the 143 who made sauerkraut) weighed the salt and cabbage. Successful sauerkraut depends on 2-3% pickling salt by weight of the prepared cabbage; this inhibits putrefactive organisms and encourages multiplication of the naturally occurring lactic bacteria which ferment the glucose present in the cabbage. Because shredded cabbage is bulky and difficult to measure, failure to weigh the salt and cabbage could result in incorrect proportions and subsequently poor quality sauerkraut. Most respondents used a dinner plate to weight the vegetable and keep it below the brine during fermentation (Table 18). A board was used by 17% and 14% put the sauerkraut directly into

jars which works well providing the lids allow the carbon dioxide being formed to escape. Approved methods suggest that the sauerkraut be covered with a sterile cloth and a plate or board which has been scalded.

Table 18. How Sauerkraut Was Covered When Being Made by Selected Alberta Homemakers

	no.	%
dinner plate	73	36
sheet of plastic	4	2
nothing	0	0
crock lid	3	1
board	34	17
directly into jars	29	14

Pickling Practices

Most respondents who made pickles, 66%, recognized that they should not alter the strength of the vinegar (Table 19). Twelve respondents, of those who made pickles, 6%, knew they could add sugar and 1% knew they could add spices without changing acidity. However, 12% said they could add water to reduce the strength of the vinegar and 15% said they could decrease the amount of vinegar. The latter two remedies could increase the pH to the point that it is no longer a safe acid medium.

Most respondents, 55%, did not know why pickles should be processed and only 4% realized that this would reduce the loss of pickles to mold

Table 19. Remedy for Tart Pickling Solution Chosen by Selected Alberta Homemakers

	n ¹ =186	
	no.	%
add water to reduce strength of vinegar	23	12
add sugar	12	6
add spices to mask acidity	1	1
do nothing	122	66
decrease the amount of vinegar in the mixture	28	15

¹Number of respondents who made pickles

which will grow if all air has not been exhausted or there is a failure to seal (Table 20). There is no basis to the belief that it will destroy

Table 20. Reasons Selected Alberta Homemakers Gave for Processing Pickles

	no.	% ¹
improved flavor	1	1
destroy <u>C. botulinum</u>	15	8
reduce loss due to molds	8	4
ensure a good seal	51	27
to process cucumber	8	4
do not know	103	55

¹Percent of respondents who made pickles

C. botulinum since the latter survive processing in the boiling water bath but will not grow in an acid medium. To ensure a good seal was the reason given by 27% of the respondents. There appears to be no basis for processing pickles for improved flavor or for processing cucumbers because they are low-acid (34). The advantage of using vinegar of four to six percent acidity is that it has a sufficiently low pH to prevent the growth of spoilage organisms that will grow at a pH above 4.6.

Food Safety Knowledge

The classification of fish as low acid was known by 85% of the respondents and the classification of poultry and tomatoes as acid by 84% (Table 21). Fewer respondents knew the acidity of peaches than

Table 21. Correct Classification of Food as Low Acid or Acid¹ by Selected Alberta Homemakers

	no.	%
peas	106	53
corn	154	77
fish	171	85
peaches	90	45
poultry	169	84
tomatoes	169	84
identify acidity to evaluate safety of home canned food	4	2

¹Correct responses out of 200

of any other food. There is some indication that as number of years of schooling increased so did the knowledge of the acidity of food (Table 22). The mean percent ranged from 58% for those respondents educated to the eighth grade level or less, to 80% for those with advanced education. Similarly 76% of those respondents who had taken biology or chemistry correctly identified the acidity of food but only 67% of those who had not did so (Table 23). Only 2% of the respondents used food acidity in evaluating the safety of home canned food, (Table 21); apparently the population sample does not relate acidity of food and the inability of C. botulinum to grow in an acid medium.

Three of the knowledge questions concerned the growth of bacteria at room, refrigerator and freezing temperatures (Table 24). The responses expected were that room temperatures permit the growth of bacteria, that refrigeration temperatures stop the growth of pathogenic bacteria and that partially frozen foods may be safely refrozen. Ice crystals in food indicate that it has not reached room temperature; therefore pathogenic bacteria have not had the opportunity to grow. Most perishable foods, including eggs, dairy products, meats, seafood, vegetables, and fruits, may be held in chilled storage (0-10°C) for a limited time with little change from their original condition. Enzymatic and microbial changes due to the growth of psychrophiles in the foods are not prevented but are slowed down considerably. Any nonsterile food is likely to spoil if moist enough and unfrozen (38).

Table 22. Correct Classification of Food as Low Acid or Acid Grouped by Last Year of Schooling Received by Selected Alberta Homemakers

	eighth grade or less n ¹ =42		two years high school n ¹ =63		four years high school n ¹ =45		one year college n ¹ =23		other training n ¹ =27	
	no.	%	no.	%	no.	%	no.	%	no.	%
peas	12	28	31	49	33	73	13	56	20	74
corn	24	57	47	74	40	88	18	78	25	92
fish	31	74	56	88	41	91	17	74	26	96
peaches	15	36	28	44	24	54	11	48	12	44
poultry	30	72	54	86	40	88	19	82	26	96
tomatoes	34	80	58	92	38	84	18	78	21	78
mean percent		58		72		80		70		80

¹Number of respondents in each school category

Table 23. Correct Classification of Food as Low Acid or Acid by Selected Alberta Homemakers Who Had and Not Had Biology or Chemistry in High School

	taken biology or chemistry n ¹ =97		not taken biology or chemistry n ¹ =103	
	no.	%	no.	%
peas	63	64	43	42
corn	84	86	70	68
fish	86	88	85	82
peaches	48	50	42	40
poultry	87	90	82	80
tomatoes	77	80	92	90
mean percent		76		67

Number of respondents

Table 24. Food Safety Knowledge of Selected Alberta Homemakers

test item	Response	correct response n ¹ =200	
		no.	%
bacteria grow rapidly at room temperature	T	197	98
food in bulging cans not safe to eat	T	194	97
refrigeration will stop growth of harmful bacteria	T	19	10
partially defrosted foods may be safely refrozen	T	105	52
freezing foods will kill illness causing bacteria	F	142	71
safe to use 2/3 processing time for thin asparagus stalks	F	142	71
processing time for quarts of cream style corn same as kernel corn	F	128	64
overall correct responses			66

n¹Total number of respondents

Toxin production by C. botulinum type E can occur at temperatures as low as 3.3⁰C (38) and strict anaerobic conditions are not required. Thus there is a theoretical possibility of growth which applies only to cooked or otherwise partially preserved sea or fresh-water foods.

Almost all respondents understood that bacteria grew rapidly at room temperature. However, only 10% realized that refrigeration temperatures would stop the growth of harmful bacteria. About half, 52%, knew that partially defrosted foods could be safely refrozen.

The questions on processing time for canning thin asparagus stalks and cream style corn were designed to assess application of basic principles determining the establishment of processing recommendations. Respondents were expected to answer both questions false. Pieces that cook apart and become or are mushy or viscous, such as cream style corn, heat slowly, because heat penetration is largely due to conduction rather than convection. In cream style corn, the sauce contains starch which increases the viscosity (38).

The processing time for a low acid food such as asparagus is not based on the time required to cook the food but on the time required to give an adequate heat treatment to kill botulinum spores and prevent spoilage. The heat transfer characteristics of the food will also determine the processing time required to give the slowest-to-heat portion an adequate heat treatment. There is no basis for decreasing the processing time for thinner asparagus stalks.

Sixty-four percent and 71% of the respondents answered the questions correctly on cream style corn and asparagus, respectively.

Another question concerned the safety of a bulging can, which is dependent on the acidity of the food. When the canned food is low or medium acid, the swelling could be produced by C. botulinum or by fermentative strains of other clostridia or bacilli or by non-sporulating genera which survived because of underprocessing.

A canned acid food may also swell as a result of the pressure from hydrogen gas released by the action of the acid of a food on the iron of the can. These hydrogen swells, which do not change food quality or safety, are helped by (1) increasing acidity of food, (2) increasing temperatures of storage, (3) imperfections in the tinning and lacquering of the interior of the can, (4) a poor exhaust, and (5) the presence of soluble sulfur and phosphorous compounds. Ninety-seven percent of the respondents answered the question correctly since acidity was not specified. Sixty-six percent of the respondents answered all the questions correctly.

Age did not appear to have a consistent effect on food safety knowledge (Table 25). The only question for which there was significant effect ($P \leq .05$) was that more older homemakers would not use bulging cans. Usually as the level of education increased however there was evidence of a concomitant increase in food safety knowledge. The exception resulting in a reversal of trends appeared when respondents were asked if refrigeration would stop the growth of harmful bacteria (Table 26) as discussed above.

Having taken biology or chemistry in high school did not necessarily result in a higher percentage of correct responses (Table 27).

Table 25. Food Safety Knowledge of Selected Alberta Homemakers Grouped by Age

test item	Response	correct responses							
		under 35 n ¹ =35		35-49 n ¹ =97		50-64 n ¹ =58		65 and over n ¹ =10	
		no.	%	no.	%	no.	%	no.	%
bacteria grow rapidly at room temperature	T	35	100	97	100	55	94	10	100
food in bulging cans is not safe to eat	T	32	92	95	98	58	100	9	90
refrigeration will stop growth of harmful bacteria	T	2	6	7	7	10	17	0	0
partially defrosted foods may be safely refrozen	T	15	42	50	52	34	58	6	60
freezing foods will kill illness causing bacteria	F	26	74	73	75	35	60	8	80
safe to use 2/3 processing time for thin asparagus stalks	F	22	62	74	76	40	68	6	60
processing time for quarts of cream style corn same as kernel corn	F	26	74	56	58	39	68	7	70
mean percent			64		66		66		66

¹Number of respondents in each age group

Table 26. Food Safety Knowledge of Selected Alberta Homemakers Classified by Level of Education

test item	Responses	correct responses									
		eighth grade or less n ¹ =42		two years high school n ¹ =63		four years high school n ¹ =45		one year of college n ¹ =23		further training n ¹ =27	
		no.	%	no.	%	no.	%	no.	%	no.	%
bacteria grow rapidly at room temperature	T	41	98	61	96	45	100	23	100	27	100
food in bulging cans is not safe to eat	T	40	95	62	98	43	96	22	96	27	100
refrigeration will stop growth of harmful bacteria	T	9	22	6	10	4	9	0	0	0	0
partially defrosted foods may be safely refrozen	T	21	50	30	48	24	54	14	60	16	60
freezing foods will kill illness causing bacteria	F	29	70	39	62	34	76	17	74	23	85
safe to use 2/3 processing time for thin asparagus stalks	F	27	64	48	76	26	58	18	78	23	85
processing time for quarts of cream style corn same as kernel corn	F	25	60	44	70	25	56	15	65	19	70
mean percent			66		66		64		68		72

¹Number of eligible respondents

Table 27. Food Safety Knowledge of Selected Alberta Homemakers Classified by Having or Not Having Taken Biology or Chemistry in High School

test item	Response	taken biology or chemistry n ¹ =97		not taken biology or chemistry n ¹ =103	
		no.	%	no.	%
bacteria grow rapidly at room temperature	T	95	98	99	96
food in bulging cans is not safe to eat	T	6	6	13	12
refrigeration will stop growth of harmful bacteria	T	55	56	50	48
partially defrosted foods may be safely refrozen	T	55	56	50	48
freezing foods will not kill illness causing bacteria	F	73	75	69	67
safe to use 2/3 processing time for thin asparagus stalks	F	72	74	70	68
processing time for quarts of cream style corn same as kernel corn	F	60	62	68	66
mean percent			61		58

n¹Possible number of respondents

Incidence of Spoilage

Spoilage of canned food was reported by 11% of the homecanners (Table 28) whereas in the National Survey of Homecanning (5) one-fourth of the respondents reported spoilage. Canning practices which were reported that could have increased the spoilage rates were the open-kettle processing for foods other than jams and jellies and using the boiling-water-bath for meats and low acid vegetables.

The Alberta results showed the highest incidence of spoilage was reported by respondents who dried food. Interrupting the drying process often results in loss of the food due to mold growth and fermentation in the interim. Significantly more ($p \leq .05$) of those who had taken biology or chemistry in high school dried foods continuously than those who did not. The incidence of spoilage in smoked and pickled foods was low; surprisingly so, considering the high number of inquiries serviced each pickling season by Alberta Agriculture district home economists.

Age, level of education, place of residence or income did not affect the level of spoilage (Tables 29, 30, 31, 32).

Recognition of Spoilage

Safety involves an assessment of several factors in the product. For canned foods, obvious organoleptic spoilage may not occur before there has been sufficient multiplication of C. botulinum to have

Table 28. Incidence of Spoilage of Home Preserved Foods of Selected Alberta Homemakers

food preservation method	n ¹	no.	%
canned	200	22	11
dried	68	27	40
smoked	16	1	6
pickled	186	34	18

¹ number of respondents using the preservation method

Table 29. Incidence of Spoilage of Home Preserved Food of Selected Alberta Homemakers Classified by Age

	n ²	under 35 n ¹ =35		35-49 n ¹ =97		50-64 n ¹ =58		65 and over n ¹ =10	
		no.	%	no.	%	no.	%	no.	%
canned	200	4	2	12	6	6	3	0	0
dried	68	3	4	16	24	8	12	0	0
smoked	16	0	0	0	0	0	0	1	6
pickled	186	4	12	15	16	12	6	3	2

¹Number of respondents

²Number of respondents using the preservation method

Table 30. Incidence of Spoilage of Home Preserved Foods of Selected Alberta Homemakers
Classified by Level of Education

	n ²	8 grade or less n ¹ =42		2 yrs high school n ¹ =63		4 yrs high school n ¹ =45		1 yr college n ¹ =23		further training n ¹ =27	
		no.	%	no.	%	no.	%	no.	%	no.	%
canned	200	3	7	5	8	6	13	4	17	4	15
dried	68	6	14	9	14	7	15	4	17	1	4
smoked	16	0	0	0	0	1	2	0	0	0	0
pickled	186	12	28	7	11	7	16	3	13	5	18

¹Number of respondents

²Number of respondents using the preservation method

Table 31. Incidence of Spoilage of Home Preserved Foods of Selected Alberta Homemakers Classified by Residence

	n ²	farm n ¹ =153		non-farm n ¹ =47	
		no.	%	no.	%
canned	200	17	11	5	11
dried	68	26	17	1	2
smoked	16	0	0	1	2
pickled	186	25	16	9	19

¹Number of respondents

²Number of respondents using the preservation method

Table 32. Incidence of Spoilage of Home Preserved Foods of Selected Alberta Homemakers Classified by Level of Income

	n	under \$5,000 n ¹ =11		\$5,000-\$12,499 n ¹ =20		\$12,500-\$19,999 n ¹ =44		\$20,000-\$24,999 n ¹ =10		\$25,000 and more n ¹ =11	
		no.	%	no.	%	no.	%	no.	%	no.	%
canned	200	4	36	4	20	5	12	4	40	2	18
dried	68	2	4	3	15	7	16	2	20	0	0
smoked	16	0	0	0	0	0	0	1	10	0	0
pickled	186	4	36	5	25	9	20	4	40	5	45

¹Number of respondents

²Number of respondents using the preservation method

produced toxin. However, there are several other guides. Most respondents judged lack of spoilage of canned food by the jar being sealed (Table 33). In the case of low acid foods, C. botulinum grows at moderate temperatures under anaerobic conditions. Therefore, a sealed jar of a low acid vegetable or meat which has been underprocessed provides ideal conditions for the production of toxin. If it is a fermentative strain, gas produced will cause loss of vacuum; however, not all strains are fermentative. Off-color was second as an indication of spoilage. Color changes may result from spoilage; however, off-color may not necessarily be a spoilage sign. Darkening of foods at the top of jars may be caused by oxidation from air in the jars. Over processing may cause discoloration of foods throughout the containers. Also, minerals from cooking utensils or from water in some localities may cause brown, black and gray coloration of some foods. However, any canned food with an unusual color should be examined carefully for other spoilage signs before use. About half, 52%, judged spoilage by off taste, which would be dangerous in a low acid food.

The acidity of the food was considered by very few when judging spoilage. Knowing that C. botulinum and other food-poisoning organisms will not grow in an acid medium and the processing history of the food would enable respondents to make accurate assessments of the safety of their home preserved food products.

Five Year Comparison of the Amount of Home Food Preservation

Freezing showed the greatest increase as a food preservation method (Table 34), probably reflecting the convenience and safety of this method.

Table 34. Five Year Comparison of Amount of Home Food Preservation Done by Selected Alberta Homemakers

	more no.	less no.	no change no.
canning	60	97	43
pickling	53	62	85
drying	15	4	176
freezing	106	38	56
making sauerkraut	21	47	131
storing food in a root cellar	44	40	115
smoking	6	14	177

Table 33. Spoilage Recognition by Selected Alberta Homemakers

test items	n ¹ =200	
	no.	%
sealed jar	199	99
color	165	82
odor	101	50
off-odor	75	38
acidity	4	2
off-taste	105	52

¹Total number of respondents

Canning was second, more being done by 60 of those interviewed. However, the increase in canning was accompanied by a large number of respondents who reported doing less canning now than five years ago. More canning was being done by those having taken biology or chemistry in high school (significance at $p \leq .05$) and those living on a farm ($p \leq .05$). Those with a family size of two to four were doing less canning ($p \leq .05$). The amount of home food preservation done by other methods had remained relatively constant.

APPLICATION

This information on household practices can be applied in developing educational programs or strategies that would be appropriate to meet the information needs of non-urban Alberta clientele who do home food preservation.

The survey results will help determine the target audience for food preservation information as well as provide guidelines on how to best deliver it. The study has pinpointed areas of misinformation and practices which are unsafe; corrected interpretations of information and practices should be incorporated into fact sheets, newsletters, workshops and programs for professionals and clientele.

The older homemaker from 35-64 years of age, who is the mother in a household of 2-4 persons, does the most methods of home food preservation, irrespective of educational level or income, and so she is a major target audience. Although other homemakers were using fewer other methods, the practices newly adapted in that stage will be used later. All age groups used canning as a method, which would indicate the needed emphasis on this. However, her sources of information appear to depend on her income level and level of schooling.

Alberta has many families moving into the province. These homemakers especially will be assisted by information on the use of preservation methods with which they may not have been familiar.

Home preservers from higher income levels apparently made more use of tax supported services such as government bulletins and the services of district home economists. Those from lower income levels seemed to rely on family members and cookbooks, implying that non-traditional methods of reaching these clientele should be found. Possibly training paraprofessionals from low income levels would be one alternative similar to the Expanded Food and Nutrition Program, United States Department of Agriculture. Making available appropriately designed and written information is another, because these income levels did use cookbooks. Printed materials, such as cartoons (39), which draw attention to hazardous practices as well as correct methods would aid the paraprofessional and assist the district home economist in reaching this group of clientele.

Survey results showed that homemakers educated beyond high school made more use of government bulletins, than those educated through high school. The reason may be that the better educated are aware of the service or that the bulletins are not readable by those with less education. Printed materials and news releases should be reviewed to determine the level of reading difficulty and revised if necessary. In the past a concerted effort has not been made to advertise in the news media the availability of consumer information bulletins, other than in district home economist news columns; this should possibly be tried and evaluated to determine if information is reaching new clientele or resulting in better service to existing clientele.

Family and friends appear to be important as information sources indicating a need to increase the visibility of district home

economist services in local communities as an information service. Traditionally publicity for these services has relied on day to day personal contacts. These contacts no doubt facilitate the "friend" relationship. However, considering the mobility and the high number of demands for the time and attention of clientele it does seem that the extension service should actively market its programs and services if local extension offices are going to continue to provide a useful education service.

In all cases cited the problem appears to be one of communication. The Extension Service in Alberta must make greater use of recorded telephone information services, taped programs for satellite transmission, increased publicity of information services and continued use of the media.

Typically in Alberta there are surpluses of carrots, tomatoes and cabbage during the harvesting season, which is one reason so many respondents made sauerkraut. Because making sauerkraut at home is popular in the survey area, district home economists should be familiar with its preparation and reasons for following the recommended procedure, as well as acceptable deviations from these procedures, so that they can be of assistance to new generations of home preservers. Training workshops for district home economists should include this information.

Surplus garden produce is also stored in root cellars. Instructions for storing, preserving and using the most popular home grown items would appear to be of use. A leaflet, for example, on how to ripen tomatoes which are picked just before the frost, preservation methods and the advantages and disadvantages of each, their nutritive

values and their use in cooking would give the homemaker a complete finger-tip reference. A similar format could be used for carrots and homegrown apples. These foods are plentiful in Alberta in the fall and surplus quantities pose preservation problems for many consumers as well as many questions for district home economists.

A trend which seemed to emerge was that younger home preservers are doing more drying, but little is known about home practices. This is an area for further investigation.

The nutritive value of dried food is relatively high and so as a method of food preservation makes economic sense when viewed from the standpoint of cost of preparation and storage. Molds growing on foods may produce mycotoxins and be potentially unsafe (38) since spoilage from drying was reported (question 20; 40%). Information bulletins giving instructions on how to dry home grown produce, preparation for eating and nutritive value would be timely in view of the level of interest the survey indicated.

Misinformation seemed to surround judging the safety of home preserved food. The hazardous practice of judging safety by taste was accepted by 52%. There was almost no association between recognizing a food as being acid and judging it as safe; not all respondents could identify the acidity of most foods correctly. Colour was ranked second as a method for judging the safety of food, and as discussed under food spoilage is not a reliable indicator.

Another area of misinformation was the belief that freezing will kill any bacteria or spoilage microorganisms, since this may lead to mishandling of cooked or thawed frozen foods. Education programs which

teach home preservers how to judge the safety of their food appear to be necessary. Newspaper releases following the food preservation season which provide this information followed by a self-administered quiz would be one way to encourage homemakers to examine their food safety knowledge. This information should also be incorporated into food preservation workshops and media programs. Above all an attempt must be made to help homemakers understand the relationship between the acidity of food and judging its safety.

There are some home food preservation issues which are controversial and the best advice depends on the problems the homemaker faces. The controversy surrounding whether or not to process pickles is one. The rationale for both processing and not should be clarified for the professional and the homemaker, so the latter can make her own decision. Releases to both via fact sheets, newsletters, and the media should point out that success and safety can be achieved without processing as well as the assurance of the jar sealing and prevention of mold growth with processing.

Information on home preservation available from extension offices, in cookbooks, and often in the popular press does give correct procedures and suggests the use of approved equipment, but does not attempt to teach homemakers why they must follow recommended procedures or use approved equipment. Very often too, the consequences of using non-recommended methods and equipment are withheld.

New and revised government home food preservation bulletins and district home economist workshops, media releases and programs should

provide clientele with the reasons and rationale for following recommended home preserving methods and using approved equipment.

SUMMARY

The home food preservation practices and knowledge of a sample of 200 non-urban Alberta homemakers were examined with regard to canning, drying, making sauerkraut, pickling, smoking, and root cellar storage.

The demographic characteristics of the sample population were delineated as to age, education, income, and size of family still living at home. These were each considered in relation to their influence on the selection of preservation methods and the choice of information sources for food preservation.

Results showed that the widest variety of home food preservation methods was used by homemakers between the ages of 35 to 64 irrespective of income or education level. The greatest number of these homemakers got their instructions from cookbooks, which may have included government bulletins, or family and friends. District home economists were a source for higher income homemakers predominantly.

The majority of these homemakers canned food, but very few did their own smoking. Most drying was done by the younger homemakers.

Some of their canning practices are not recommended and could result in C. botulinum toxin being present in their canned food. Only 12% used pressure canners when canning low acid vegetables or meats and the open-kettle processing method was used for foods other than jams or jellies. Both recommended and non-recommended jars were used. The glass lid, rubber ring and metal band combination closures were

most popular followed by the two-piece flat metal lid with sealing compound and metal band. Those who used the latter often used them correctly, but did not understand why.

Pickling ranked second in food preservation methods used. The majority of those who made pickles knew that the vinegar should not be diluted; however, fewer realized that sugar or spices could be added without altering the pH.

Sauerkraut, a similar product, was the third most used food preservation method. Very few followed the recommended technique of weighing the cabbage and salt. Most packed it directly into jars rather than making it in larger quantities.

In addition to surveying home food preservation practices, an attempt was made to assess the adequacy of food safety knowledge. Most knew that bacteria grew at room temperature. Very few realized that refrigeration temperature would stop the growth of harmful bacteria; if considering the possibility of C. botulinum causing spoilage of preserved fish products, most were correct.

The incidence of spoilage was low; most occurred in food which was dried. The way in which homemakers judged the safety of food was not complete. Few related the acidity classification of the food with its safety.

New and revised home food preservation instruction booklets should provide the rationale for following recommended methods and using approved equipment, and guidelines for determining the safety of food. The use of a wider variety of contact methods and materials is recommended for extension home economists.

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APPENDIX

HOME FOOD PRESERVATION QUESTIONNAIRE

*1. What kind(s) of jar lids or tops did you last use for canning fruits and vegetables other than jams and jellies?

(Circle as many numbers as apply)

1. New flat metal lid, metal band (two piece).
2. Reused flat metal lid, metal band (two-piece).
3. Porcelain-lined zinc cap with rubber ring.
4. Glass with rubber ring and wire bail.
5. Glass with rubber ring and metal band.
6. Plastic flat lid with metal band.
7. Plastic film.
8. Paraffin.
9. Other (record type)

*2. What kind(s) of jars or cans did you use for home canning fruits and vegetables, other than jams and jellies?

1. Tin cans designed for home canning.
2. Jars designed for home canning.
3. Other jars, such as peanut butter, coffee, salad dressing.

3. Do you have a pressure saucepan? (Check (✓) appropriate answer)

yes ___ no ___

4. If you have a pressure canner with a dial gauge or pressure indicator gauge, have you had it checked within the last year?

dial gauge

yes ___ no ___

pressure indicator gauge

yes ___ no ___

- *5. What foods do you can? (Record the number of jars and the method used to can the product--hot water bath, pressure canner, open kettle, oven, other).

	<u>No. of Jars</u>	<u>Method</u>
___ fruits: peaches, apples, apricots	_____	_____
___ vegetables (excluding tomatoes)	_____	_____
___ meats	_____	_____
___ mixed products--e.g. stews	_____	_____

6. Did you have any canned food spoil last year?

yes ___ no ___

7. During this past year did any of your canned food spoil

in a few jars (4-5)? ___

in many jars (5-20)? ___

over 20? ___

What were the most common signs of spoilage? (Record answer verbatim).

8. The relative acidity of food is an important factor in its safe preservation. Would you call the following foods acid or slightly acid? (Check (✓) the answer given for each food on the following table).

FOOD	ACID	LOW ACID
Peas		
Corn		
Fish		
Peaches		
Poultry		
Tomatoes		

9. Currently we are able to buy sealer lids with sealing compound on them which fits over the rim of the jar. Do you

turn the metal ring tight? _____

turn the metal ring back 1/2 turn? _____

tighten only until firm? _____

Why?

to ensure a good seal _____

to allow air to escape _____

to allow for expansion _____

10. How do you evaluate safety in canned foods? (Have them rank 1 to 6 and record numbers).

jar is sealed _____

color _____

odor _____

off-odor _____

acidity of the food _____

off-taste _____

11. Do you make sauerkraut?

yes _____ no _____

Every year _____

Have made it, but not often _____

Would like to, but don't know how _____

12. Sauerkraut is a fermentation process requiring salt and cabbage. Do you

weigh salt and cabbage? _____

measure salt and cabbage? _____

estimate amount of salt needed for the cabbage you have? _____

13. When you cover the sauerkraut during fermentation, do you use
- a dinner plate? _____
- sheet of plastic on top of liquid? _____
- nothing? _____
- a lid for the crock? _____
- board? _____
14. Do you make pickles?
- yes _____ no _____
15. Did you have any jars which showed signs of spoilage last year?
- yes _____ no _____
16. When a pickling solution is too tart, do you
- add water to reduce the strength of the vinegar? _____
- add sugar? _____
- add spices to mask the acidity? _____
- do nothing? _____
- decrease the amount of vinegar mixture? _____
17. Recent recommendations suggest processing pickles for 20 minutes after the pickles are put into the jars. Why?
- to ensure destruction of C. botulinum bacteria which cause botulism _____
 - to reduce the loss of pickles due to molds _____
 - to ensure a good seal _____
 - to complete processing of cucumbers which are a non-acid vegetable. _____
18. Do you preserve any foods by drying?
- yes _____ no _____
19. Is the drying of your food continuous?
- yes _____ no _____

20. Have you thrown away any dried food because of spoilage?
 this past year ____
 the year before ____
21. Do you root cellar vegetables?
 yes ____ no ____
22. Do you cure or smoke any food yourself? yes ____ no ____
 Does your husband or anyone in the family do it for you?
 yes ____ no ____
 Do you have any done commercially for you? yes ____ no ____
23. How do you store smoked food that is ready for eating?
 - frozen ____
 - canned ____
 - left in the smoke house ____
 - refrigerator ____
 - packages at room temperature ____
24. Have you had any of the smoked food spoil due to
 mold? ____
 souring? ____
 other? ____ (Indicate) _____
25. I'll read you a statement and perhaps you would tell me if it is true or false. (Indicate whether T or F answer).
1. Bacteria in food grow rapidly at room temperature. ____
 2. The food in bulging cans would not be safe to eat. ____
 3. Refrigeration of perishable foods will completely stop the growth of harmful bacteria. ____
 4. Frozen meat, fruits and vegetables that are partially thawed (still have ice crystals) can

be refrozen and remain safe to eat, though there may be some damage to the texture. _____

5. Freezing of foods will kill any bacteria that may cause illness or food poisoning. _____

26. What would you do? The asparagus in your garden has very thin stalks, and when canned it becomes mushy. Would it be safe to use 2/3 the processing time for asparagus in the canning booklet?

yes___ no___

27. Your family is large and you would like to can quarts of cream style corn. However, your instruction booklet gives instructions for only pints of cream corn, but gives instructions for both pints and quarts of kernel corn. Would you use the time for quarts of kernel corn to do the cream style corn?

yes___ no___

28. You have just finished canning tomatoes, but now you must leave for an appointment before the jars can be removed from the canner. Would you leave the jars in the canner to cool?

yes___ no___

29. You have just discovered a jar of tomatoes 2/3 full with a heavy growth of mold which completely covers the top. How would you dispose of it?

30. Think back to five years ago. Are you doing more or less food preservation now?

yes___ no___

31. Are you doing more or less of the following now?

	<u>MORE</u>	<u>LESS</u>	<u>NO CHANGE</u>
Canning	_____	_____	_____
Drying	_____	_____	_____
Freezing	_____	_____	_____
Krauting	_____	_____	_____
Pickling	_____	_____	_____
Root Cellaring	_____	_____	_____
Smoking	_____	_____	_____

32. Age of homemaker

under 25 _____

25 - 34 _____

35 - 49 _____

50 -64 _____

65 and over _____

33. Size of family living at home

2 - 4 _____

4 - 6 _____

6 - 8 _____

more _____

34. Last year completed in school by the homemaker

eighth grade or less _____

2 years high school _____

4 years high school _____

1 year or more college _____

post secondary education _____

35. Family income level

under \$5,000 _____

\$5,000 - \$12,499 _____

\$12,500 - \$19,999 _____

\$20,000 - \$24,999 _____

\$25,000 - \$29,999 _____

\$30,000 and over _____

36. Residence

farm home _____
community (under 1,000) _____
community (1,000 - 3,000) _____
town over 3,000 _____

*37. Where do you usually obtain information on food preservation?

neighbours, friends _____
home experience and family _____
club contacts _____
newspaper or magazine _____
cookbook _____
government bulletins _____
district home economist _____

38. Did you take biology or chemistry in high school?

yes _____ no _____

*Items are from the National Survey on Home Canning (5).