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IMPACT OF SOCIOECONOMIC FACTORS ON FLORIDA CONSUMERS' PERCEPTIONS ON USE OF CHEMICALS IN LOCALLY OR REGIONALLY PRODUCED LIVESTOCK PRODUCTS

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Abstract

The use of chemicals in livestock production has been an issue for consumers for several decades. This study, therefore, assessed the impact of socioeconomic factors on Florida consumers' perceptions on the use of chemicals in locally or regionally produced livestock products. Data were collected from a sample of 404 participants from several Florida counties and were analyzed using descriptive statistics and ordinal logistic analysis. Most of the respondents 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 ordinal logistic regression results showed that several socioeconomic factors, such as household size, gender, age, and education had significant effects on pesticide residues; antibiotics; artificial fertilizers; additives and preservatives, and artificial coloring. It was recommended that producers and processors should minimize the use of chemicals in livestock products as this has both short- and long-term benefits.

Keywords: Socioeconomic Factors, Chemicals, Consumer Perceptions, Locally or Regionally Produced, Livestock Products

Introduction

As a result of changing consumer tastes and preferences (Frickie and von Alvensleben, 1997), media attention and publicity on food related issues (Strak et al., 1997), attention has been given to research on food and related products. According to Marvin et al. (2009) changes in food production methods and eating habits have contributed to current food safety problems. For example, Sirieix et al. (2007) stated that increased complexity and length of food chains have resulted in increased opportunity for contamination by chemical or microbial agents. The FDA (1992) reported that Salmonella, Staphylococcus aureus, Clostridium botulinum, Shigella, Listeria monocytogenes, Norovirus, E. Coli, and Toxoplasma gondii were among the list of pathogens associated with most foodborne illnesses around the world. Even recently, Clark (2016) reported that food poisoning caused by E. Coli 026 affected the health of sixty customers who ate at several Chipotle restaurants.

Further, Hwang et al. (2005) stressed that the introduction of new technological procedures such as genetically modified organisms, irradiation, additives, etc. which were intended to increase the number of food products available to consumers, has generated new concerns regarding their long-term effects on environmental and human health. Lusk and Fox (2000) observed that about 95% of all cattle in the U.S. are injected with growth hormones to increase production efficiency and decrease production costs. Although Kenny and Fallert (1989) explained that residues from hormones administered in proper doses do not pose any threat to human health, some consumers are still not convinced. In fact, Olynk (2012) indicated that consumers are making food

purchasing decisions based on their concerns for the use of chemicals and related products, such as hormones, additives, artificial fertilizers, and pesticides, as well as environmental and social impacts of production agriculture.

Campiche et al. (2004) further argued that changes in consumer demand and the concerns described above have prompted some producers to emphasize programs such as marketing local, organic (i.e., no growth hormones or antibiotics), and integrated pest management-raised. Francis (1990) emphasized that there is a growing consciousness among consumers that food grown without chemicals can become readily available if proper incentives are given to farmers to produce such products and market them at a profit. Lusk and Fox (2000) also contended that the recent success of niche markets for local or organic beef provide evidence that consumers are concerned about hormone and pesticide use in food. Other researchers, such as Boland et al. (1999), argued that producing local or organic beef without chemicals leads to increased production cost due to lower feed conversion efficiency, marketing cost, time investment, and potentially lower carcass yield. Despite the above, limited empirical work has been conducted to examine the influences of socioeconomic factors on the use of chemicals in locally or regionally produced livestock products, broadly in the Southeast and particularly in Florida. There is a need to conduct such a study to assess consumers' views on the subject and add to the existing literature.

The purpose of this study was to assess the impact of socioeconomic factors on Florida 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 degree to which socioeconomic factors influence perceptions on the use of chemicals in beef and goat meat.

Literature Review

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

Perceptions about Production Methods

Misra et al. (1995) analyzed consumer attitude and awareness on irradiation and food safety. They found that consumers perceived pesticide residues as the greatest safety threat (54%), followed by growth hormones (52%), drug residues (51%), bacteria (50%), food additives (43%), irradiation (39%), and naturally occurring toxins (22%). Overall, the study revealed that chemical use in agriculture is a serious risk that elicits a high level of public concern.

Kuperis et al. (1996) investigated preferences for pesticide and hormone regulation regarding food safety. The authors reported that pesticide in food was rated as moderate or high health risk by over 75% of the respondents; growth hormones were rated as moderate or high risk by 67% of the respondents; whereas, food additives were rated as moderate or high risk by 62% of the

respondents. The authors concluded that the use of pesticides and growth hormones should be restricted in food production.

Govindasamy et al. (1998) assessed consumer response and perceptions for integrated pest management and organic produce. They reported that residues from pesticides or herbicides were perceived to be the most hazardous, followed by antibiotics, growth stimulants, artificial fertilizers, additives, and artificial coloring. The authors argued that the results should provide valuable information for those developing marketing strategies for low-input agriculture and that there was also a need to encourage producers and processors to use minimum amounts of chemicals in food products.

Ventura-Lucas (2004) examined consumer perceptions and attitudes towards food safety in Portugal, using a system of 1 = not safe and 5 = very safe. He reported that consumers showed lower confidence level in the safety of meat (1.51); food with residues of permitted pesticides (1.89), and fruits and vegetables with artificial coloring (1.95). However, he reported a relatively higher confidence level with meat produced with permitted antibiotic level (2.75); food with additives (2.50), and meat produced with permitted hormone level (2.30). The author concluded that consumers do not consider most foods as healthy as they could be, because of the use of chemicals in producing them. He further emphasized that to restore consumer confidence product labeling as well as truthful product information should be given to consumers.

Tackie et al. (2012) evaluated perceptions of consumers and the impact of selected socioeconomic variables on organic farming and products. They found that 94% of respondents ranked pesticide or herbicide residues in food as either a serious or somewhat serious hazard; 96% ranked use of antibiotics as either a serious or somewhat serious hazard, and 92% ranked using growth stimulants as either serious or somewhat serious hazard. Also, 87% ranked using artificial fertilizers as either a serious or somewhat serious hazard; 86% ranked using additives and preservatives as either a serious and somehow serious hazards, and 78% ranked using artificial coloring as either a serious or somewhat serious hazard. Overall, the study implied that consumers were concerned about their health and the environment, and were willing to pay more for organic products because of the nonuse of the usual chemicals in producing them.

Kher1 et al. (2013) assessed consumer perceptions of risks of chemical and microbiological contaminants associated with food chains, using focus groups. The results showed that participants were concerned about different types of food additives, including preservatives and artificial coloring in food. The authors also reported that chemical contaminants were perceived to have particularly severe consequences and potential long-term negative effects on human health.

Tackie et al. (2016) examined the impact of socioeconomic factors on Alabama consumers' perceptions on the use of chemicals in livestock products. Their findings showed that 87% ranked residues from use of pesticides in beef or goat meat as a serious or somewhat serious hazard; 85% ranked residues from the use of antibiotics as serious or somewhat serious hazard, and 90% ranked the use of growth stimulants or hormones as a serious or somewhat serious hazard. In addition, 85% considered the use of artificial fertilizers in pastures as a serious or somewhat serious hazard; 82% stated the use of additives and preservatives in beef or meat goat

as somewhat serious hazard, and 79% considered the use of artificial coloring in beef or meat goat as a serious or somewhat serious hazard. The authors suggested that producers and processors should minimize the use of chemicals in meat products.

Socioeconomic Factors and Chemicals in Food/Livestock Products

Dunlap and Beus (1992) analyzed public concerns about pesticides and investigated if these concerns could be predicted by demographic characteristics. They reported that gender had a significant effect on pesticide use in food; women were more concerned about the use of pesticides in food than men. Also, age and education had significant effects on pesticide use in food. Younger consumers and those with higher levels of education were more concerned about the use of pesticides in food than their counterparts. Also, higher income respondents were less concerned about the use of pesticides in food than lower income respondents.

Misra et al. (1995) conducted a study on consumer attitude and awareness on irradiation and food safety. They found that gender had a significant effect on consumer perceptions for irradiation, and that, females more so than males considered irradiation as a more serious problem. They also reported that educational level and income significantly affected consumer perception of irradiation, and indicated that respondents with less than a college education and with low income considered irradiation as a more serious problem than otherwise. Age, race, marital status, and household size showed no significant effects.

Kuperis et al. (1996) assessed preferences for pesticide and hormone regulation relative to food safety. They found that men were less likely than women to restrict the use of pesticide and hormones in food production. Consumers with higher educational levels were more likely to restrict the use of pesticide or hormones in food than those with lower levels of education. Moreover, older consumers were more likely to restrict the use of pesticide or hormones in food than younger consumers. Consumers with higher income levels were more likely to restrict the use of pesticide or hormones in food than consumers with lower income levels.

Baker (1999) analyzed consumer preferences for food safety attributes in fresh apples. He reported that more females than males were concerned about the safety of pesticides and their associated cancer risk in apples (68 vs. 32%). White consumers were more concerned about the safety of pesticides than Black consumers, Hispanic consumers, and American Indian consumers (86 vs. 6 vs. 2 vs. 6%). He also reported that household income and household size had significant effects on consumer perceptions about pesticides in apples. Consumers with an annual household income of $40,000-54,999 were more concerned about pesticides in apples than those who earned more than $54,999. Larger household sizes were more likely to be concerned with pesticides than smaller household sizes.

Grobe et al. (1999) evaluated consumers' risk perceptions toward recombinant bovine growth hormone (rBGH). The authors 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 perceived risks of rBGH.

Govindasmy and Italia (2004) examined consumer concerns about pesticide residues. They reported that females compared to males were more likely to be concerned about pesticide

residues. They also reported that households with children were much more concerned about pesticide residues than those without children.

Tackie et al. (2016) assessed the impact of socioeconomic factors on Alabama consumers' perceptions on the use of chemicals in livestock products. The results showed that education had a significant effect on the perception that antibiotics, growth hormones, additives and preservatives, and artificial coloring in beef or goat meat are hazardous. Also, household income had a significant effect on the perception that antibiotics and artificial coloring in beef or goat meat are hazardous. Specifically, consumers with higher levels of education were more likely to be of the opinion that antibiotics in beef or goat meat are hazardous compared to those with lower levels of education, and consumers with higher household incomes were less likely to be of the opinion that antibiotics in beef or goat meat are hazardous relative to those with lower levels of household incomes. Furthermore, consumers with higher levels of education were more likely to be of the opinion that growth hormones, additives and preservatives, and artificial coloring in beef or goat meat are hazardous than those with lower levels of education; consumers with higher household incomes were less likely to be of the opinion that artificial coloring in beef or goat meat is hazardous compared to those with lower household incomes.

Methodology

Data Collection

The study used a structured questionnaire adopted, with permission, from Govindasamy et al. (1998) to collect data for the study. There were two parts, specifically, attitudes and beliefs, and socioeconomic characteristics. Before the questionnaire was administered, it was submitted to the Human Subjects Committee of the Institution for approval. It was administered to participants by using convenience sampling. This technique was chosen because of a lack of known sampling frame from which subjects could be drawn.

Data were obtained from participants using self-administration methods in the summer of 2013 through the spring of 2014 in several Florida counties (Alachua, Broward, Calhoun, Franklin, Gadsden, Hardee, Jefferson, Leon, Madison, Orange, Polk, Taylor, and Wakulla). Extension agents in the various counties, other personnel from Florida A&M University, and a graduate student from Tuskegee University, Alabama helped with collecting the data. The final sample size was 404 participants, and this was considered adequate for analysis.

Data Analysis

Data were analyzed by descriptive statistics and ordinal logistic regression analysis. The ordinal logistic model was a modified version of the one used by Banterle and Cavaliere (2009), and was identical to the one used by Tackie et al. (2015). It is as follows:

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

Where:

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

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

Six models were developed based on the six chemicals identified as used in livestock production. The term "chemicals" is generally defined as a wide range of substances (liquids or otherwise) used in livestock production. Particularly, in this study, they are pesticides, antibiotics, growth stimulants or hormones, artificial fertilizers, additives and preservatives, and artificial coloring. The emphasis was on beef and goat meat locally or regionally produced. The estimation model for Model 1 is stated as:

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

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 short, the estimation model hypothesizes that the perception that residues from pesticides in beef or goat meat produced and sold locally or regionally are hazardous is influenced by household size, gender, race/ethnicity, age, education, household income, and marital status.

Identical 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
This estimation model hypothesizes that the perception that residues from antibiotics in beef or goat meat produced and sold locally or regionally are hazardous is influenced by household size, gender, race/ethnicity, age, education, household income, and marital status.

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

This estimation model hypothesizes that the perception that residues from growth stimulants or hormones in beef or goat meat produced and sold locally or regionally are hazardous is influenced by household size, gender, race/ethnicity, age, education, household income, and marital status.

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

This estimation model hypothesizes that the perception that artificial fertilizers in pastures used to raise beef cattle or meat goats and sold locally or regionally are hazardous is influenced by household size, gender, race/ethnicity, age, education, household income, and marital status.

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

This estimation model hypothesizes that the perception that residues from additives and preservatives in beef or goat meat produced and sold locally or regionally are hazardous is influenced by household size, gender, race/ethnicity, age, education, household income, and marital status.

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

This estimation model hypothesizes that the perception that residues from artificial coloring in beef or goat meat produced and sold locally or regionally are hazardous is influenced by household size, gender, race/ethnicity, age, education, household income, and marital status.

It was assumed that the expected signs of the independent variables were not known a priori, because of mixed results from the literature (i.e., the signs could be positive or negative). 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 also 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 shows the socioeconomic characteristics of the respondents. Nearly 82% had household sizes of 1-3 persons, and 17% had household sizes of 4-6 persons. The mean number of persons in a household was two (not shown in Table). About 74% of respondents were females and 67% were Whites. Considering age and education, 27% were, at most, 44 years and 72% were over 44 years of age; 37% had at most a two-year/technical degree or some college education, and 63% had a college education. Furthermore, looking at annual household income and marital status, 19% earned $30,000 or less annual household income and 70% earned over $30,000 as annual household income, including 32% that earned $30,000-$60,000. About 40% were singles, and 58% were married. The respondents comprised more females than males, more Whites than Blacks, more middle-aged and older persons than younger persons (i.e., greater than 44 years), with relatively high educational levels, with moderate to moderately high household incomes (i.e., greater than $50,000), and more married persons than single persons.

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. About 91% indicated that residues from the use of pesticides in beef or goat meat are a serious or somewhat serious hazard; approximately 90% indicated that residues from the use of antibiotics in beef or goat meat is a serious or somewhat serious hazard, and nearly 92% stated that the use of growth stimulants or hormones in beef or goat meat are a serious or somewhat serious hazard. In addition, 88% stated that the use of artificial fertilizers in pastures used to raise beef cattle or meat goats is a serious or somewhat serious hazard; another 88% indicated that the use of additives and preservatives in beef or goat meat is a serious or somewhat serious hazard, and about 78% indicated that the use of artificial coloring in beef or goat meat is a serious or somewhat serious hazard.

Table 1. Socioeconomic Characteristics (N = 404)

Variable	Frequency	Percent
Number of Persons in Household		
1-3	332	82.2
4-6	67	16.6
7-9	0	0.0
No Response	5	1.2
Gender		
Male	104	25.7
Female	300	74.3
Race/Ethnicity		
Black	113	28.0
White	271	67.1
Other	18	4.5
No Response	2	0.5
Age		
20-24 years	8	2.0
25-34 years	53	13.1
35-44 years	47	11.6
45-54 years	62	15.3
55-64 years	136	33.7
65 years or older	93	23.0
No Response	5	1.2
Educational Level		
High School Graduate or Below	32	7.9
Two-Year/Technical Degree	38	9.4
Some College	78	19.3
College Degree	129	31.9
Post-Graduate/Professional Degree	124	30.7
No Response	3	0.7
Annual Household Income		
$10,000 or less	14	3.5
$10,001-20,000	32	7.9
$20,001-30,000	30	7.4
$30,001-40,000	43	10.6
$40,001-50,000	39	9.7
$50,001-60,000	49	12.1
$60,001-70,000	62	15.3
Over $70,000	88	21.8
No Response	47	11.6

Table 1. Continued

Variable	Frequency	Percent
Marital Status		
Single, never married	67	16.6
Married	235	58.2
Separated	11	2.7
Divorced	59	14.6
Widowed	24	5.9
No Response	8	2.0

Overall, at least, 78% thought that using chemicals in (to raise) locally or regionally produced and sold beef or goat meat (beef cattle or meat goats) is a serious or somewhat serious hazard. The results are similar to those obtained by Misra et al. (1995), Govindasamy et al. (1998), Tackie et al. (2012), Kherl et al. (2013), and Tackie et al. (2016) who found that consumers were concerned about chemicals in meat products or food.

Table 2. Attitudes and Beliefs about the Use of Chemicals in Locally or Regionally Produced and Sold Beef or Goat Meat (N = 404)

Variable	Frequency	Percent
Residues from Pesticides		
Serious Hazard	164	40.6
Somewhat of a Serious Hazard	202	50.0
Not at all a Hazard	37	9.2
No Response	1	0.2
Antibiotics		
Serious Hazard	147	36.4
Somewhat of a Serious Hazard	218	54.0
Not at all a Hazard	37	9.2
No Response	2	0.5
Growth Stimulants or Hormones		
Serious Hazard	202	50.0
Somewhat of a Serious Hazard	169	41.8
Not at all a Hazard	33	8.2
Artificial Fertilizers in Pastures		
Serious Hazard	125	30.9
Somewhat of a Serious Hazard	229	56.7
Not at all a Hazard	49	12.1
No Response	1	0.2

Table 2. Continued

Variable	Frequency	Percent
Additives and Preservatives		
Serious Hazard	123	30.4
Somewhat of a Serious Hazard	234	57.9
Not at all a Hazard	47	11.6
Artificial Coloring		
Serious Hazard	107	26.5
Somewhat of a Serious Hazard	213	52.7
Not at all a Hazard	83	20.5
No Response	1	0.2

Regression Results

Table 3 shows estimates for the various models. Regarding the residues from pesticides model, it reflects the overall significance of the model (p = 0.006), 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 produced and sold locally or regionally is hazardous, PES). This perception is significantly affected by household size, gender, and household income, respectively, p = 0.031, p = 0.040, and p = 0.036. The higher the household size, the more likely the perception that residues from pesticides in beef or goat meat produced and sold locally or regionally are hazardous. Females are more likely than men to perceive that residues from pesticides in beef or goat meat sold locally or regionally are hazardous. The higher the household income, the less likely the perception that residues from pesticides in beef or goat meat produced and sold locally or regionally are hazardous. The results on gender are in agreement with Dunlap and Beus (1992), Kuperis et al. (1996), and Govindasamy and Italia (2004) who also found females significantly more likely to be concerned about pesticide residues in foods than males. However, the results are contrary to those obtained by Tackie et al. (2016) for Alabama, in which they found no significant influence of socioeconomic factors on the perception that residue from pesticides in meats are hazardous. Race/ethnicity, age, education, and marital status were statistically insignificant.

Regarding the antibiotics model, it reflects overall insignificance of the model (p = 0.197), i.e., all of the socioeconomic variables jointly did not explain the dependent variable (the perception that antibiotics in beef or goat meat produced and sold locally or regionally is hazardous, ANT). However, the perception is significantly affected by age, p = 0.063. The higher the age, the more likely the perception that antibiotics in beef or goat meat produced and sold locally or regionally are hazardous. The findings are not in agreement with Tackie et al. (2016) for Alabama. They found that education and household income significantly affected the perception that antibiotics

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

	PES		ANT		GSH	
Variable	β	*p*	β	*p*	β	*p*
HHS	0.223**	0.031	0.047	0.646	0.035	0.729
GEN	-0.519**	0.040	-0.351	0.162	-0.207	0.400
RAC	-0.064	0.770	0.219	0.317	0.107	0.622
AGE	-0.108	0.243	0.173*	0.063	0.035	0.700
EDU	-0.046	0.628	-0.129	0.176	-0.132	0.164
HHI	-0.124**	0.036	-0.004	0.947	-0.070	0.227
MAS	0.061	0.599	-0.057	0.625	-0.001	0.991
Chi-square	20.031*** (p = 0.006)		9.859 (p = 0.197)		6.289 (p = 0.506)	

Table 3 Continued.

	AFP		ADP		ARC	
Variable	β	*p*	β	*p*	β	*p*
HHS	0.041	0.684	0.014	0.888	0.070	0.488
GEN	-0.685***	0.007	0.176	0.485	-0.026	0.915
RAC	-0.110	0.614	0.176	0.424	-0.135	0.533
AGE	-0.168*	0.071	0.137	0.142	0.160*	0.078
EDU	-0.186**	0.052	-0.210**	0.029	-0.011	0.904
HHI	0.039	0.500	-0.011	0.856	-0.062	0.282
MAS	0.143	0.221	-0.041	0.727	-0.149	0.192
Chi-square	16.220*** (p = 0.023)		9.066 (p = 0.248)		4.662 (p = 0.701)	

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

in meat are hazardous; education positively affected the perception, whereas household income negatively affected the perception. Household size, gender, race/ethnicity, age, household income, and marital status were statistically insignificant.

Also, considering the growth stimulant or hormone model, it reflects overall insignificance of the model (p = 0.506), 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 produced and sold locally or regionally are hazardous, GSH). All the coefficients were statistically insignificant. In sum, none of the socioeconomic variables contributed immensely to the perception. This finding is in opposition to Tackie et al. (2016) for Alabama, where education was significantly and positively found to influence this perception.

With regards to the artificial fertilizers in pasture model, it shows overall significance of the model (p = 0.023), 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 are hazardous, AFP). This perception is significantly affected by gender, age, and educational level, respectively, p = 0.007, p = 0.071, and p = 0.052. Females are more likely than men to perceive that residues from artificial fertilizers in pastures used to raise beef cattle or meat goats sold locally or regionally is hazardous. The higher the age, the less likely the perception that residues from artificial fertilizers in pastures used to raise beef cattle or meat goats sold locally or regionally are hazardous. Also, the higher the educational level, the less likely the perception that residues from artificial fertilizers in pastures used to raise beef cattle or meat goats sold locally or regionally are hazardous. Again, the results are contrary to those obtained by 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 are hazardous. Household size, race/ethnicity, household income, and marital status were statistically insignificant.

Considering the additives and preservatives model, it reflects overall insignificance of the model (p = 0.248), 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 produced and sold locally or regionally are hazardous, ADP). However, the perception is significantly affected by education, p = 0.029. The higher the educational level, the less likely the perception that additives and preservatives in beef or goat meat produced and sold locally or regionally is hazardous. This finding is in agreement with Tackie et al. (2016) for Alabama who found a significant relationship between education and additives and preservatives in beef or goat meat; though in that case, those with higher education were more concerned with additives and preservatives in food than otherwise. Household size, gender, race/ethnicity, age, household income, and marital status were statistically insignificant.

Focusing on the artificial coloring model, it also shows overall insignificance of the model (p = 0.701), i.e., all of the socioeconomic variables jointly did not explain the dependent variable (the perception that artificial coloring in beef or goat meat produced and sold locally or regionally is hazardous, ARC). Despite this, the perception is significantly affected by age, p = 0.078. The higher the age, the more likely the perception that artificial coloring in beef or goat meat produced and sold locally or regionally is hazardous. This result is 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. Household size, gender, race/ethnicity, education, household income, and marital status were statistically insignificant. A plausible explanation for the insignificance of the overall models for the “antibiotics”, “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 Florida consumers’ perceptions on the use of chemicals in locally or regionally produced livestock products. In particular, it identified and described socioeconomic factors, described and assessed attitudes and beliefs about 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 statistics

showed more females than males, more Whites than Blacks, more middle-aged and older persons than younger persons, with relatively high educational levels, with moderate to moderately high household incomes, 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 ordinal logistic analyses showed that selected socioeconomic factors influenced consumers' perceptions of use of chemicals in livestock or livestock products: specifically, household size, gender, and education had significant effects on pesticide residues; age had a significant effect on antibiotics; gender, age, and education had significant effects on artificial fertilizers in pastures; education had a significant effect on additives and preservatives, and age had a significant effect on artificial coloring.

Since consumers had a high concern about the use of chemicals in livestock or livestock products, there is a need for producers and processors to minimize the use of chemicals in the production of livestock or livestock products. The process could either start from policy makers reviewing and modifying policies in place regarding the use of these chemicals, or the former groups voluntarily amending production practices. The short-term benefits will be relatively less chemicals, especially, antibiotics, growth stimulants or hormones, artificial fertilizers, additives and preservatives, and artificial coloring in livestock or livestock products. The long-term benefit will be decreased cumulative effects on the environment and health of consumers.

The study has provided an insight into how socioeconomic factors affect consumers' perceptions on the use of chemicals in livestock or livestock products, especially beef and goat meat. Its major contribution is the implication that household size, gender, and household income influence or affect consumer perceptions on pesticide residues; age influences or affects consumers' perceptions on antibiotics; gender, age, and education influence or affect consumers' perceptions on artificial fertilizers in pastures; education influences or affects consumers' perceptions on additives and preservatives, and age influences or affects consumers' perceptions on artificial coloring in beef or goat meat. However, the direction of the influence or effect is mixed. Future studies may include replicating the study and/or covering a larger area or another geographic area.

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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 2 = 4-6	2.36	1.10
Gender	1 = male 0 = female	0.26	0.44
Race/ethnicity	1 = Black 2 = White 3 = other	1.76	0.52
Age	1 = 20-24 2 = 25-34 3 = 35-44 4 = 45-54 5 = 55-64 6 = 65 or above	4.36	1.41
Education	1 = high school or less 2 = two-year/technical 3 = some college 4 = college degree 5 = post-graduate/professional	3.69	1.23
Household income	1 = $10,000 or less 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	5.51	2.17
Marital status	1 = single, never married 2 = married 3 = separated 4 = divorced 5 = widowed	2.34	1.11

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

Variable	Description	Mean	Standard Deviation
Pesticides	0 = not at all a hazard 1 = somewhat a serious hazard 2 = serious hazard	1.32	0.63
Antibiotics	0 = not at all a hazard 1 = somewhat a serious hazard 2 = serious hazard	1.27	0.62
Growth Stimulants/hormones	0 = not at all a hazard 1 = somewhat a serious hazard 2 = serious hazard	1.42	0.64
Artificial Fertilizers	0 = not at all a hazard 1 = somewhat a serious hazard 2 = serious hazard	1.19	0.63
Additives and Preservatives	0 = not at all a hazard 1 = somewhat a serious hazard 2 = serious hazard	1.19	0.62
Artificial Coloring	0 = not at all a hazard 1 = somewhat a serious hazard 2 = serious hazard	1.06	0.69

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