RURAL ECONOMY

Consumer Preferences for Biopreservatives in Beef and Pork Packaging and Testing the Importance of Product Origin

James Unterschultz, Kwamena Quagrainie and Michele Veeman

Project Report 96-03

Alberta Agricultural Research Institute Project No. 94L601

Project Report

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ABSTRACT

Recent food science research on packaging at the University of Alberta has focused on the use of biological agents (biopreservatives) to extend meat shelf life. This potential technology involves the introduction of microbial organisms into food packages to control or inhibit the growth of disease causing organisms such as *Escherichia coli* (commonly associated with hamburger disease). Biopreservatives are not yet in commercial use. The study evaluated Western Canadian consumers' preferences regarding the potential use of biopreservatives in fresh red meat packages (beef and pork). The study also assessed the effect of product origin on consumers' purchasing decisions; in particular, whether there is an increasing or decreasing probability of purchase if a fresh meat product is labeled as a product of Alberta, product of Canada, product of United States or if no origin is displayed.

The research objectives were achieved through the collection and analysis of data from mailed survey questionnaires that included stated preference and scaling methodologies. The study used multinomial nested logit models to examine the potential effect of the identified product characteristics on the probability of a product being purchased. It is found that in aggregate, the potential use of biopreservatives in fresh meats packages is currently not acceptable to consumers, although many consumers are not opposed to research in this area. The price reductions required for consumer acceptance of a product packaged with a biopreservative are not currently feasible. The study also finds that Western Canadian consumers are generally loyal to meat products from Alberta and Canada as a whole, relative to fresh meat products sourced from the US or products without any indication of origin. For high quality beef products, Alberta is seen as a preferred source compared to other sources in Canada. Simulation results suggest that the price of beef cuts from other Canadian sources need to be reduced before consumers will be indifferent between that product and a beef cut from Alberta. On average, a price reduction of about 15 percent is required for a high quality beef product from other Canadian sources before consumers are indifferent to a Canadian labeled product versus an Alberta product. For a high quality pork cut and for ground beef, the study results indicate that consumers generally are indifferent between products from Alberta and products from other Canadian sources. Branding Alberta pork for export to other provinces does not appear to provide benefits at this time. A comparison of a US product and a product from Alberta suggests that the US product price would have to be reduced by at least 35 percent, whether for a beef cut or a pork cut, before consumers would be indifferent between these products from the two sources. There is a strong bias towards purchase of local product in meat consumption by Western Canadian consumers as long as the domestic product is perceived to be of the same quality as the US fresh meat product.

SUMMARY

Consumer Preferences for Biopreservatives in Beef and Pork Packaging and Testing the Importance of Product Origin

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This study evaluates Western Canadian consumers' preferences regarding the potential use of biopreservatives in the packaging of three specific fresh red meat products. Biopreservatives are not yet in commercial use. Recent food science research on packaging at the University of Alberta has focused on the use of biological agents (biopreservatives) to extend meat shelf life. This potential technology may reduce the costs of handling and merchandising meat by extending the shelf life of the packaged product. The technology involves the introduction of microbial organisms into food packages to control or inhibit the growth of disease causing organisms such as *Escherichia coli* (commonly associated with hamburger disease). The study also assesses the effect of product origin on consumers' purchasing decisions. In particular, one issue examined in the study is whether there is an increasing or decreasing probability of purchase if a fresh meat product is labeled as a product of Alberta, product of Canada, product of United States or if no origin is displayed. The research objectives are achieved through the collection and analysis of data from stated preference and scaling survey questionnaires.

Data for the study are obtained from a survey questionnaire administered in the four western provinces, namely, British Columbia, Alberta, Saskatchewan and Manitoba, in February and March, 1996. The questionnaire covered the following issues: consumers' concerns towards consumption of red meat, convenience of preparation, freshness, over all product quality, price, food safety, health issues as well as the biopreservative technology. Consumers' concerns related to the above issues were rated on a scale where 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree and 5 = strongly agree. Separate stated preference questions were asked pertaining to a high quality beef cut, a high quality pork cut and ground beef. The questions outlined different descriptions of each of the products and respondents were asked to choose from among three alternatives, i.e. alternative A, alternative B, and alternative C. Alternatives A and B describe products that include different product characteristics. Alternative C is to be chosen if neither descriptions of the product in alternatives A and B are preferred. Demographic factors such as family size, age and income were asked of each respondent.

Potential respondents were randomly selected from current local telephone directories and contacted by phone regarding participation in the survey. Respondents were chosen from the cities of Winnipeg, Regina, Edmonton and Victoria. Out of a total of 700 questionnaires sent to consumers, 530 questionnaires were returned; 125 from Winnipeg, 135 from Regina, 141 from Victoria and 129 from Edmonton. This represented an 76% response to the study. The analysis in the study incorporates the two methodological approaches of a scaling method and a stated preference method.

Scaling Method Ratings of responses to open ended questions of general issues involving convenience of preparation, freshness, over all product quality, price, food safety and health are examined to determine the issues of most concern to consumers. Respondents generally strongly indicated that the above issues were either important or of concern to them. For example, on the issue of speed and ease of meat preparation, 79% of respondents indicated that this was very important to them. The average rating on the importance of ease and convenience of meat preparation was 4 (very important). Regarding food safety, 87% of respondents agreed that drug residue, dyes and other inorganic substances in fresh meats are of concern to them. The average rating for food safety is 4.3 (very concerned). Respondents also indicated that price is important to them. Generally, 54% of respondents agreed or strongly agreed that beef was relatively expensive when compared to other meats. About 81% of respondents indicated they prefer or strongly prefer all the outside fat of a meat cut to be trimmed off. In response to a related question that was not scaled about 23% of survey respondents indicated that biopreservative research should be stopped; 35% indicated such research is a good idea and should continue while 42% had no opinion on this issue. Many respondents stated they needed more information on biopreservatives to evaluate the benefits of these.

Stated Preference Method Data elicited from this part of the questionnaire were tested using a multinomial non-linear nested logit model to examine the potential effect of the identified product and consumer characteristics on the probability of a product being purchased. Product characteristics evaluated include the price of the product, whether packaging includes biopreservatives, outside fat trim (or fat content), product origin and packaging date. Consumer characteristics that were examined include family size, age, and income group.

The results from this study indicate that consumers generally reacted negatively to adding biopreservatives to fresh meat products. Consumers prefer packages without any biopreservative. For example, estimated coefficients for the presence of biopreservative have a statistically significant negative sign which indicates that adding a biopreservative will decrease the probability of choosing that product. The use of biopreservatives in either fresh pork, fresh beef or hamburger results in a similar negative response from consumers. However, consumers in different cities do seem to view biopreservatives somewhat differently. The responding consumers in Winnipeg, Regina and Victoria were strongly opposed to the presence of biopreservatives in beef steak, pork cut and hamburger packages, but consumers in Edmonton were relatively indifferent to biopreservatives in fresh beef and pork packages.

Regarding the effects of product origin, products from Alberta and Canada are generally more preferred by consumers. Products of these regions evidently have a significant effect on the utility of the responding consumers since these origins increase the probability that consumers will purchase meat products from these sources. However, there is a significant difference in the effect of the two product origins regarding beef. For high quality beef steak, the effect of product-of-Alberta is stronger than the effect of product-of-Canada. For ground beef, the effect of product-of-Canada is stronger than the effect of Alberta. This suggests that there is no benefit to labeling ground beef as a product of Alberta. However, evidently Alberta has an image as a source of high quality beef cuts which could be utilized in marketing.

For high quality pork cuts, there is no significant difference in the effects of Alberta origin and Canadian origin on purchases. For consumers in Winnipeg, Regina and Victoria, there is also no benefit to labeling pork cuts as a product of Alberta. However, the reactions to fresh meat products that are labeled to be from the US and to products without an origin label were strongly negative.

The results of demographic factors in the stated preference models indicate that there is an increasing probability for a family of size 3 or less to purchase high quality beef cuts. Conversely, a family size of more than 6 has a decreased probability of purchasing beef steak. People of age 30 years and below have a higher probability of purchasing meat while those over 60 years have a decreased probability of purchasing meat products. Households with income of $20,000 and less have a decreased probability of purchasing high quality beef products. Households with income of over $50,000 have an increased probability of purchasing high quality beef products.

Simulations used the results of the estimated multinomial logit model to evaluate the value of biopreservatives and product origin by estimating the price change that would lead to a consumer having the same probability of choosing either of two competing products. The price change required can be viewed to represent an estimate of the dollar value of a product characteristic. For example, if a consumer is offered two products of the same quality labeled from two different sources, such as Alberta and Canada, it can be determined which product is most likely to be chosen. Then, from an Alberta point of view, it is possible to assess price changes to the competing product that will make consumers indifferent between a produced-in-Alberta product versus a produced-in-Canada product. These simulations were conducted based on the model results for (1) beef steak with a trace of visible fat and packaged today, (2) a pork cut that has no visible fat and packaged today and (3) ground beef that is extra lean (10% or less fat) and packaged fresh. A summary of the scenarios are as follows:

Scenarios 1 & 2: Economic Evaluation of Biopreservatives: Comparing Products with biopreservative and without biopreservative

In scenario 1, two products of Alberta origin are compared; one is packaged with a biopreservative and the other without. Scenario 2 compares two products from Canada, one packaged with biopreservative and the other without. For all survey respondents, the probability of choosing a meat product without biopreservative is about twice the probability of choosing a meat product with biopreservative. The same finding is found for consumers in each of the cities surveyed except for Edmonton. Specifically, for beef steak and pork cuts with biopreservative, an average price reduction of about 16% and 21% respectively is required for consumers in Winnipeg, Regina and Victoria. Consumers in Edmonton appear to be indifferent to biopreservatives and therefore do not require any significant price change to encourage the choice of meat products with biopreservatives. Price reductions required for products with a biopreservative are particularly high for ground beef. For example, a price reduction of as much as 54% is required for Winnipeg consumers before consumers can be viewed as indifferent between the two products. Similarly, Regina consumers will be indifferent to biopreservatives in packaging with a price reduction of about 37% for ground beef. Such high dollar values suggest that the widespread introduction of biopreservatives is not currently feasible. A change in consumer attitude is apparently required for biopreservatie use in consumer packaging.

Scenario 3: Economic Evaluation of Product of Alberta Labeling: Comparing Product Labeled as Product-of-Alberta versus Product Labeled as Product-of-Canada

Only beef steak and pork cuts are considered in this scenario. Generally, there is a relatively higher probability of choosing a high quality beef product from Alberta than from other sources considered in this study (Canada or US). For example, the probabilities of choosing a high quality beef steak from Alberta and from the rest of Canada are 30% and 17% respectively. A price reduction from 3 to 26 percent on beef products is required for products labeled as a product-of-Canada before consumers are indifferent to the purchase of an Alberta or Canadian product. This applies in all Western cities. For a pork cut, there is no significant difference between the probability of choosing a product from Alberta and a product from the rest of Canada, therefore price reductions required to equalize the probability of purchase are not appreciable. The price change required to obtain an equal probability of purchase of an Alberta product for a produced-in-Canada pork product is about -7.5 % or less. It appears there is little benefit to branding Alberta pork products with an Alberta-origin relative to Canadian-origin pork.

Scenario 4: Economic Evaluation of Product of Alberta Labeling: Comparing Product Labeled Product-of-Alberta versus other Labeled as Product-of-USA

This scenario evaluates the value of product origin for high quality beef and high quality pork products from Alberta relative to a similar product labeled as a product of the United States. Generally, the probability of choosing a product from Alberta is five times greater than that of choosing a product from the US. For beef steak, the price of the US product has to be reduced by more than 25% before consumers will have an equal probability of purchasing either product. For pork cuts, the US product requires an average price reduction of about 38% for all consumers to be indifferent between this and the Canadian product. There is a strong preference for either Alberta or Canadian beef products over similar US beef products. Branding beef products is definitely a potential marketing strategy in Canada relative to competing US beef cuts.

Summary

The study used advanced stated preference research methods to ascertain consumers' attitudes to the potential use of biopreservatives in fresh meat packages and to the identification of the Alberta origin of fresh meat products in Western Canada. It is found that in aggregate, the potential use of biopreservatives in fresh meats packages is currently not acceptable to consumers, although many consumers are not opposed to research on this issue. The price reductions required for consumer acceptance of a product packaged with a biopreservative are not currently feasible. A concerted effort is required to educate consumers on this technology if it is to be accepted in the

market. Consumers in Edmonton are the only group indifferent to the technology and this reaction is probably due to the identified location of this research project and its association with the local University.

The study also finds that Western Canadian consumers are generally loyal to meat products from Alberta and Canada as a whole, relative to fresh meat products sourced from the US or products without any indication of origin. For high quality beef products, Alberta is seen as a preferred source compared to other sources in Canada. Simulation results suggest that the price of beef cuts from other Canadian sources need to be reduced before consumers will be indifferent between that product and a beef cut from Alberta. On average, a price reduction of about 15% is required for a high quality beef product from other Canadian sources before consumers are indifferent to a Canadian labeled product versus an Alberta product. This strongly suggests that Alberta has the ability to brand its beef in Western Canada. These results may extend to non-Western provinces but this issue is not explored in this study.

For a high quality pork cut and for ground beef, the study results indicate that consumers generally are indifferent between products from Alberta and products from other Canadian sources. Branding Alberta pork for export to other provinces does not appear to provide benefits at this time. A comparison of a US product and a product from Alberta suggests that the US product price would have to be reduced by at least 35 percent, whether for a beef cut or a pork cut, before consumers will be indifferent between these products from the two sources. There is a strong bias towards purchase of local product in meat consumption by Western Canadian consumers as long as the domestic product is of the same quality (or perceived to be of the same quality) as the US fresh meat product. This is useful information should there be exportation of fresh pork from the United States to Western Canada.

1.0. INTRODUCTION

1.1 Background

Consumption of meat in Canada has shown some appreciable changes since the mid-1970s. There is clear evidence that the demand for beef has trended downward over the past 20 years. Pork consumption has remained fairly constant. This phenomenon in the consumption of beef and pork has been attributed to changes in relative prices of meats (Alston and Chalfant 1990). Other researchers have attributed the decline in beef consumption and the apparent constant pork consumption trends to convenience of preparation and changes in lifestyle of consumers, including health-related factors (Capps et al. 1988; Menkhaus et al. 1988; Menkhaus et al. 1990; Schmitz and Nayga 1991; Eales 1993; Menkhaus et al. 1993). Generally however, consumers are increasingly reported to be more discriminating in their food product choices. They are demanding freshness, quality, convenience and novelty more than ever before, therefore packaging of products has become important in purchasing decisions. Traditional processing, packaging and distribution methods are not always perceived as meeting the demands of consumers for freshness, quality, convenience and variety (Agriculture Canada 1990).

As a result of the changing consumer preferences and in response to incentives to reduce processing and merchandising costs, new technologies are being pursued that seek to extend the shelf life of packaged food products. These include vacuum packaging (VP), where all the air within the package is removed to extend the shelf life of the product; controlled atmosphere packaging (CAP), where the atmosphere in a package is continuously controlled; and modified atmosphere packaging (MAP) technology, where the initial atmosphere inside a package is modified with the addition of a range of chemical compounds or gases. Recent food science research on packaging at the University of Alberta has focused on the use of biological agents (biopreservatives) to extend meat shelf life. The technology involves the introduction of microbial organisms into food packages to control or inhibit the growth of disease causing organisms such as Escherichia coli (commonly associated with hamburger disease. The biopreservative technology will allow fresh meat to remain packaged and stored for longer periods without loss in freshness or quality.

The potential benefits of the emerging technology of biopreservatives are also a food safety issue. The technology involves an introduction into fresh meat packages of a biological agent that

may be naturally occurring or bio-engineered. It is reported that 25% of consumers are concerned with preservatives or similar agents in food products while 22% are concerned with tampering with food products (Consumer Association of Canada 1990). This project assesses consumers' reactions to a biopreservative packaging technique, relative to other features of selected meat products. The project also seeks to evaluate the effects of product origin on consumers' purchasing decisions. Specifically, the project assesses the importance to consumers' purchasing attitudes of meat produced in Alberta, meat produced in Canada and meat produced in the United States. The fresh meat products examined in the study include beef, pork and ground beef. These are chosen for examination because they are of particular importance to the meat industry in Alberta, a major producer of beef and pork in Canada. Alberta is trying to enhance the image of Alberta-produced fresh meat products, both nationally and internationally, with the production of quality fresh beef and pork products.

1.2. Research Objectives

This study assesses the importance of product attributes to consumers through a survey questionnaire. The questions concern a high quality beef cut, high quality pork cut and ground beef. The study includes consumers in major cities in Western Canada. The study's purpose is to:

1. evaluate consumers' preference for the potential use of biopreservatives in fresh red meat packages since biopreservatives are not yet in commercial use;
2. assess the effectiveness of product origin on consumer purchasing decisions; and
3. relate the results of the study to domestic market prospects facing Alberta's and Canada's cattle and hog industries with the introduction of new packaging technologies to improve the shelf life of fresh meat.

These objectives are pursued through analysis of data and information from survey questionnaires. Separate econometric models are specified for high quality beef and pork as well as ground beef to assess the potential effects of biopreservatives and the effects of product origin. Estimated coefficients from the econometric models are used to calculate probabilities of choosing meat products based on the presence or absence of a biopreservative in a package and also calculate probabilities of purchasing a product based on product origin. Based on these estimated probabilities, it is assessed by how much price must change before consumers are indifferent between choosing two products, with and without a biopreservative, or between choosing products

from different origins. The price change measure represents an estimate of the dollar value of the biopreservative technology or the dollar value of the product origins considered in the survey.

1.3. Benefits of the Study

The results provide information regarding attributes of fresh red meats preferred by consumers in major Western Canadian cities. Information on consumers' perceptions of biopreservatives is expected to be useful in directing packaging and biopreservatives research in fresh meat packages. This information will help direct strategies regarding the introduction of the technology into the market. This is of particular importance to the Alberta beef and pork industry because this information will be useful in guiding commodity merchandising strategies and product development of fresh beef and pork in Alberta and the other western provinces. Information on product origin obtained in the study indicates consumers' preference for selected meat products that are produced-in-Alberta, produced-in-Canada, and produced-in-the United States.

The results from the study indicates that introduction of the biopreservative technology in the market is currently not commercially feasible. The strong rejection of biopreservatives by consumers suggests that prior consumer education on the technology is required before its introduction. As well, pork cuts labeled as produced-in-Alberta are not preferred to pork cuts labeled as produced-in-Canada by consumers in Winnipeg, Regina and Victoria. This suggests that changes to pork product labeling and promotional programs are necessary to promote Alberta pork products in other Western Canadian cities. However, consumers show a strong preference for beef labeled as produced-in-Alberta. Evidently, Alberta has an image as a source of high quality beef cuts which can be utilized in marketing. Generally, the value consumers place on product origin will be useful in directing market entry strategies for new products and market expansion for fresh red meats.

The remaining parts of the report provide an outline of the methodology used for the analysis, the experimental design and then a discussion of the results. Several conclusions are drawn from the results and given in the concluding section. A copy of the survey instrument can be found in Appendix III.

2.0. THEORETICAL FRAMEWORK

2.1. Overview of previous studies

This section gives an overview of previous studies on factors influencing consumers' purchasing intentions for beef and the methodologies used in these studies. Both consumer and product attributes have been examined in previous studies. Some studies have used variations of conjoint analysis. Examples of such conjoint techniques are the "revealed preference" and the "stated preference" methods. These methods are briefly discussed in the following sections. Stated preference techniques are applied in this study along with selected types of rating/scaling questions.

2.2. Revealed Preference and Scaling Methods

The revealed preference approach involves direct observation of choices made by consumers and then comparison of the observed choices to the rejected alternatives. Inferences can be made about consumers' preferences based on these choices. In effect, the comparison of the chosen alternatives with the rejected ones reveals the preferences of the consumer. Capps et al. (1988) use such a technique to study the importance of consumers' characteristics in beef purchasing decisions. By asking respondents to rank their choice of three types of beef packages, it was determined that age, education level, household size and predisposition to buying low-fat foods were consumer characteristics relevant to beef purchasing decisions. Contrary to Capps et al. (1988), Menkhaus et al. (1988), using a similar analytical technique, conclude that age, education, total family income, household size, type of residence and other demographic characteristics do not have any significant influence on either the probability of purchasing or reordering a branded, low-fat, fresh beef product. Menkhaus et al. (1988) however, found health related factors such as trim, fat content and visual characteristics to be very important. Schmitz and Nayga (1991), did not find demographic variables to play a major role in determining consumers' perceptions of meat products.

The studies noted above applied revealed preference techniques by examining preference structures of consumers expressed by rank ordering or scaling. A scaling approach can also be used to develop profiles for consumer attitudes and product attributes and to develop total scores

by which these factors can be compared. The scaling method entails scaling preferences or behavior. Depending on the order of scaling, relatively higher or lower ratings are taken to indicate preferred product attributes or dominant consumer behavior. For example, Pelzer et al. (1991) use a ranking technique to examine some factors influencing consumer preference for retail beef packaging. Respondents were asked to rank steaks and roasts in three different package types: over-wrapped styrofoam tray, vacuum skin package (VSP), and VSP with the meat exposed to carbon monoxide prior to vacuum packaging. Results from this study suggest that consumers have a high preference for VSP with carbon monoxide, followed by over wrapped styrofoam tray and then VSP.

Capps, Moen and Branson (1988) used the scaling method to examine the attitude of consumers toward price and toward purchasing low fat foods during grocery shopping. Respondents were asked to rank these attitudes on a 7-point scale of 1 = extremely price conscious or fat conscious to 7 = not at all price or fat conscious. They report the average ranking of 2.75 for price consciousness and 2.94 for fat consciousness indicating consumers tend to be very price and fat conscious during grocery shopping.

The study reported here employs the scaling method in two parts of the analysis to evaluate consumer attitudes to fresh meat and biopreservatives.

2.3. The Stated Preference Method

Generally, the revealed preference technique has the advantage of revealing the preferences of consumers from their rankings or from rejected alternatives based on peoples' observed market behavior. However, the limitations with this procedure are that it can be difficult to obtain sufficient variation in the revealed preference data to examine all variables of interest. This procedure cannot be used in a direct way to evaluate demand under conditions which do not yet exist (Louviere 1994). As Wilkie and Pessemier (1973) have observed, many revealed preference models draw upon a "build-up" approach in which the total utility for some multi-attribute product is found as a weighted sum of the product's perceived attribute levels and associated value ratings, as separately judged by the respondent. In contrast, more recent techniques move beyond the examination of preference structures to direct examination of hypothetical choice processes. These are based on a decompositional approach, in which respondents react to a set of "total" profile descriptions. One such technique is the stated preference method which is applied in this study. Details of this method are outlined below.

The stated preference method (SPM), also referred to as experimental or stated choice analysis, involves asking respondents for their hypothetical or discrete choices, rather than for their preferences expressed by rank ordering or scaling. Questions are put in a behavioral choice context ("if you were to have these alternatives available to you, which one would you choose?"). This method is relatively easy to control because it allows explicit definitions of the conditions or factors which are being evaluated by the respondents. It is also flexible (being capable of dealing with a wider variety of variables), and it is cheap to apply. Louviere (1994), suggests that the SPM has good predictive ability.

Against these advantages, there is the potential disadvantage that people may not necessarily do what they say. The other issue is whether a respondent to whom a set of alternate options has been described can adequately evaluate these by expressing his/her preferences properly on the measurement scale that is used. Despite these potential disadvantages, the stated preference model has been used extensively in empirical work. Examples are its use in examining choice of travel, environmental amenities, and recreational facilities (see for example Ben-Akiva and Lerman 1987; Kroes and Sheldon 1988; Hensher, Barnard and Truong 1988; Mcleod, Boxall and Adamowicz 1993; Adamowicz et al. 1994a, 1994b; Louviere 1994).

2.3.1. Stated Preference: Analytical Framework

The stated preference method is based on economic principles. A choice among alternatives (discrete choices) can be modeled in a random utility framework. With a definition of the attributes and the levels that are being evaluated, a utility function can be specified, expressing the hypothesis about the way in which individual respondents combine their part-utilities into an overall evaluation or preference. Following Ben-Akiva and Lerman (1987), Kolstad and Braden (1991), Louviere (1994), and Adamowicz et al. (1994a), a general random utility function, in terms of attributes can be expressed as;

$$U_{in} = V(X_{in}) + \varepsilon(X_{in}) \qquad (1)$$

where U_{in} = person n's utility of choosing alternative i,

V = indirect utility,

X_{in} = a vector of attribute values for alternative i as viewed by respondent n, and

ε = a random element.

Total utility, U_{in} is a sum of observable and unobservable components which can also be expressed as V_{in} and ε_{in} respectively. The utilities are not known with certainty and are treated

as random variables. From this perspective, the choice probability of alternative i, is equal to the probability that the utility of alternative i, U_{in}, is greater than or equal to the utilities of all other alternatives in the choice set. This can be written as follows:

$$_n(i) = Pr[V_{in} + _{in} \geq V_{jn} + _{jn}; \quad all \ j \in C_n] \tag{2}$$

where C_n = choice set for respondent n.

Assuming that all the disturbances, $_{in}$, are independently, identically, and Gumbel-distributed with a scale parameter $\mu > 0$, then the probability of choosing an alternative is expressed as:

$$_n(i) = \frac{\exp[\ V_{in}]}{\sum_j \exp[\ V_{jn}]} \tag{3}$$

Assuming that V_{in} is linear-in-parameters, the functional form can be expressed as:

$$V_{in} = _1 + _2 x_{in2} + \ldots + _k x_{ink} \tag{4}$$

where, V_{in} = respondent n's utility of choosing alternative i,

x_{ink} = kth attribute values for alternative i as viewed by respondent n.

$\beta 1$, $\beta 2$ to βk are coefficients to be estimated.

If a single vector of coefficients β that applies to all the utility functions is defined and the scale parameter $\mu=1$ then equation (3) can be expressed as:

$$_n(i) = \frac{\exp[\ ' X_{in}]}{\sum_j \exp[\ ' X_{jn}]} \tag{5}$$

where, π_n (i) = Respondent n's choice probability of alternative i,

X_{in} and X_{jn} = vectors describing the attributes of alternative i and j, and

β = vector of coefficients.

In experimental design, decision attributes, X_i, are termed "factors", and the values that each factor takes on in the experiment are called "levels." The functional form expressed in equation (4) is additive and indicates that the factors are independent in their respective effects on consumer utility. It is assumed that interaction effects are negligible and therefore only main effects are assessed.

The discrete choice or general multinomial logit model outlined above is used in this study to analyze the data from the survey questionnaire. Alternatives, factors and factor levels specific to this study are discussed in the next chapter. The next chapter also gives a description of the

survey questionnaire, the survey method and the estimated models as well as the estimation procedure.

3.0. RESEARCH METHODOLOGY

3.1. Research Procedure

In this section, the econometric models are outlined. This involves explaining the general specification regarding choices relating to study area, variables, survey method and functional form.

3.2. Study Area

Since Alberta is a major producer of beef and exports this to most parts of the country, the study should ideally cover Canadian consumers in general. However, due to financial constraints, the study is limited to the four western provinces, namely, British Columbia, Alberta, Saskatchewan and Manitoba. The provincial capitals were selected as representative of consumers in each province and a random sample of consumers in each city was chosen with the aid of a market research firm.

3.3. Product Characteristics or Attributes

Considering the objectives of the study, the attributes of price, product origin and presence of biopreservatives were automatically chosen for the study. Further characteristics or attributes needed for the study were chosen from a preliminary survey on meat attributes. A sample of 20 consumers was randomly selected in the Edmonton area and each person was asked to indicate the level of importance of a selected number of meat attributes in their meat purchasing decisions. The levels of significance were specified as “not important”, “important” and “very important”. The factors of fat trim and packaging date had the highest score as “very important” and so were included in the major study, in addition to product price, product origin and product packaging, specifically, packaging with and without biopreservatives. The cited levels for the attributes were obtained from various sources. Price levels were obtained from a series of quotations from retail grocery stores such as IGA, Safeway, Super Store and Save-on-Foods. The meat managers of these stores also provided useful information regarding fat trim levels and packaging dates. Some information on fat trim for steak and pork cut as well as fat content of ground beef were obtained from the Department of Food Science and Nutrition, University of Alberta.

For a high quality beef cut, product attributes used in the study include price, presence of biopreservatives, product origin, outside fat trim level and packaging date. For a high quality pork

cut, attributes used in the study are price, presence of biopreservatives, product origin, outside fat trim level and packaging date. For ground beef, attributes used include price, presence of biopreservatives, product origin, fat content and packaging date. Each of these factors and the respective levels for each meat type are presented in Appendix I.

3.4. The Questionnaire

A fractional factorial experiment was designed involving all possible combinations of the factor levels. The design produced a sample of 32 treatments selected from the complete factorial design. The 32 treatments obtained for each meat type formed the basis of the questionnaire. To avoid a lengthy questionnaire, the 32 questions were blocked into 4 section, providing 8 questions on each meat type per questionnaire. This resulted in 4 different versions of the questionnaire covering all 32 questions for each meat type. The final questionnaire consisted of three parts.

Part A consisted of introductory statements on consumers eating habits and attitudes regarding meats. These questions probe the direction and intensity of consumers' attitudes towards consumption of red meat, convenience of preparation, freshness, over all product quality, price, food safety and health issues. The statements were assigned a rating of 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree and 5 = strongly agree. Respondents indicated which rating best described their acceptance of the statement. Only one choice from the ratings was to be made for each statement. These questions are presented in Appendix III which provides an example of the questionnaire.

Part B of the survey is made up of 8 stated preference questions for each of a high quality beef cut, a high quality pork cut and ground beef, generating a total of 24 questions. The questions provide different descriptions of the product and respondents were asked to choose from among three alternatives, i.e. alternative A, alternative B, and alternative C. Alternatives A and B contain different profiles of the product relating to the factors. It is assumed that the descriptions of the factors will affect the consumer's perceptions of the product and ultimately translate into a decision to purchase or not to purchase the specified products. The inclusion of a non-choice, alternative C, which is to be chosen if neither description of the product in alternatives A and B are preferred sets the origin of the utility scale. This is termed the "base" alternative. Louviere (1988), explains that the base alternative acts as a constant subtracted from the utilities of the other alternatives. Hence, the design properties of the factor treatments (e.g., orthogonality of factor vectors) are unaffected unless the factor levels of the base vary across choice sets. Example questions are presented in Appendix III.

Part C of the questionnaire is the section on demographic factors such as family size, age and income. It also contains a question asking respondents to indicate their opinion on the

biopreservative research. There is also a question on how frequently respondents eat beef, pork, poultry and fish/sea food. The questionnaire was pretested and adjusted accordingly.

3.5. Survey Method

The mail back method of survey was employed in this study. The questionnaire was administered by a commercial market research firm. Potential respondents were randomly selected from current local telephone directories and contacted by phone regarding participation in the survey. Respondents were chosen from Winnipeg, Regina, Edmonton and Victoria. A total of 700 respondents agreed to participate in the survey and were mailed copies of the survey questionnaire for completion. Each mailed questionnaire also included an introductory letter explaining the objective of the study[1]. It was explained that the questionnaire was directed to the individual in the household who made the majority of meat purchases. Completed questionnaires were returned in an enclosed stamped self addressed envelope.

To encourage a high response rate, a reminder letter was sent to those respondents who had not returned their completed questionnaire 14 days after the initial mailing. Eventually, out of a total of 700 questionnaires sent to consumers, 530 questionnaires were returned; 125 of those are from Winnipeg, 135 from Regina, 141 from Victoria and 129 from Edmonton. This represented a 76% response to the study.

3.6. Model Specification Estimation Procedure

Information provided from the stated preference questions of the survey (Part B) were used as the data to estimate a multinomial nested logit (discrete choice) model to assess the impact on consumers' choice of each specified attribute. In all models the inclusive value was significantly different from 1 indicating a nesting structure. The nesting incorporated in this model assumes that there are two levels of the purchasing decision process. The first level is the decision as to whether to purchase or not to purchase a meat product. The first level decision is not based on any factors, however after the decision to purchase is taken, a choice is made between two products A and B based on the specified attributes. Alternative C is the choice if products A and B are not preferred.

[1] A copy of the introductory letter to respondents is provided in Appendix II.

The specifications for alternatives A and B (the decision to purchase a particular specified product) incorporate the attribute levels of price, presence of biopreservative, fat trim (fat content), origin of product and packaging date. Dummy variables, (-1, +1), are used to effects-code the factor levels so that the base alternative C, will be exactly equal to the origin i.e. for any occurrence of the omitted variable, the included variables are coded -1, (see Louviere 1988 and Johnson et al. 1987 for detailed discussion on effects coding). One factor level of each attribute is omitted in the estimation procedure to avoid singularity. For alternatives A and B, estimated coefficients on the attribute levels are to be interpreted as the effect of the attribute level on the probability of a product being purchased (equation 5). Hence a positive (negative) coefficient on a factor means that the factor has an effect of increasing (decreasing) the probability of a product being purchased by consumers.

For alternative C (the decision of non-purchase of the product), the specifications use demographic factors of family size, age, and income group. Dummy variables, (-1, 1), are also used to effects-code the factor levels and one level is omitted to avoid a dummy variable trap. Estimated coefficients on these demographic factors are to be interpreted as the effect of the factor on the probability of a product not being purchased. Hence, a positive (negative) coefficient on a factor means that increasing the level of the factor increases (decreases) the probability of non-purchase. A decrease in the probability of non-purchase implies an increase in the probability of purchase.

Separate models are estimated for high quality beef cuts, high quality pork cuts and ground beef. For each of these meat types, a model is specified for all respondents using the attributes of actual continuous price, presence of biopreservative, origin, fat level, package date as well as demographic factors of family size, age and income group. This is estimated as Model I. The same specification of each meat type is also made for each location of the respondents; i.e. for Winnipeg, Regina, Victoria and Edmonton. The purpose is to examine the effects of the factors by location and to test the location differences, if any, in the effects of the variables. These location specifications are estimated as Model II. In order to examine the effects of each of the price levels on the probability of purchase, a third model (Model III) is estimated in which the price factor is effects-coded as for the other product attributes. The estimating models are presented below.

Model 1: **Non-segmented Model with Demographic Factors (Continuous Price Variable)**

$$U_t(A) = U_t(B) = {}^{*}_{1t} X^{*}_{1t} + \sum_{k=1}^{2} {}_{2kt} X_{2kt} + \sum_{k=1}^{4} {}_{3kt} X_{3kt} + \sum_{k=1}^{4} {}_{4kt} X_{4kt} + \sum_{k=1}^{4} {}_{5kt} X_{5kt} + {}_{t} \quad (6a)$$

$$U_t(C) = \sum_{k=1}^{3} {}_{6kt} X_{6kt} + \sum_{k=1}^{4} {}_{7kt} X_{7kt} + \sum_{k=1}^{4} {}_{8kt} X_{8kt} + {}_{t} \quad (6b)$$

where U(A), U(B), U(C) = utility of choosing alternatives A, B and C respectively,

X^{*}_{1t} = actual continuous price variable for meat type *t*,

X_{2kt} = biopreservative level *k* in packaging of meat type *t*,

X_{3kt} = product origin label *k* of meat type *t*,

X_{4kt} = fat trim (or content) level *k* of meat type *t*,

X_{5kt} = package date *k* of meat type *t*,

X_{6kt} = family size category *k* of respondents choosing meat type *t*,

X_{7kt} = age group *k* of respondents choosing meat type *t*,

X_{8kt} = income group *k* of respondents choosing meat type *t*, and

ε_i = error term specific to each alternative choice (A, B or C) and

t = meat type (high quality beef, high quality pork or ground beef).

The equations for all of the three meat types are jointly estimated. This permits testing whether coefficients are different among meat types.

Model 2: **Segmented Model by Location with Demographic Factors (Continuous Price Variable)**

$$U(A) = U(B) = {}^{*}_{1tl} X^{*}_{1tl} + \sum_{k=1}^{2} {}_{2ktl} X_{2ktl} + \sum_{k=1}^{4} {}_{3ktl} X_{3ktl} + \sum_{k=1}^{4} {}_{4ktl} X_{4ktl} + \sum_{k=1}^{4} {}_{5ktl} X_{5ktl} + {}_{l} \quad (7a)$$

$$U(C) = \sum_{k=1}^{3} {}_{6ktl} X_{6ktl} + \sum_{k=1}^{4} {}_{7ktl} X_{7ktl} + \sum_{k=1}^{4} {}_{8ktl} X_{8ktl} + {}_{l} \quad (7b)$$

where X^{*}_{1tl} = actual continuous price variable of meat type t as viewed by respondents in location l,

X_{2ktl} = biopreservative level k in packaging of meat type t as viewed by respondents in location l,

X_{3ktl} = product origin label k of meat type t as viewed by respondents in location l,

X_{4ktl} = fat trim (or content) level k of meat type t as viewed by respondents in location l,

X_{5ktl} = package date k of meat type t as viewed by respondents in location l,

X_{6ktl} = family size category k of respondents living in location l,

X_{7ktl} = age group k of respondents living in location l,

X_{8ktl} = income group k of respondents living in location l and

l = location of respondent (Winnipeg, Regina, Victoria or Edmonton).

All other variables are as defined earlier. The above specifications are estimated separately for each meat type but models for each city are jointly estimated. This has the advantage of providing a means of testing whether coefficients on the meat attributes are significantly different between locations for a specific meat type.

Model 3: **Non-segmented Model with Demographic Factors (Price Effects Coded)**

$$U(A) = U(B) = \sum_{k=1}^{4} {}_{1kt} X_{1kt} + \sum_{k=1}^{2} {}_{2kt} X_{2kt} + \sum_{k=1}^{4} {}_{3kt} X_{3kt} + \sum_{k=1}^{4} {}_{4kt} X_{4kt} + \sum_{k=1}^{4} {}_{5kt} X_{5kt} + {}_{t} \quad (8a)$$

$$U(C) = \sum_{k=1}^{3} {}_{6kt} X_{6kt} + \sum_{k=1}^{4} {}_{7kt} X_{7kt} + \sum_{k=1}^{4} {}_{8kt} X_{8kt} + {}_{t} \quad (8b)$$

where X_{1kt} = coded price level k of meat type t.

All other variables are as previously defined. In this study, t equals 1, 2, 3 for beef steak, pork cut and ground beef respectively. The levels, k, of each factor, are presented in Appendix I. The locations where the study was conducted, l, are Winnipeg, Regina Victoria and Edmonton.

Estimated coefficients from all three models are tested across the meat types to evaluate whether the effects of the attributes and demographic factors vary across meat type. A test is also conducted to examine any difference in the effects on the probability of purchasing a product from

Alberta versus products from the rest of Canada. In addition, coefficients in Model II are also tested to see if the effects of product attributes and demographic factors vary across location.

Finally, using different scenarios, results from Models I and II are used to determine the value of biopreservatives and product origin. Probabilities of product choice under the various scenarios are calculated to assess which product is most likely to be purchased given products with or without biopreservatives or products from different origins. Then the price change of a product that would make consumers indifferent to the competing product is examined. The non-linear logit procedure of the statistical program Limdep 7.0 (Greene, 1995) was used for estimation of the multinomial logit models.

4.0. FINDINGS AND DISCUSSION

4.1. Introduction

This chapter presents results from the study. The multinomial logit model results are first outlined and discussed. Emphasis is placed on biopreservatives and product origin. There is also a discussion on the findings on demographic factors and their effects on consumer meat purchasing decisions. A summary of the demographic characteristics of respondents are presented in figures following the discussion.

4.2. Red Meat Consumption

Data used in the study were obtained from respondents who purchase and consume red meat. Based on responses from the supplementary question on frequency of meat and fish/sea food consumption (Part C question 5), over 76% of respondents indicate they consume red meat quite frequently (Figures 1a to 1e). Results are also presented for each location. From the stated preference portion of the questionnaire (Part B), 63% of respondents chose to select a product from the two descriptions provided while 37% chose neither of the two alternative products described[2]. In terms of location, a relatively higher percentage of respondents from Winnipeg, Regina and Edmonton chose a product, compared to respondents in Victoria.

4.3. Stated Preference Results and Related Scaling Results

Tables 1 to 3 present analytical results for the stated preference data. Table 1 presents estimated coefficients for Model 1 which is the unsegmented model for each meat type. All the respondents are examined together in this model using a continuous price variable. Tables 2a to 2c present the results of estimated coefficients for the segmented model for beef steak, pork cut and ground beef respectively. In this model, respondents are segmented into city or location of respondents. The price variable is continuous. Table 3 (model 3) presents the results of the unsegmented model using effects coded price variable. Table 4 presents the results of the log

[2] See Table 15.

likelihood tests for the 3 models. These results indicate that in all three models, the specified attributes are jointly important in affecting consumer utility for purchasing meat products. In all three models, the Pseudo $\bar{R}^2$ statistics indicate a reasonable measure of goodness-of-fit. The inclusive values for the decision to purchase a product are significantly less than one, suggesting that a nested logit model is an appropriate model specification for the consumers' decision process regarding the purchase of beef steak, pork cut and ground beef (Ben-Akiva and Lerman 1987).

4.3.1. Adding Biopreservatives to fresh meat packages

The results in Tables 1 to 3 indicate that consumers reacted negatively to adding biopreservatives to fresh meat products. Estimated coefficients on this factor are negative and statistically significant in all the models evaluated. Consumers prefer packages without any biopreservative. Tests were conducted on the estimated coefficients on biopreservatives to examine any differences in the effects with respect to meat type. These results indicate that there is no statistically significant difference in the effect of biopreservative on the probability of purchasing a high quality beef, high quality pork and ground beef. The effect of biopreservative is similar for all three meat types. For example, from Table 1, estimated coefficients on the presence of biopreservative are -0.312, -0.371 and -0.266 for beef steak, pork cut and ground beef respectively. The negative coefficient indicates a decreasing probability of choice. A similar finding can be seen from estimated coefficients in Table 3.

However, from Tables 2a to 2c, when tests are conducted across locations for each meat type, results indicate that there is some statistically significant difference in the effects of biopreservatives. Respondents in different locations appear to view biopreservatives differently. For example, the estimated coefficients for beef steak are -0.409, -0.541, -0.336 and -0.007 for Winnipeg, Regina , Victoria and Edmonton respectively (Table 2a). The estimated coefficient for Edmonton is not statistically significant implying that while respondents from Winnipeg, Regina and Victoria are strongly opposed to the presence of biopreservatives in beef steak packages, Edmonton respondents may be indifferent to the issue. Similar results are obtained for the high quality pork cut. For both beef steak and pork cut, Regina respondents show the strongest rejection of biopreservatives in fresh meat packages while Edmonton shows the least rejection.

Responses to questions from Part A and Part C of the questionnaire regarding research on biopreservatives and related subjects are consistent with these findings, though these questions are stated in an entirely different format. For example, in Part A statement 6, respondents were asked

to indicate their acceptance of the statement, "the presence of drug residue, dyes and other inorganic substances in fresh meats are of concern to me." On this statement, 87 % of respondents agree or strongly agree, 9% neither agree nor disagree and 4% disagree. Using a scale of 1 to 5 to rate the extent of acceptance of the statement, the average rating for all respondents is 4.3. For each location, the average rating is about the same (see Figure 2a). In Part C question number 4, respondents were asked to indicate their opinion on the research on biopreservatives. Over all respondents, 23% indicate the research should be stopped; 35% indicate the research is a good project and should continue; and 42% have no opinion on the issue. When the sample is separated by location, 25% or more of respondents indicate the research should be stopped except for Edmonton where only 12% indicate the research should be stopped (see figure 3). Comments written by respondents indicate that they need more information on the merits and demerits of the use of biopreservatives. Selected comments are presented in Appendix IV. Consumers lack information on biopreservatives and further information on the technology is required.

4.3.2. Origin of the Product

From the stated preference results in Tables 1 to 3, meat products from Alberta and Canada are generally more preferable to responding consumers than products from the other specified regions. The preferred regions have a significant effect on the utility of consumers since they increase the probability that consumers will purchase meat products from these sources. In the segmented beef steak model (Table 2a), estimated coefficients on Canada origin for respondents from Regina and Edmonton suggest that high quality beef from the rest of Canada does not have any significant effect on the utility of these respondents. Similarly, for Winnipeg respondents, ground beef from Alberta does not significantly increase their utility (Table 2c).

A test was conducted to examine any differences in the effects of product-of-Alberta versus product-of-Canada on the probability of purchasing a meat product. A test of coefficients from Tables 1 and 3 (all respondents) indicate that there is a statistically significant difference in the effect of the two product origins. The effect of product-of-Alberta is stronger than the effect of product-of-Canada for high quality beef. For example, from Table 1, the estimated coefficient for product-of-Alberta for beef steak is 0.879 but the corresponding coefficient for product-of-Canada is 0.304. The same phenomenon can be seen from testing coefficients from Table 3 and also from the locationally segmented model versions (Tables 2a to 2c). It appears that generally, Alberta is

well known as a source of high quality beef. Only Winnipeg estimated coefficients do not show a statistically significant difference between the two product sources for beef steak.

In contrast, tests of differences between estimated coefficients for Alberta and Canada origin of a high quality pork cut do not show a statistically significant difference between the two sources, except for Edmonton. This suggests that consumers typically do not prefer pork from a particular source in Canada. Consumers in Winnipeg, Regina and Victoria appear indifferent between pork from Alberta and the rest of Canada but Edmonton consumers show a strong preference for pork from Alberta to pork from the rest of Canada. This finding may arise since each province has a well established pork industry and consumers may not necessarily prefer pork cuts from other provinces. The reaction of respondents to products from the US and products without an origin identification were negative and usually statistically significant. This suggests that meat products without origin identification reduce the utility of consumers and will reduce the probability of such products being purchased by consumers.

4.3.3. Price and other Product Attributes

Estimated coefficients on (continuous) prices were all negative and statistically significant indicating consumers show a strong preference for lower prices. This is also the case for the results from Model 3 (Table 3) where the price levels are coded. From Model 3, the reaction to relatively higher prices is strongly negative; similarly, the reaction to relatively lower prices is strongly positive.

Fat trim and fat content of products are also of concern to consumers. Fat trim of about a quarter inch or more is strongly rejected by consumers for beef steak and pork cut, probably due to the belief that there are health risks of consuming large amounts of foods containing high levels of saturated fats,. Similarly, fat content of over 23% in ground beef is strongly rejected. Consumers appear to prefer beef steak with no visible fat and beef steak with a trace of outside fat trim; pork cut with no outside fat trim and extra lean and regular lean ground beef are also preferred. Any product packaged two or more days earlier is also strongly rejected. Consumers evidently prefer freshly packaged meats.

4.3.4. Socioeconomic Factors

Tables 1 to 3 also presents estimated coefficients on respondents' socioeconomic factors incorporated in the specifications for alternative C (no purchase). As indicated earlier, for alternative C (decision to not purchase the product), a positive (negative) coefficient implies that the factor has the effect of increasing (decreasing) the probability of non-purchase of the product. An increase (decrease) in the probability of non-purchase implies a decrease (increase) in the probability of purchase of a product.

The effect of family size is consistent in the beef models examined. For example, all estimated coefficients for a family size of 3 or less and family size of 4 to 6 are negative and statistically significant in the high quality beef model (Tables 1 and 2a). In the models for ground beef, estimated coefficients on family size of 3 or less are mostly negative and statistically significant (Table 1 and 2c). These indicate that there is an increased probability for a relatively small family of 3 or less to purchase beef. Conversely, all estimated coefficients on family size 6 or more in the high quality beef models are positive and statistically significant (Tables 1 and 2a). This implies that a family size of more than 6 has a lower probability of purchasing beef. These findings apply both to aggregate consumers as well as to consumers in the various city locations. These results may be related to the relatively higher price of high quality beef products. Beef steaks are higher priced than many other meat products so it may be economically feasible for a relatively smaller family size to purchase high quality beef products compared to a family of larger size. A small size household may be able to purchase such high quality beef products regularly compared to a large household. Regarding the probability of purchasing high quality pork, the survey results are not as consistent as for high quality beef. For the aggregate consumer, a family size of 4 or less has an increased probability of purchasing pork cuts while there is a decreased probability for a family size of 6 or more to purchase pork cuts. In the location-segmented models, the findings for pork vary with these locations.

The effects of age are consistent in all models for high quality beef, high quality pork and ground beef. For all the meat types, the results from both the non-segmented and segmented models indicate that people of age 30 years and below have a higher probability of purchasing meat products.(Tables 1 to 2c). Only Winnipeg consumers are exceptions to these general results for beef steak and pork cuts (Tables 2a and 2b). Except for Winnipeg consumers, the estimated coefficients on the age group that is less than 30 years and for the age group 30 to 40 years generally have a negative sign and are statistically significant for all products. Also except for

Winnipeg consumers, estimated coefficients for age groups of 40 years and above generally have a positive sign, indicating a decreasing probability of purchasing meat. The finding that people of age above 40 years have a decreased probability of purchasing meat products may be health-related because Capps et. al. (1988) report that consumers older than 30 years of age were more likely to try lean meat products than consumers from 20 - 29 years of age. Older people may be more health conscious in their eating habits than younger people and in view of the medical belief that meats contain saturated fats, which are viewed as primary causes of heart problems, it is expected that older people will tend to prefer less meat products.

Regarding the effects of income, there is some consistency on the probability of purchasing meat in the effect of families with income of $20,000 and less. In all high quality beef and pork models, estimated coefficients on this income group have a positive sign and most are statistically significant. This suggests that consumers in this income group have an increased probability of not purchasing high quality beef or high quality pork cut. Families with income of over $50,000 have an increased probability of purchasing high quality beef. The estimated coefficients for this income group are negative and statistically significant in the high quality beef models (Tables 1 and 2a).

4.4. Simulation Results

The results from Models 1 and 2 (Tables 1 to 2c) are used to evaluate the value of biopreservatives and product origin. It is assumed that the price change that will lead to a consumer having the same probability of choosing either of two competing products represents an estimate of the dollar value of the biopreservative use or of product origin. A consumer having an equal probability of choosing two products is indifferent between the two products. For example, if a consumer is offered two products of the same quality labeled from two different sources, such as from Alberta and Canada, it can be determined which product is most likely to be chosen, using equation (5). Then, from an Alberta point of view, it is possible to assess price changes to the Alberta product that will make consumers indifferent to the two products, i.e. that will give an equal probability of purchasing a produced-in-Alberta product versus a produced-in-Canada product. The implicit assumption here is that only two products are available to consumers to choose from.

This type of analysis provides information that can be used to direct market penetration and pricing strategies. A biopreservative-packaged technology will be new to the market and its introduction may require pricing strategies for many consumers to be indifferent to the new technology. That is, if consumers are found to have negative preferences for biopreservatives in fresh meat packages, this type of analysis will provide an estimate of the amount of price reduction that may be required for consumers to be indifferent to the new product.

The simulations are conducted by comparing meat products with and without biopreservatives and by comparing products from Alberta versus products from Canada and products from Alberta versus products from the US. For beef steak, estimated coefficients indicate that a product with trace of visible fat, packaged today, with no biopreservative is more acceptable to consumers. This product profile is chosen for the simulation analysis (Tables 5 to 8). For pork, a product that has no visible fat, packaged today and has no biopreservative is more acceptable to consumers. This is also chosen for the analysis (Tables 9 to 12). For ground beef, a product that is extra lean and packaged fresh is seen as the most preferred product and is used in the scenarios (Tables 13 and 14). Calculated probabilities of choosing an alternate product are also presented in the tables. The scenarios are examined for the aggregate respondents model as well as for respondents in the various locations. Several different scenarios can be evaluated to assess the effects of a change in an attribute on price but for this study the scenarios were focused on biopreservative and product origin. A summary of the scenarios are given below.

Scenario 1: Alberta Origin - no biopreservative versus biopreservative

Two produced-in-Alberta products, one with packaging biopreservatives and the other without, are examined. Results are presented in Tables 5, 9 and 13 for beef steak, pork cut and ground beef respectively. Except for Edmonton consumers, the probability of choosing a meat product without biopreservative is about twice the probability of choosing a meat product with biopreservative. For Edmonton consumers, the probability of choosing a meat product without biopreservative is not different from the probability of choosing a meat product with biopreservative. Therefore, except for consumers in Edmonton, a price reduction of 15% or more is required for each of the meat products before consumers will be indifferent between the two products. Price reductions required are particularly high for ground beef with biopreservatives. For example, for Winnipeg consumers, a price reduction of as much as 54% would be required for ground beef with a biopreservative if consumers are to be indifferent between the two products.

Similarly Regina consumers would be indifferent with a price reduction of about 37% (see Table 13). This suggests that for such consumers, the introduction of the technology of biopreservative in the market will not be feasible without a change in consumer attitudes. For each meat type examined, Edmonton consumers require the least price reduction for consumers to have the same probability of choosing the two products.

Scenario 2: Canada Origin - no biopreservative versus biopreservative

Two produced-in-Canada products, one with a biopreservative and the other without, are examined. The results are presented in Tables 6, 10 and 14 for beef steak, pork cut and ground beef respectively. Similar to the findings of scenario 1, the probability of choosing a product without biopreservative is about twice the probability of choosing a product with biopreservative, except for Edmonton consumers. For Edmonton consumers, the probability of choosing either product is about the same. Therefore, the percentage change in price required for a product with biopreservative to have an equal probability of being chosen by consumers is the same as that for scenario 1. Edmonton consumers are indifferent to beef steak with or without biopreservatives.

The responses of Edmonton consumers suggests they may have some knowledge about the biopreservative research being done at the University of Alberta. It may also suggest that consumers have more confidence in the University of Albert and so are willing to accept the use of the preservation technology developed by these means.

Scenario 3: No Biopreservative: - Alberta Origin versus Canada origin

This scenario evaluates the value of product origin for high quality beef and high quality pork products. For the competing products, one product is a product of Alberta while the other is a product of Canada. The products do not contain biopreservatives. Results are presented in Tables 7 and 11 for beef and pork respectively. Generally, there is a relatively higher probability of choosing a high quality beef product from Alberta. A price reduction between 3% to 26% is required for beef products from Canada before consumers will exhibit an equal probability of purchasing beef labeled product-of Alberta or product-of-Canada (Table 7). Specifically, consumers in Winnipeg, Regina, Victoria and Edmonton, will be indifferent between the two products if a price reduction of about 3%,13%, 17% and 26% respectively is applied for the produced-in-Canada beef product. For the pork cut, there is no real difference between the probability of choosing a product from Alberta and a product from the rest of Canada. Except for Edmonton consumers, the price change required for a produced-in-Canada pork product is about

9% or less (Table 11). Edmonton consumers require a price change of the Canadian pork product by about 9% before they will be indifferent.

This finding for pork may arise from the fact that most provinces have an established pork industry and tend to be self sufficient in pork production. The provincial pork industries have probably been able to establish an origin image in the local market so that pork products from a different province may not be seen as relatively better. This has implications for inter-provincial trade in pork. For the Alberta pork industry to penetrate the market in other provinces, other pork attributes must be considered other than the origin of the product.

Scenario 4: No biopreservative: - Alberta Origin versus USA origin

This scenario also evaluates the value of product origin for high quality beef and high quality pork products. Product origins considered in this case are Alberta and the US. The products do not contain biopreservatives. The results are presented in Tables 8 and 12. Generally, the probability of choosing a product from Alberta is over five times the probability of choosing a product from the US. For beef steak from the US, the price has to be reduced by over 24% before consumers will have an equal probability of purchasing either product. Specifically, consumers in Winnipeg, Regina, Victoria and Edmonton will be indifferent between the two products when the price of the US product is reduced by about 24%,30%, 34% and 44% respectively (Tables 8). For a pork cut, the US product requires an average price reduction of about 35% for all consumers to be indifferent.

4.5. Scaling Method Results (General Questions in Part "A" of the questionnaire)

In Part A of the survey questionnaire, respondents were asked to indicate their degree of acceptance of various statements. Issues raised in the statements concerned preference for red meats, convenience of preparation, general meat quality, food safety, product packaging, price and health issues. Details of the statements and the ratings scheme for these can be found in Appendix III. The results of average ratings of the statements are presented in Figures 2a and 2b. Respondents generally disagreed with four statements. These included; "poultry is expensive when compared to other meats", "pork is expensive when compared to other meats", "buying pork cuts is a game of chance, since quality is so variable" and "buying beef cuts is a game of chance since quality is so variable." From these answers, it can be inferred that poultry and pork products are not perceived to be expensive.

Factors that appear to be of great concern to consumers since they are rated very highly as a concern are the presence of drug residues, dyes and other inorganic substances in fresh meats as well as the presence of outside fat trim on meat cuts. The concern for food safety is substantiated from the comments of respondents (see Appendix IV for some comments). The average rating given for food safety is 4.3 while the average rating for fat concerns is 4.0. In view of a high concern for food safety, much consumer education would be required with the introduction of biopreservative in packaging. Consumers would have to be convinced that a biopreservative is safe and useful. A detailed analysis of the results of the Part A section is given in Appendix V.

4.6. Summary of Demographic Factors of Respondents

Figures 4 to 6 presents the groupings of demographic factors and the categories respondents fall in by city. Regarding family size, over 50% of respondents have a family size of 3 or less. Less than 5% of respondents have a family size of 6 or more (Figure 4). Regarding age, the greater percentage (over 60%) of respondents are between the ages of 30 years and 60 years. On average, 15% of all respondents fall under the age of 30 years and another 15% is over the age of 60 years (Figure 5). The income group of respondents are similar for all the locations examined. Over all, between 36% and 43% of respondents have a household income over $50,000; between 26% and 37% of respondents earn between $35,000 and $50,000; 15% to 23% earn between $20,000 and $35,000; and 12% and less earn below $20,000 (Figure 6).

4.7. Conclusions

The study used stated preference methods to ascertain consumer attitudes to the potential use of biopreservatives in fresh meat packages and to the origin of fresh meat products. The study finds that the potential use of biopreservatives in fresh meats packages is not acceptable to Western Canadian consumers at the moment, though many consumers do not oppose this research. It seems that consumers are concerned about the presence of preservatives and other inorganic substances in food, therefore a major education program would be required to make biopreservatives acceptable to consumers. Simulation results suggest that the price of products with a biopreservative needs to be significantly reduced for consumers to be indifferent between a biopreservative product and a product without it. This further strengthens the finding that packaging biopreservatives are not acceptable to consumers at the moment. Comprehensive consumer education on this technology

would be necessary for this technology to be acceptable. There is a general lack of knowledge about biopreservatives (see Appendix IV). The meat industry should be involved in the propagation of the technology, informing consumers of the benefits of the technology and its advantages over existing meat packaging technologies. A better informed consumer will not totally reject biopreservative as seen by the Edmonton response to the survey.

The study also finds that consumers are loyal to meat products from Alberta and Canada as a whole, compared to fresh meat products from the US, or products without any indication of origin. For high quality beef products, Alberta is seen as a preferred source compared to other sources in Canada. Simulation results suggest that the price of beef cuts from other Canadian sources need to be reduced before consumers will be indifferent between the product and a beef cut from Alberta. On the average, a price reduction of about 15% is required for this to be the case for a beef product from other Canadian sources. Clearly, Alberta has an image in the production of high quality beef which could be capitalized to expand beef sales in the rest of Canada. High quality is what seems to have distinguished Alberta as a beef source and so a possible marketing strategy could be for an Alberta logo or insignia that will distinguish Alberta beef from other beef.

For a high quality pork cut, the study finds that consumers generally are indifferent between products from Alberta and products from other Canadian sources. A comparison of a US product and a product from Alberta suggests that there is a need to reduce the price of US products by at least 25%, whether for a beef cut or a pork cut, before consumers will be indifferent between products from the two sources. High promotional effects are required to make Alberta pork a well accepted branded product in other provinces.

Price, fat trim and packaging date are also found to be of concern to consumers. Consumers prefer low prices, low fat trim for steak and pork cuts, low fat content for ground beef and meat products that are freshly packaged. Socioeconomic factors are also found to play a significant role in consumers' fresh meat purchasing decisions. Family of small sizes show a stronger preference for beef steaks than large families.

Future research could focus on extending this work to consumers' reactions in Central and Eastern Canada. Focus group work is required to determine appropriate methods to introduce biopreservatives into commercial use. Focus groups could also be used to evaluate different Alberta beef brand images. Alberta evidently has a positive brand image for high quality beef and this advantage could be exploited. This suggests a differentiation strategy for beef. Alberta pork has no brand image. Significant efforts would be required to develop an Alberta image in pork.

This suggests an undifferentiated strategy focusing on providing high quality pork at the lowest costs in the domestic market for this meat.

Table 1: Estimated Coefficients For Model 1 - Non-segmented model:

(Specified for all respondents using a Continuous Price Variable)

PRODUCT ATTRIBUTE	ESTIMATED COEFFICIENTS		
	Beef Steak	**Pork Cut**	**Ground Beef**
PROBABILITY OF PURCHASE:			
Price[1]	-0.397*	-0.474*	-0.654*
No biopreservative[3]	0.312*	0.371*	0.266*
With biopreservative[3]	-0.312*	-0.371*	-0.266*
Alberta origin[1]	0.879*	0.760*	0.241*
Canadian origin[1]	0.304*	0.568*	0.468*
USA origin[1]	-0.551*	-0.808*	-0.524*
Origin not indicated[1]	-0.633*	-0.521*	-0.186*
Fat level 1[1]	0.296*	0.229*	1.047*
Fat level 2[1]	0.541*	0.217*	0.508*
Fat level 3[2]	-0.244*	-0.040	-0.148*
Fat level 4[1]	-0.593*	-0.406*	-1.408*
Packaged Today[1]	0.992*	1.042*	0.543*
Packaged Yesterday[1]	0.135*	0.280*	0.409*
Packaged 2 days ago[1]	-0.362*	-0.314*	-0.316*
Packaged 3 days ago[1]	-0.764*	-1.007*	-0.636*
PROBABILITY OF NON-PURCHASE:			
Family size of 3 or less[1]	-1.041*	-0.798*	-0.380
Family size of 4 to 6[1]	-0.678*	-0.703*	0.274*
Family size of more than 6[1]	1.719*	1.501*	0.654*
Age under 30 years[3]	-0.268*	-0.247*	-0.436*
Age from 30 to 40 years[3]	-0.196*	-0.145*	-0.133*
Age from 40+ to 60 years[3]	0.032	0.145*	0.063
Age over 60 years[2]	0.432*	0.247*	0.506*
Household income of less than $20,000[3]	0.398*	0.457*	0.201*
Household income of $20,000+ to $35,000[3]	-0.105	-0.190*	-0.097
Household income of $35,000+ to $50,000[3]	0.050	-0.030	-0.058
Household income of over $50,000[1]	-0.343*	-0.237*	-0.047
Inclusive values			
Purchase	0.187*		
Non-purchase	1.000 (fixed parameter)		
Pseudo R^2	0.166		

* indicates significance at 95% confidence level.

[1] indicates estimated coefficients significantly different across meat type (5% probability).

[2] indicates estimated coefficients significantly different across meat type (10% probability).

[3] indicates estimated coefficients not significantly different across meat type (10% probability).

Table 2a: Estimated Coefficients For Model 2 - Segmented Model:

(Beef Steak model segmented by location using a Continuous Price Variable)

PRODUCT ATTRIBUTE	ESTIMATED COEFFICIENTS			
	Winnipeg	**Regina**	**Victoria**	**Edmonton**
PROBABILITY OF PURCHASE:				
Price[1]	-0.563*	-0.587*	-0.455*	-0.393*
No biopreservative[1]	0.409*	0.541*	0.336*	-0.007
With biopreservative[1]	-0.409*	-0.541*	-0.336*	0.007
Alberta origin[3]	0.802*	0.954*	1.008*	1.069*
Canadian origin[3]	0.631*	0.241	0.290*	0.093
USA origin[3]	-0.501*	-0.736*	-0.485*	-0.596*
Origin not indicated[3]	-0.933*	-0.459*	-0.814*	-0.565*
No outside fat trim[3]	0.074	0.270*	0.405*	0.274[a]
Trace of outside fat trim[3]	0.789*	0.835*	0.461*	0.591*
About quarter fat trim[3]	-0.431*	-0.189	-0.350*	-0.201
Over quarter fat trim[3]	-0.432*	-0.916*	-0.516*	-0.663*
Packaged Today[3]	0.977*	1.372*	0.991*	0.969*
Packaged Yesterday[3]	0.126	0.252[a]	0.006	0.102
Packaged 2 days ago[3]	-0.395*	-0.645*	-0.282[a]	-0.313*
Packaged 3 days ago[3]	-0.708*	-0.979*	-0.715*	-0.758*
PROBABILITY OF NON-PURCHASE:				
Family size of 3 or less[3]	-0.881*	-0.832*	-0.824*	-0.587*
Family size of 4 to 6[1]	-0.568*	-0.588*	-0.071	-0.637*
Family size of more than 6[2]	1.448*	1.420*	0.895*	1.223*
Age under 30 years[1]	0.238	-0.024	-0.412*	-0.753*
Age from 30 to 40 years[3]	0.041	-0.062	-0.254[a]	-0.304*
Age from 40+ to 60 years[1]	-0.052	-0.235[a]	0.237*	0.136
Age over 60 years[1]	-0.226	0.321	0.429*	0.921*
Household income of less than $20,000[3]	0.762*	0.172	0.265	0.226
Household income of $20,000+ to $35,000[1]	-0.001	0.127	-0.424*	0.061
Household income of $35,000+ to $50,000[2]	-0.252	0.030	0.249[a]	0.019
Household income of over $50,000[3]	-0.509*	-0.329*	-0.089	-0.335*
Inclusive values				
Purchase	0.048*			
Non-purchase	1.000 (fixed value)			
Pseudo R^2	0.221			

* indicates significance at 95% confidence level.

[a] indicates significance at 90% confidence level

[1] indicates estimated coefficients significantly different across location (5% probability).

[2] indicates estimated coefficients significantly different across location (10% probability).

[3] indicates estimated coefficients not significantly different across location (10% probability).

Table 2b: Estimated Coefficients For Model 2- Segmented Model:

(Pork Cut model segmented by location using a Continuous Price Variable)

PRODUCT ATTRIBUTE	ESTIMATED COEFFICIENTS			
	Winnipeg	**Regina**	**Victoria**	**Edmonton**
PROBABILITY OF PURCHASE:				
Price[1]	-0.490*	-0.555*	-0.528*	-0.502*
No biopreservative[1]	0.432*	0.574*	0.548*	0.221*
With biopreservative[1]	-0.432*	-0.574*	-0.548*	-0.221*
Alberta origin[3]	0.884*	0.825*	0.795*	0.834*
Canadian origin[3]	0.626*	0.422*	0.743*	0.425*
USA origin[3]	-0.718*	-0.758*	-0.944*	-0.853*
Origin not indicated[3]	-0.792*	-0.490*	-0.595*	-0.405*
No outside fat trim[3]	0.283*	0.377*	0.136	0.342*
Trace of outside fat trim[1]	0.081	0.080	0.479*	0.100
About quarter fat trim[3]	-0.014	0.108	-0.066	-0.013
Over quarter fat trim[3]	-0.349*	-0.564*	-0.549*	-0.429*
Packaged Today[3]	1.091*	1.048*	1.346*	0.903*
Packaged Yesterday[3]	0.318*	0.403*	0.266*	0.241*
Packaged 2 days ago[3]	-0.416*	-0.301*	-0.184	-0.359*
Packaged 3 days ago[1]	-0.992*	-1.150*	-1.428*	-0.789*
PROBABILITY OF NON-PURCHASE:				
Family size of 3 or less[1]	0.198	-1.100*	0.334*	-0.016
Family size of 4 to 6[1]	0.076	-0.220	0.300	-0.307a
Family size of more than 6[1]	-0.274	0.330	-0.634*	0.323
Age under 30 years[1]	0.341*	-0.752*	-0.600*	-1.941*
Age from 30 to 40 years[3]	0.283a	0.284a	-0.056	0.083
Age from 40+ to 60 years[3]	0.351	0.170	0.478*	0.498*
Age over 60 years[1]	-0.974*	0.299	0.178	1.360*
Household income of less than $20,000[1]	0.025	0.015	0.496*	2.634*
Household income of $20,000+ to $35,000[1]	0.252a	0.341	-0.907*	-0.075
Household income of $35,000+ to $50,000[1]	-0.465*	-0.056	0.384*	-0.163
Household income of over $50,000[1]	-0.187	-0.270	0.027	-2.396*
Inclusive values				
Purchase	0.632*			
Non-purchase	1.000 (fixed parameter)			
	0			
Pseudo R^2	.237			

* indicates significance at 95% confidence level.

a indicates significance at 90% confidence level

1 indicates estimated coefficients significantly different across location (5% probability).

2 indicates estimated coefficients significantly different across location (10% probability).

3 indicates estimated coefficients not significantly different across location (10% probability).

Table 2c: Estimated Coefficients For Model 2- Segmented Model:

(Ground Beef model segmented by location using a Continuous Price Variable)

PRODUCT ATTRIBUTE	ESTIMATED COEFFICIENTS			
	Winnipeg	**Regina**	**Victoria**	**Edmonton**
PROBABILITY OF PURCHASE:				
Price[3]	-0.355*	-0.480*	-0.427*	-0.415*
No biopreservative[1]	0.342*	0.315*	0.146*	0.143*
With biopreservative[1]	-0.342*	-0.315*	-0.146*	-0.143*
Alberta origin[3]	0.163	0.229*	0.239*	0.268*
Canadian origin[3]	0.338*	0.623*	0.499*	0.313*
USA origin[3]	-0.340*	-0.533*	-0.363*	-0.591*
Origin not indicated[2]	-0.161	-0.319*	-0.375*	0.010
Extra lean (10% or less fat)[3]	0.853*	0.769*	0.765*	1.022*
Medium lean (10 - 17% fat)[3]	-0.049	-0.082	-0.071	-0.091
Regular lean (17 - 23% fat)[3]	0.426*	0.560*	0.480*	0.310*
Regular ground beef (over 23% fat)[3]	-1.230*	-1.246*	-1.174*	-1.241*
Packaged Today[3]	0.426*	0.358*	0.281*	0.632*
Packaged Yesterday[3]	0.293*	0.567	0.595*	0.339*
Packaged 2 days ago[3]	-0.233*	-0.218*	-0.321*	-0.256*
Packaged 3 days ago[3]	-0.485*	-0.707*	-0.555*	-0.715*
PROBABILITY OF NON-PURCHASE:				
Family size of 3 or less[3]	-0.267*	-0.523*	-0.389*	-0.210a
Family size of 4 to 6[1]	-0.030	-0.450*	0.156	-0.505*
Family size of more than 6[1]	0.297	0.973*	0.232	0.715*
Age under 30 years[1]	-0.069	-0.677*	-0.480*	-0.636*
Age from 30 to 40 years[2]	-0.161	0.030	-0.428*	-0.037
Age from 40+ to 60 years[3]	0.113	-0.146	0.207a	0.034
Age over 60 years[1]	0.116	0.793*	0.702*	0.639*
Household income of less than $20,000[1]	0.488*	0.170	-0.157	-0.860*
Household income of $20,000+ to $35,000[2]	-0.229a	0.219	-0.289*	-0.006
Household income of $35,000+ to $50,000[1]	-0.097	-0.164	0.279*	-0.384*
Household income of over $50,000[2]	-0.162	-0.225a	0.167	0.114
Inclusive values				
Purchase	0.751*			
Non-purchase	1.000 (fixed parameter)			
Pseudo R^2	0.165			

* indicates significance at 95% confidence level.

a indicates significance at 90% confidence level

1 indicates estimated coefficients significantly different across location (5% probability).

2 indicates estimated coefficients significantly different across location (10% probability).

3 indicates estimated coefficients not significantly different across location (10% probability).

Table 3: Estimated Coefficients For Model 3- Non-segmented model:

(Specified for all respondents using Effects Coded Price Variable)

PRODUCT ATTRIBUTE	ESTIMATED COEFFICIENTS		
	Beef Steak	**Pork Cut**	**Ground Beef**
PROBABILITY OF PURCHASE:			
Price level 1[1]	1.283*	1.119*	0.741*
Price level 2[1]	0.769*	0.810*	0.265*
Price level 3[1]	-0.347*	-0.423*	-0.088
Price level 4[1]	-1.705*	-1.506*	-0.918*
No biopreservative[1]	0.386*	0.459*	0.255*
With biopreservative[1]	-0.386*	-0.459*	-0.255*
Alberta origin[1]	0.926*	0.845*	0.230*
Canadian origin[3]	0.369*	0.542*	0.491*
USA origin[1]	-0.582*	-0.764*	-0.507*
Origin not indicated[1]	-0.712*	-0.624*	-0.214*
Fat level 1[1]	0.336*	0.284*	0.891*
Fat level 2[1]	0.393*	0.180*	0.478*
Fat level 3[1]	-0.153*	0.014	-0.103
Fat level 4[1]	-0.576*	-0.478*	-1.265*
Packaged Today[1]	1.004*	1.084*	0.465*
Packaged Yesterday[1]	0.158*	0.314*	0.432*
Packaged 2 days ago[3]	-0.334*	-0.306*	-0.282*
Packaged 3 days ago[1]	-0.828*	-1.092*	-0.614*
PROBABILITY OF NON-PURCHASE:			
Family size of 3 or less[1]	-0.147*	0.009	0.175*
Family size of 4 to 6[2]	0.058	-0.054	0.172*
Family size of more than 6[1]	0.089	0.045	-0.347*
Age under 30 years[3]	-0.457*	-0.437*	-0.524*
Age from 30 to 40 years[3]	-0.063	-0.004	-0.051
Age from 40+ to 60 years[3]	0.212*	0.304*	0.142*
Age over 60 years[1]	0.309*	0.137	0.433*
Household income of less than $20,000[3]	0.174[a]	0.252*	0.086
Household income of $20,000+ to $35,000[3]	0.022	-0.093	-0.065
Household income of $35,000+ to $50,000[3]	0.058	-0.043	-0.059
Household income of over $50,000[1]	-0.253*	-0.116[a]	0.038
Inclusive values			
Purchase	0.593*		
Non-purchase	1.000 (fixed parameter)		
Pseudo R^2	0.202		

* indicates significance at 95% confidence level.

[a] indicates significance at 90% confidence level

[1] indicates estimated coefficients significantly different across meat type (5% probability).

[2] indicates estimated coefficients significantly different across meat type (10% probability).

[3] indicates estimated coefficients not significantly different across meat type (10% probability).

Table 4: Results of Log Likelihood Ratio Tests

	Restricted Model	Unrestricted Model	χ^2 Statistic
Model 1: All sample with continuous prices			
H_o = all coefficients equal zero	-12217.41	-10195.27	4044.29*
Model 2a (Steak model) Sample by location with continuous prices			
H_o = all coefficients equal zero	-4061.84	-3164.44	1794.82*
Model 2b (Pork model) Sample by location with continuous prices			
H_o = all coefficients equal zero	-3830.33	-3103.41	1453.85*
Model 2c (Ground Beef model) Sample by location with continuous prices			
H_o = all coefficients equal zero	-4325.24	-3610.90	1428.68*
Model 3: All sample with coded prices			
H_o = all coefficients equal zero	-12217.41	-9745.80	4943.22*

* indicates significance at 99% level confidence

Table 5: Beef Steak Scenario 1:

(Alberta Origin - No Biopreservative versus Biopreservative)

Scenario	Alternative A	Alternative B
Unit price	$9.56/lb.	$9.56/lb.
Packaging Type	Styrofoam tray over-wrap	Styrofoam tray over-wrap + biopreservative
Product Origin	Product of Alberta	Product of Alberta
Outside fat trim	Trace of visible fat	Trace of visible fat
Package label date	Packaged today	Packaged today
Probability of choice		
All respondents	0.306	0.164
Winnipeg respondents	0.330	0.146
Regina respondents	0.359	0.122
Victoria respondents	0.322	0.164
Edmonton respondents	0.246	0.249
Price Change required for indifference		
All respondents	-	-16.4%
Winnipeg respondents	-	-15.2%
Regina respondents	-	-19.3%
Victoria respondents	-	-15.4%
Edmonton respondents	-	0.40%
Probability of choice after price change		
All respondents	0.241	0.241
Winnipeg respondents	0.240	0.240
Regina respondents	0.243	0.243
Victoria respondents	0.245	0.245
Edmonton respondents	0.247	0.247

Table 6: Beef Steak Scenario 2:

(Canada Origin - No Biopreservative versus Biopreservative)

Scenario	Alternative A	Alternative B
Unit price	$9.56/lb.	$9.56/lb.
Packaging Type	Styrofoam tray over-wrap	Styrofoam tray over-wrap + biopreservative
Product Origin	Product of Canada	Product of Canada
Outside fat trim	Trace of visible fat	Trace of visible fat
Package label date	Packaged today	Packaged today
Probability of choice		
All respondents	0.289	0.155
Winnipeg respondents	0.328	0.145
Regina respondents	0.353	0.120
Victoria respondents	0.316	0.162
Edmonton respondents	0.240	0.243
Price Change required for indifference		
All respondents	-	-16.4%
Winnipeg respondents	-	-15.2%
Regina respondents	-	-19.3%
Victoria respondents	-	-15.4%
Edmonton respondents	-	0.40%
Probability of choice after price change		
All respondents	0.228	0.228
Winnipeg respondents	0.239	0.239
Regina respondents	0.238	0.238
Victoria respondents	0.240	0.240
Edmonton respondents	0.241	0.241

Table 7: Beef Steak Scenario 3:

(No biopreservative - Alberta origin versus Canada origin)

Scenario	Alternative A	Alternative B
Unit price	$9.56/lb.	$9.56/lb.
Packaging Type	Styrofoam tray over-wrap	Styrofoam tray over-wrap
Product Origin	Product of Alberta	Product of Canada
Outside fat trim	Trace of visible fat	Trace of visible fat
Package label date	Packaged today	Packaged today
Probability of choice		
All respondents	0.301	0.169
Winnipeg respondents	0.260	0.219
Regina respondents	0.323	0.159
Victoria respondents	0.327	0.159
Edmonton respondents	0.356	0.134
Price Change required for indifference		
All respondents	-	-15.1%
Winnipeg respondents	-	-3.2%
Regina respondents	-	-12.7%
Victoria respondents	-	-16.5%
Edmonton respondents	-	-26.0%
Probability of choice after price change		
All respondents	0.241	0.241
Winnipeg respondents	0.240	0.240
Regina respondents	0.243	0.243
Victoria respondents	0.245	0.245
Edmonton respondents	0.247	0.247

Table 8: Beef Steak Scenario 4:

(No biopreservative - Alberta origin versus USA origin)

Scenario	Alternative A	Alternative B
Unit price	$9.56/lb.	$9.56/lb.
Packaging Type	Styrofoam tray over-wrap	Styrofoam tray over-wrap
Product Origin	Product of Alberta	Product of USA
Outside fat trim	Trace of visible fat	Trace of visible fat
Package label date	Packaged today	Packaged today
Probability of choice		
All respondents	0.371	0.089
Winnipeg respondents	0.373	0.101
Regina respondents	0.405	0.075
Victoria respondents	0.395	0.089
Edmonton respondents	0.412	0.078
Price Change required for indifference		
All respondents	-	-37.7%
Winnipeg respondents	-	-24.2%
Regina respondents	-	-30.1%
Victoria respondents	-	-34.3%
Edmonton respondents	-	-44.3%
Probability of choice after price change		
All respondents	0.241	0.241
Winnipeg respondents	0.240	0.240
Regina respondents	0.243	0.243
Victoria respondents	0.245	0.245
Edmonton respondents	0.247	0.247

Table 9: Pork Cut Scenario 1:

(Alberta Origin - No Biopreservative versus Biopreservative)

Scenario	Alternative A	Alternative B
Unit price	$9.56/lb.	$9.56/lb.
Packaging Type	Styrofoam tray over-wrap	Styrofoam tray over-wrap + biopreservative
Product Origin	Product of Alberta	Product of Alberta
Outside fat trim	No visible fat	No visible fat
Package label date	Packaged today	Packaged today
Probability of choice		
All respondents	0.284	0.135
Winnipeg respondents	0.184	0.077
Regina respondents	0.151	0.048
Victoria respondents	0.171	0.057
Edmonton respondents	0.134	0.086
Price Change required for indifference		
All respondents	-	-16.4%
Winnipeg respondents	-	-18.4%
Regina respondents	-	-21.7%
Victoria respondents	-	-21.7%
Edmonton respondents	-	-9.2%
Probability of choice after price change		
All respondents	0.216	0.216
Winnipeg respondents	0.152	0.152
Regina respondents	0.122	0.122
Victoria respondents	0.138	0.138
Edmonton respondents	0.121	0.121

Table 10: Pork Cut Scenario 2:

(Canada Origin - No Biopreservative versus Biopreservative)

Scenario	Alternative A	Alternative B
Unit price	$9.56/lb.	$9.56/lb.
Packaging Type	Styrofoam tray over-wrap	Styrofoam tray over-wrap + biopreservative
Product Origin	Product of Canada	Product of Canada
Outside fat trim	No visible fat	No visible fat
Package label date	Packaged today	Packaged today
Probability of choice		
All respondents	0.278	0.132
Winnipeg respondents	0.162	0.068
Regina respondents	0.122	0.039
Victoria respondents	0.166	0.055
Edmonton respondents	0.109	0.070
Price Change required for indifference		
All respondents	-	-16.4%
Winnipeg respondents	-	-18.4%
Regina respondents	-	-21.7%
Victoria respondents	-	-21.7%
Edmonton respondents	-	-9.2%
Probability of choice after price change		
All respondents	0.212	0.212
Winnipeg respondents	0.136	0.136
Regina respondents	0.100	0.100
Victoria respondents	0.135	0.135
Edmonton respondents	0.099	0.099

Table 11: Pork Cut Scenario 3:

(No biopreservative - Alberta origin versus Canada origin)

Scenario	Alternative A	Alternative B
Unit price	$9.56/lb.	$9.56/lb.
Packaging Type	Styrofoam tray over-wrap	Styrofoam tray over-wrap
Product Origin	Product of Alberta	Product of Canada
Outside fat trim	No visible fat	No visible fat
Package label date	Packaged today	Packaged today
Probability of choice		
All respondents	0.235	0.194
Winnipeg respondents	0.163	0.128
Regina respondents	0.134	0.090
Victoria respondents	0.140	0.133
Edmonton respondents	0.133	0.088
Price Change required for indifference		
All respondents	-	-4.2%
Winnipeg respondents	-	-5.5%
Regina respondents	-	-7.6%
Victoria respondents	-	-1.0%
Edmonton respondents	-	-8.5%
Probability of choice after price change		
All respondents	0.216	0.216
Winnipeg respondents	0.152	0.152
Regina respondents	0.122	0.122
Victoria respondents	0.138	0.138
Edmonton respondents	0.121	0.121

Table 12: Pork Cut Scenario 4:

(No biopreservative - Alberta origin versus USA origin)

Scenario	Alternative A	Alternative B
Unit price	$9.56/lb.	$9.56/lb.
Packaging Type	Styrofoam tray over-wrap	Styrofoam tray over-wrap
Product Origin	Product of Alberta	Product of USA
Outside fat trim	No visible fat	No visible fat
Package label date	Packaged today	Packaged today
Probability of choice		
All respondents	0.339	0.071
Winnipeg respondents	0.201	0.040
Regina respondents	0.158	0.032
Victoria respondents	0.182	0.032
Edmonton respondents	0.157	0.029
Price Change required for indifference		
All respondents	-	-34.6%
Winnipeg respondents	-	-34.2%
Regina respondents	-	-29.8%
Victoria respondents	-	-34.5%
Edmonton respondents	-	-35.1%
Probability of choice after price change		
All respondents	0.216	0.216
Winnipeg respondents	0.152	0.152
Regina respondents	0.122	0.122
Victoria respondents	0.138	0.138
Edmonton respondents	0.121	0.121

Table 13: Ground Beef Scenario 1:

(Alberta Origin - No Biopreservative versus Biopreservative)

Scenario	Alternative A	Alternative B
Unit price	$3.56/lb.	$3.56/lb.
Packaging Type	Styrofoam tray over-wrap	Styrofoam tray over-wrap + biopreservative
Product Origin	Product of Alberta	Product of Alberta
Fat content	Extra lean (10% or less fat)	Extra lean (10% or less fat)
Package label date	Packaged today	Packaged today
Probability of choice		
All respondents	0.322	0.189
Winnipeg respondents	0.444	0.224
Regina respondents	0.373	0.199
Victoria respondents	0.286	0.214
Edmonton respondents	0.402	0.302
Price Change required for indifference		
All respondents	-	-22.9%
Winnipeg respondents	-	-54.2%
Regina respondents	-	-36.8%
Victoria respondents	-	-19.1%
Edmonton respondents	-	-19.4%
Probability of choice after price change		
All respondents	0.261	0.261
Winnipeg respondents	0.357	0.357
Regina respondents	0.310	0.310
Victoria respondents	0.250	0.250
Edmonton respondents	0.362	0.362

Table 14: Ground Beef Scenario 2:

(Canada Origin - No Biopreservative versus Biopreservative)

Scenario	Alternative A	Alternative B
Unit price	$3.56/lb.	$3.56/lb.
Packaging Type	Styrofoam tray over-wrap	Styrofoam tray over-wrap + biopreservative
Product Origin	Product of Canada	Product of Canada
Fat content	Extra lean (10% or less fat)	Extra lean (10% or less fat)
Package label date	Packaged today	Packaged today
Probability of choice		
All respondents	0.329	0.193
Winnipeg respondents	0.463	0.233
Regina respondents	0.419	0.223
Victoria respondents	0.286	0.214
Edmonton respondents	0.406	0.305
Price Change required for indifference		
All respondents	-	-22.9%
Winnipeg respondents	-	-54.2%
Regina respondents	-	-36.8%
Victoria respondents	-	-19.1%
Edmonton respondents	-	-19.4%
Probability of choice after price change		
All respondents	0.266	0.266
Winnipeg respondents	0.370	0.370
Regina respondents	0.344	0.344
Victoria respondents	0.250	0.250
Edmonton respondents	0.365	0.365

Table 15: Proportion of Respondents regarding Alternatives chosen in Stated Preference

(Alternatives A & B = Purchase; Alternative C = Non-purchase)

	All respondents	Winnipeg respondents	Regina respondents	Victoria respondents	Edmonton respondents
High quality Beef					
Purchase	68%	69%	69%	65%	69%
Non- purchase	32%	31%	31%	35%	31%
High quality Pork					
Purchase	64%	64%	68%	60%	65%
Non- purchase	36%	36%	32%	40%	35%
Ground Beef					
Purchase	59%	59%	63%	55%	58%
Non- purchase	41%	41%	37%	45%	42%

Figure 1a

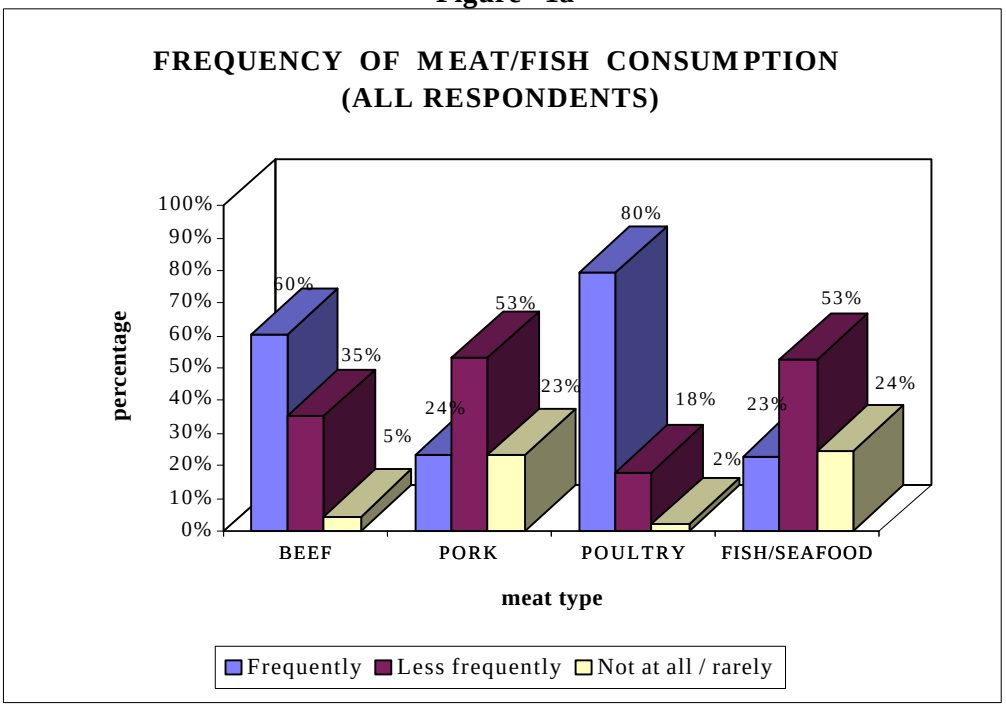


Figure 1b

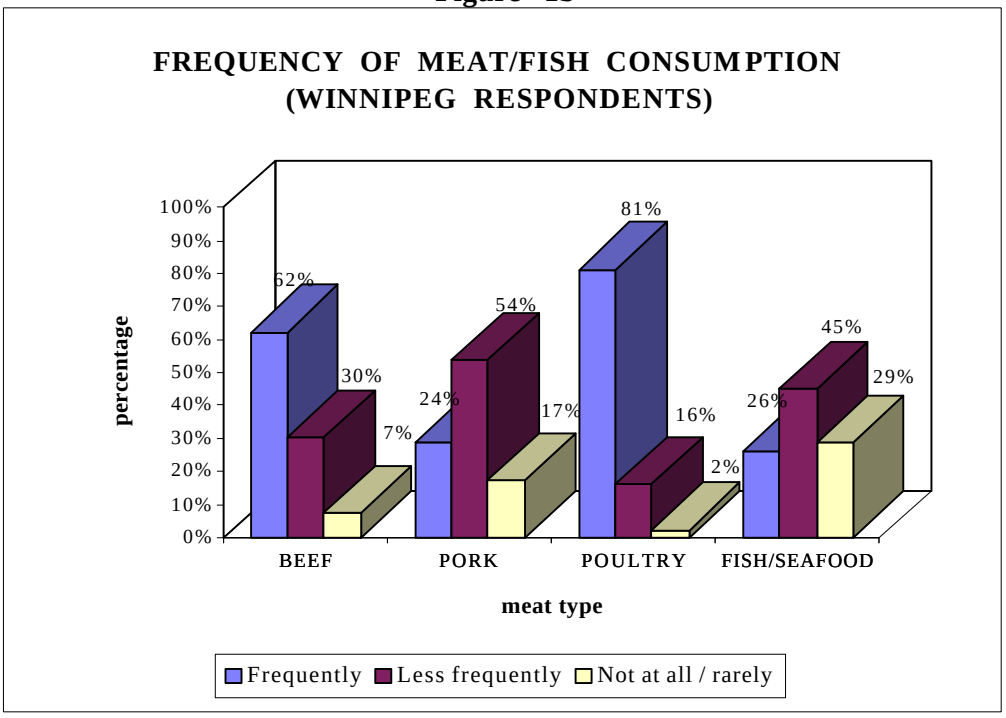


Figure 1c

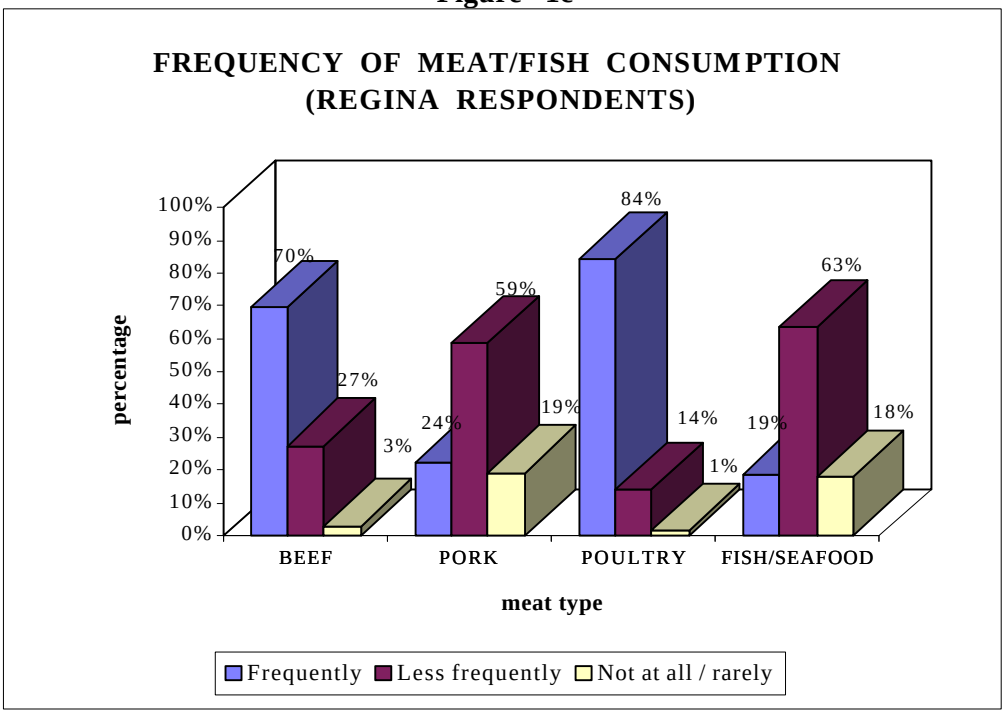


Figure 1d

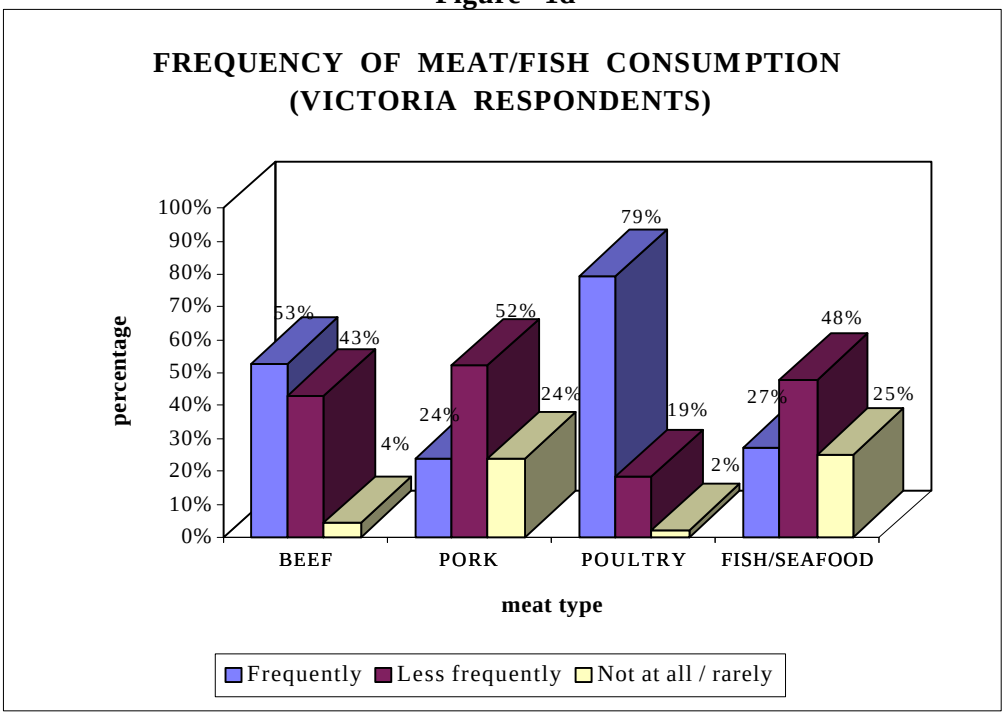


Figure 1e

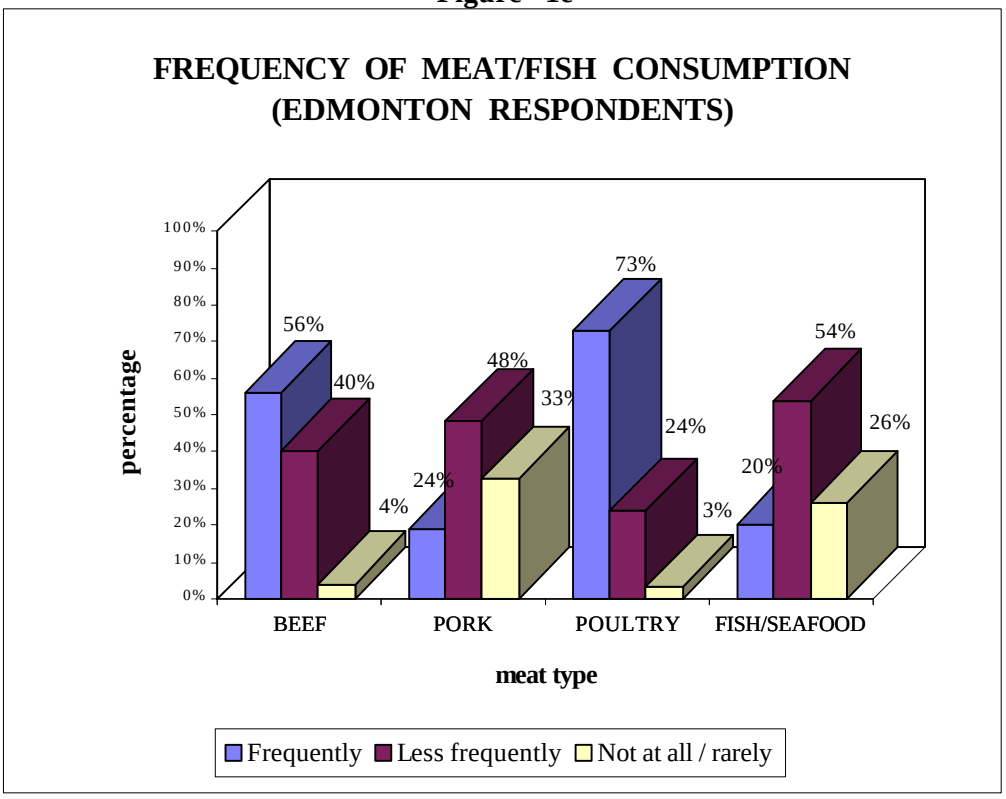
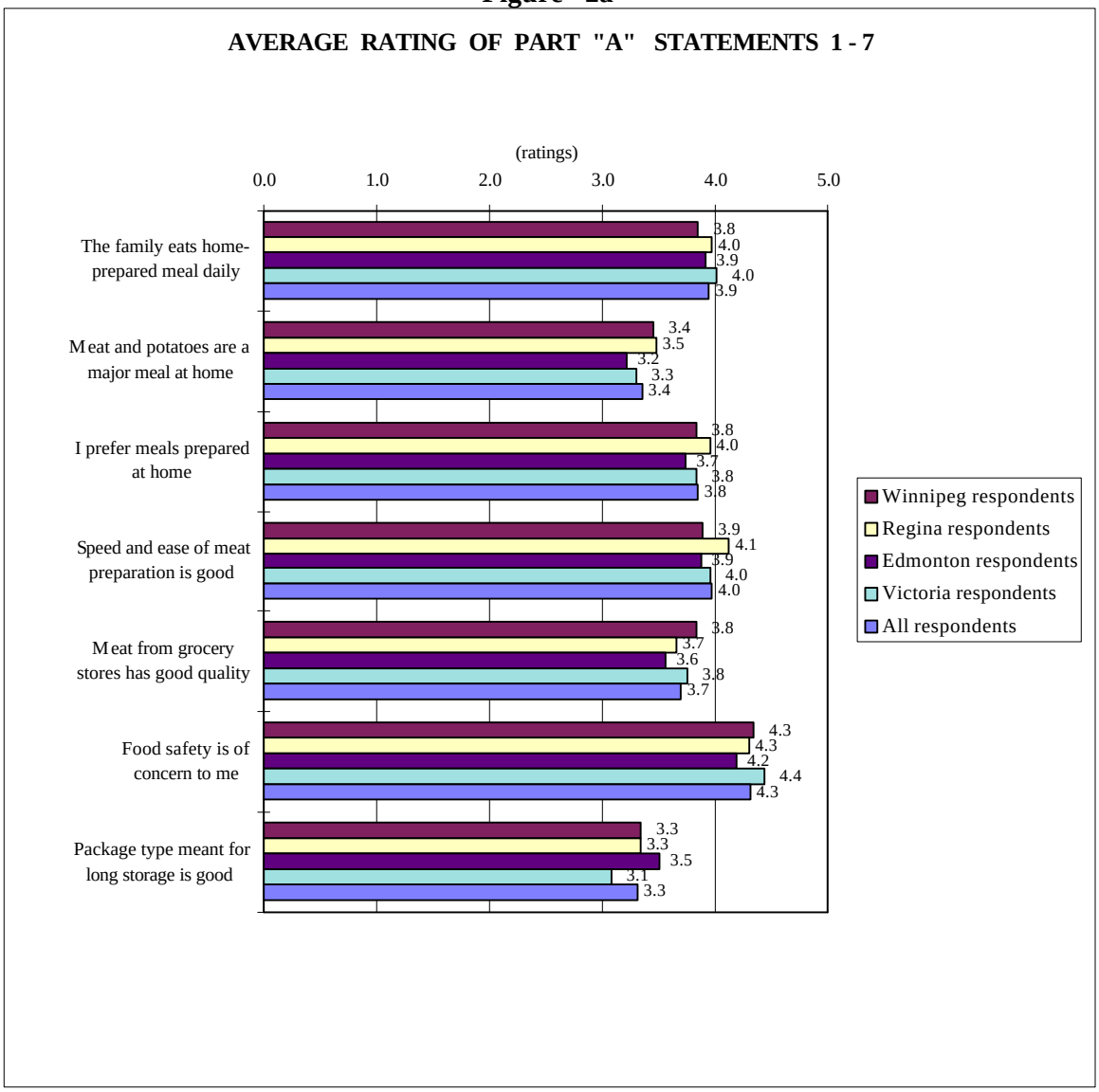
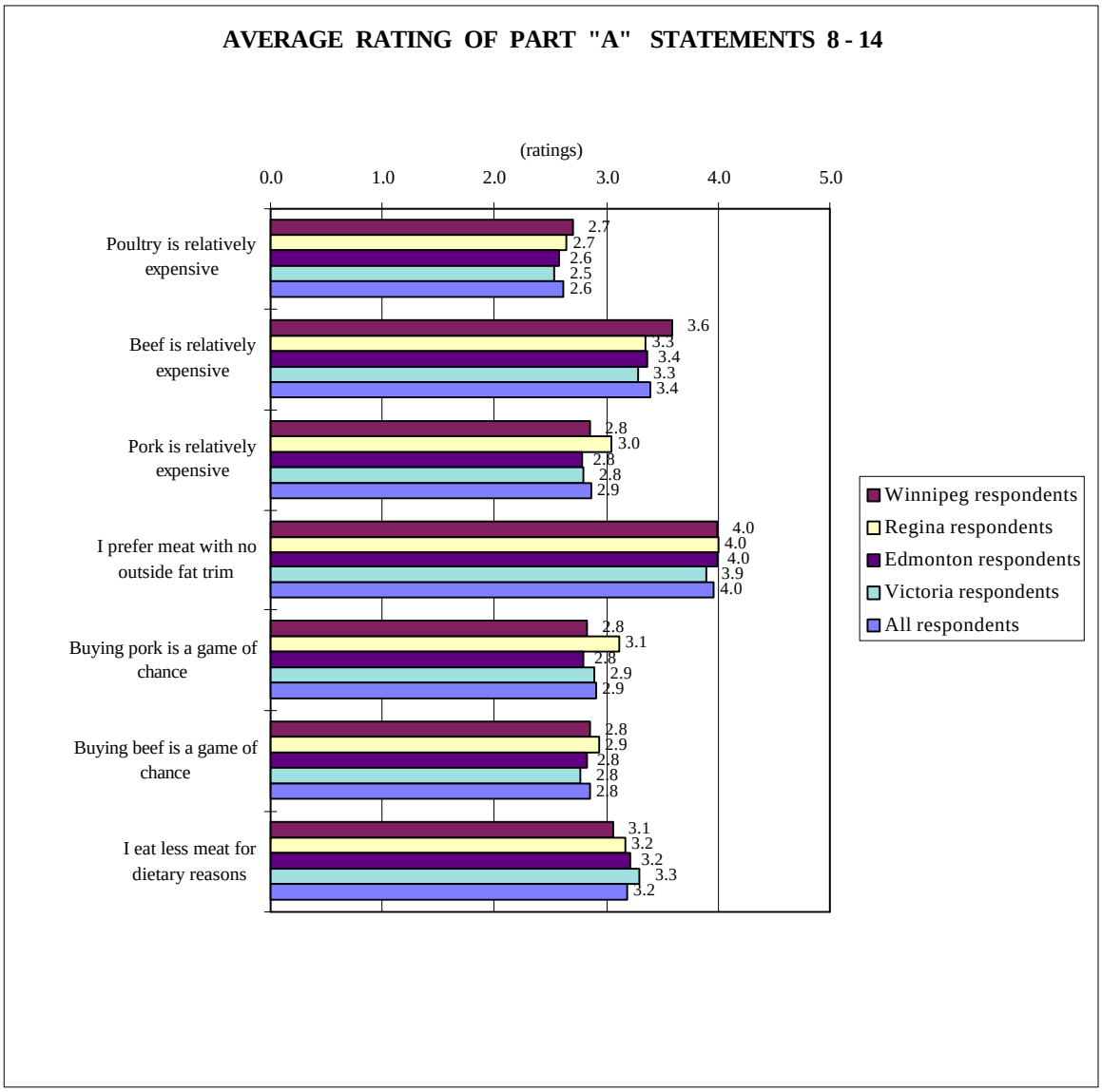

FREQUENCY OF MEAT/FISH CONSUMPTION
(EDMONTON RESPONDENTS)
percentage
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
56%
40%
4%
24%
48%
33%
73%
24%
3%
20%
54%
26%
BEEF
PORK
POULTRY
FISH/SEAFOOD
meat type
Frequently
Less frequently
Not at all / rarely

Figure 2a[a]



[a] Ratings are; 1 = strongly disagree; 2 = disagree; 3 = neither agree nor disagree; 4 = agree; 5 = strongly agree

Figure 2b[a]



[a] Ratings are; 1 = strongly disagree; 2 = disagree; 3 = neither agree nor disagree; 4 = agree; 5 = strongly agree

Figure 3

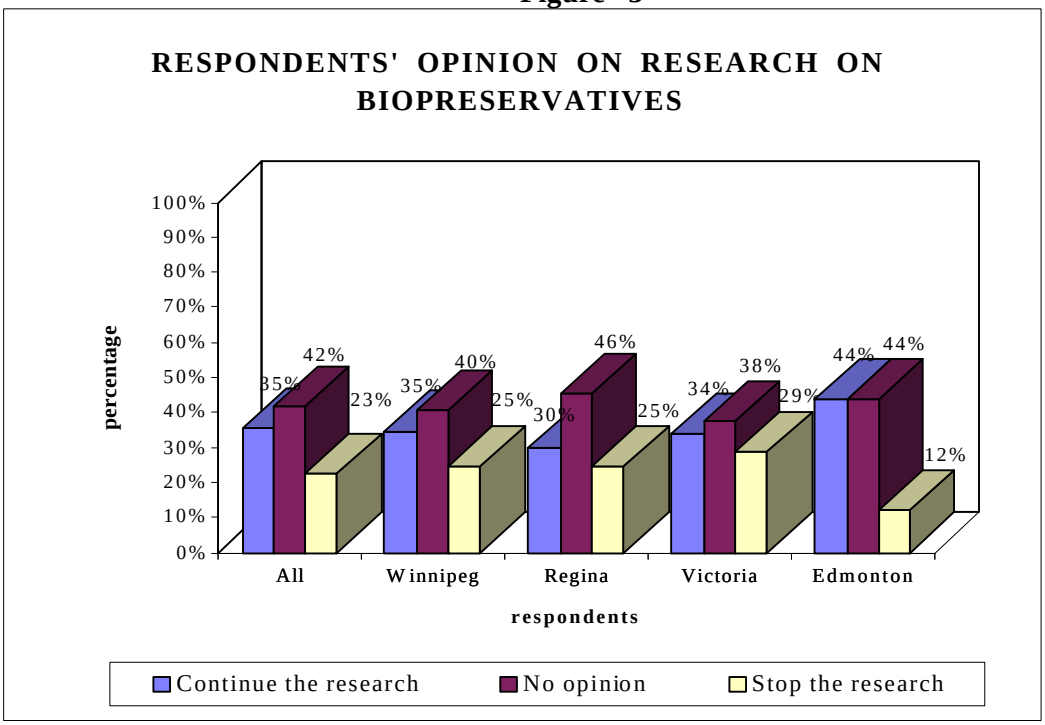


Figure 4

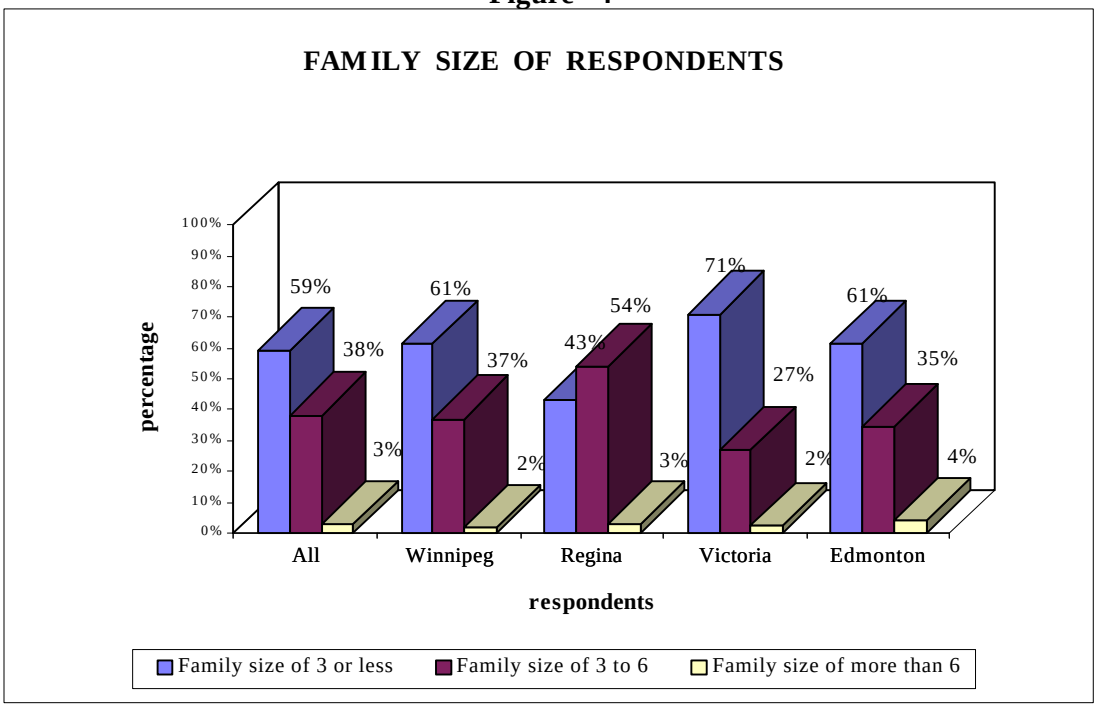


Figure 5

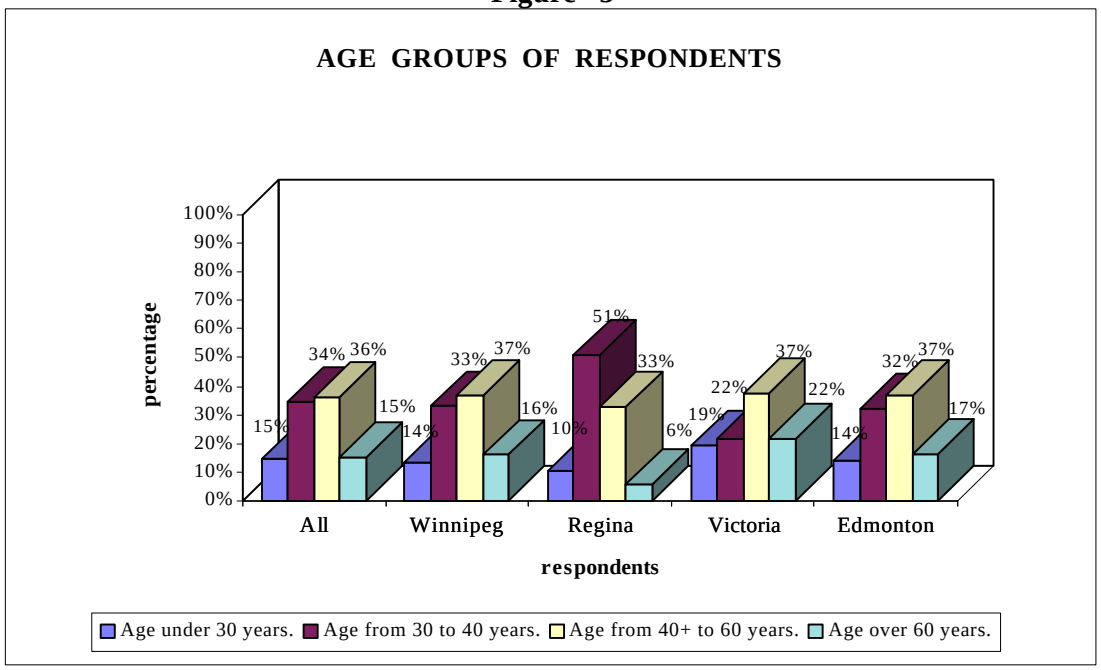
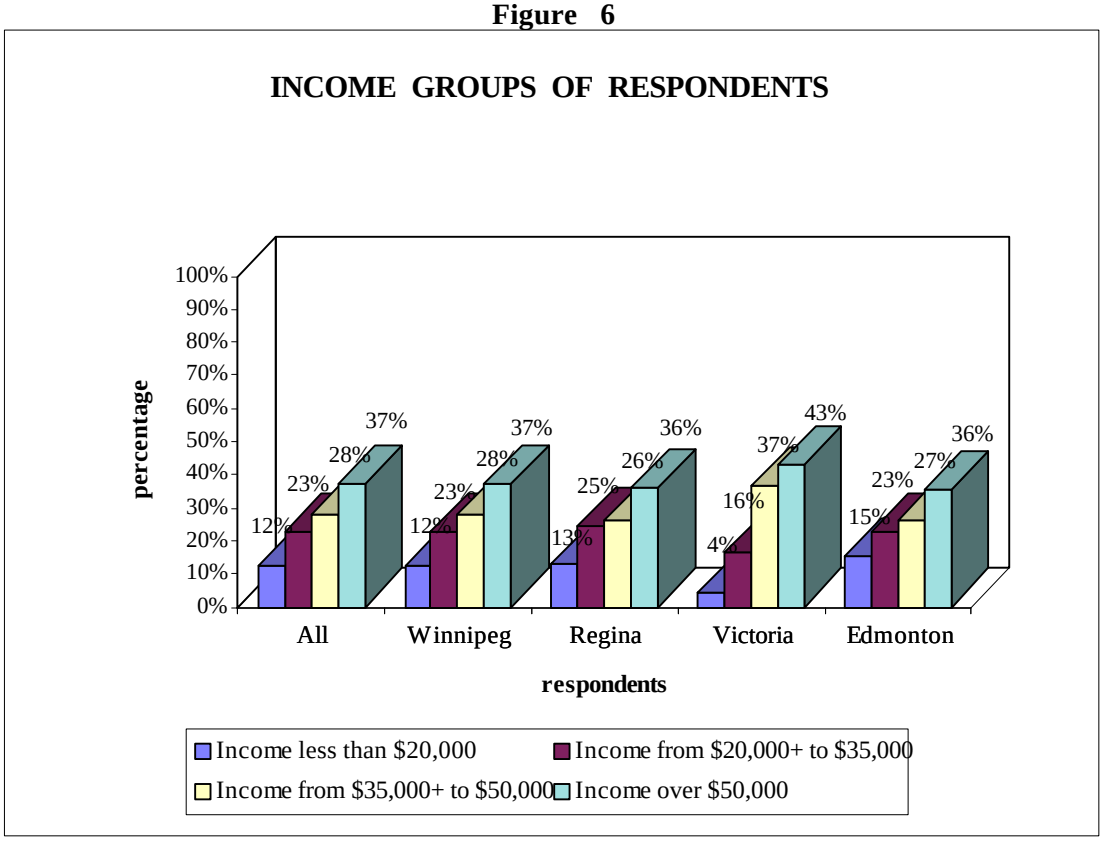


Figure 6



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APPENDIX I: Product Factors and Levels

Product Factors	Level 1 ↓	Level 2 ↓	Level 3 ↓	Level 4 ↓
Beef steak				
Unit price	$5.66/lb	$7.36/lb	$9.56/lb	$12.43/lb
Packaging Type	Styrofoam tray overwrap	Styrofoam tray overwrap + biopreservative	-	-
Outside fat trim	No visible fat	Trace of visible fat	About 1/4 inch visible fat	More than 1/4 inch visible fat
Product Origin	Product of Alberta	Product of Canada	Product of US	Not indicated
Package date	Packaged Today	Packaged Yesterday	Packaged 2 days ago	Packaged 3 days ago
Pork				
Unit price	$4.35/lb	$5.57/lb	$7.35/lb	$9.56/lb
Package Type	Styrofoam tray overwrap	Styrofoam tray overwrap + biopreservative	-	-
Outside fat trim	No visible fat	Trace of visible fat	About 1/4 inch visible fat	More than 1/4 inch visible fat
Product Origin	Product of Alberta	Product of Canada	Product of US	Not indicated
Package date	Packaged Today	Packaged Yesterday	Packaged 2 days ago	Packaged 3 days ago
Ground beef				
Unit price	$0.98/lb	$1.84/lb	$2.70/lb	$3.56/lb
Packaging Type	Styrofoam tray overwrap	Styrofoam tray overwrap + biopreservative	-	-
Fat content	Extra lean (10% or less fat)	Regular lean (10% to 17% fat)	Medium lean (17% to 23% fat)	Regular ground beef (23% to 30% fat)
Product Origin	Product of Alberta	Product of Canada	Product of US	Not indicated
Package date	Packaged Today	Packaged Yesterday	Packaged 2 days ago	Packaged 3 days ago

APPENDIX II: Sample Introductory Letter sent to all participants

Date ?

Address ?
?

Dear ?,

The University of Alberta, a leader in meat research, is currently researching meat packaging and shelf life issues involving the use of biological preservatives (biopreservatives) to extend meat shelf life. Biopreservatives are bacteria that control or inhibit the growth of pathogens that cause illness, such as *E. coli* (commonly associated with hamburger disease). Research on biopreservatives is on-going, and these preservatives **are not** presently in use. The introduction of a biopreservative in meat packages would allow fresh meat to remain packaged and stored for longer periods without loss in quality. The Department of Rural Economy, University of Alberta is conducting a survey to determine consumers' views and opinions regarding this potential new packaging technology for fresh meat. The survey is funded by the Alberta Agricultural Research Institute (AARI).

The enclosed survey is being sent to you to obtain your opinions on this potential new packaging technology. We would appreciate your participation in the study by answering all questions (if applicable) and also adding any comments, if any. Your answers to the questions will help direct research in the area of packaging technology and also provide input into industry policy issues regarding meat production and promotion. Every opinion is important to us and as such your input on these issues will be much appreciated.

Recently you were contacted by telephone and asked if you would be willing to participate in this survey and your response was positive. You are among a group of randomly selected households chosen to participate in the survey. Advantage Field Research in Edmonton is administering the survey on behalf of the Department of Rural Economy, University of Alberta. Data processing and handling of information in the survey is entirely the responsibility of the department. We wish to assure you that all answers are completely confidential but each survey is numbered to prevent duplicate mailing. As only a select group of households have been chosen, we would appreciate you completing and returning the questionnaire as soon as possible. Your answers are important to us.

Your name is not required for this survey, only your opinions. **The questionnaire is directed to the individual in the household who makes the majority of meat purchases.** Your participation in voluntary. For any further information, you can contact me at (403)492-4225 [fax: 492-0268].

Thank you for your cooperation and assistance.

Sincerely,

James R. Unterschultz
AARI Professorship

APPENDIX III: A Sample Copy of the Survey Questionnaire

A SURVEY ON POTENTIAL NEW PACKAGING TECHNOLOGIES FOR FRESH MEAT

The University of Alberta is currently researching meat packaging that uses biological preservatives (biopreservatives). As indicated in the cover letter, biopreservatives are bacteria that control or inhibit the growth of pathogens that cause illness and therefore their introduction in fresh meat packages will allow fresh meat to remain safely packaged and stored for longer periods without loss in quality. **Biopreservatives are currently not in use** This survey is aimed at evaluating your views on this potential new packaging technology. Your response will help direct research in the area of packaging technology and also provide input into industry policy issues related to fresh meat promotion. This survey is a University of Alberta sponsored project funded by the Alberta Agricultural Research Institute (AARI). Please take a few minutes now to respond to the questions in this survey. Your participation is voluntary.

Thank you for your help!!

James R. Unterschultz, AARI Professorship
Department of Rural Economy,
University of Alberta,
Edmonton. T6G 2H1.
Tel: (403)492-4225.
Fax: (403)492-0268
E-mail: juntersc@re.ualberta.ca

PART A: General questions

Please check(✓) only one box to indicate your answer for each of the following statements about fresh meats. In answering these questions, note the following;

SD = Strongly disagree; **D** = Disagree; **N** = Neither agree nor disagree;
A = Agree; **SA** = Strongly agree

STATEMENTS	SD	D	N	A	SA
1. The whole family usually sits down together for at least one home prepared meal each day.	❑1	❑2	❑3	❑4	❑5
2. Meat and potatoes are a basic major daily meal for the family.	❑1	❑2	❑3	❑4	❑5
3. I prefer meals prepared at home to eating out.	❑1	❑2	❑3	❑4	❑5
4. Speed and ease of meal preparation are important to me.	❑1	❑2	❑3	❑4	❑5
5. Overall, I consider meat purchased from grocery stores or other similar stores to be of good quality.	❑1	❑2	❑3	❑4	❑5
6. The presence of drug residue, dyes and other inorganic substances in fresh meats are of concern to me.	❑1	❑2	❑3	❑4	❑5
7. I prefer packaging types that will allow meat to be kept for longer periods.	❑1	❑2	❑3	❑4	❑5
8. Poultry is expensive when compared to other meats.	❑1	❑2	❑3	❑4	❑5
9. Beef is expensive when compared to other meats.	❑1	❑2	❑3	❑4	❑5
10. Pork is expensive when compared to other meats.	❑1	❑2	❑3	❑4	❑5
11. I prefer meat cuts with all the outside fat trimmed off.	❑1	❑2	❑3	❑4	❑5
12. Buying pork cuts is a game of chance, since quality is so variable.	❑1	❑2	❑3	❑4	❑5
13. Buying beef cuts is a game of chance, since quality is so variable.	❑1	❑2	❑3	❑4	❑5
14. For dietary reasons, I eat less meat now than 2 years ago.	❑1	❑2	❑3	❑4	❑5

PART B: Choosing Between Products

QUESTIONNAIRE ON CONSUMER CHOICES FOR *BEEF STEAK*

Suppose that on your next grocery shopping trip, you are at the meat counter to purchase **Beef strip loin (boneless) steak** or a similar beef steak such as T-bone, tenderloin, sirloin or prime rib steak. Assume the package size is suitable for your household and you are comparing different packages of the same beef steak. Considering the various attributes of beef, such as price, packaging, origin of meat production, outside fat trim and package label date, which one of the alternatives, ***A to C***, presented in the scenarios following are you most likely to choose?

Alternatives *A* and *B* outline different descriptions for the steak. Choice *C* applies if you would not purchase either *A* or *B*. Check **(✓)** only one alternative as an answer in each case.

SCENARIO 1

Product Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Unit price	$7.36/lb.	$7.36/lb.	
Packaging Type	Styrofoam tray over-wrap + biopreservative	Styrofoam tray over-wrap + biopreservative	Neither A or B
Product Origin label	Product of Canada	Product of Canada	is chosen
Outside fat trim	No visible fat	More than 1/4 inch of visible fat	
Package label date	Packaged 2 days ago	Packaged Yesterday	
I would choose	⇩ ❑	⇩ ❑	⇩ ❑

SCENARIO 2

Product Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Unit price	$5.66/lb.	$12.43/lb.	Neither A or B is chosen
Packaging Type	Styrofoam tray over-wrap + biopreservative	Styrofoam tray over-wrap + biopreservative	
Product Origin label	Product of Canada	Product of US	
Outside fat trim	Trace of visible fat	No visible fat	
Package label date	Packaged Yesterday	Packaged 2 days ago	
I would choose	⇩ ❑	⇩ ❑	⇩ ❑

QUESTIONNAIRE ON CONSUMER CHOICES FOR *PORK TENDERLOIN CUT*

Suppose that on your next grocery shopping trip, you are at the meat counter to purchase **pork tenderloin (boneless)** or a similar pork cut such as loin chop, loin roast, or center cut chop. Assume the package size is suitable for your household and you are comparing different packages of the same pork cut. Considering the various attributes of pork, such as price, packaging, origin of meat production, outside fat trim and package label date, which one of the alternatives, ***A to C***, presented in the scenarios following are you most likely to choose?

Alternatives *A* and *B* outline different descriptions for the pork cut. Choice *C* applies if you would not purchase either *A* or *B*. Check **(✓)** only one alternative as an answer in each case.

SCENARIO 1

Product Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Unit price	$5.57/lb.	$5.57/lb.	Neither A or B is chosen
Packaging Type	Styrofoam tray over-wrap + biopreservative	Styrofoam tray over-wrap + biopreservative	
Product Origin label	Product of US	Product of US	
Outside fat trim	No visible fat	Over 1/4 inch of visible fat	
Package label date	Packaged 2 days ago	Packaged Yesterday	
I would choose	⇩ ❑	⇩ ❑	⇩ ❑

SCENARIO 2

Product Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Unit price	$4.35/lb.	$9.56/lb.	Neither A or B is chosen
Packaging Type	Styrofoam tray over-wrap + biopreservative	Styrofoam tray over-wrap + biopreservative	
Product Origin label	Product of US	Product of Canada	
Outside fat trim	Trace of visible fat	No visible fat	
Package label date	Packaged Yesterday	Packaged 2 days ago	
I would choose	⇩ ❑	⇩ ❑	⇩ ❑

QUESTIONNAIRE ON CONSUMER CHOICES FOR *GROUND BEEF*

Suppose that on your next grocery shopping trip, you are at the meat counter to purchase **Ground beef or patties**. Assume the package size is suitable for your household and you are comparing different packages of the same product. A fat content of 10% or less refers to extra lean, 10 - 17% is regular lean, 17 - 23% is medium lean and 23 - 30% is the fat content of regular ground beef. Considering the various attributes of ground beef, such as price, packaging, origin of meat production, fat content and package label date, which one of the alternatives, ***A to C***, presented in the scenarios following are you most likely to choose?

Alternatives *A* and *B* outline different descriptions for ground beef. Choice *C* applies if you would not purchase either *A* or *B*. Check **(✓)** only one alternative as an answer in each case.

SCENARIO 1

Product Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Unit price	$2.70/lb.	$2.70/lb.	Neither A or B is chosen
Packaging Type	Styrofoam tray over-wrap + biopreservative	Styrofoam tray over-wrap + biopreservative	
Product Origin label	Product of Alberta	Not indicated	
Fat Content	Regular lean (10% to 17% fat)	Regular lean (10% to 17% fat)	
Package label date	Packaged 2 days ago	Packaged Yesterday	
I would choose	⇩ ❑	⇩ ❑	⇩ ❑

SCENARIO 2

Product Attribute	**Alternative A**	**Alternative B**	**Alternative C**
Unit price	$3.56/lb.	$0.98/lb.	Neither A or B is chosen
Packaging Type	Styrofoam tray over-wrap + biopreservative	Styrofoam tray over-wrap + biopreservative	
Product Origin label	Product of Canada	Product of Alberta	
Fat Content	Regular lean (10% to 17% fat)	Medium lean (17% to 23% fat)	
Package label date	Packaged Yesterday	Packaged 2 days ago	
I would choose	⇩ ❑	⇩ ❑	⇩ ❑

PART C: Supplementary Questions

Please check (✓) only one of the alternatives as your answer.

1. How many people are in your household?
   - ❑ 3 or less
   - ❑ 4 to 6
   - ❑ More than 6

2. What is your age?
   - ❑ Under 30 years
   - ❑ 30 - 40 years
   - ❑ 40^{+} - 60 years
   - ❑ Over 60 years

3. What is your approximate total household income?
   - ❑ Less than $20,000
   - ❑ $20,000^{+}$ to $35,000
   - ❑ $35,000^{+}$ to $50,000
   - ❑ Over $50,000

4. What is your opinion on the potential future use of biopreservatives?
   - ❑ It is a good project. Continue with the research.
   - ❑ I have no opinion on the issue.
   - ❑ I will not encourage its use. Stop the research.

5. Indicate how often in a month you eat each of the following meats in your household.

	Frequently	Less frequently	Not at all / rarely
Beef	❑	❑	❑
Pork	❑	❑	❑
Poultry	❑	❑	❑
Fish/seafood	❑	❑	❑

6. Do you have anything on the above issue to tell us? If so, please use the space below for the purpose, or include your comments on a separate sheet of paper.

_____
_____
_____
_____

APPENDIX IV: Some Comments by Respondents on the Issue of Biopreservatives

1. "If the biopreservative will not be harmful as to any side effects it should be used to control the bacteria in the meats."

2. "I would like to know more about the biopreservative added, and long term effects of ingestion of the additive."

3. "The mistake that you made was not informing on the possible side affects of this agent. The meat might last longer, but is this chemical immune to all the diseases, viruses, and infections one might have? Does this speed up disease or not affect a person? Please send me medical proof that this will not harm people."

4. "Additives to any food product is of high concern due to susceptibility to allergies. Are there likely to be allergic reactions to the biopreservative and is the problem being considered?"

5. "I suppose if biopreservatives are the way of the future, the public should be made aware of its effectiveness and safety. A safety concern might be; accidental overdose of bacteria. As it stands, I do not have enough data to form an informed opinion."

6. "It is interesting research, however I would like to know more about it. If it is harmless to people and does not increase the price of the product, then I say go for it."

7. "In part C question 4 I answered that I have no opinion on biopreservatives; in actuality I know very little on the subject. This lack of knowledge does cause some concern for me."

8. "Biopreservative!! Is it safe? How will it effect me, my family, the taste of the product etc."

9. "As long as biopreservatives would not cause health problems, I would agree with it."

10. "One must assume that a public education program i.e. TV, newspapers would be necessary prior to the introduction of biopreservatives."

11. "As a know nothing about biopreservatives, their use concerns me. I prefer meat to have as few preservatives added as possible."

12. "Although these biopreservatives are potentially natural, I still have the feeling they are additives which I would prefer not to have."

13. "I have no opinion on whether or not we should use preservatives in food as there is not enough knowledge that the average person can understand given to them."

14. "Please excuse my ignorance of these so called, biopreservatives. If we know their properties and functions we could better serve this poll. Are these chemicals, or naturally produced products? Side effects? etc."

15. "I'm not knowledgeable about biopreservatives so really can't give you an opinion. Because of this survey, I will learn about them."

16. "I feel very strongly about the future long term effects of this "bacteria" on our bodies. I will not buy anything packaged in it."

17. "Some of my answers are based on the premise that the biopreservatives are a safe method to use. I would hate to think the 'cure' is worse that the 'disease' as so many of these new inventions are. However I think it could be an exciting concept if it proves safe to humans."

18. "My only concern with biopreservatives is that they may have adverse effects on the consumers and I would expect that this aspect would be thoroughly and diligently researched."

19. "I think we get enough additives and preservatives in our food that we eat without adding it to fresh meat; if you used a preservative in meats, you couldn't call it "FRESH MEAT" now could you?"

20. "Would biopreservatives bring the cost of meat down? How long would it preserve the meat? What effects do biopreservatives have on humans? Would stores abuse the shelf life of meats with biopreservatives in them. Would biopreservatives be put in sausages and cold cuts? Would this help to reduce the amount of salt and other things in them? Would it cut down on the use of nitrates?"

21. "You have not provided sufficient background information for me to decide whether I would want to buy meat containing biopreservatives. Does it affect taste? Are there any controversial issues surrounding its use?"

22. "Although there indicated no opinion on the new biopreservatives it is from lack of knowledge rather than interest. A product that will help guarantee freshness and germ or disease free foods should be strongly pursued. Also, anything short of drugs or other unsafe products or packaging, is useful in prolonging shelf life, would be welcomed by infrequent shoppers."

23. "Biopreservatives need publicity and consumer education.

APPENDIX V: Results of Analyses of Parts A and C of Questionnaire[3]

Introduction

The University of Alberta recently conducted a survey to evaluate consumer opinions on the potential use of a new packaging technology for fresh meat. Two important components of this study were to assess the potential use of a biological preservative in meat packages and the importance of product origin. Biopreservatives are a new technology meant to allow fresh meat to be stored for long periods without any loss of quality.

Methodology

We evaluated the survey results from parts 'A' and 'C' of the survey on biopreservatives and product origin. Part 'A' of the questionnaire provides a series of statements to which respondents are to indicate their agreement or disagreement. Part 'C' seeks to gather specific information on income range, opinions on the continuing research on biopreservative, and other demographics including age group and family size. Mean responses from the surveys were tabled and graphed. Differences between groups are small and may be the result of sampling variability. Statistical testing of the differences was not conducted.

Discussion of Results

Response to Part 'A' Statements

Response to the statements by the various respondents in Part 'A' of the questionnaire are presented in Figures 7, 8, 9, 10 and 11 respectively for all respondents, Winnipeg respondents, Regina respondents, Victoria respondents and Edmonton respondents. The figures present percentages of respondents and their agreement or disagreement to the statements presented to them. Some of the responses are worth highlighting. For example, there are some issues raised in the statements which over 50% of respondents either strongly agreed or agreed.

On the issueof eating at least one home prepared meal a day, 80% of all respondents agreed indicating they ate at least one home prepared meal a day. For Winnipeg consumers, 77% agreed, 80% of Regina respondents agreed, 84% of Victoria respondents agreed and 79% of Edmonton respondents also agreed. However, when asked about preference for home prepared meals versus eating out, 72% of all respondents indicated they preferred meals prepared at home (Figure 7). In Winnipeg, Regina, Victoria and Edmonton, 71%, 78%, 72% and 67% of respondents respectively preferred home prepared meals to eating out. These responses indicate that though people eat outside the home, they still prefer eating at home and home prepared meals.

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[3] The assistance ofMarty Foster is gratefully acknowledged for doing this analysis.

Consumers also indicated that meat and potatoes are a basic major daily meal at home. The percentage of overall respondents who agreed to this is 56%. In Winnipeg, 59% of respondents agreed to the statement (figure 8), 62% agreed in Regina (figure 9), 52% agreed in Victoria (figure (10) and 53% agreed in Edmonton (figure 11). Though over 50% of respondents indicated potatoes and meat as a major meal at home, relatively less indicated they ate less meat due to dietary reasons. For all respondents, 49% indicated they ate less meat now than before, 42% of respondents in Winnipeg agreed to this statement, 49% of respondents in Regina also agreed, 50% of respondents in Victoria agreed and 51% of respondents in Edmonton also agreed. It is an indication that about 50% of consumers eat meat, i.e. beef, pork and chicken.

Another issue that consumers preferred was the speed and ease of meat preparation. For all respondents, 79% considered this as very important. In Winnipeg, 76% of respondents agreed this is important to them. For Regina, Victoria and Edmonton respondents, 84%, 74% and 81% respectively also agreed this is important to them.

Food safety is also seen as of great concern to consumers. When asked to indicate their agreement or disagreement to the statement that inorganic substances, preservatives, dyes and drug residues in food were of concern, 87% of all respondents agreed that this is of concern. For the individual cities, 87%, 85%,92%, and 85% of respondents in Winnipeg, Regina, Victoria and Edmonton respectively agreed this was of concern to them.

Regarding packaging meat for long storage periods, 56% of all respondents agreed this is a good concept. For Winnipeg respondents, 57% agreed this is good. Similarly, 53%, 50% and 67% respectively of respondents in Regina, Victoria and Edmonton agreed that packaging that allows meat to store for longer periods is good. Quality was also expressed as a concern with over 75% of all respondents agreeing that grocery shops offer good quality meat. Over 80% of respondents expressed that they prefer meat with all the outside fat trimmed. On price, beef was considered the most expensive among the three meat types of beef, pork and chicken.

Response to Part ‘A’ statements were also segmented by income group, age, family size, and opinion on the research on biopreservatives (Figures 12, 13, 14 and 15 respectively). The figures express the rankings each sub-group of a segment assigned to the statements. The rankings were of the order; strongly disagree = 0, disagree = 1, neither agree nor disagree = 3, agree = 4 and strongly agree = 5.

For a family size of 6 and above, issues that were ranked very high include speed and ease of meat preparation, presence of drug residue, dyes and other inorganic substances in food as well as outside fat trim. These issues had a score of over 4 indicating the importance of these issues to that group of family size. The next in ranking and, therefore important for a family size of 6 and above are eating at least one home prepared meal once a day, preference for home food to eating outside and the relatively high price of beef. These had a score of about 3.9 (figure 12). Similarly,

for a family size of 4 to 6, issues that were ranked high i.e. 4 and above, include the family eating at least one home prepared meal a day, preference for home prepared food compared to eating out, food safety and outside fat trim of meats. Though relatively lower, similar rankings for these issues were also given by the group of family size 3 or less.

The rankings are not very different when the issues are assessed by age group. For each of the age groups, the highest rank was given to food safety. Other issues which were ranked high include speed and ease of preparation of meats, outside fat trim, preference for home prepared meals compared to eating out and for that matter eating at least one home prepared meal a day (figure 13). Similar patterns in rankings can be found with the income groups (figure 14) and groupings of opinions on biopreservative research (figure 15).

These findings strongly suggest that consumers are very concerned about food safety, especially the presence of inorganic substances in food in the form of preservatives, dyes, additives etc. Consumers also prefer convenience in their cooking habits. They prefer meat that can be prepared in a relatively short time and with less work. It is also clear that many consumers prefer home-prepared meals to eating out.

Finally, we assessed at how often in a month meat was eaten in the household of each survey respondent. Winnipeg had the most respondents who frequently ate pork (figure 17) while Regina responded most frequently to beef consumption (figure 18). For Victoria, fish and seafood were consumed more frequently than in any other city (figure 19). Edmonton respondents (figure 20) seems to eat less meat overall. However, the definition of frequently was left to each individual respondent.

Conclusions

By comparing responses for each Canadian city that was surveyed we can look at the city trends and compare them to the overall average response. Winnipeg respondents, on average, agreed to most statements in the various segments. They generally thought that meat quality was very good and were more favorably inclined to new packaging techniques. Responses from Regina respondents were much the same as those from Winnipeg. except that Regina respondents were less favorably inclined to new packaging techniques. They were not as confident about beef and pork consistency. Although Victorian respondents ate at home they did not eat meat and potatoes as much as the average. However those who did were generally positive about meat quality and consistency. Finally, Edmontonians eat the least at home and prefer to eat out. They also potentially eat less meat and potatoes than on average. These results are only indicative since the questions did not specify any specific quantity.

We also looked at segmenting Part A responses by demographics other than location based upon specific responses in part C. Comparing income range to the part A statements showed no unexpected results. Looking at the age demographic we find that older people are more satisfied

with the quality of meat. Finally, the size of family demographic shows us that the largest families are also the most demanding, as well, in regards to consistency in larger portions to feed larger families. Perhaps because larger families are not the norm anymore, they may be looking for better quality in larger sizes which may hard to come by.

There are many positive results in regards to peoples' perceptions of meat quality. However, about 30% of respondents agreed or strongly agreed that buying pork or beef was still a game of chance. The majority of respondents are quite concerned about food safety. These and other concerns need to be targeted by the industry.

Figure 7:

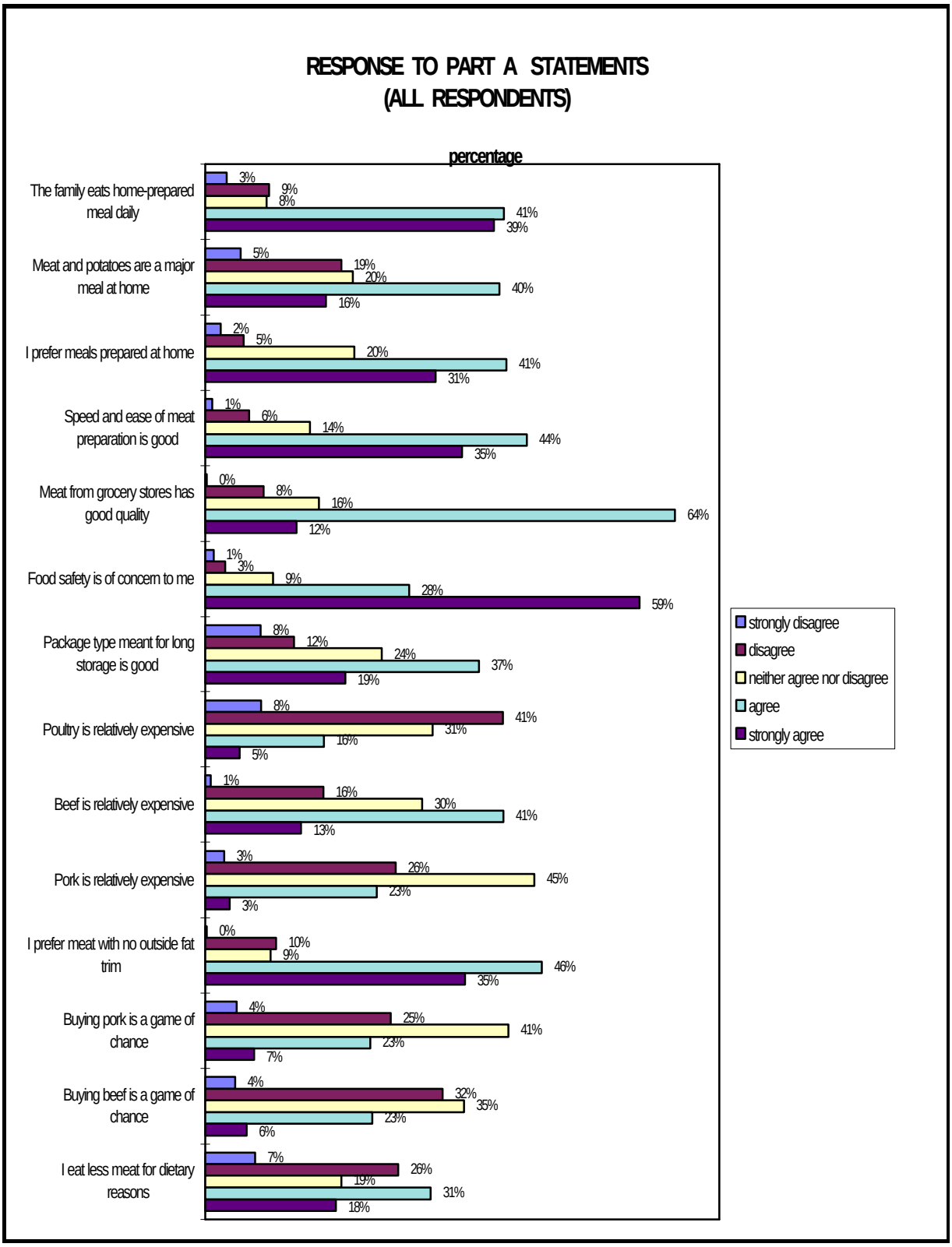

RESPONSE TO PART A STATEMENTS
(ALL RESPONDENTS)
percentage
The family eats home-prepared meal daily
3%
9%
8%
41%
39%
Meat and potatoes are a major meal at home
5%
19%
20%
40%
16%
I prefer meals prepared at home
2%
5%
20%
41%
31%
Speed and ease of meat preparation is good
1%
6%
14%
44%
35%
Meat from grocery stores has good quality
0%
8%
16%
64%
12%
Food safety is of concern to me
1%
3%
9%
28%
59%
Package type meant for long storage is good
8%
12%
24%
37%
19%
Poultry is relatively expensive
8%
41%
31%
16%
5%
Beef is relatively expensive
1%
16%
30%
41%
13%
Pork is relatively expensive
3%
26%
45%
23%
3%
I prefer meat with no outside fat trim
0%
10%
9%
46%
35%
Buying pork is a game of chance
4%
25%
41%
23%
7%
Buying beef is a game of chance
4%
32%
35%
23%
6%
I eat less meat for dietary reasons
7%
26%
19%
31%
18%
strongly disagree
disagree
neither agree nor disagree
agree
strongly agree

Figure 8:

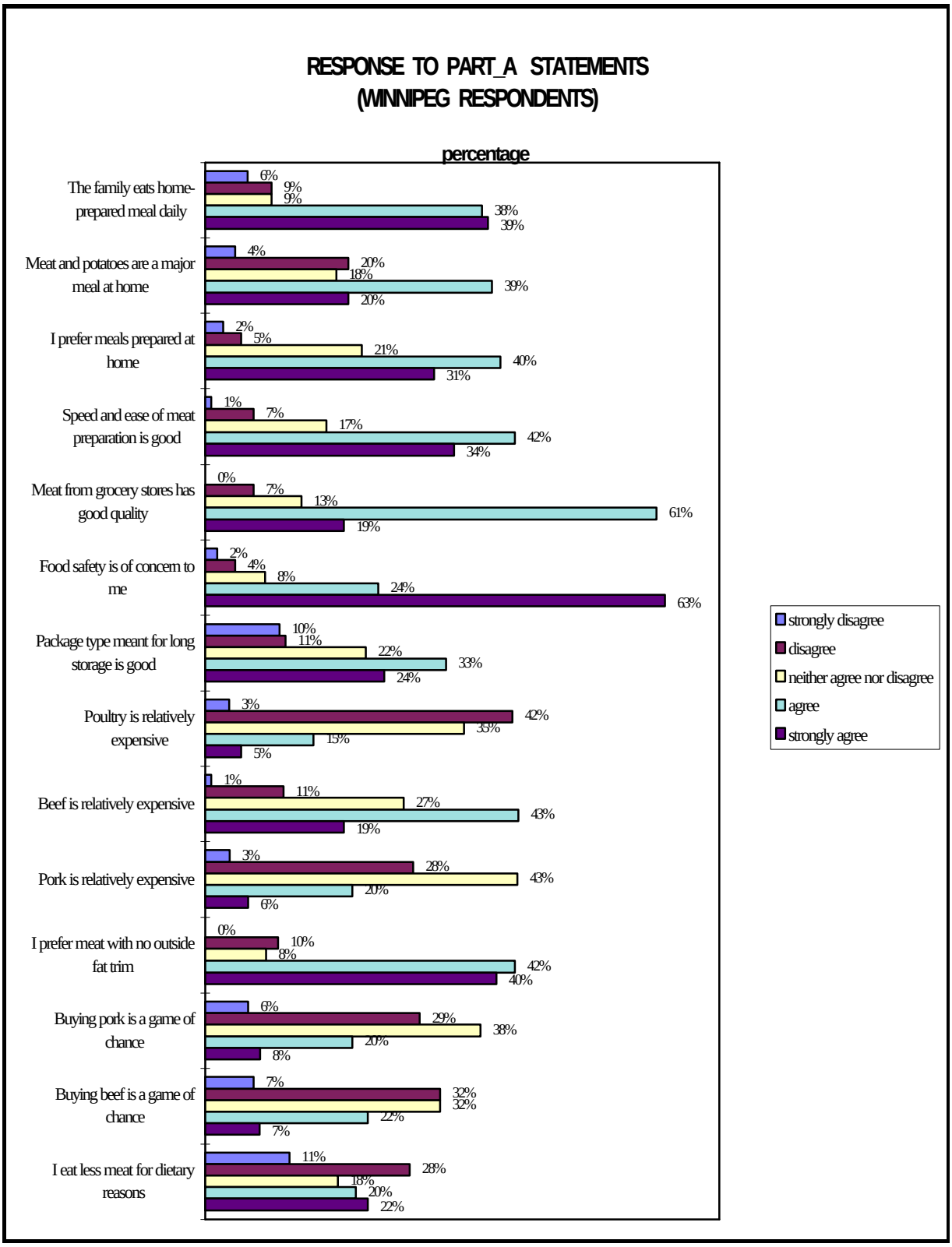

RESPONSE TO PART_A STATEMENTS
(WINNIPEG RESPONDENTS)
percentage
The family eats home-prepared meal daily
6%
9%
9%
38%
39%
Meat and potatoes are a major meal at home
4%
20%
18%
39%
20%
I prefer meals prepared at home
2%
5%
21%
40%
31%
Speed and ease of meat preparation is good
1%
7%
17%
42%
34%
Meat from grocery stores has good quality
0%
7%
13%
61%
19%
Food safety is of concern to me
2%
4%
8%
24%
63%
Package type meant for long storage is good
10%
11%
22%
33%
24%
Poultry is relatively expensive
3%
42%
35%
15%
5%
Beef is relatively expensive
1%
11%
27%
43%
19%
Pork is relatively expensive
3%
28%
43%
20%
6%
I prefer meat with no outside fat trim
0%
10%
8%
42%
40%
Buying pork is a game of chance
6%
29%
38%
20%
8%
Buying beef is a game of chance
7%
32%
32%
22%
7%
I eat less meat for dietary reasons
11%
28%
18%
20%
22%
strongly disagree
disagree
neither agree nor disagree
agree
strongly agree

Figure 9:

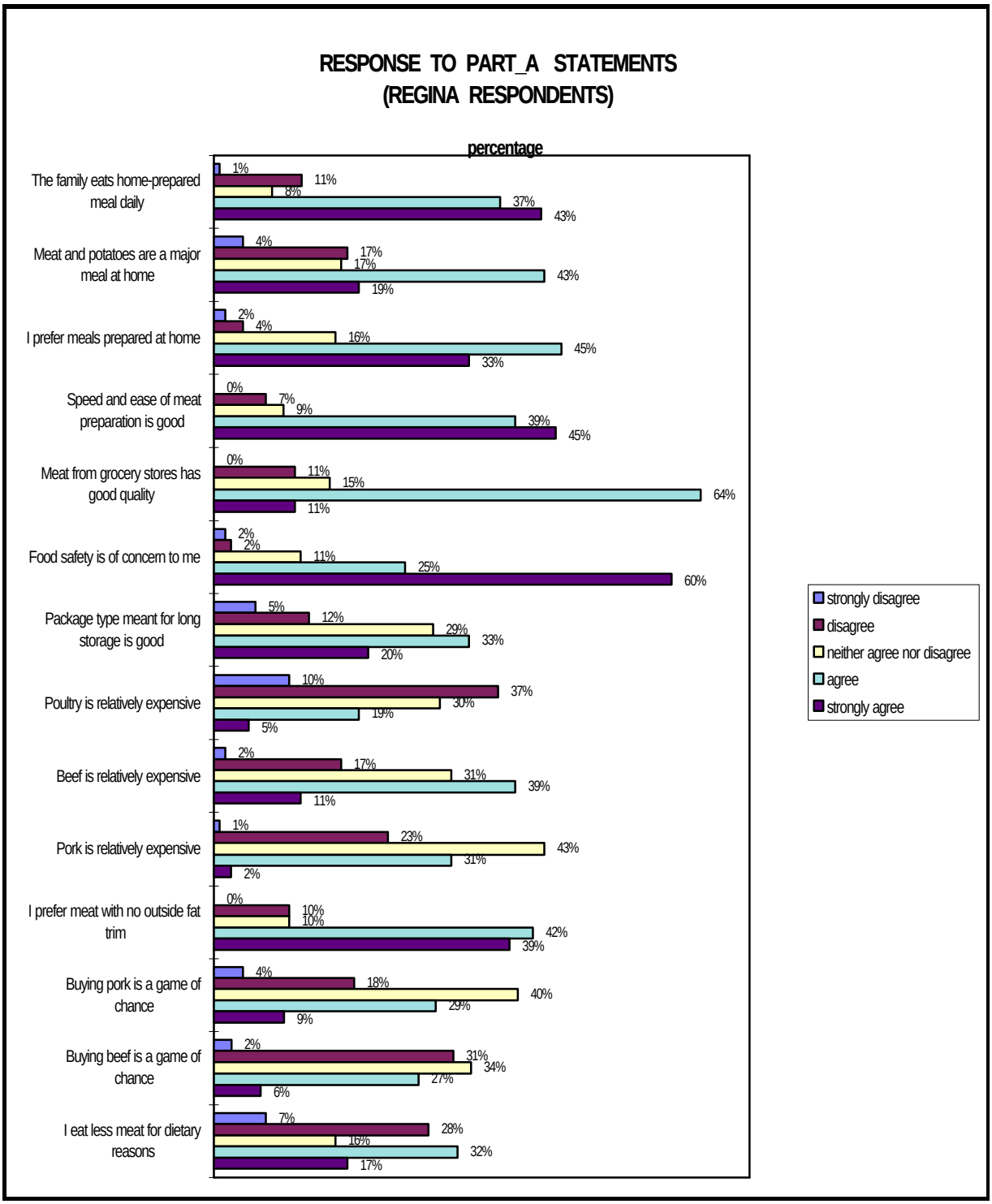

RESPONSE TO PART_A STATEMENTS
(REGINA RESPONDENTS)
percentage
The family eats home-prepared meal daily
1%
11%
8%
37%
43%
Meat and potatoes are a major meal at home
4%
17%
17%
43%
19%
I prefer meals prepared at home
2%
4%
16%
45%
33%
Speed and ease of meat preparation is good
0%
7%
9%
39%
45%
Meat from grocery stores has good quality
0%
11%
15%
64%
11%
Food safety is of concern to me
2%
2%
11%
25%
60%
Package type meant for long storage is good
5%
12%
29%
33%
20%
Poultry is relatively expensive
10%
37%
30%
19%
5%
Beef is relatively expensive
2%
17%
31%
39%
11%
Pork is relatively expensive
1%
23%
43%
31%
2%
I prefer meat with no outside fat trim
0%
10%
10%
42%
39%
Buying pork is a game of chance
4%
18%
40%
29%
9%
Buying beef is a game of chance
2%
31%
34%
27%
6%
I eat less meat for dietary reasons
7%
28%
16%
32%
17%
strongly disagree
disagree
neither agree nor disagree
agree
strongly agree

Figure 10:

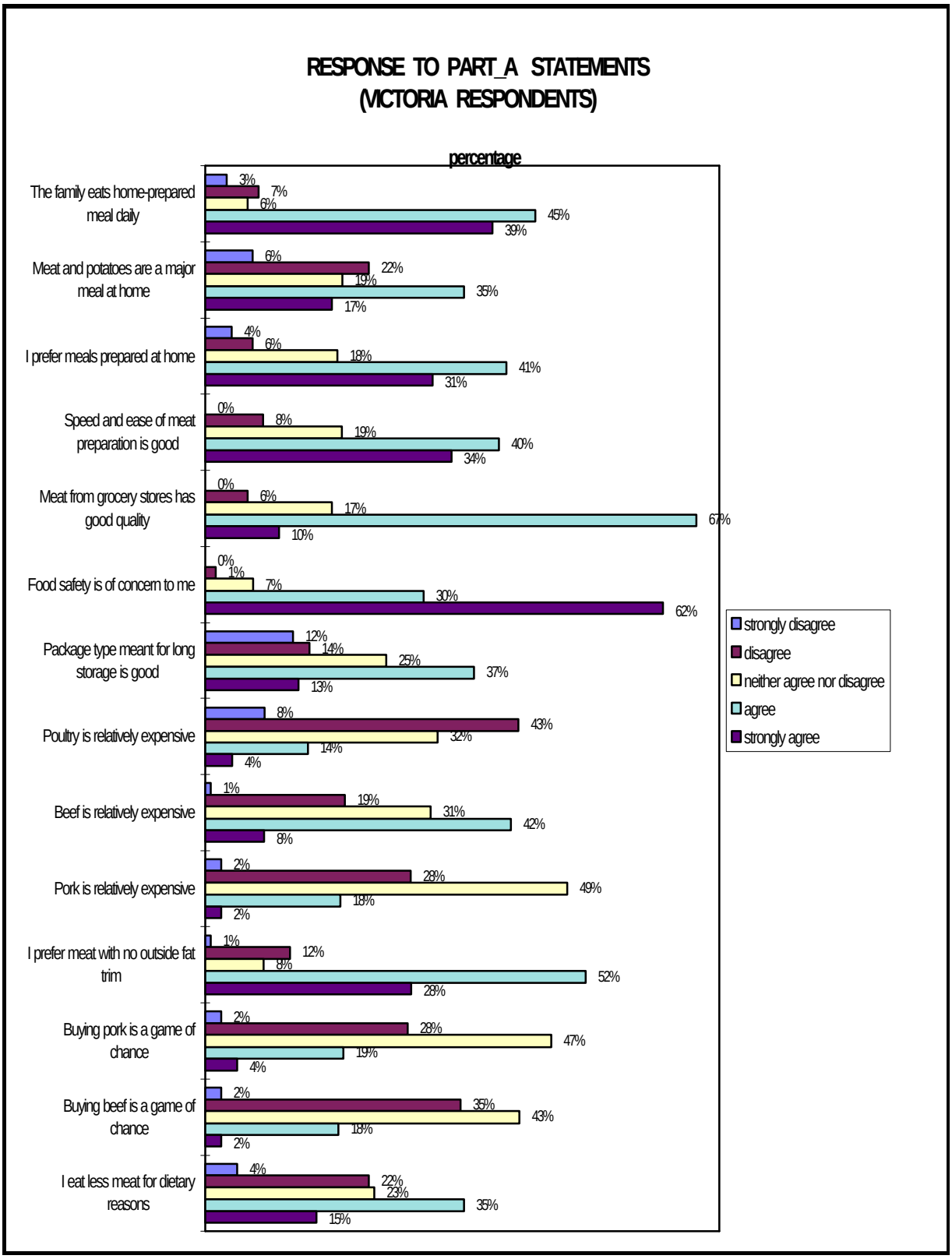

RESPONSE TO PART_A STATEMENTS
(VICTORIA RESPONDENTS)
percentage
The family eats home-prepared meal daily
3%
7%
6%
45%
39%
Meat and potatoes are a major meal at home
6%
22%
19%
35%
17%
I prefer meals prepared at home
4%
6%
18%
41%
31%
Speed and ease of meat preparation is good
0%
8%
19%
40%
34%
Meat from grocery stores has good quality
0%
6%
17%
67%
10%
Food safety is of concern to me
0%
1%
7%
30%
62%
Package type meant for long storage is good
12%
14%
25%
37%
13%
Poultry is relatively expensive
8%
43%
32%
14%
4%
Beef is relatively expensive
1%
19%
31%
42%
8%
Pork is relatively expensive
2%
28%
49%
18%
2%
I prefer meat with no outside fat trim
1%
12%
8%
52%
28%
Buying pork is a game of chance
2%
28%
47%
19%
4%
Buying beef is a game of chance
2%
35%
43%
18%
2%
I eat less meat for dietary reasons
4%
22%
23%
35%
15%
strongly disagree
disagree
neither agree nor disagree
agree
strongly agree

Figure 11:

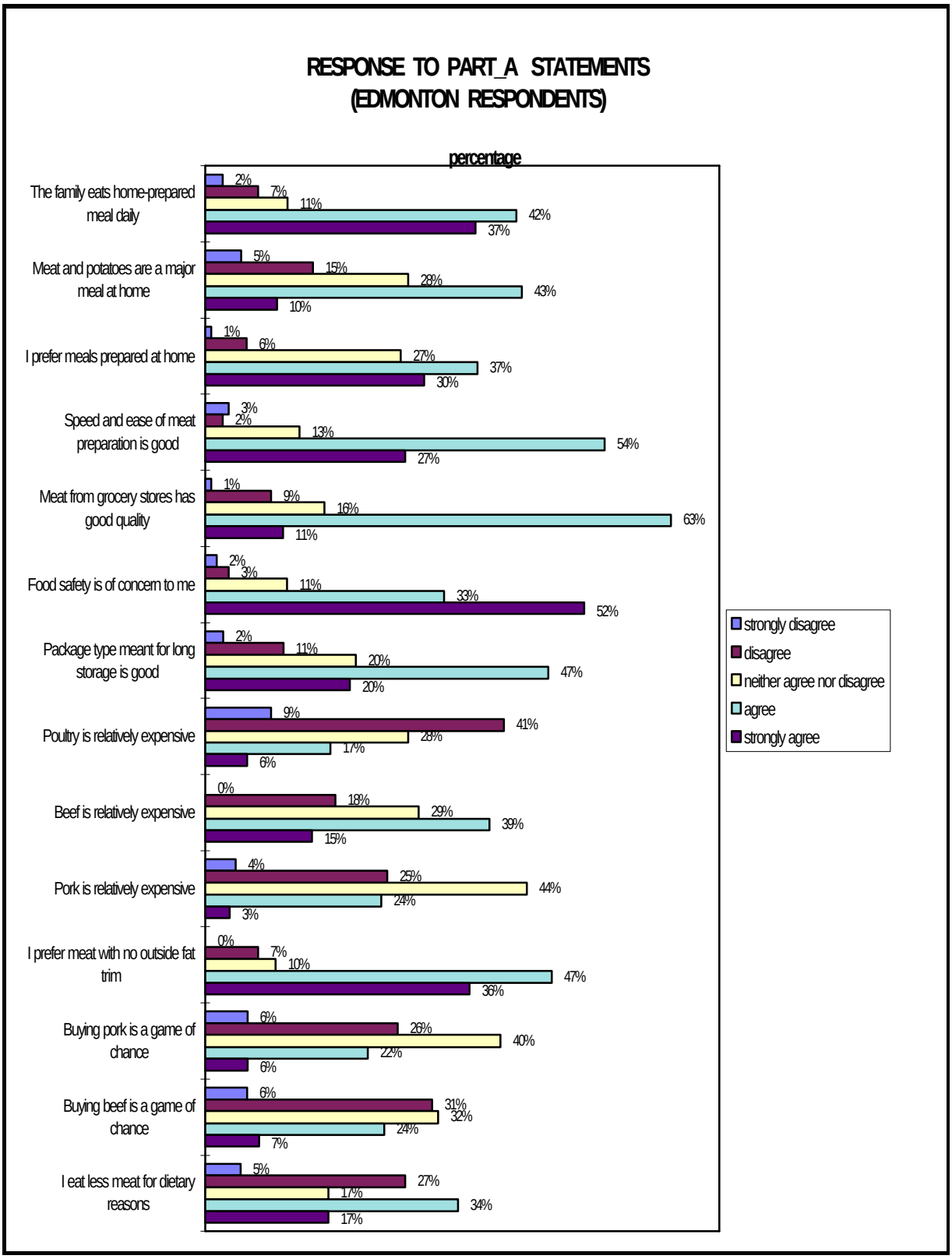

RESPONSE TO PART_A STATEMENTS
(EDMONTON RESPONDENTS)
percentage
The family eats home-prepared meal daily
2%
7%
11%
42%
37%
Meat and potatoes are a major meal at home
5%
15%
28%
43%
10%
I prefer meals prepared at home
1%
6%
27%
37%
30%
Speed and ease of meat preparation is good
3%
2%
13%
54%
27%
Meat from grocery stores has good quality
1%
9%
16%
63%
11%
Food safety is of concern to me
2%
3%
11%
33%
52%
Package type meant for long storage is good
2%
11%
20%
47%
20%
Poultry is relatively expensive
9%
41%
28%
17%
6%
Beef is relatively expensive
0%
18%
29%
39%
15%
Pork is relatively expensive
4%
25%
44%
24%
3%
I prefer meat with no outside fat trim
0%
7%
10%
47%
36%
Buying pork is a game of chance
6%
26%
40%
22%
6%
Buying beef is a game of chance
6%
31%
32%
24%
7%
I eat less meat for dietary reasons
5%
27%
17%
34%
17%
strongly disagree
disagree
neither agree nor disagree
agree
strongly agree

Figure 12:

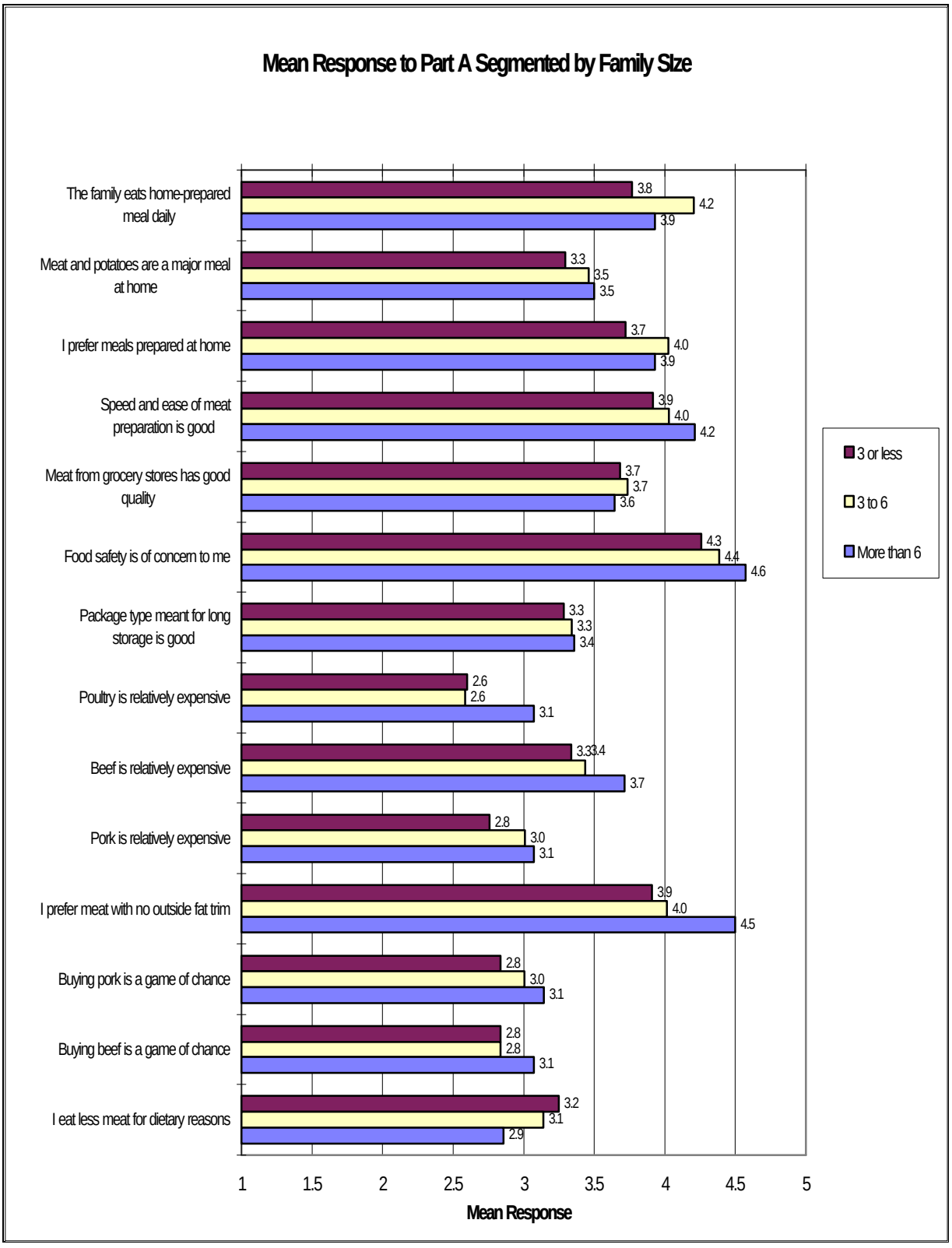

Mean Response to Part A Segmented by Family Size
The family eats home-prepared meal daily
3.8
4.2
3.9
Meat and potatoes are a major meal at home
3.3
3.5
3.5
I prefer meals prepared at home
3.7
4.0
3.9
Speed and ease of meat preparation is good
3.9
4.0
4.2
Meat from grocery stores has good quality
3.7
3.7
3.6
Food safety is of concern to me
4.3
4.4
4.6
Package type meant for long storage is good
3.3
3.3
3.4
Poultry is relatively expensive
2.6
2.6
3.1
Beef is relatively expensive
3.3
3.4
3.7
Pork is relatively expensive
2.8
3.0
3.1
I prefer meat with no outside fat trim
3.9
4.0
4.5
Buying pork is a game of chance
2.8
3.0
3.1
Buying beef is a game of chance
2.8
2.8
3.1
I eat less meat for dietary reasons
3.2
3.1
2.9
3 or less
3 to 6
More than 6
1
1.5
2
2.5
3
3.5
4
4.5
5
Mean Response

Figure 13:

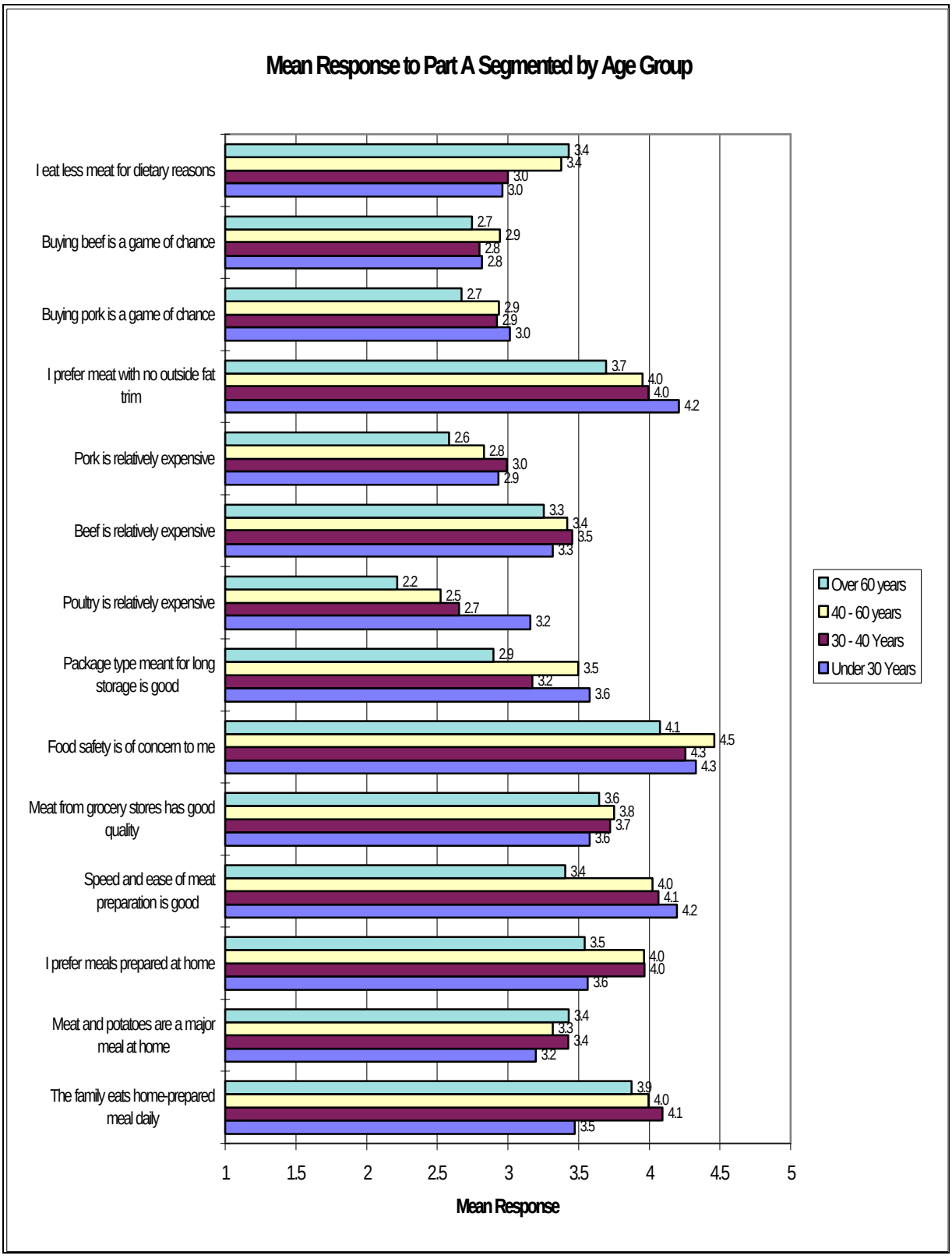

Mean Response to Part A Segmented by Age Group
I eat less meat for dietary reasons
3.4
3.4
3.0
3.0
Buying beef is a game of chance
2.7
2.9
2.8
2.8
Buying pork is a game of chance
2.7
2.9
2.9
3.0
I prefer meat with no outside fat trim
3.7
4.0
4.0
4.2
Pork is relatively expensive
2.6
2.8
3.0
2.9
Beef is relatively expensive
3.3
3.4
3.5
3.3
Poultry is relatively expensive
2.2
2.5
2.7
3.2
Package type meant for long storage is good
2.9
3.5
3.2
3.6
Food safety is of concern to me
4.1
4.5
4.3
4.3
Meat from grocery stores has good quality
3.6
3.8
3.7
3.6
Speed and ease of meat preparation is good
3.4
4.0
4.1
4.2
I prefer meals prepared at home
3.5
4.0
4.0
3.6
Meat and potatoes are a major meal at home
3.4
3.3
3.4
3.2
The family eats home-prepared meal daily
3.9
4.0
4.1
3.5
1
1.5
2
2.5
3
3.5
4
4.5
5
Mean Response
Over 60 years
40 - 60 years
30 - 40 Years
Under 30 Years

Figure 14:

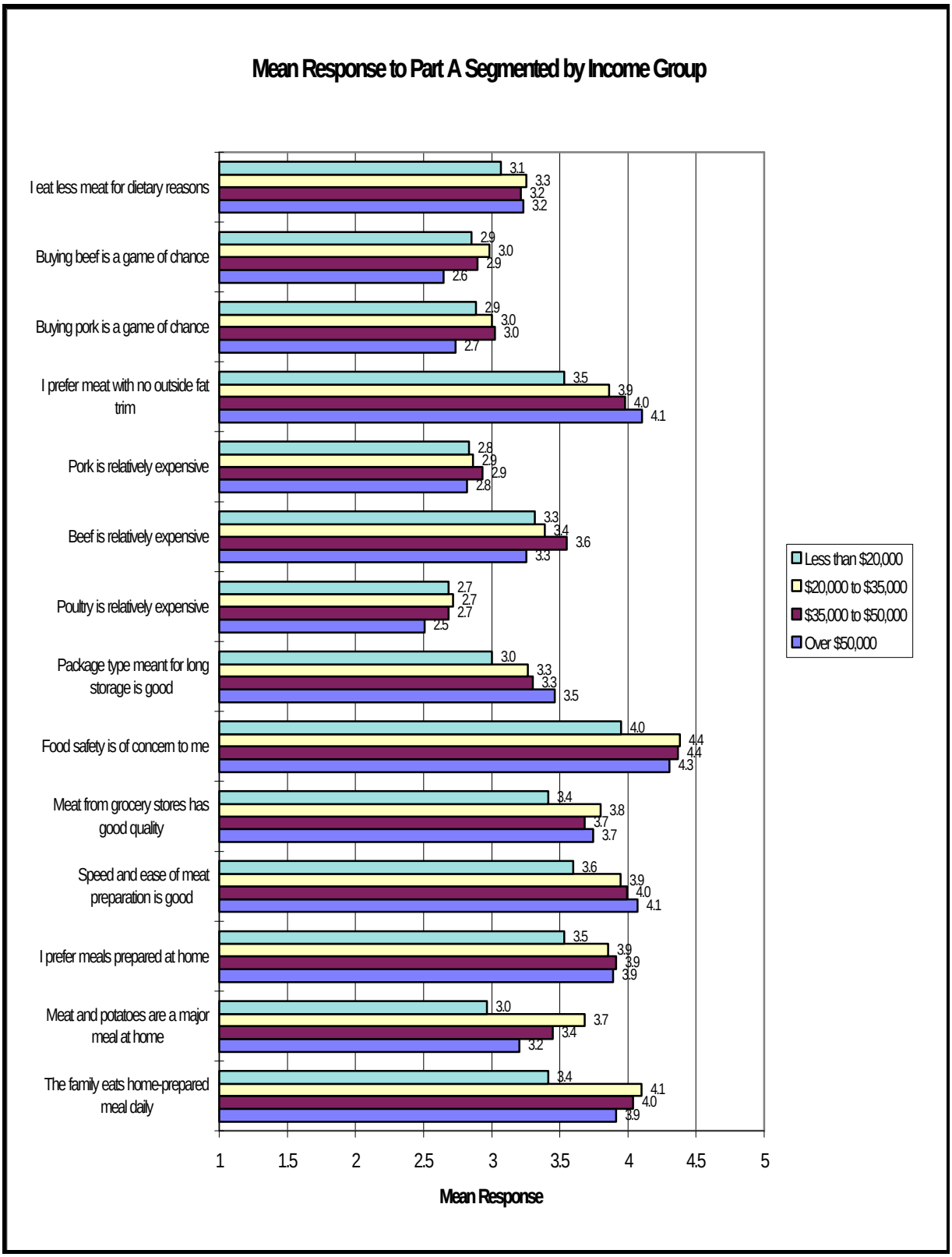

Mean Response to Part A Segmented by Income Group
I eat less meat for dietary reasons
3.1
3.3
3.2
3.2
Buying beef is a game of chance
2.9
3.0
2.9
2.6
Buying pork is a game of chance
2.9
3.0
3.0
2.7
I prefer meat with no outside fat trim
3.5
3.9
4.0
4.1
Pork is relatively expensive
2.8
2.9
2.9
2.8
Beef is relatively expensive
3.3
3.4
3.6
3.3
Poultry is relatively expensive
2.7
2.7
2.7
2.5
Package type meant for long storage is good
3.0
3.3
3.3
3.5
Food safety is of concern to me
4.0
4.4
4.4
4.3
Meat from grocery stores has good quality
3.4
3.8
3.7
3.7
Speed and ease of meat preparation is good
3.6
3.9
4.0
4.1
I prefer meals prepared at home
3.5
3.9
3.9
3.9
Meat and potatoes are a major meal at home
3.0
3.7
3.4
3.2
The family eats home-prepared meal daily
3.4
4.1
4.0
3.9
1
1.5
2
2.5
3
3.5
4
4.5
5
Mean Response
Less than $20,000
$20,000 to $35,000
$35,000 to $50,000
Over $50,000

Figure 15:

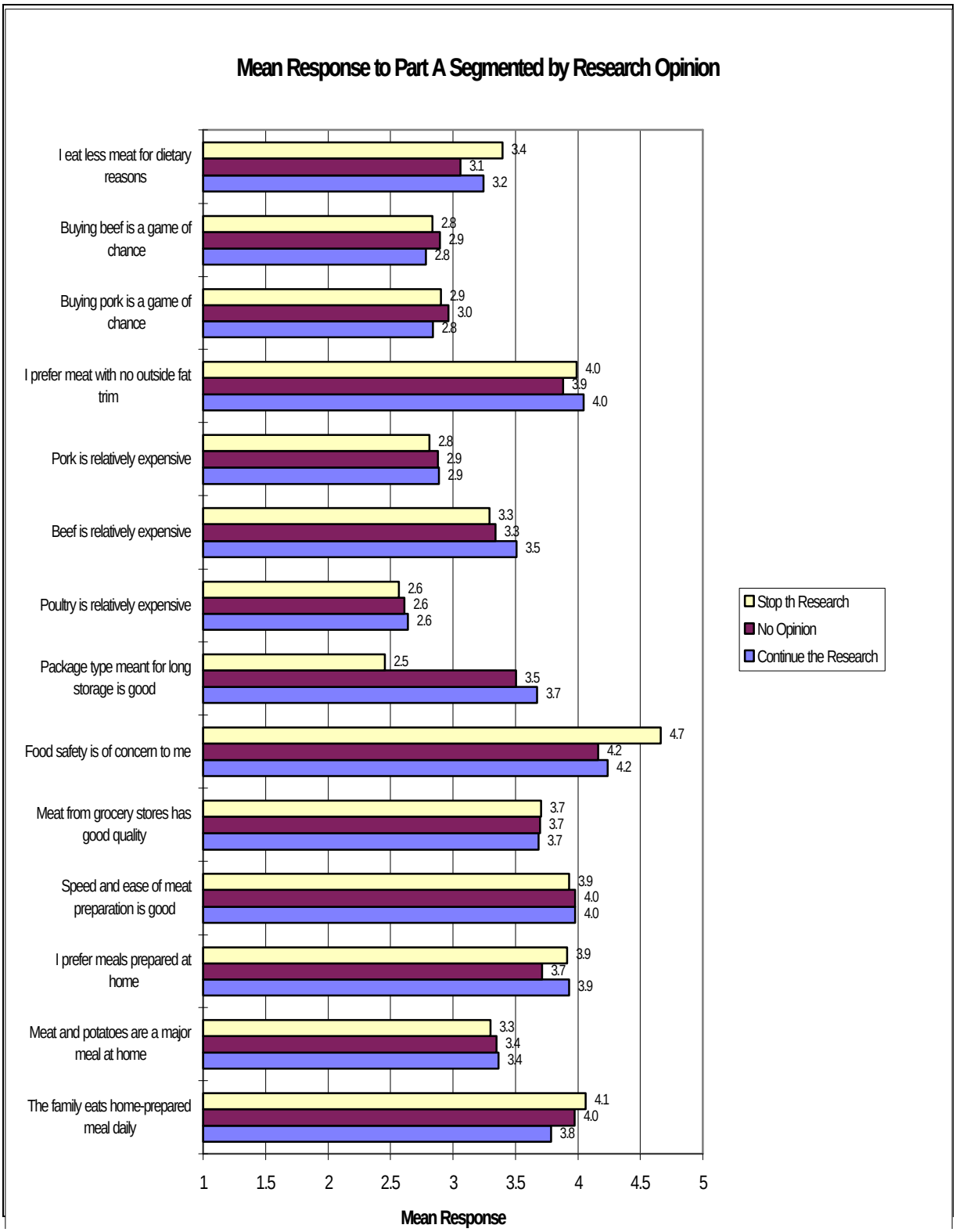

Mean Response to Part A Segmented by Research Opinion
I eat less meat for dietary reasons
3.4
3.1
3.2
Buying beef is a game of chance
2.8
2.9
2.8
Buying pork is a game of chance
2.9
3.0
2.8
I prefer meat with no outside fat trim
4.0
3.9
4.0
Pork is relatively expensive
2.8
2.9
2.9
Beef is relatively expensive
3.3
3.3
3.5
Poultry is relatively expensive
2.6
2.6
2.6
Package type meant for long storage is good
2.5
3.5
3.7
Food safety is of concern to me
4.7
4.2
4.2
Meat from grocery stores has good quality
3.7
3.7
3.7
Speed and ease of meat preparation is good
3.9
4.0
4.0
I prefer meals prepared at home
3.9
3.7
3.9
Meat and potatoes are a major meal at home
3.3
3.4
3.4
The family eats home-prepared meal daily
4.1
4.0
3.8
1
1.5
2
2.5
3
3.5
4
4.5
5
Mean Response
Stop th Research
No Opinion
Continue the Research

Figure 16:

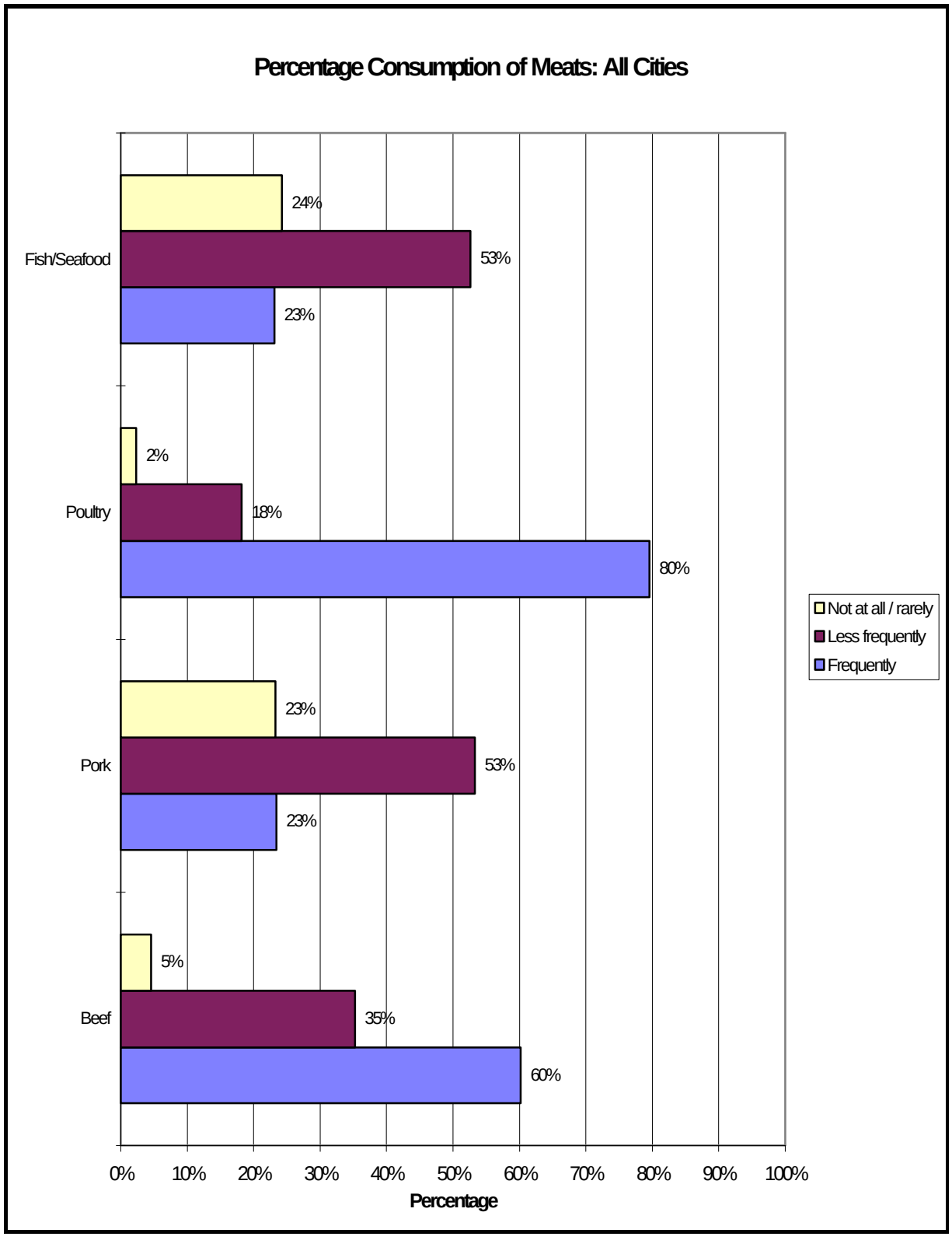

Percentage Consumption of Meats: All Cities
Fish/Seafood
24%
53%
23%
Poultry
2%
18%
80%
Pork
23%
53%
23%
Beef
5%
35%
60%
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percentage
Not at all / rarely
Less frequently
Frequently

Figure 17:

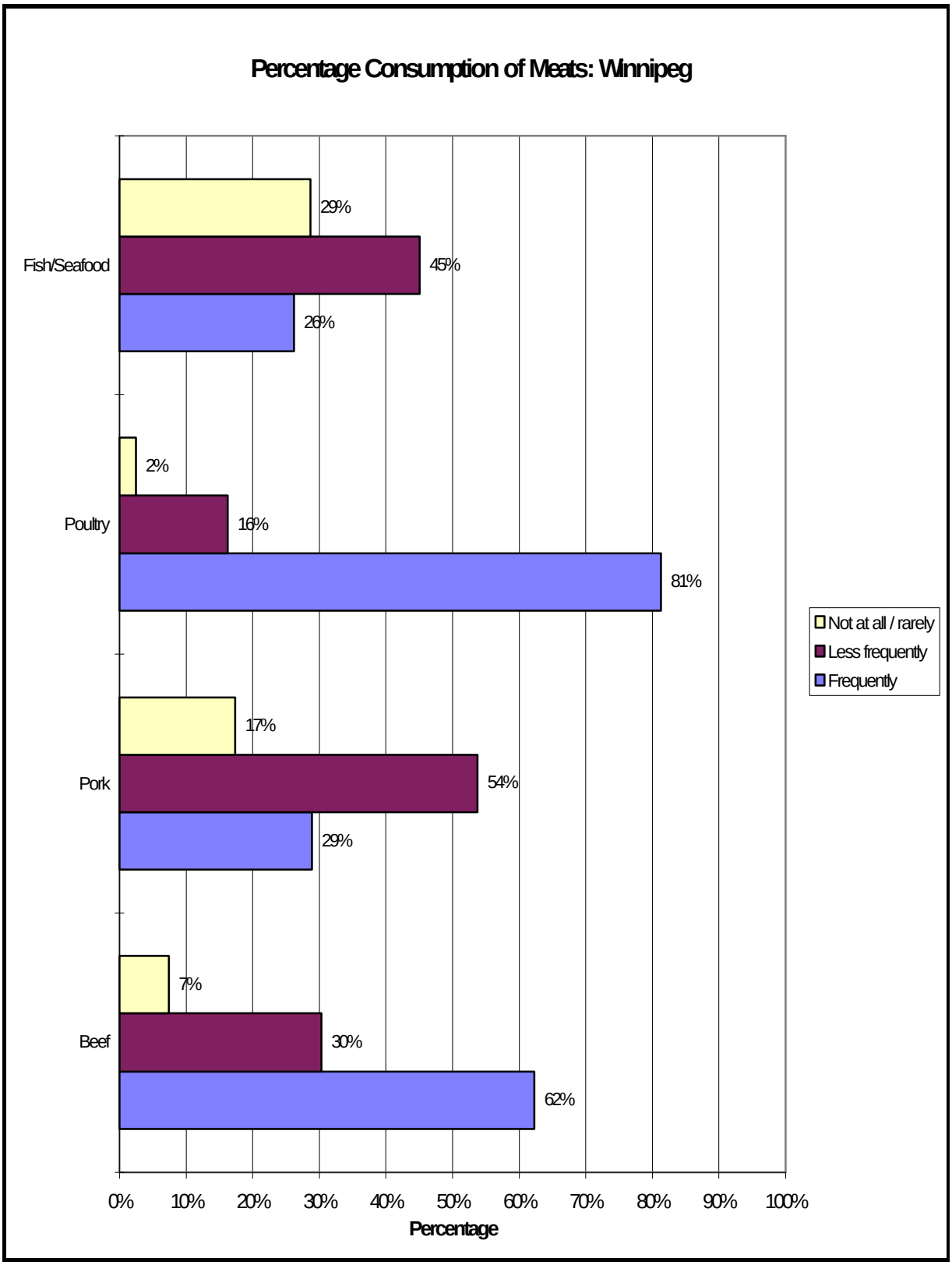

Percentage Consumption of Meats: Winnipeg
Fish/Seafood
29%
45%
26%
Poultry
2%
16%
81%
Pork
17%
54%
29%
Beef
7%
30%
62%
Not at all / rarely
Less frequently
Frequently
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percentage

Figure 18:

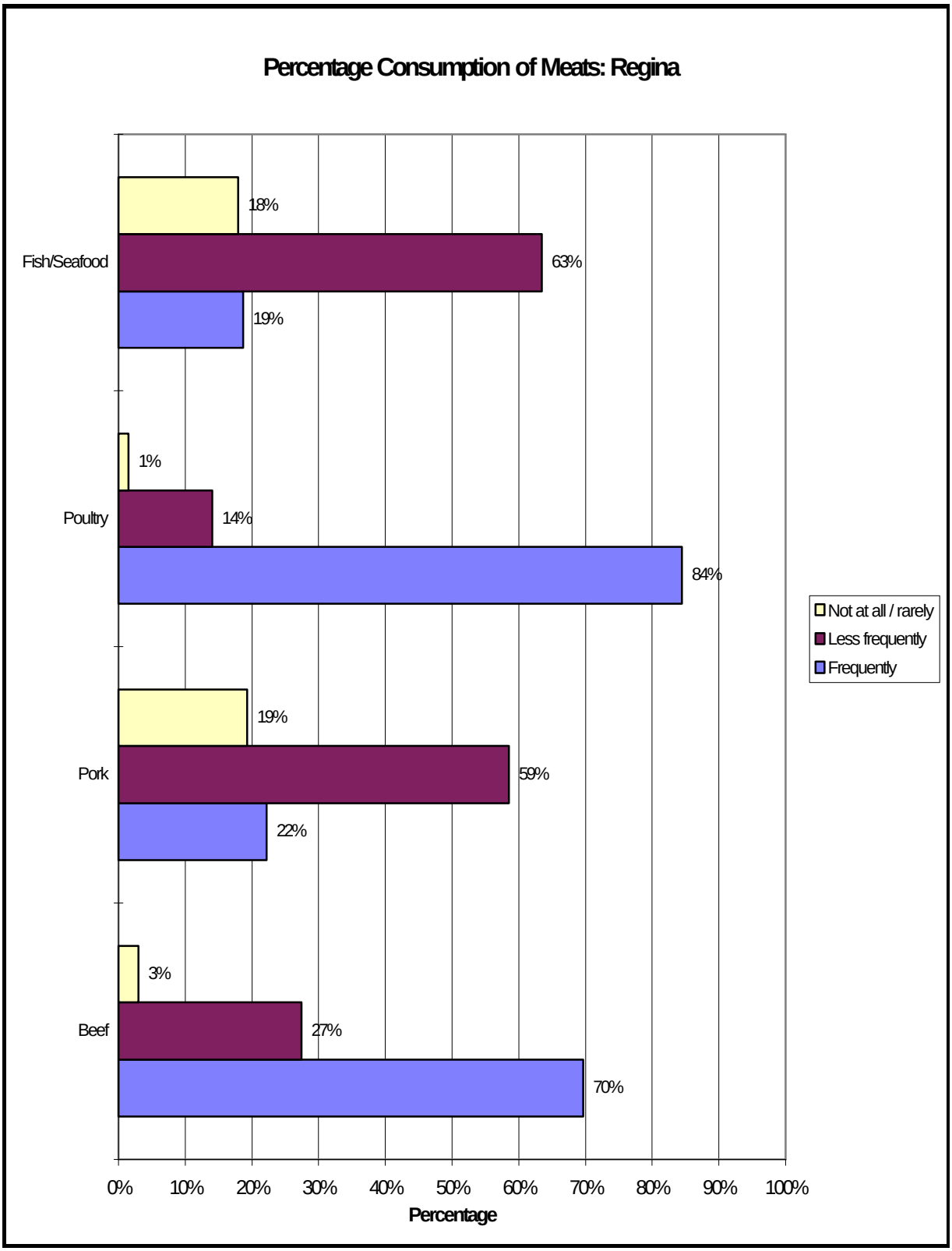

Percentage Consumption of Meats: Regina
Fish/Seafood
18%
63%
19%
Poultry
1%
14%
84%
Pork
19%
59%
22%
Beef
3%
27%
70%
Not at all / rarely
Less frequently
Frequently
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percentage

Figure 19:

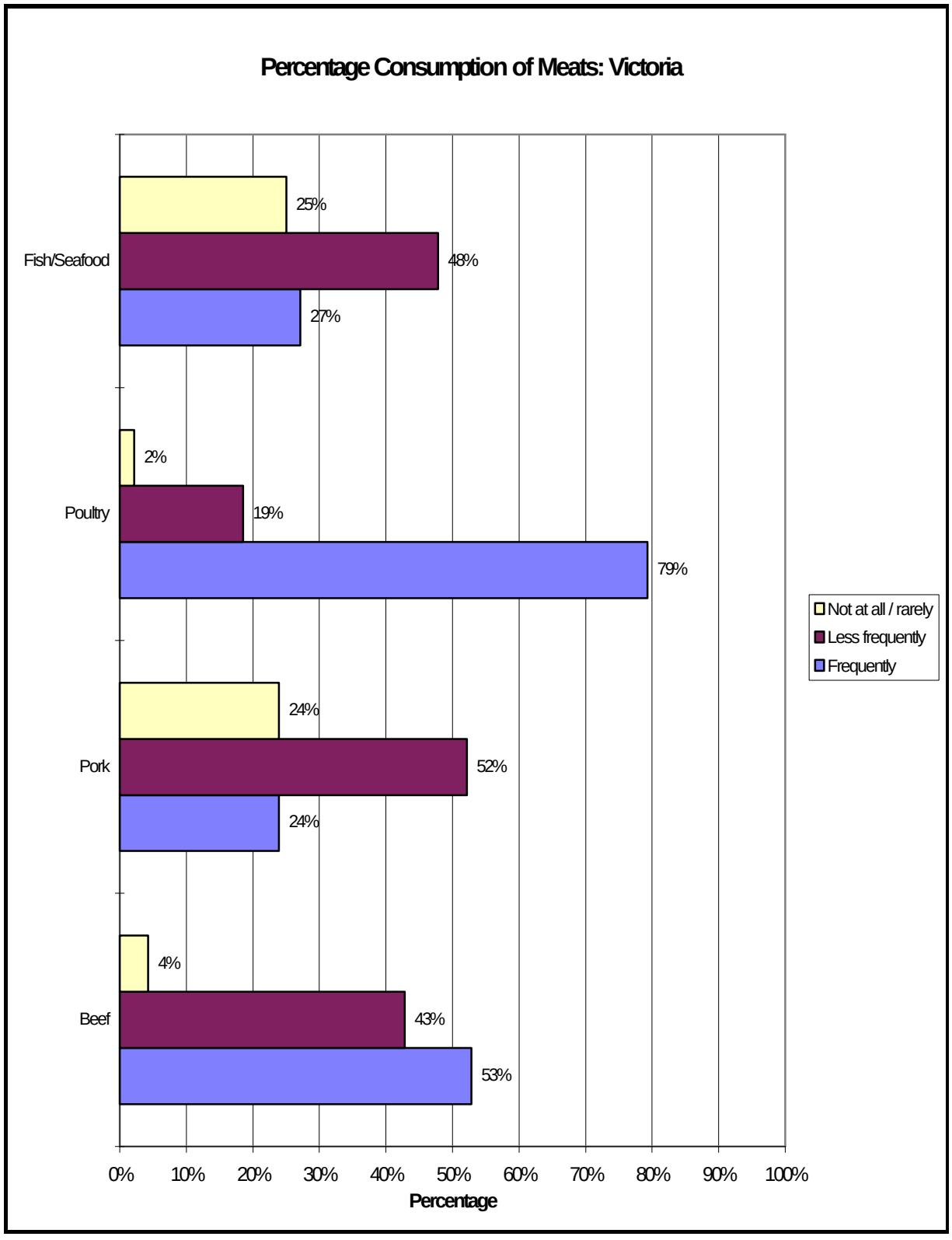
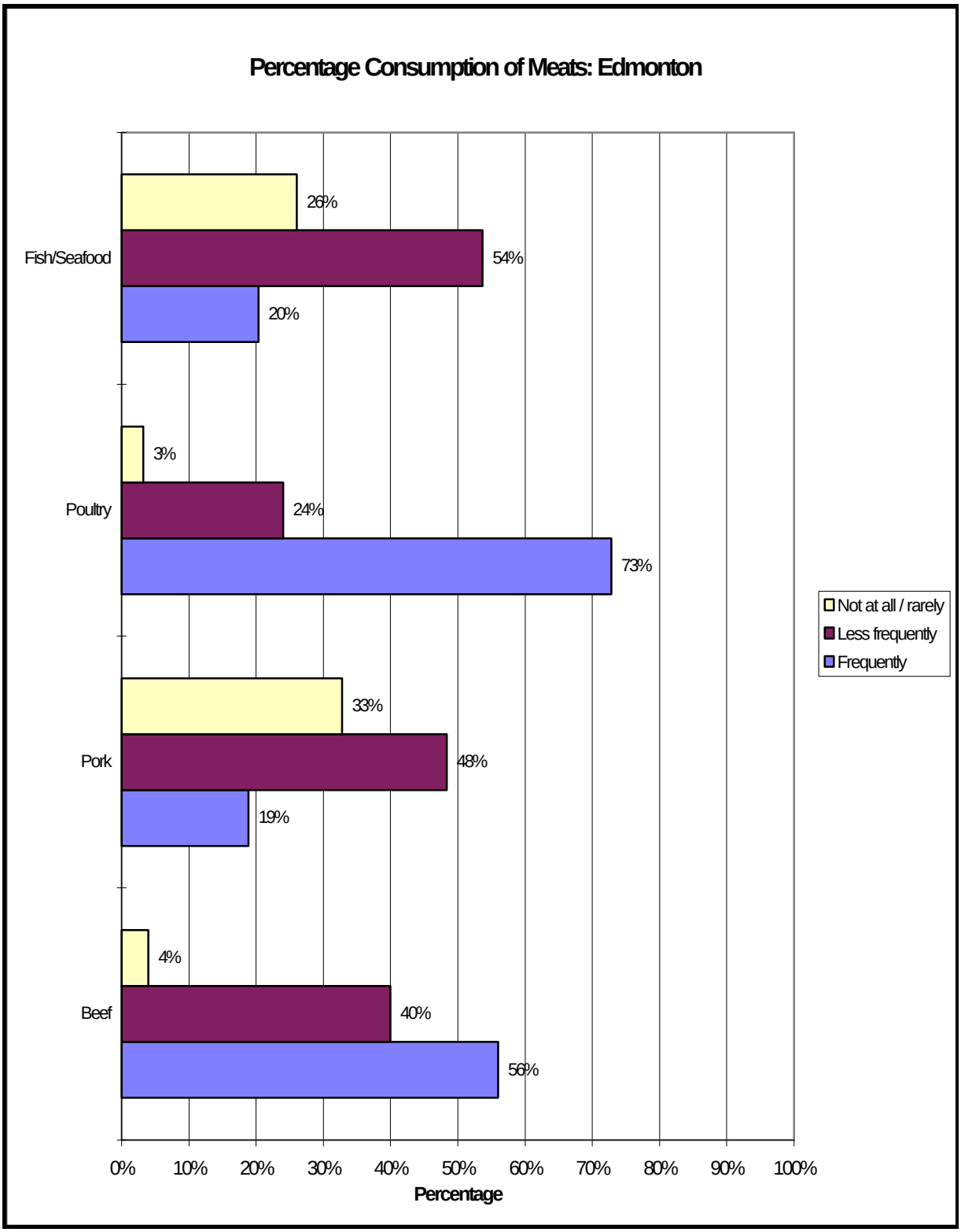

Percentage Consumption of Meats: Victoria
Fish/Seafood
25%
48%
27%
Poultry
2%
19%
79%
Pork
24%
52%
24%
Beef
4%
43%
53%
Not at all / rarely
Less frequently
Frequently
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percentage

Figure 20:


Percentage Consumption of Meats: Edmonton
Fish/Seafood
26%
54%
20%
Poultry
3%
24%
73%
Pork
33%
48%
19%
Beef
4%
40%
56%
Not at all / rarely
Less frequently
Frequently
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percentage