

RESEARCH ARTICLE

Factors affecting the changes in meat and meat product consumption of high school students: A logistic regression analysis

J.M.D.R. Jayawardana^a, R.H.W. Nadeeshani^a, K.M.N.T.K. Bandara^b,
D.D. Jayasena^{a*} and C.M.B. Dematawewa^c

^a*Department of Animal Science, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, Badulla 90 000, Sri Lanka*

^b*Department of Technical Education, National Institute of Education, Maharagama 10 280, Sri Lanka*

^c*Department of Animal Science, Faculty of Agriculture, University of Peradeniya, Peradeniya, 20 400, Sri Lanka*

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*Correspondence: dinesh@uwu.ac.lk, ORCID: <http://orcid.org/0000-0002-2251-4200>

ABSTRACT

Protein malnutrition remains a challenging and unresolved health problem among young children in Sri Lanka. This paper aimed to explore the impact of socio demographic attributes on meat and meat product consumption of young children and the factors that affect to change meat and meat products consumption. A total of 387 students aged 17-18 y from different subject streams in Kandy district, Sri Lanka were interviewed using a pre-tested structured questionnaire. Binary logistic regression analysis was performed to investigate the socio-demographic factors. All factors possibly influencing meat and meat product consumption pattern were summarized into six factors (monetary, nutritional, health, quality, animal welfare, and advertising) using principal component analysis. Ordinal logistic regression analysis was performed for the linear combination of the above six principal components to investigate how those components affected the changes in meat and meat product consumption. The majority of students (82%) consumed both meat and processed meat products and chicken meat had the highest preference (75%) among the meat-eaters followed by beef (25.3%), pork (14.7%), and mutton (9.0%), respectively. Knowledge on meat quality standards, family income, and religion was the dominant socio-demographic factors that affected meat and meat product consumption ($P < 0.01$). The majority of high school students (91%) were in the normal range of body mass index (18.5-24.9). Monetary and advertising factors had a positive and negative impact (odds ratio=1.66 and 0.70) on the changes in meat and meat products consumption, respectively ($P < 0.01$). Proper maintenance of meat quality and further research and development on nutritional aspects targeting healthier meat and meat products could lead to change in the perception of meat consumption of young school children in Sri Lanka.

Keywords: *body mass index, chicken, high school, logistic regression, meat consumption*

INTRODUCTION

Annual per capita meat consumption has doubled worldwide from 23.1 kg in 1961 to 42.2 kg in 2011 (Sans and Combris, 2015) and is likely to rise by 72% 2000 to 2030 (Fiala, 2008). However, meat consumption and meat processing industry have not yet been well developed in the Asian region compared to Europe and America (Nam *et al.*, 2010; OECD/FAO, 2019). As an Asian country, the annual per capita meat and meat product availability in Sri Lanka was 9.8 kg per year for chicken, followed by beef (1.4 kg per year), pork (0.41 kg per year), and mutton (0.14 kg per year) in 2020 (Department of Animal Production and Health, 2020). There has been an increased consumer demand for poultry meat compared to other meat types and varieties of meat products in Sri Lanka (Department of Animal Production and Health, 2021) with the increase in per capita income, urbanization, and socio-cultural changes (Department of Census and Statistics, 2019).

Consumer behavior of meat consumption depends on economic, cultural, religious, social, personal, and marketing factors, and knowledge of nutritional information (Dietz *et al.*, 1995; Guenther *et al.*, 2005; Yen *et al.*, 2008). Being a multicultural country, Sri Lankan consumers exhibit a variety of meat consumption patterns. Religious beliefs also have a strong impact on the meat consumption pattern in Sri Lanka (Silva *et al.*, 2010). Thus, the development of the meat industry is hampered by ethnic diversity where some religious communities are reluctant to consume beef and pork (Alahakoon *et al.*, 2016).

Meat and meat products consumption pattern vary depending on the age distribution. Townsend *et al.* (2015) reported that school students at ages 16 and 18 had barriers to healthy dietary choice in Sri Lanka due to lack of education on healthy diet in the curriculum and the pressure being put on them to achieve in the national examinations in that age. Nutritional problems of young students are a critical issue in Sri Lanka that must be addressed through the school education system (Jayatissa and Ranbanda, 2006). Kumarapeli and Athauda (2004) revealed that meat consumption of adolescent females was different between urban and rural settings in Sri Lanka. Food based dietary guidelines of Sri Lankan ministry of health reported that children and adolescents require more fish or egg or lean meat with pulses, vegetables and fruits (Ministry of Health, 2022). Understanding of the socio demographic factors that influence young children's meat and meat product consumption pattern is essential to prevent malnutrition among the Sri Lankan young children.

Many studies have been conducted on the knowledge, attitudes, beliefs and animal welfare issues towards meat and meat product consumption in worldwide (Verbeke and Viaene, 1999; Guenther *et al.*, 2005; Krystallis *et al.*, 2007; Yen *et al.*, 2008; Whybrow and Macdiarmid, 2018). However, relatively few studies have only explored the factors that affect changes in meat and meat product consumption (Verbeke and Vackier, 2004; Latvala *et al.*, 2012). To our knowledge, no studies have investigated the factors that influenced to change the

meat and meat product consumption pattern of young school children in Sri Lanka. Therefore, this study aims to investigate the influence of socio-demographic factors on meat and meat product consumption and to identify the factors having a significant impact on the changes in meat and meat product consumption of Sri Lankan high school students.

MATERIALS AND METHODS

Respondents

This study investigated the factors affecting the changes in meat and meat product consumption patterns of high school students (aged 17-18) in Kandy district, Central Province, Sri Lanka which has high ethnic diversity. A total of 387 students from the population of 38,419 high school students were selected from six educational zones, namely Denuwara (24), Gampola (49), Kandy (209), Katugasthota (51), Theldeniya (23), and Waththegama (34) according to a combination of multi-stage stratified sampling, systematic sampling, and simple random sampling techniques.

Procedure

Secondary data were obtained from the Department of Education, Central Province, Sri Lanka for selecting the sample sizes from each educational zone. Before the data collection, a reliability analysis (Cronbach's alpha=0.82) was conducted, and adjustments were made to correct the errors in the questionnaire. Initially stratified random sampling was used treating six educational zones as strata. Then, within an educational zone (stratum), schools were selected using the systematic sampling technique based on the available list of schools in each educational zone. The sample proportion from different zones was determined based on the student population size of each zone. Within a school, different academic streams were defined as strata and the number of students to be surveyed was determined proportionally to the sizes of the strata. It was assumed that the different strata of the stratified sampling had the same variance in this study. Finally, the exact students to be surveyed were selected using the simple random sampling technique from each academic stream. Respondents were then interviewed face-to-face by a pre-tested structured questionnaire which consisted of several sections including personal details, educational information, family background, meat consumption (fresh, processed, organ), knowledge on meat and meat product consumption, factors concerned for changing the meat and meat product consumptions recently (monetary, nutritional, health, quality, animal welfare, and advertising).

The weight and height of each student were measured to calculate body mass index (BMI). The calculated BMI values were categorized according to the standard of the World Health Organization (WHO) defined cut-off points; underweight $BMI \leq 18.5$, normal $18.5 < BMI \leq 24.9$, and overweight $25 \leq BMI \leq 29.9$ (WHO, 1995).

Data analysis

The data were analyzed using MINITAB 17 software. Meat and meat product consumption was labeled as “yes” if either fresh or processed meat (or both) is consumed and “no” if neither was consumed. Demographic information was summarized using descriptive statistics and binary logistic regression analysis. To identify the impact of socio-demographic attributes on the students’ meat and meat product consumption binary logistic analysis was performed considering meat and meat product consumption (yes=1 or no=0) as the dependent variable and knowledge on the quality standard, gender, monthly income of family, religion, living place and academic stream as independent variables. Furthermore, the study was focused to identify the effect of six factors used in this study (monetary, nutritional, health, quality and safety, welfare, and advertising), on changing the meat and meat product consumption of adolescent school children. In addition, each factor was focused to measure sub-variables specified for the meat and meat product consumption and, those were measured using a five-point Likert scale ranging from ‘strongly disagree’ [1] to ‘strongly agree’ [5]. A principal component analysis was carried out for the same sub-variables within a factor and five principal components (PCs) were derived. The first PC was selected to represent the first factor which was concerned (i.e. monetary factors) and the selected PCs were used for further modeling. Thereafter, ordinal logistic regression analysis was performed by considering the identified PC as independent variables to investigate how these factors affect the dependent variable of changes in meat and meat product consumption measured as 1=less than past, 2=no change, 3=greater than the past.

Logistic regression analysis

Logistic regression analysis indicates the likelihood of respondents to perceive a claim or statement credible, depending on the independent variables considered in the model. The following linear equation was used for fitting binary and ordinal logistic regression models separately.

$$P = \frac{\exp(B_o + B_1x_1 + \dots + B_kx_k)}{1 + \exp(B_o + B_1x_1 + \dots + B_kx_k)} \text{ and through algebraic manipulation,}$$

$$\ln\left(\frac{P}{1-P}\right) = B_o + B_1x_1 + \dots + B_kx_k$$

where $\beta_0, \beta_1, \dots, \beta_k$ are the estimators and x_1, x_2, \dots, x_k are independent variables.

In the analysis of binary logistic model x_1, x_2, \dots, x_k represented socio-demographic variables such as knowledge on the quality standard, gender, monthly income of family, religion, living place and academic stream whereas

for the ordinal logistic model it represented the loaded value of PCs for the monetary, nutritional, health, quality and safety, welfare, and advertising factors. Furthermore, P is a nonlinear function of the response variable, in case of binary logistic model responses were coded with meat and meat product consumption as 'yes' or 'no' whereas ordinal logistic regression model it was ordinal responses, whether the student changed the meat and meat product consumption recently as 'changed less than past', 'not changed' and 'more than past'.

RESULTS AND DISCUSSION

Socio-demographic characteristics of the students used in the present study are shown in Table 1. Several previous studies have reported that the age of respondents significantly affected their opinions on meat and meat product consumption (Krystallis *et al.*, 2007; Latvala *et al.*, 2012; Ergönül, 2013). In Sri Lanka, limited information is available on the meat consumption patterns of adolescents (Kumarapeli and Athauda, 2004; Jayatissa and Ranbanda, 2006). The current study targeted the young population in the country which reduced the impact of knowledge on purchasing meat and meat products and avoided the biasness of responses due to different age categories. In addition, the total population in Sri Lanka is mainly comprised of Buddhists (70.1%), Hindus (12.6%), Muslims (9.7%), and Roman Catholics and other Christians (7.6%) with a significantly less proportion of others (Department of Census and Statistics, 2012). Therefore, the Kandy district in Central Province depicted an overall trend of different religious groups as it provided comparative patterns of meat consumption under different religious believes.

According to the results, most of the students (82%) consumed both meat and processed meat products whereas only 8% of students did not consume any meat or processed meat products. The rest consumed either meat or processed meat products. Furthermore, the majority of students (75.4%) preferred to consume chicken meat whereas consumption of beef (25.3%), pork (14.7%), and mutton (9.0%) by high school students was comparatively low. These results are in agreement with the findings of Silva *et al.* (2010) which concluded that chicken meat and processed chicken were more popular than other meat types among consumers in Southern Province, Sri Lanka. Similarly, Alahakoon *et al.* (2016) have documented that consumption of pork and beef was mainly delimited by ethnoreligious beliefs and chicken meat consumption was growing rapidly due to the less religious barriers.

Table 1: Descriptive statistics of the demographic information.

Variable	Levels	Frequency	Percentage (%)
Age (years)	17	231	59.7
	18	156	40.3
Sex	Female	236	61.0
	Male	151	39.0
Religion	Buddhist	296	76.5
	Christian	50	12.9
	Muslim	24	6.2
	Hindu	17	4.4
Academic stream	Art	192	49.6
	Commerce	79	20.4
	Biological Science	72	18.6
	Physical Science	44	11.4
Living place	Urban	102	26.3
	Semi Urban	154	39.8
	Rural	131	33.9
Monthly family income (LKR)	≤10,000	12	3.1
	10,000 < Income ≤ 20,000	30	7.8
	20,000 < Income ≤ 30,000	78	20.2
	30,000 < Income ≤ 40,000	116	30.0
	>40,000	151	39.0

Approximately half of the students surveyed (45.1%) consumed meat because of its nutritive value. However, the majority of students consumed processed meat products due to the taste (36.3%), followed by convenience (30.6%), nutritive value (19.4%), and tradition in the family (13.4%). Alahakoon *et al.* (2016) report that most Sri Lankans in urban areas preferred to eat processed meat due to the convenience, and availability of different varieties.

When considering the frequency of meat consumption, a significantly smaller percentage of students (2.8%) consumed meat daily, and the majority of the students consumed meat once a week (57.4%) followed by twice a week (13.7%), more than twice a week (10.1%), once a month (8.1%) and twice a month (8.1%), respectively. The present results are in accordance with the findings of Jayatissa and Ranbanda (2006) who have reported that only a small percentage of school children consumed chicken (11.2%), pork, beef, or sausages (7.8%) daily whereas 27.2% of school children consumed chicken, pork, beef or sausages weekly. Although the meat consumption patterns in European and Asian regions are different, Heuer (2014) also reported that only a small proportion of students (14%) consumed meat on a daily basis in Europe. One of the possible factors which had affected less daily meat consumption in our results could be moderate monthly income of the households.

With respect to the body mass index, almost 91% of high school students were in the normal range ($18.5 < \text{BMI} \leq 24.9$) followed by lesser percentages (5.7% and 3.6%) in the underweight ($\text{BMI} \leq 18.5$) and overweight ($25 \leq \text{BMI} \leq 29.9$) categories, respectively. When the reported BMI values were analyzed according to living areas, 72% of overweight consumers were from urban areas, followed by 28% from semi-urban localities. Interestingly, no students from villages belonged to the overweight category. Nevertheless, the results of the present study were insufficient to identify a direct association between meat consumption and obesity. In another study, Kumarapeli and Athauda (2004) have concluded that obesity was higher among urban students whereas underweight was higher in the rural population. Lack of awareness about the new products, lack of knowledge regarding the nutritional value of meat products, lack of facilities, and low income could be the leading factors that diminished meat and meat product consumption in rural areas. Alahakoon *et al.* (2016) have suggested improving transport, meat storage, and proper marketing practices in rural areas in Sri Lanka for distributing good quality meat at a reasonable price.

Impact on socio-demographic factors on the meat consumption

Binary logistic regression model was comprised of six independent variables such as knowledge on the quality standard, gender, monthly income of family, religion, living place, and academic stream. In this regard, it was revealed that the fitted model was able to predict the data adequately at a 1% significance level (deviance P -value, $0.42 > 0.01$) where the model had the maximum log-likelihood value and the minimum AIC (346.5) and BIC (374.2) values compared to the other stepwise selection models.

According to the odds ratios of meat consumption related to the socio-demographic variables (Table 2), awareness on the meat quality standards, monthly income of family and religion of students significantly affected meat consumption ($P < 0.01$). Nevertheless, gender, living place, and the academic stream had no effect on the meat consumption of high school students ($P > 0.01$). Similarly, Silva *et al.* (2010) highlight that the living area does not influence the meat consumption habits of individuals. In addition, the present study revealed that awareness on the quality standards is likely to increase meat consumption by 0.8 times. Yeung and Morris (2001) found that consumers had growing concerns on the risk factors such as microbiological and chemical components and the quality standard of chicken meat when they purchased the products. However, Grunert *et al.* (2004) concluded that consumers' expectations and experiences on meat quality were limited and they had difficulties in evaluating meat quality. Since the present study was more oriented to adolescent high school children, they were well aware of the meat quality standards (Table 2).

Furthermore, students with a family income above LKR 40,000 recorded a 0.5 times higher tendency for meat consumption than the other income categories. According to the national survey report of household income and expenditure in Sri Lanka, the estimated average household income per month at the national level was LKR 62,237, and expenditure on food was LKR 19,114 as one of the major categories of household expenditures (Department of Census and Statistics, 2016). Therefore, it is evident that monthly income plays a significant role in consumer purchasing patterns in Sri Lanka which in turn is more important for meat consumption. Schroeder *et al.* (1996) have report that low-income countries with growing incomes have experienced increasing per capita meat consumption. Similarly, Henchion *et al.* (2014) highlight that the influence of income and price is likely to decline over time due to slower income growth rates and saturation rates in the market and the fact that quality will become more important for meat consumption.

Table 2: Odds ratio of meat consumption related to the socio-demographic variables.

Variables	Levels	Estimate	Odds ratio (OR)	<i>P</i> value
Intercept		0.91	2.48	0.34
Awareness on quality standards	Yes	-0.24	1.79	0.01*
Gender	Female	-0.46	0.63	0.09
Monthly income		0.26	1.30	0.04*
	10,000 < Income ≤ 20,000	-0.76	0.47	0.33
	20,000 < Income ≤ 30,000	-1.41	0.24	0.29
	30,000 < Income ≤ 40,000	0.19	1.20	0.67
	>40,000	0.42	1.51	0.01*
Living place		-0.01	0.99	0.97
	Urban	0.09	1.10	0.82
	Semi-urban	0.31	1.36	0.39
Religion		0.62	1.85	0.01*
	Buddhism	-19.63	0.00	0.99
	Hindu	-20.14	0.00	0.99
	Islam	0.08	1.93	0.00*
	Catholic	-18.09	0.00	0.99
Academic stream		0.03	1.03	0.84
	Biological Science	-0.12	0.79	0.89
	Physical Science	-0.17	0.72	0.84
	Commerce	-0.59	0.12	0.55

Interestingly, the results of the current study showed that meat consumption patterns depended on the religion of the student where Muslim students were 0.9 times more likely for meat consumption than students of other religions. It was found that different religious groups had different consumption patterns and Muslims had no religious barriers to animal slaughter or meat consumption except for pork. This agrees with the findings of Silva *et al.* (2010) who reported a significant association between religion and meat consumption in Sri Lanka.

Identification of factors affecting changes in meat consumption

Principal component analysis was performed for the monetary, nutritional, health, quality, animal welfare, and advertising factors separately. The first PCs were extracted from all factors for modelling, because in every factor the first PC was dominant in the factor loadings. For instance, in monetary factor, the first PC was sufficient to explain the higher percent (81%) of the total variance whereas all the variables were positively loaded to the first PC (Table 3). Likewise, other five linear combinations of principal components (PC2, PC3, PC4, PC5, and PC6) were obtained and the first principal components in every factor were able to explain the total variation of nutrition (73%), health (83%), quality and safety (77%), animal welfare (65%) and advertising (79%), respectively.

Table 3: Factor loading and the variables concerned in monetary and advertising.

Factor	Variables concerned within factor	Eigen values	Loading in PC
Monetary	My meat consumption decision depends on its price (x_1)	4.04	0.44
	If meat would be cheap, my consumption would increase (x_2)	0.28	0.46
	If meat would be more expensive, my consumption would decrease (x_3)	0.26	0.44
	I think, family income level directly affects the meat consumption (x_4)	0.23	0.44
	I would consider meat/ meat product prices when deciding to eat out at restaurants/ hotels (x_5)	0.19	0.45
Advertising	By looking at the advertisements, it increases meat purchasing and consumption frequency (z_1)	3.95	0.45
	Television advertisements are the most suitable way of advertising than other types such as cut-outs/banners, radio advertisements, and bills (z_2)	0.43	0.44
	Advertising induce to try out the different meat types, new processed meat products (z_3)	0.26	0.46
	My friend's/neighbor's food patterns induce me to try out meat products (z_4)	0.20	0.44
	Advertisements are essential for promoting meat/ meat products while it helps in increasing consumer awareness about the product (z_5)	0.16	0.49

The results of ordinal logistic regression between ordinal responses and the six PCs were significant ($P < 0.01$). According to the results of the goodness of fit test the higher P values were obtained for Pearson and Deviance tests as 0.40 ($P > 0.01$) and 0.88 ($P > 0.01$), respectively. It suggested sufficient evidence to claim a model fitted to the data adequately. Further, R^2 (P value = 0.004) revealed that the fitted model was able to explain 99.6% of the total variance of the response variable of changes in meat consumption in high school students (Table 4).

Table 4: Results of the ordinal logistic regression model.

Predictors	Coefficient	Standard error	P value	Odds ratio
Constant (1)	-2.275	0.173	0.000*	-
Constant (2)	1.046	0.118	0.000*	-
PC1	0.508	0.164	0.002*	1.66
PC2	-0.199	0.158	0.208	0.82
PC3	-0.058	0.156	0.707	0.94
PC4	-0.026	0.180	0.885	0.97
PC5	0.021	0.117	0.853	1.02
PC6	-0.353	0.129	0.006*	0.70
Log-likelihood	-329.15			
P value	0.004			

*Significant at 1% significance level

Table 4 shows that constant (1) and constant (2) estimated intercepts for the logits of the cumulative probabilities of changes in meat consumption were significant ($P < 0.01$). Furthermore, PC1 (linear combination of all the monetary factors) and PC6 (linear combination of all advertising factors) significantly ($P < 0.01$) affected the changes in the meat and meat product consumption of the high school students in Kandy district (Table 4).

$$PC1 = 0.44 x_1 + 0.46 x_2 + 0.44 x_3 + 0.44 x_4 + 0.45 x_5$$

$$PC6 = 0.45 z_1 + 0.44 z_2 + 0.46 z_3 + 0.44 z_4 + 0.49 z_5$$

Where PC1 and PC6 represent the monetary and advertising factors. A detailed description of the variables concerned within each PC was defined in Table 3.

The odds ratio of PC of monetary factors was 1.66 and the present results further confirmed that family income had a significant impact on changes in meat consumption of the students ($P < 0.01$). Silva *et al.* (2010) also showed that the purchasing behavior of meat and meat products was attributed to financial capabilities and students' preferences on meat products. Remarkably, the PC for advertising factor had a negative impact on the meat or meat product consumption of students and its odds ratio was less than 1.0 (Table 4) indicating that advertising had less likely on changing meat consumption. Although this study cannot establish reasons for the negative influence of advertisement on the

changes in meat and meat products consumption the existing literature establishes advertising about the potential health risks associated with meat consumption had a negative impact on decision-making towards meat consumption (Woodward *et al.*, 1997; Verbeke *et al.*, 2000).

Results of the present study revealed that PCs related to nutrition, health, quality and safety, and animal welfare did not significantly affect the recent changes in meat consumption of students. Hence, these results are more vital for the meat producers to develop new meat products targeting niche markets and consisting of more health and quality benefits to attract young consumers. Taylor *et al.* (2012) showed that perceptions of people on the safety and quality of meat products are important in their buying choices. Although the students showed a better knowledge regarding animal welfare in this study, it had not altered their meat consumption. In contrast, Latvala *et al.* (2012) reported that many Finnish consumers had either changed or intended to change their meat consumption pattern, particularly concerning environmental and animal welfare issues.

CONCLUSIONS

The key socio-demographic attributes that affected the meat and meat products consumption of high school students in Kandy district were awareness on the meat quality standards, monthly income of the family and religious status. Conducting educational programmes about meat and meat product quality standards is likely to increase meat consumption in young students. The advertising factors used by meat processing companies to promote their products had significant negative impact to change the meat and meat products consumption of adolescent school student. This suggests that proper market analysis, effective marketing strategies and advertising techniques are essential for promoting commercial meat product in future. Nutrition, health, quality and safety, and animal welfare factors had no effect on changing the meat consumption of young school children. Therefore, understanding the children's perception and their awareness on nutritional, health, quality and animal welfare aspects of meat and meat products need to be further investigate in future studies.

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