International Journal of Economics, Commerce and Management
United Kingdom Vol. V, Issue 11, November 2017
http://ijecm.co.uk/ ISSN 2348 0386

IMPACT OF SOCIOECONOMIC FACTORS ON GEORGIA CONSUMERS' PERCEPTIONS ON USE OF CHEMICALS IN LIVESTOCK PRODUCTS

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Abstract

The use of chemicals in livestock production has been an issue for many consumers. The study, therefore, assessed the impact of socioeconomic factors on Georgia consumers' perceptions on the use of chemicals in livestock products. Data were collected from a convenience sample of 384 participants from several Georgia counties, and were analyzed using descriptive statistics

and ordinal logistic analysis. The socioeconomic statistics revealed more females than males, slightly more Whites than Blacks, more middle-aged or younger persons, with relatively moderate educational levels, with moderate household incomes (i.e., greater than $40,000), and more married persons than single persons. Most were of the opinion that using chemicals in locally or regionally produced and sold beef or goat meat was a serious or somewhat serious hazard. The regression results showed that gender had a significant effect on pesticide residues, antibiotics, artificial fertilizers, additives and preservatives, and artificial coloring; household size had a significant effect on growth stimulants or hormones, additives and preservatives, and artificial coloring; and age had a significant effect on antibiotics and artificial coloring. Since socioeconomic factors matter in the use of chemicals in livestock products, producers and processors should minimize such use in livestock products.

Keywords: Socioeconomic Factors, Chemicals, Consumer Perceptions, Livestock Products

INTRODUCTION

Many consumers have lost trust in the traditional food production sector, because of what they see as questionable production practices (Grunert, 2005; Vanhonacker & Verbeke, 2014). For instance, Yeung & Morris (2001) stated that the growing concern about food production methods, such as the use of antibiotics, growth protectants, feed additives, pesticides as well as microbiological contamination (e.g., bovine spongiform encephalopathy [BSE]), has decreased consumer confidence and impacted consumer purchasing behavior. According to Palmer (1996) the collapse of the beef market in the UK, France, and Germany following the BSE outbreak in 1996, which caused major losses to producers, is an example of a food safety scare that buttresses consumer fears.

Aleksejeva (2014) maintained that the increase in global population has resulted in the use of new technologies (e.g., genetical modification and biotechnology) and chemicals (e.g., growth hormones, additives, coloring, antibiotics, and pesticides). However, the debate about their effects on humans and the environment is still ongoing in many countries around the world. Aleksejeva further emphasized that the use of these new technologies and chemicals has potential benefits for both food manufacturers and consumers. The argument is that the food industry is creating new products, and farmers are growing new crops with improved or modified characteristics and applying chemicals to feed a growing population. Baker (2003) also argued that food producers believe that the benefits of using agricultural chemicals far exceed the risks and it is almost impossible to grow food without the use of chemicals.

Some have argued that the benefits derived from the use of chemicals and new technologies in food production notwithstanding, the negative effects that they have on human health and the environment cannot be overlooked. For instance, Pimentel et al. (1992) mentioned that exposure to higher levels of pesticides and chemical residues in food production can cause health ailments, environmental pollution, and increased presence of toxin residues. Grunert (2005) stated that, as a result of this, consumers have become skeptical about the increased use of agro-chemicals worldwide. Hennebery, Piethongngam, & Qiang (1999) posited that a direct effect of this issue is the increasing demand for organic, local, and fresh foods. Engel, Schauza, Klein, & Somogyi (1995) explained that consumers are not only faced with food safety concerns, but are also faced with the decision to select from different beneficial attributes prior to purchasing food products. In particular, Brooks & Ellison (2014) mentioned product attributes as a way of communicating messages to consumers. For example, they indicated labeling as one way of making consumers aware of ingredients in products. Similarly, Schroeder & McEachern (2004) emphasized that labeling helps in answering questions often asked by consumers such as, where their food was produced; what animals were fed on; whether animals received growth hormones or antibiotics, and whether their food is organic?

Doyle (2006) also drew attention to the fact that over the past few years, many consumers have shifted to local foods and organic products, because of increased outbreaks of foodborne illnesses associated with certain imported and conventionally produced food products. Doyle gave several examples of such outbreaks documented by the FDA, such as, Cyclospora in Guatemalan Raspberries, Hepatitis A virus in Mexican-grown strawberries, Salmonella in Mexican-produced fresh orange juice, and Shigella in Mexican-processed chopped parsley. In addition, Peters, Bills, Lembo, Wilkins, & Fick (2008) were of the opinion that the growth in the consumption of local or regional foods is driven by two key things. First, the belief that such food systems are more sustainable, healthy, and supportive of local economies. Second, that food travel shorter distances between production and consumption centers compared to other food systems. Also, the Food Processing Center (2003) reported that there were four main reasons why consumers purchased locally grown foods. These were higher/better quality, fresher products; less use of chemicals; positive relationships with producers, and opportunity to purchase unique products. Furthermore, the Food Marketing Institute (1996) asked why consumers bought local. The top three reasons given were freshness, supporting the local economy, and knowing where the product came from.

According to Nayga (1996), information on the effects of socioeconomic factors on consumer concerns for various food safety related production practices such as the use of irradiation, antibiotics, hormones, and pesticides is limited, probably, in the Southeastern U.S.

However, Tackie, Bartlett, Adu-Gyamfi, Quarcoo, & Jahan (2016) and Tackie, Adu-Gyamfi, Bartlett, & Perry (2017) conducted studies on socioeconomic factors and their impacts on consumer perceptions on chemicals in Alabama and Florida, respectively. The purpose of this study, therefore, was to assess the impact of socioeconomic factors on Georgia consumers' perceptions on the use of chemicals in locally or regionally produced livestock products. Specific objectives were to (1) identify and describe socioeconomic factors, (2) describe and assess attitudes and beliefs about chemicals in beef or goat meat, and (3) estimate the extent to which socioeconomic factors affect perceptions on the use of chemicals in beef and goat meat. This study is fashioned closely after the ones conducted by Tackie et al. for Alabama and Florida.

LITERATURE REVIEW

The literature reflects consumer concerns with chemicals in foods. Furthermore, socioeconomic factors could influence consumer perceptions about the use of chemicals in food. This literature review examines a few examples of these studies in two subsections.

Perceptions about Production Methods

Misra, Grotegut, & Clem (1997) evaluated consumer attitude toward Recombinant Porcine Somatotropine (rPST). They reported that 67% of respondents perceived pesticides and farm chemicals to be the greatest food safety threat; 61% perceived food additives to be a threat; 60% perceived Bovine Somatotropin to be a threat; 58% perceived rPST to be a threat; 51% perceived irradiation to be a threat, and 38% perceived genetic engineering of fruit and vegetables to be a threat. The authors concluded that food safety policies should restrict the use of chemicals and growth hormones in food production in order to guarantee a more secure food supply chain.

Veeman & Adamowicz (2000) investigated consumers' perceptions of environmental risks and the demand for food safety. They found that 75% of respondents viewed the use pesticides as moderate or high risk; 67% viewed the use of growth hormones as moderate or high risk, and 62% viewed the use of food additives as moderate or high health risk. The study also found that consumers were concerned about their health because of the use of chemicals in food production and were willing to pay more for chemical-free products.

Tackie, Siaway, Baharanyi, & Abhulimen (2000) analyzed consumer perceptions on the use of recombinant bovine somatotropin (rBST) in fluid milk production. They found that 38% of respondents were concerned that the use of rBST in milk would cause human health problems, and 23% were concerned that rBST would cause environmental problems. Moreover, 22% of respondents were of the view that the use of rBST in milk would increase the price of milk. In

this study also, the authors reported that consumers were concerned about the potential health effects of rBST in milk and were willing to pay more for rBST-free milk.

Harper & Henson (2001) assessed consumer concerns about animal welfare and the impact on food choice. The results showed that consumers generally believed that modern, intensive production is unnatural, unsafe, and unhealthy. Respondents with children were more concerned about the health and well-being of their children than those without children. Respondents were also concerned about standards of animal welfare because of the impact on the well-being of the animals and the impact on food safety, quality, and healthiness. The authors concluded that policies must be devised to address standards of animal welfare and food safety. They suggested compulsory product labeling and education to help inform on the safety of food products.

Mehta (2002) analyzed the risks posed by genetic modification, irradiation, pesticides, microbiological contamination, and high fat/high calorie foods. The author reported that 32% of respondents were concerned with high fat/high calorie foods; 29% were concerned with pesticide residues; 25% were concerned with microbiological contamination, and 10% were concerned about genetically modified foods. The author indicated the benefits and effects of new technologies and use of chemicals are not fully communicated to the public and policy makers. He emphasized that policy debates about regulations should reflect both scientific knowledge and social acceptability of these new technologies.

Dressel et al. (2010) investigated public perceptions about pesticide residues in food in Germany. They found that 88% of respondents rated bacteria contamination of meat as a very high food safety risk; 59% rated pesticide residues as a very high food safety risk; 39% rated genetically modified food as a very high food safety risk; 16% rated flavor enhancers as a very high food safety risk, and13% each rated preservatives and artificial aromas as very high safety risks. The authors concluded that chemical use in agriculture is a serious safety risk that poses a high level of public concern. The authors also emphasized product labeling and information as a way of restoring consumer confidence in food products.

Suresh et al. (2015) examined food safety concerns of consumers regarding pesticide residues on vegetables. They reported that more than 75% of consumers believed that the presence of pesticide residues in vegetables was unsafe for health. More than 80% strongly agreed or mostly agreed that intake of vegetables with pesticide residues cause health issues. Also, 60% believed that the application of pesticides was necessary to control pest-induced crop damage. The authors concluded that the use of pesticides should be restricted in vegetable and food production.

Tackie et al. (2016) assessed impact of socioeconomic factors on Alabama consumers' perceptions on the use of chemicals in livestock products. They found that, at least, 79% of consumers agreed or strongly agreed that pesticide residues, antibiotics, growth hormones, artificial fertilizers, additives and preservatives, and artificial colorings in livestock products are a serious or somewhat serious hazard.

Socioeconomic Factors and Chemicals in Food/Livestock Products

Sapp, Harrod, & Zhao (1995) examined consumers' social demographic and attitudinal determinants of food. The results showed that gender had a significant effect on health determinants. Females were more concerned with irradiated foods than males. Also, age had a significant but negative effect on health determinants of food. Older consumers were less likely to be concerned about the health risk associated with the use of irradiation in food production than younger consumers. Education and income did not have significant effects on health risks associated with irradiation use.

Misra et al. (1997) assessed consumer attitude toward Recombinant Porcine Somatotropine (rPST). The authors reported that gender, education, age and knowledge of rPST were significantly related to the concern for rPST. Female consumers, older consumers, less educated consumers, and consumers with relatively low knowledge of rPST were more likely to have a greater concern about rPST than male consumers, younger consumers, more educated consumers, and consumers with relatively high knowledge of rPST.

Heiman, Just, & Zilberman (2000) evaluated the role of socioeconomic factors and lifestyle variables in attitude and the demand for genetically modified foods. They reported that income and education impacted perceptions about genetically modified foods and use of antibiotics or hormones in food production. Respondents with higher incomes were less concerned about genetically modified foods than those with lower incomes. Respondents with lower incomes were more concerned about the use of antibiotics or hormones in food production than those with higher incomes. Those with higher education were less concerned about the use of genetic modification than those with lower education. Those with a high school or lower education were more concerned about the use of antibiotics or hormones in food production than those with at least a college degree.

Hine & Loureiro (2002) analyzed consumers' perceptions toward biotechnology and labeling. The results revealed that age had a significant effect on the use of pesticides in food production. Older consumers were significantly less concerned about the use of pesticides in food than the younger consumers. Also, females with children less than 18 years in the

household were significantly more concerned about the use of pesticides in food. Education and income were not significant.

Mehta (2002) investigated the risk posed by genetic modification, irradiation, pesticides, microbiological contamination and high fat/high calorie foods. They found that gender and had significant effects on the aforementioned processes and/or chemicals. Women were more likely to be concerned about pesticide residues, irradiated foods, and genetically modified foods than men. Also, older consumers were more likely to be concerned with foods treated by irradiation or grown with pesticides than younger consumers. Education did not have any significant effects.

Knight & Warland (2004) assessed the relationship between sociodemographics and concern about food safety issues. The results showed that gender, race and age had a significant effects on the use of pesticides. Women were more concerned about pesticides than men. Blacks were more concerned about pesticides than Whites and other ethnic groups. Younger consumers were less concerned about pesticide than older consumers. Education and household income were not significant.

Grobe, Douthitt, & Zepeda (2004) evaluated consumers' risk perceptions toward recombinant bovine growth hormone (rBGH). They found that only households with younger children had a significant effect on perceived risks of rBGH. Gender, age, education, household size, and household income did not have significant effects on perceived risks of rBGH.

Miles et al. (2004) analyzed the public worry about specific food safety issues. They reported that gender and age had significant effects on the concern about technological issues such as pesticide residues, use of additives, antibiotics, genetically modified foods, and hormones. Females and older consumers were more concerned about the effects of these technological issues on human health than males and younger consumers.

Tackie et al. (2016) examined impact of socioeconomic factors on Alabama consumers' perceptions on the use of chemicals in livestock products. They found that education had significant and positive effects on antibiotics, growth hormones, additives and preservatives, and artificial coloring in livestock products. This means that those with higher educational levels were more concerned about the use of chemicals in livestock products than those with lower educational levels. Similarly, household income had significant and negative effects on antibiotics and artificial coloring in livestock products. This also means that those with higher incomes were less concerned about the use of chemicals in livestock products than those with lower incomes.

Tackie et al. (2017) assessed the impact of socioeconomic factors on Florida consumers' perception on the use of chemicals in livestock products. The authors reported that

household size had significant and positive effects on pesticide residues and age had significant and positive effects on artificial colorings. Also, gender had significant and negative effects on pesticides and artificial fertilizers; age had significant and negative effects on antibiotics and artificial fertilizers; education had significant and negative effects on artificial fertilizers and additives and preservatives; and household income had significant and negative effects on pesticides. The explanations of the statistical significance are identical to those in the preceding study.

METHODOLOGY

Data Collection

The questionnaire used was adopted, with permission, from Govindasamy, Italia, & Rabin (1998). It had two main sections, namely, attitudes and beliefs, and socioeconomic characteristics. Before the questionnaire was administered, it was submitted to the Human Subjects Committee of the Institution for approval. The sampling method of choice was convenience sampling, because there was no known sampling frame from which subjects could be drawn.

In the summer of 2013 through the spring of 2015, data were collected from respondents from several counties of Georgia and at the Georgia National Fair in Perry, Georgia. These respondents came from the following counties: Barrow, Bartow, Butts, Cherokee, Clarke, Clayton, Cobb, Coweta, Dekalb, Elbert, Fayette, Forsyth, Fulton, Gwinnett, Hall, Henry, Jackson, Lincoln, Morgan, Newton, Oconee, Oglethorpe, Pickens, Rockdale, Spalding, Walton (northern Georgia); Baldwin, Bibb, Bleckley, Bryan, Burke, Chattahoochee, Crawford, Dodge, Dooley, Effingham, Emanuel, Harris, Houston, Jefferson, Laurens, Macon, Marion, Monroe, Muscogee, Peach, Pike, Screven, Sumter, Tattnall, Taylor, Troup, Upson, Wilcox (central Georgia); Appling, Brooks, Calhoun, Clay, Coffee, Colquitt, Dougherty, Glynn, Jeff Davis, Lanier, Lee, Lowndes, Mitchell, Pierce, Randolph, Terrell, Turner, Ware, and Worth (southern Georgia). Extension agents and other technical personnel in the various counties of Georgia, as well as graduate students from Alabama assisted in collecting the data from a sample of 384 respondents which was considered adequate for the study. The Cronbach's alpha was 0.63, which is relatively good (Goforth, 2015).

Data Analysis

Data were analyzed by descriptive statistics and ordinal logistic regression analysis. The latter was a modified version of the one used by Banterle & Cavaliere (2009), as well as, identical to

the one used by Tackie, Bartlett, & Adu-Gyamfi (2015), Tackie et al. (2016), and Tackie et al. (2017). It is as follows:

$C_j(X_i) = \ln[P(Y>j|X_i)/P(Y\leq j|X_i)] = \beta_1 X_{i1} + \ldots + \beta_n X_{in} - \tau_j + 1$ (1)

Where:

$C_j(X_i)$ = cumulative odds of being at or below category j of an ordinal variable with k categories, $1 \leq j \leq k-1$

i = number of participants considered

j = score for a category

Y = dependent variable

n = number of independent variables

X_i = independent variables

β_i = coefficients

τ = cut points between categories

Just as in Tackie et al. (2016) and Tackie et al. (2017), six models were developed based on the six chemicals identified as used in livestock production, specifically beef cattle and meat goats. Similarly, as in the previous studies, the term “chemicals” is defined as a wide range of substances (liquids or otherwise) used in livestock production. In this study, they are pesticides, antibiotics, growth stimulants or hormones, artificial fertilizers, additives and preservatives, and artificial coloring. The estimation model for Model 1 is stated as:

$\ln(P\text{PES}>j/P\text{PES}\leq j) = \beta_1 \text{HHS} + \beta_2 \text{GEN} + \beta_3 \text{RAE} + \beta_4 \text{AGE} + \beta_5 \text{EDU} + \beta_6 \text{HHI} + \beta_7 \text{MAS} - \tau + 1$ (2)

Where:

$\ln(P\text{PES}>j/P\text{PES}\leq j)$ = cumulative odds of being at or below a “residues from pesticides” (PES) category.

HHS = Household size

GEN = Gender

RAE = Race/ethnicity

AGE = Age

EDU = Education

HHI = Household income

MAS = Marital status

In sum, the estimation model posits that there is a perception that residues from pesticides in beef or goat meat sold locally or regionally is influenced by household size, gender, race/ethnicity, age, education, household income, and marital status.

Similar models, 2 to 6, were set up for statements regarding:

"Antibiotics" (ANT)

"Growth stimulants or hormones" (GSH)

"Artificial fertilizers in pastures" (AFP)

"Additives and preservatives" (ADP)

"Artificial coloring" (ARC)

Specifically,

Model 2

$$\ln(P\text{ANT}>j/P\text{ANT}\leq j) = \beta_1\text{HHS} + \beta_2\text{GEN} + \beta_3\text{RAE} + \beta_4\text{AGE} + \beta_5\text{EDU} + \beta_6\text{HHI} + \beta_7\text{MAS} - \tau + 1 \quad (3)$$

Where:

$\ln(P\text{ANT}>j/P\text{ANT}\leq j)$ = cumulative odds of being at or below an "antibiotics" (ANT) category.

Dependent variables = as previously described

Model 3

$$\ln(P\text{GSH}>j/P\text{GSH}\leq j) = \beta_1\text{HHS} + \beta_2\text{GEN} + \beta_3\text{RAE} + \beta_4\text{AGE} + \beta_5\text{EDU} + \beta_6\text{HHI} + \beta_7\text{MAS} - \tau + 1 \quad (4)$$

Where:

$\ln(P\text{GSH}>j/P\text{GSH}\leq j)$ = cumulative odds of being at or below a "growth stimulants or hormones" (GSH) category.

Dependent variables = as previously described

Model 4

$$\ln(P\text{AFP}>j/P\text{AFP}\leq j) = \beta_1\text{HHS} + \beta_2\text{GEN} + \beta_3\text{RAE} + \beta_4\text{AGE} + \beta_5\text{EDU} + \beta_6\text{HHI} + \beta_7\text{MAS} - \tau + 1 \quad (5)$$

Where:

$\ln(P\text{AFP}>j/P\text{AFP}\leq j)$ = cumulative odds of being at or below a "artificial fertilizers in pastures" (AFP) category.

Dependent variables = as previously described

Model 5

$$\ln(P\text{ADP}>j/P\text{ADP}\leq j) = \beta_1\text{HHS} + \beta_2\text{GEN} + \beta_3\text{RAE} + \beta_4\text{AGE} + \beta_5\text{EDU} + \beta_6\text{HHI} + \beta_7\text{MAS} - \tau + 1 \quad (6)$$

Where:

$\ln(P\text{ADP}>j/P\text{ADP}\leq j)$ = cumulative odds of being at or below a "additives and preservatives" (ADP) category.

Dependent variables = as previously described

Model 6

$$\ln(P\text{ARC}>j/P\text{ARC}\leq j) = \beta_1\text{HHS} + \beta_2\text{GEN} + \beta_3\text{RAE} + \beta_4\text{AGE} + \beta_5\text{EDU} + \beta_6\text{HHI} + \beta_7\text{MAS} - \tau + 1 \quad (7)$$

Where:

$\ln(P\text{ARC}>j/P\text{ARC}\leq j)$ = cumulative odds of being at or below an "artificial coloring" (ARC) category.

Dependent variables = as previously described

An assumption was made that the expected signs of the independent variables were not known a priori. The details of the independent variable names and descriptions used for the models are shown in Appendix Table 1. The details of the dependent variable names and descriptions are shown in Appendix Table 2. The ordinal logistic regression analysis was run for the various models using SPSS 12.0© (MapInfo Corporation, Troy, NY). The criteria used to assess the models were the model chi-squares, beta coefficients, and *p* values.

RESULTS AND DISCUSSION

Descriptive Results

Table 1 presents the socioeconomic characteristics of the respondents. About 58% had household sizes of 1-3 persons, and 28% had household sizes of 4-6 persons. The mean household size was three (not shown in Table). Almost 63% were females; 46% were Blacks, and 48% were Whites. Also, 50% were 44 years or less and 50% were more than 44 years of age; at most 61% had a two-year/technical degree or some college education and 39% had at least a 4-year college degree. In addition, 29% earned $30,000 or less annual household income and 61% earned over $30,000 as annual household income (including 30% who earned $30,001-$60,000). About 41% were singles, and 57% were married. The respondents comprised more females than males, slightly more Whites than Blacks, more middle-aged or

younger persons, with relatively moderate educational levels, with moderate household incomes (i.e., greater than $40,000), and more married persons than singles.

Table 1. Socioeconomic Characteristics (N = 384)

Variable	Frequency	Percent
Household Size		
1-3	224	58.3
4-6	109	28.4
7-9	4	1.0
10 or more	3	0.8
No Response	44	11.5
Gender		
Male	141	36.7
Female	241	62.8
No Response	2	0.5
Race/Ethnicity		
Black	175	45.6
White	186	48.4
Other	19	4.9
No response	4	1.0
Age		
20-24 years	69	18.0
25-34 years	54	14.1
35-44 years	68	17.7
45-54 years	79	20.6
55-64 years	84	21.9
65 years or older	27	7.0
No Response	3	0.8
Educational Level		
High School Graduate or Below	68	17.7
Two-Year/Technical Degree	56	14.6
Some College	107	27.9
College Degree	87	22.7
Post-Graduate/Professional Degree	63	16.4
No Response	3	0.8

Table 1. Continued

Variable	Frequency	Percent
Annual Household Income		
$10,000 or less	40	10.4
$10,001-20,000	30	7.8
$20,001-30,000	43	11.2
$30,001-40,000	31	8.1
$40,001-50,000	45	11.7
$50,001-60,000	38	9.9
$60,001-70,000	49	12.8
Over $70,000	69	18.0
No Response	39	10.2
Marital Status		
Single, never married	102	26.6
Married	220	57.3
Separated	3	0.8
Divorced	33	8.6
Widowed	18	4.7
No Response	8	2.1

Table 2 depicts respondents' attitudes and beliefs about the use of different types of chemicals in locally or regionally produced and sold beef or goat meat. Nearly 84% indicated that residues from the use of pesticides in beef or goat meat is a serious or somewhat serious hazard; about 81% indicated that the use of antibiotics in beef or goat meat is a serious or somewhat serious hazard, and approximately 89% stated that the use of growth stimulants or hormones in beef or goat meat is a serious or somewhat serious hazard. In addition, 81% stated that the use of artificial fertilizers in pastures used to raise beef cattle or meat goats is a serious or somewhat serious hazard; 83% indicated that the use of additives and preservatives in beef or goat meat is a serious or somewhat serious hazard, and 75% indicated that the use of artificial coloring in beef or goat meat is a serious or somewhat serious hazard.

At least, 75% thought that using chemicals in locally or regionally produced and sold beef or goat meat is a serious or somewhat serious hazard. The results are similar to those obtained by Misra et al. (1997), Veeman & Adamowicz (2000), Dressel et al. (2010), Suresh et

al. (2015), Tackie et al. (2016), and Tackie et al. (2017) who found that consumers were concerned about chemicals in foods or meat products.

Table 2. Attitudes and Beliefs about the Use of Chemicals in Locally or Regionally Produced and Sold Beef or Goat Meat (N = 384)

Variable	Frequency	Percent
Residues from Pesticides		
Serious Hazard	146	38.0
Somewhat of a Serious Hazard	177	46.1
Not at all a Hazard	58	15.1
No Response	3	0.8
Antibiotics		
Serious Hazard	104	27.1
Somewhat of a Serious Hazard	205	53.4
Not at all a Hazard	67	17.4
No Response	8	2.1
Growth Stimulants or Hormones		
Serious Hazard	174	45.3
Somewhat of a Serious Hazard	167	43.5
Not at all a Hazard	41	10.7
Artificial Fertilizers in Pastures		
Serious Hazard	125	32.6
Somewhat of a Serious Hazard	184	47.9
Not at all a Hazard	72	18.8
No Response	8	0.8
Additives and Preservatives		
Serious Hazard	117	30.5
Somewhat of a Serious Hazard	203	52.9
Not at all a Hazard	63	16.4
Artificial Coloring		
Serious Hazard	99	25.8
Somewhat of a Serious Hazard	189	49.2
Not at all a Hazard	93	24.2
No Response	3	0.8

Regression Results

Table 3 reflects estimates for the various models. Considering the residues from pesticides model, it reflects overall statistical significance of the model (p = 0.084), i.e., at least one or all of the socioeconomic variables jointly explained the dependent variable (the perception that residues from pesticides in beef or goat meat sold locally or regionally is hazardous, PES). This perception is significantly affected by gender p = 0.016. Females are more likely than males to be of the perception that residues from pesticides in beef or goat meat sold locally or regionally is hazardous. The results on gender are in agreement with Sapp et al. (1995), Misra et al. (1997), Hine & Loureiro (2002), Mehta (2002), Knight &Warland (2004), and Tackie et al. (2017) for Florida who also found females significantly more likely to be concerned about pesticide residues in foods than males. On the contrary, the results are in opposition to those obtained by Tackie et al. (2016) for Alabama, in which they found no significant effect of socioeconomic factors on the perception that residues from pesticides in meats are hazardous. Household size, race/ethnicity, age, education, household income, and marital status were statistically insignificant.

Table 3. Estimates for Various Models on Perceptions on Using Chemicals and Additives in Locally or Regionally Produced Livestock Products

	PES		ANT		GSH	
Variable	β	*p*	β	*p*	β	*p*
HHS	0.106	0.180	0.046	0.566	0.194***	0.019
GEN	-0.566***	0.016	-0.718***	0.004	-0.343	0.150
RAC	0.215	0.285	0.312	0.131	-0.045	0.826
AGE	-0.036	0.679	0.159*	0.078	0.135	0.122
EDU	-0.018	0.843	-0.070	0.454	0.113	0.220
HHI	-0.084	0.120	-0.036	0.524	-0.042	0.442
MAS	0.008	0.954	-0.084	0.532	-0.003	0.982
Chi-square	12.545*		16.538***		11.368	
(p = 0.084)	(p = 0.021)		(p = 0.123)			
Nagelkerke R^2	0.048		0.064		0.045	

Table 3 Continued.

	AFP		ADP		ARC	
Variable	β	*p*	β	*p*	β	*p*
HHS	0.086	0.271	0.188***	0.019	0.142*	0.071
GEN	-0.900***	0.000	-0.399*	0.093	-0.406*	0.083
RAC	0.024	0.905	0.182	0.367	0.036	0.856
AGE	-0.049	0.565	0.123	0.157	0.199***	0.020
EDU	-0.003	0.976	-0.015	0.871	0.078	0.388
HHI	-0.020	0.703	-0.035	0.519	-0.068	0.207
MAS	0.049	0.706	-0.024	0.853	-0.130	0.317
Chi-square	17.450***		10.723		11.137	
(*p* = 0.015)	(*p* = 0.151)		(*p* = 0.133)			
Nagelkerke R^2	0.066		0.041		0.042	

***Significant at 1%; **Significant at 5%; *Significant at 10%

Considering the antibiotics model, it also reflects overall statistical significance of the model (*p* = 0.021), i.e., at least one or all of the socioeconomic variables jointly explained the dependent variable (the perception that antibiotics in beef or goat meat sold locally or regionally is hazardous, ANT). This perception is significantly affected by gender and age, respectively, *p* = 0.004 and *p* = 0.078. Females are more likely than males to be of the perception that antibiotics in beef or goat meat sold locally or regionally is hazardous. The higher the age, the more likely the perception that antibiotics in beef or goat meat sold locally or regionally is hazardous.

The findings are in agreement with Miles et al. (2004) and Tackie et al. (2017) for Florida. Miles et al. found that gender significantly affected the use of antibiotics in foods. Females more than males were concerned about the use of antibiotics in foods. What is more, both Miles et al. and Tackie et al. found that age significantly affected the use of antibiotics in foods. Older persons were more concerned about the use of antibiotics than younger persons. The findings, however, are not in agreement with Tackie et al. (2016) for Alabama, who reported that education and household income significantly affected the perception that antibiotics in meat are hazardous; education positively affected the perception and household income negatively affected the perception. Household size, race/ethnicity, education, household income, and marital status were statistically insignificant.

Also, regarding the growth stimulant or hormone model, it reflects overall statistical nonsignificance of the model (p = 0.123), i.e., all of the socioeconomic variables jointly did not explain the dependent variable (the perception that growth stimulants or hormones in beef or goat meat sold locally or regionally is hazardous, GSH). However, the perception is significantly affected by household size, p = 0.019. The larger the household size, the more likely the perception that growth stimulants or hormones in beef or goat meat sold locally or regionally is hazardous. This finding is in opposition to that reported by Tackie et al. (2016) for Alabama, where education was found to significantly and positively influence the perception that growth stimulants or hormones in beef or goat meat sold locally or regionally is hazardous. Similarly, it is in opposition to Tackie et al. (2017) for Florida, in which they reported that no socioeconomic factor was found to statistically affect the perception. Gender, race/ethnicity, age, education, household income, and marital status were statistically insignificant.

With regards to the artificial fertilizers in pasture model, it shows overall significance of the model (p = 0.015), i.e., at least one or all of the socioeconomic variables jointly explained the dependent variable (the perception that artificial fertilizers in pastures used to raise beef cattle or meat goats sold locally or regionally is hazardous, AFP). This perception is significantly affected by gender, p = 0.000. Females are more likely than males to be of the perception that residues from artificial fertilizers in pastures used to raise beef cattle or meat goats sold locally or regionally is hazardous. The result is somewhat similar to those found by Tackie et al. (2017) for Florida. They found that gender, age, and education significantly affected the perception. In the case of gender, females more than males were concerned about the use of artificial fertilizers in pastures. The result is contrary to Tackie et al. (2016) for Alabama who found no significant relationship between socioeconomic factors and the perception that the use of artificial fertilizers to raise beef cattle or meat goats is hazardous. Household size, race/ethnicity, age, education, household income, and marital status were statistically insignificant.

Focusing on the additives and preservatives model, it reflects overall statistical nonsignificance of the model (p = 0.151), i.e., all of the socioeconomic variables jointly did not explain the dependent variable (the perception that additives and preservatives in beef or goat meat sold locally or regionally is hazardous, ADP). However, the perception is significantly affected by household size and gender, respectively, p = 0.019 and p = 0.093. The larger the household size, the more likely the perception that additives and preservatives in beef or goat meat sold locally or regionally is hazardous. Also, females are more likely than males to be of the perception that additives and preservatives in beef or goat meat sold locally or regionally is hazardous. These findings are contrary to Tackie et al. (2016) for Alabama and Tackie et al.

(2017) for Florida who found a significant relationship between education and additives and preservatives in beef or goat meat. The relationship was, however, positive in the case of Alabama and negative in the case of Florida. Race/ethnicity, age, education, household income, and marital status were statistically insignificant.

Focusing on the artificial coloring model, it also shows overall statistical nonsignificance of the model (p = 0.133), i.e., all of the socioeconomic variables jointly did not explain the dependent variable (the perception that artificial coloring in beef or goat meat sold locally or regionally is hazardous, ARC). Despite this, the perception is significantly affected by household size, gender, and age, respectively, p = 0.071, p = 0.083, and p = 0.020. The larger the household size, the more likely the perception that artificial coloring in beef or goat meat sold locally or regionally is hazardous. Furthermore, females are more likely than males to be of the perception that artificial coloring in beef or goat meat sold locally or regionally is hazardous. The higher the age, the more likely the perception that artificial coloring in beef or goat meat sold locally or regionally is hazardous. The results are partially consistent with Tackie et al. (2017) for Florida where they also reported, among others, that age significantly and positively affected the perception that artificial coloring in beef or goat meat sold locally or regionally is hazardous. However, the results are contrary to Tackie et al. (2016) for Alabama. They reported that those with higher levels of education were significantly more concerned with artificial coloring in food than those with lower levels of education. Race/ethnicity, education, household income, and marital status were statistically insignificant. A plausible explanation for the statistical nonsignificance of the overall models for the “growth stimulants or hormones”, “additives and preservatives”, and “artificial coloring” may be inherent in the data or intrinsic to the models.

CONCLUSION

The study analyzed the impact of socioeconomic factors on Georgia consumers’ perceptions on the use of chemicals in livestock products. In particular, it identified and described socioeconomic factors, described and assessed attitudes and beliefs about chemicals in beef or goat meat, developed models for perceptions on the use of chemicals in beef or goat meat, and estimated the extent to which socioeconomic factors influenced perceptions on the use of chemicals in beef or goat meat.

The socioeconomic variables reflected respondents more females than males, slightly more Whites than Blacks, more middle-aged or younger persons, with relatively moderate educational levels, with moderate household incomes (i.e., greater than $40,000), and more married persons than singles. A majority, at least, 75% were of the view that using chemical in locally or regionally produced and sold beef or goat meat is a serious or somewhat serious

hazard. The ordinal logistic regression analyses showed that selected socioeconomic factors influenced consumers' perceptions of use of chemicals in livestock products. Specifically, gender had a significant effect on pesticide residues, antibiotics, artificial fertilizers, additives and preservatives, and artificial coloring; household size had a significant effect on growth stimulants or hormones, additives and preservatives, and artificial coloring; and age had a significant effect on antibiotics and artificial coloring.

Overall, the high concern about the use of chemicals in livestock and livestock products, should generate an impetus for producers and processors to find innovative ways of raising livestock and and/or processing livestock products. There is an obvious need for producers and processors to minimize the use of chemicals in the production of livestock products. The process should involve policy makers who should review and revise policies regarding the use of these chemicals. In fact, producers and processors could also voluntarily change production practices. There are two benefits that could be derived if the aforementioned is done, namely, short- and long-term benefits. The short-term benefits will result in relatively less chemicals, especially, pesticides, antibiotics, growth stimulants or hormones, artificial fertilizers, additives and preservatives, and artificial coloring, being used in livestock products. The long-term benefit will result in decreased cumulative effects on the environment and health of consumers. The study has provided yet more insight into how socioeconomic factors affect consumers' perceptions on the use of chemicals in livestock products, especially beef and goat meat. The major contribution is the implication that gender, household size, and age affect consumer perceptions on pesticide residues, antibiotics, hormones, artificial fertilizers, additives and preservatives, and artificial coloring in beef or goat meat. However, the direction (positive or negative) of the effect is mixed. Future studies are needed which may include replicating the study, covering a larger area, focusing on another geographic area, or using other analytical techniques.

ACKNOWLEDGMENT

This study was funded by USDA National Institute of Food and Agriculture, Agriculture and Food Research Initiative Competitive Grant, Number 2013-68004-20357.

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APPENDIX

Table 1. Variable Definitions and Description of Data for Socioeconomic Factors

Variable	Description	Mean	Standard Deviation
Household Size	1 = 1-3	3.06	1.73
	2 = 4-6		
	3 = 7 or above		
Gender	1 = male	0.37	0.48
	0 = female		
Race/ethnicity	1 = Black	1.59	0.59
	2 = White		
	3 = other		
Age	1 = 20-24	3.36	1.57
	2 = 25-34		
	3 = 35-44		
	4 = 45-54		
	5 = 55-64		
	6 = 65 or above		
Education	1 = high school or less	3.06	1.32
	2 = two-year/technical		
	3 = some college		
	4 = college degree		
	5 = post-graduate/professional		
Household income	1 = $10,000 or less	4.93	2.39
	2 = $10,001-20,000		
	3 = $20,001-30,000		
	4 = $30,001-40,000		
	5 = $40,001-50,000		
	6 = $50,001-60,000		
	7 = $60,001-70,000		
	8 = more than $70,000		
Marital status	1 = single, never married	2.06	1.03
	2 = married		
	3 = separated		
	4 = divorced		
	5 = widowed		

Table 2. Variable Definitions and Description of Data for Dependent Variables

Variable	Description	Mean	Standard Deviation
Pesticides	0 = not at all a hazard	1.23	0.70
	1 = somewhat a serious hazard		
	2 = serious hazard		
Antibiotics	0 = not at all a hazard	1.10	0.69
	1 = somewhat a serious hazard		
	2 = serious hazard		
Growth Stimulants/hormones	0 = not at all a hazard	1.35	0.67
	1 = somewhat a serious hazard		
	2 = serious hazard		
Artificial Fertilizers	0 = not at all a hazard	1.14	0.71
	1 = somewhat a serious hazard		
	2 = serious hazard		
Additives and Preservatives	0 = not at all a hazard	1.14	0.67
	1 = somewhat a serious hazard		
	2 = serious hazard		
Artificial Coloring	0 = not at all a hazard	1.02	0.71
	1 = somewhat a serious hazard		
	2 = serious hazard		