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Introduction

The safety of food is a continuing concern for consumers. A Consumer's Association of Canada survey found that 25% of consumers "worry a lot" about food safety. When asked about specific food safety issues, 42% indicated pesticides as a major source of concern. Pollution, preservatives and hormones were indicated as concerns by 36%, 25% and 21% respectively (Consumer's Association of Canada, 1990). A more recent survey found that approximately 30% of Canadians considered "pesticides in food" and "food additives" as high health risks (Government of Canada, 1993)Most recently a National Angus Reid poll conducted in May 1995 among a random representative group of 1500 Canadians found that 41% had concerns about food safety that had "increased a great deal" over the past few years, while for 21% of respondents, food safety concerns had increased slightly. An increasing level of concern was seen in all provinces. This was particularly evident amongst women (77%). Canadians with post-secondary (65%) and University education (67%) and those earning more than $30,000 (66%) were more likely to indicate an increasing concern with food safety. A 1994 survey of Albertans, (Jardine, et al., 1995), found that approximately 70% of the respondents rated pesticides as a high or moderate health risk.

Consumers generally cannot choose their level of exposure to pesticide and other chemical residues in food. Consumers depend on regulatory agencies to ensure that the food supply is safe. The level of food safety mandated by regulatory agencies can be regarded as a public good. Thus, for purposes of public policy it is necessary to determine the level of food safety that consumers desire. Aggregate food consumption data normally do not give an indication of the demand for food safety. Further, increased food safety can be expected to come with a cost, either in the form of lower quality food (eg. increased insect damage) or higher prices for food. That is, the production techniques used in place of pesticides and hormones may increase the cost of food. What are

consumers willing to pay for a higher level of food safety? Will they trade lower quality or higher prices for lower pesticide residues?

Contingent valuation (CV) methods can be used to determine the demand for food safety. Contingent valuation methods involve presenting a representative sample of consumers with an array of possible products or programs and asking them to determine the maximum amount they would be willing to pay for each product or program. This approach has been used to assess the demand for differing levels of pesticide residue on apples (Van Raavensway and Hoehn, 1991).Horowitz and Carson (1991) used CV to determine the demand for hypothetical food safety programs. In a later study Horowitz (1994) found that consumers consistently prefer a program to reduce pesticides to a program to reduce automobile exhaust, even when the cost and number of lives saved is identical for both programs.

In this study residents of Alberta were surveyed to determine their willingness to pay for the reduced use of pesticides or growth hormones in food production. Attitudes towards food-borne health risks were also surveyed. Multinomial logit analysis is used to analyze the effect of demographic characteristics on the probability of respondents choosing to restrict pesticide or hormone use in food production. The effect of increasing cost on these choice probabilities is also examined.

Theoretical Approach

Consumer theory assumes that consumers are rational, in the sense that they allocate their resources in the form of their available budget, among a variety of goods and services in a way that maximizes their utility relative to their preferences for these goods and services. A refinement of this framework of consumer theory is given by Lancaster (1966) in which it is pointed out that consumers typically purchase attributes which are embodied in goods rather than purchasing goods

for their own sake. An example would be the desire to obtain a healthy diet, which is reflected in the purchase of foods that contain relatively low fat levels, and other nutritive attributes.

Discrete choice theory follows the major concepts of consumer theory but allows for the consumption of discrete quantities of goods and services in a manner that allows consumption of one or more goods to be zero. Consider a set of restaurants at a particular point of time. Trips to restaurants are mutually exclusive because one cannot visit two restaurants simultaneously. Thus, in any one time period a consumer will choose only one restaurant from the set of all restaurants. Individual n chooses restaurant i over restaurant j only if the utility of i exceeds the utility of j, for individual *n*. That is, i is chosen over j if

$$U_{in} > U_{jn} \qquad (1)$$

The utility of i and j are postulated to be functions of their attributes and the personal characteristics of individual *n*. Discrete choice theory is useful in examining food safety issues. Consumers cannot directly buy units of food safety. They can choose to avoid foods which they perceive to be risky. As taxpayers and voters they can also provide support for or choose programs to increase the level of food safety. These choices lend themselves to analysis in a discrete choice framework. Programs to increase the level of food safety may increase costs in food production. Contingent valuation methods can be used to determine the willingness of consumers to pay for programs to increase food safety.

Discrete choice models can be formulated in terms of deterministic and random utility comparatively. In such "random utility" models the probability of an individual choosing a particular alternative is calculated as a function of both the attributes of the alternative and of the characteristics of that individual. It is assumed that the researcher knows some or all of the attributes of an alternative and can measure the individual's characteristics. The researcher cannot, however, know all of the preferences and characteristics of an individual. In addition, there may be

unknown or unobserved attributes of an alternative that enter into the individual's utility function. Thus, there is both a deterministic component (attributes and characteristics known by the researcher) and a random component (unknown attributes and characteristics) of a random utility model. The overall utility of an alternative, i, can be expressed as the sum of the deterministic and random components (Train, 1986):

$$U_{in} = V(Z_{in}, S_n, \beta) + e_{in} \qquad (2)$$

where: Z = a vector of the attributes of alternative i, as experienced by consumer n

S = a vector of the characteristics of the consumer

β = a vector of parameters estimated by the researcher

e_{in} = the difference between the "true" utility and the observation of utility by the researcher.

The probability that individual *n* will choose i is equal to the probability that Ui is greater than the utility received from any other alternatives in the set of alternatives. Random utility models are obtained by specifying a distribution for the error terms, e_{in} (in equation 2). It is commonly assumed that the e terms are IID Gumbel (or Extreme Value Type 1) random distributions. This allows the use of the multinomial logit model (Ben Akiva and Lerman, 1985).

Methods

A Discrete Choice Model of Pesticide and Hormone Regulation

Multinomial logit analysis is used in this study to examine consumer preferences for programs that restrict the use of pesticides or hormones in food production. Choice is expressed as a function of cost and individual characteristics. The model chosen to predict choices is:

$$\text{choice} = \alpha_p + \alpha_h + \beta\text{Cost} + \delta Z \qquad (3)$$

where:

α = an alternative specific constant (α_p for choosing to restrict pesticides, α_h for choosing to restrict hormones)

Z = a vector of individual characteristics (age, sex, household income, number of children, years of education, urban or rural residence).

β, δ = vectors of coefficients

The alternative specific constant, α_i, is intended to capture the satisfaction an individual obtains when he or she chooses that alternative. That is, α_p expresses the utility gained by choosing to restrict pesticide use, all other variables held constant. The program LIMDEP (Greene, 1994) was used to analyze the data using the model described above. In this model, the stated choices made available to each individual were: to restrict the use of pesticides; to restrict the use of hormones; or to restrict neither pesticides nor hormones. The stated effect of cost on the probability of each choice was examined, as was the effect of the individual respondent's various demographic variables. Increasing food cost from restriction of pesticide or growth hormone in food production is expected to reduce the probability of choosing to restrict these farming technologies. That is, a tradeoff between food safety and increasing food cost is expected to appear in the data set. The coefficients resulting from this analysis are used to calculate willingness-to-pay measures of Alberta consumers for reducing pesticide and hormone use in food production.

The Data for the Study

The data for this study were collected as part of an annual survey of Albertans conducted by the Population Research Laboratory of the Department of Sociology at the University of Alberta. The survey was conducted by means of telephone interviews conducted between February and April, 1995. Initial contact was made with 1, 695 Albertans. Call backs were made to reluctant householders to increase the response rate. A final sample of 1, 240 interviews was obtained, for a response rate of 73.2%. The sample consisted of 607 men and 633 women. The average age of respondents was 38.3 years.

The interviews covered a wide range of subjects, including food safety. The data on food safety were collected through six questions placed near the middle of the interview. Respondents were first asked to rate five food safety concerns (pesticides, bacteria in food, food additives,

hormones, fat and cholesterol) as: almost no health risk, slight health risk, moderate health risk or high health risk. Subsequently, each respondent was asked the following three questions, the responses to which compose the discrete choice data for this study:

1. Now suppose each of these will lead to a 10% increase in food prices. If you HAD to choose, would you choose limiting pesticide use, limiting use of growth hormones or not restricting either and keeping food prices at current levels?

2. Suppose that restricting pesticides leads to a 20% increase in food costs and restricting growth hormones leads to a 10% increase in food costs. Which would you choose to restrict: pesticide use, growth hormone use or not restricting either and keeping food prices at current levels?

3. Suppose that restricting growth hormones leads to a 20% increase in food costs and restricting pesticides leads to a 10% increase in food costs. Which would you choose to restrict: pesticide use, growth hormone use or not restricting either and keeping food prices at current levels?

Respondents choosing to restrict pesticide use in the first question were then asked the second question. Respondents choosing to restrict hormone use in the first question were asked the third question. Respondents who chose to restrict neither pesticides or hormones in response to question 1 were not asked the second or third question. This format elicited responses to the concern, identified in the first question, of increasing cost for food safety. After this task, respondents were asked to rank the five food safety concerns mentioned above (pesticides, bacteria, hormones, food additives, fat and cholesterol). Last, each respondent was queried as to the major sources of their food safety information and how reliable they considered these sources to be. Demographic data including age, gender, years of education, household income, number of children, religious and political affiliation, were also collected from each respondent.

Results and Discussion

Comparison of results from this survey with previous studies suggest that Albertans are similar to other consumers in their rating of food safety concerns. Pesticides and dietary fat and cholesterol were rated as moderate or high health risks by over 75% of the respondents. Growth

hormones, bacteria in food and food additives were rated as moderate or high risks by two thirds of the respondents. These ratings are described in more detail in Table 1.

Table 1. Albertans' Rating of Food Safety Issues

	Percentage of Respondents Choosing:			
	Almost No Health risk	Slight Health Risk	Moderate Health Risk	High Health Risk
Pesticides	4.4	18.3	40.0	37.4
Bacteria In Food	9.2	28.1	39.1	23.6
Food Additives	7.9	29.6	39.3	23.1
Growth Hormones	10.0	23.3	37.1	29.5
Fat and Cholesterol	3.6	9.5	37.3	49.5

The responses reported in Table 1 for pesticide concerns agree with an earlier study of Albertans assessments of food safety, (Finn and Louviere, 1992), which found that pesticide residues ranked as the issue of greatest concern The relatively high rating of bacteria in food as a source of food safety concern differs from that earlier study by Finn and Louviere (1992) where bacteria were not rated as a significant concern by consumers. One possible explanation is the intervening publicity over *haemmoragic e. coli* in Alberta. This microorganism can be found in undercooked hamburger and has caused deaths in Alberta. Media stories warning of this danger have been featured during the barbecue season in Alberta.

In the second group of food safety questions, designed to elicit discrete choice responses, respondents tended to persist in their initial response to the choices of the first question. That is, many individuals who stated that they chose to regulate pesticides at a 10% food cost again chose also to restrict pesticides when the stated consequences for this were for a 20% increase in food costs. The same tendency applied for respondents who initially chose to restrict hormone use at a 10% food cost. The aggregate responses to this portion of the survey are presented in Table 2.

Table 2. Albertans' Choice to Restrict Pesticides, Hormones or Neither

Choice	*Pesticides at 10% Hormones at 10%*	*Pesticides at 20% Hormones at 10%*[1]	*Pesticides at 10% Hormones at 20%*[2]
Pesticides	548 (48.8%)	413 (78.2%)	62 (20.0%)
Hormones	325 (28.9%)	50 (9.5%)	220 (71.0%)
Neither	251 (22.3%)	65 (12.3%)	28 (9.0%)

[1,2] These choices are conditional on the choice of pesticides or hormones at a 10% cost. That is, the responses to a 20% cost of the 548 individuals choosing to restrict pesticides at a 10% cost are given in column 3. The responses of the 325 individuals who chose hormones at a 10% cost are given in column 4.

Seventy eight percent of those who chose to restrict pesticides at a 10% added cost of food persisted in this choice at an added cost of 20%. Seventy one percent of those who chose to restrict hormones at a 10% added food cost continued with this choice at a 20% added cost.

The final section of the questions on food safety examined the ranking of food safety concerns by Albertans. Fat and cholesterol were most frequently ranked as the most important concern, followed by pesticides. Hormones, food additives and bacteria ranked as less significant concerns for most respondents. These rankings are consistent with the degree of concern ratings given in Table 1. Fat and cholesterol and pesticides are considered as significant health risks whether respondents ratings are by degree of concern or whether the ranking is from most to least significant health concern. More detail on these responses is given in Table 3.

Table 3. Ranking of Health Concerns

Concern	**Numbers Citing Concerns as the Most Significant Health Risk**	
	Number	**Percent (%)**
Pesticides	362	30.3
Bacteria in Food	127	10.6
Food Additives	104	8.7
Growth Hormones	111	9.3
Fat and Cholesterol	491	41.1

It is evident that Albertans consider pesticides to be a greater health risk than growth hormones. This is reflected in the ranking of the two risks, shown in Table 3, and in the choices to restrict at a 10% cost given in Table 2.

Econometric Analysis of Regulation Choice: The Multinomial Logit Model

Based on the data described in the preceding sections, the econometric model of Equation 3 was estimated, using the entire data sample for which individual-specific responses were available. Thus, those individuals who did not answer one or more of the relevant demographic questions (age, gender, number of children, income, years of education, urban resident) were not included in this section of the analysis. The dependent variable in this analysis is the choice to restrict pesticide use, hormone use, or to restrict neither pesticide or hormone use in food production.

It is hypothesized that the estimated coefficients in the variables of respondents' gender and the added food cost specified in the questions will each have negative coefficients. This is based on the expectation that increasing food cost will decrease the probability of choosing to restrict pesticides or hormones; a negative coefficient on the food cost variable is generally in accord with the standard economic theory of demand. The gender variable is specified as a (0,1) dummy variable, with male equated to one. The hypothesized negative effect is based on the observation that women typically appear to express more concerns with food safety, as shown by the Angus Reid Poll (1995). This tendency has been viewed as men generally being more confident regarding the safety of food (Lin, 1995).

It is often suggested that the other individual-specific variables of the effect of age, number of children, income level, urbanization and education on regulation choice will be positive. That is, it may be that consumers with higher education levels may be more aware of health concerns, while consumers with higher incomes have a greater ability to bear the cost of food safety restrictions and may feel that they have a greater ability to reduce external risks. Households

with young children are generally expected to be more concerned with food safety than those without children. Urban dwellers may be less familiar with the use of pesticides and hormones and may be expected to be more suspicious of them. It has also been suggested that older consumers may be more concerned about the safety of food than are younger consumers (Lin, 1995).

The alternative specific constants that reflect choice of restricting pesticide or hormone use, α_p and α_h, capture the utility associated with choosing to restrict pesticide or hormone use, as opposed to the base case of choosing not to restrict their use. In discrete choice models it is also necessary to express the demographic variables as alternative specific. That is the variables, gender, age, etc. are each expressed as constants that are specific to each alternative. Thus, there are two age coefficients in the model: AGEP and AGEH. The coefficient AGEP expresses the effect of age on the probability of choosing to restrict pesticide use over the base case (choosing not to restrict pesticides or hormones). In turn, AGEH reflects the effect of age on the probability of choosing to restrict the use of hormones. Similarly the variables GENDERP, NCHILDP, HINCP, YRSEDP and URBANP express the effect of gender, number of children in the household, household income, education level and living in an urban residence, respectively, on the probability of choosing to restrict pesticide use. The variables GENDERH, NCHILDH, HINCH, YRSEDH and URBANH express the effect of gender, number of children, household income, education level and living in an urban residence on the probability of choosing to restrict hormone use in food production.

The results of the analysis of the full sample, described above, are presented in Table 4. The estimated coefficients for respondents' income, education, number of children and urbanization are all positive as was expected. Respondents' education levels are significant in both the choices to restrict pesticide or hormone use. The number of children is significant in choosing to restrict pesticides. The coefficients for gender are negative and significant in both choices, reflecting that

men are less likely to choose to restrict pesticides or hormones than are women . Age is positive, but insignificant in the choice to restrict pesticides. Age is positive and significant in the choice to restrict hormones. It appears that increasing age may have a greater effect on the choice to restrict hormone use in food production than on the choice to restrict pesticides.

The alternative specific constants are negative and significant for both choices, however these estimates cannot be interpreted in isolation from the other estimated coefficients. That is, when the "representative effects" are summed across the relevant associated coefficients the result is positive. This sum of the representative effects for the choice to restrict pesticides is 1.37669.[1]

Table 4: Results of the Econometric Analysis for the Multinomial Logit Model of Food Safety Choices

Variable	**Coefficient**	**Mean**	**Representative Effect**
Alphap	-0.32229*	1	-0.32229
Agep	0.20668E-02	40.501	0.83707E-01
Genderp	-0.31662*	0.526	-0.16633
Nchildp	0.88351E-01*	0.822	0.72624E-01
Hincp	0.14785E-02	51.621	0.76322E-01
Yrsedp	0.10950*	14.034	1.5367
Urbanp	0.17888E-01	0.778	0.13917E-01
Cost	-0.47174E-01*	13.318	-0.62826
Alphah	-0.78440*	1	-0.78440
Ageh	0.71986E-02*	40.501	0.29155
Genderh	-0.57315*	0.526	-0.30148
Nchildh	0.23353E-01	0.822	0.19196E-01
Hinch	-0.10943E-02	51.621	-0.56489E-01
Yrsedh	0.11205*	14.034	1.5725
Urbanh	-0.69637E-02	0.778	0.54178E-02
* indicates significance at the $\alpha = 0.05$ level			

The sum of the representative effects for the choice to restrict hormones is 0.74629. This indicates that, for a representative individual from the sample, there is a positive utility associated with

[1] The sum of the representative effects is the sum of the product of each variable (except cost) evaluated at the mean times its respective coefficient.

choosing to restrict the use of pesticides or hormones in food production. These results also indicate that there is greater utility associated with choosing to restrict pesticides than with choosing to restrict hormones.

The effect of gender is negative. Being male decreases the probability of choosing to restrict pesticides or hormones, as opposed to the base case of choosing to restrict neither. The effect of education is positive and significant. An increasing level of education results in a greater probability of choosing to restrict pesticides and hormones. An increasing number of children in the household increases the probability of choosing to restrict pesticide use. Increasing age increases the probability of choosing to restrict hormones but does not have a significant effect on choosing to restrict pesticides.

The elasticity of cost associated with the probability of choosing to regulate pesticides or hormones is calculated and presented in Table 5. Both choices are relatively inelastic. This feature is apparently associated with the tendency to persistence in maintaining the initial choice as displayed in Table 2. Many of the individuals who choose to restrict pesticides or hormones at a 10% cost persist in this choice as cost increases to 20%. The choice of hormones is more elastic than is the choice of pesticides, reflecting the higher concern with pesticides in the sample group.

Table 5. Own Cost Elasticities

Choice	**Own Cost Elasticities ***
Pesticides	-0.461
Hormones	-0.535

These elasticities are interpreted as % change in probability of choosing to restrict % change in cost. The larger the elasticity estimate obtained the more responsive the sample group is to increasing cost. The negative number indicates that increasing cost decreases the probability of choosing to restrict. Elasticities smaller than -1.0 indicate that the sample group is inelastic. That is, they tend not to alter their choice to restrict pesticide or hormone use as cost increases.

Measures of Alberta respondents' willingness-to-pay for reducing pesticide and hormone use are calculated using average weekly food expenditure data for Alberta (Statistics Canada,

1992). The average weekly food expenditure for an Alberta household in 1992 was $113.06. If the costs in the data set are adjusted from percentages to dollar amounts, this introduces an adjustment factor of 1.13. That is, a 10% increase in food cost would be equivalent to a $11.30 increase in weekly food expenditures. Median willingness-to-pay measures are calculated using Hanemann's (1984) approach. This approach divides the sum of the coefficients for an alternative by the estimated marginal utility of money (obtained from the estimated coefficient on the cost variable, adjusted by the budgetary factor cited above) in order to obtain the value of restricting pesticide and hormone use. Thus, the value of restricting pesticide use is 1.37669/0.0417 = $33.01. The value of restricting hormone use is 0.74629/0.0417 = $17.90. That is, a representative consumer in the sample is willing to pay an increase in weekly food costs of $33.01 for restrictions on pesticide use. He or she is willing to pay an increase in weekly food costs of $17.90 for restrictions on hormone use.

It must be noted that these willingness-to-pay values are implicit in the data based on respondents' choices and that these may not be as precise as measurements of the value of restrictions on pesticides and hormones that might be obtained directly through survey questions. There may be a tendency among respondent's to overstate their true willingness-to-pay when the costs are expressed as percentages. If the respondents had been asked if they would pay an additional $33.01 per week for restrictions on pesticide use and $17.90 for restrictions on hormone use fewer respondents may have chosen to regulate pesticides or hormones. The implicit willingness-to-pay measures calculated here are based on weekly food expenditure data which includes a wide variety of food items. If food expenditures on those items most affected by pesticide and hormone use (fresh fruit, vegetables, meat and dairy products) were used in the calculation, the implicit willingness-to-pay measures calculated in this paper may have been reduced. However, the implicit willingness-to-pay measures obtained in this study may be an

accurate reflection of the value to Alberta consumers of regulations on pesticide and hormone use. If the respondents believed that restricting the use of pesticides and hormones would remove all risk associated with pesticide and hormone use in food production the implicit willingness-to-pay values calculated may accurately reflect the value of removing these risks from food consumption.

Contingent valuation surveys are subject to questions of hypothetical and strategic bias. The situations described in a CV survey are hypothetical. The knowledge that the situation presented is hypothetical may lead to an overstatement of the respondent's willingness-to-pay. If respondents respond strategically willingness-to-pay may also be overstated. That is, respondents who are especially concerned about pesticides may intentionally overstate their willingness-to-pay in the hope of influencing policy decisions about the use of pesticides. We believe that the fact that the questions regarding pesticide and hormone use are part of a larger survey and are placed near the middle of the interview offsets the possibility of strategic bias in the results. The possibility of hypothetical bias, however, cannot be completely ruled out .

Conditional Analyses of the Multinomial Logit Model of Choice to Restrict Pesticides or Hormones in Food Production

The results outlined above indicate that respondents' gender is a significant variable in the analysis of the entire sample. Fifty nine percent of the men in the sample chose to restrict pesticides or hormones at a 10% added food cost. Eighty five percent of the women in the sample chose to restrict at a 10% cost. Thus, being male decreased the probability of choosing to restrict pesticides or hormones. This appears to indicate that men and women may perceive the risks from pesticides and hormones differently. In order to examine this possibility, the sample was further divided according to gender.

The model was estimated on the two gender-based subsets and the results are given in Tables 6 and 7. Higher levels of education increase the probability of a man choosing to restrict pesticides or hormones. Older men are more likely to choose to restrict hormones than are younger

men. Increasing cost decreases the probability of a man choosing to restrict pesticide or hormone use.

Women with higher levels of education are more likely to choose to restrict pesticide or hormone use. Women from higher income households have a higher probability of choosing to restrict pesticide use. Income and education, however, may be correlated. Increasing cost decreases the probability of a woman choosing to restrict pesticide or hormone use. The number of children in the household is a significant factor in the choice to restrict pesticides in the entire sample. It is not, however, a significant variable in either the male and female subgroups.

Men and women do appear to perceive the risks from pesticides and hormones differently. Women appear to perceive pesticides and hormones as a greater risk than do men. This is further illustrated by the observation that most of the estimated coefficients for women are appreciably larger than for men, as shown by comparison of Tables 6 and 7.

Table 6: Male Subset

Variable	**Coefficient**	**Mean**	**Representative Effect**
Alphap	-0.21793	1	-0.21793
Agep	0.19339E-02	41.086	0.79456E-01
Nchildp	0.10306	0.729	0.75131E-01
Hincp	-0.20148E-02	54.089	-0.10898
Yrsedp	0.92476E-01*	14.210	1.31408
Urbanp	0.40785E-01	0.779	0.31771E-01
Cost	-0.48949E-01*	13.319	-0.65195
Alphah	-0.90723*	1	-0.90723
Ageh	0.97679E-02*	41.086	0.40132
Nchildh	-0.42900E-01	0.729	-0.31274E-01
Hinch	-0.41496E-02	54.089	-0.22445
Yrsedh	0.10570*	14.210	1.5011
Urbanh	0.33003	0.779	0.25709
* indicates significance at the α=0.05 level.			

Table 7: Female Subset

Variable	Coefficient	Mean	Representative Effect
Alphap	-0.98107*	1	-0.98107
Agep	0.35999E-02	39.852	0.14346
Nchildp	0.86610E-01	0.926	0.80201E-01
Hincp	0.56470E-02*	48.885	0.27605
Yrsedp	0.13763*	13.839	1.90328
Urbanp	0.36106E-01	0.776	0.28018E-01
Cost	-0.45568E-01*	13.316	-0.60678
Alphah	-1.4839*	1	-1.4839
Ageh	0.60759E-02	39.852	0.24214
Nchildh	0.70415E-01	0.926	0.65204E-01
Hinch	0.26716E-02	48.885	0.1306
Yrsedh	0.13186*	13.839	1.82481
Urbanh	0.31628	0.776	0.24543
* indicates significance at the $\alpha = 0.05$ level			

This result is consistent with those found by Flynn and others in a study of gender differences in the perception of environmental risks (Flynn, et al., 1994) and with a 1994 survey of Albertans (Jardine, et al., 1995), which both found that women perceive many environmental and health risks as more serious threats than do men.

Own cost elasticities are calculated for men and women and are given in Table 8. Both estimates for men and women are inelastic with respect to cost. The elasticities are smaller than in Table 5. This suggests that the gender based sub-groups are less elastic to cost than the is entire sample. It may result from the necessary differences in the statistical models underlying tables 5 and 8. The variables GENDERP and GENDERH are necessarily absent from the statistical model used to analyze the male and female sub-groups. The results do indicate that men are slightly more responsive to added food costs than women. This feature may be due to women perceiving pesticides and hormones as a greater risk. In each case (Table 5 and Table 8) the elasticity of hormone restriction, with respect to food cost, is greater than that for pesticides, reflecting the

greater concern with pesticide use expressed by the respondents and less willingness to avoid pesticide regulation in response to added food costs .

Median willingness-to-pay measures were calculated for men and women and are given in Table 9.

Table 8: Own-Cost Elasticities: Male and Female Subgroups

Choice	**Men**	**Women**
Pesticides	-0.329	-0.305
Hormones	-0.452	-0.391

Table 9: Willingness To Pay: Male and Female Subgroups[1]

	Willingness To Pay ($)	
Choice	**Men**	**Women**
Pesticides	27.01	35.96
Hormones	23.00	25.40

[1] These measures were calculated using the models estimated for men and women and the method described above which converts the percentage change in food expenditures into a dollar amount.

Women are evidently willing to pay a larger amount for restrictions on pesticide use. This is a reflection of the greater concern about pesticide use expressed by the women in the sample. The willingness-to-pay measures for restrictions on hormones are similar for both men and women. This may indicate that men and women perceive the risk from hormone use in the same way.

Conclusions

This study used contingent valuation methods to ascertain Albertans' attitudes to two specific food safety concerns, pesticide and growth hormone use in food production. Albertans' stated choices to restrict either pesticide or hormone use, as opposed to restricting neither, were examined. Some of the general results are similar to those elicited by earlier surveys (Consumer's Association of Canada 1990; Finn and Louviere, 1992). Albertans are more concerned about

pesticide use in food production than about the use of hormones. When asked to choose, more Albertans will choose to restrict pesticide use than hormone use, as opposed to the base case of not restricting either. They tend to persist in these choices in the face of rising food costs. The choice to restrict pesticides is more persistent than the choice to restrict hormones. This reflects the higher level of concern with pesticides. Increasing education increases the probability of an Albertan choosing to restrict pesticides or hormones. Increasing food cost decreases the probability of choosing to restrict pesticide or hormone use. Women appear to perceive pesticide use in food production as a greater food safety risk than men do. A significantly larger number of women than men chose to restrict pesticide use and are willing to pay a larger amount for a program to do so. The inferred average willingness to pay to restrict pesticide and growth hormone use in food production amounted to about 25% and 13% respectively of the average Albertan's food expenditures respectively. While the estimates of the implicit willingness-to-pay for food safety values may seem large, they do not differ greatly from amounts consumers are estimated to pay for various agricultural support programs in some high income countries.

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