

Economic Analysis of Consumer Demand for Indigenous Chicken Eggs in Kenya

Charles Ndenga^{1*} Lucy W. Kabuage² Eric K. Bett¹

1.Department of Agribusiness Management and Trade, Kenyatta University,
P.O Box 43844-0100, Nairobi, Kenya

2.Department of Agricultural Sciences and Technology, Kenyatta University,
P.O Box 43844 0100, Nairobi, Kenya

Abstract

The World health organization recommends a daily protein requirement of 55 grams per person to avert health and nutritional related problems. This requirement is hardly met in majority of developing countries' households especially in the sub Saharan African. Indigenous chicken eggs have potential to position themselves as a major source of proteins in these households due to their low prices compared to other sources of proteins. However, average per capita egg consumption in Kenya has remained low compared to the world average. Consequently, no research has been done to determine factors that influence egg consumption in Kenya. It is on the basis of this research gap that this study is conducted with three specific objectives; to characterize indigenous chicken egg consumers, to estimate the level of preferences in different egg types and to determine factors influencing household demand for indigenous chicken eggs in the counties of Makeni and Nairobi in Kenya. A total of 174 respondents were sampled in across sectional survey design using a multistage sampling technique. The data was collected with the aid of a structured questionnaire and analyzed using descriptive statistics, non parametric Kendall coefficient of concordant test and multiple regression models in STATA 11.0 version. Results showed that there was a significant agreement ($p < 0.01$) among consumers in the ranking of indigenous chicken eggs as the most important compared to all other eggs available in the market. Gender, age, education, price, income and household size had a significant effect ($p < 0.01$) on demand for indigenous chicken eggs. All variables estimated had the expected sign. Policy should focus on these factors in order to increase both consumption levels and competitiveness of the egg value chain.

Keywords: Indigenous chicken eggs, demand, Kendall coefficient and multiple regression models.

1.0 INTRODUCTION

Protein is an essential component of diet and is either sourced from plant or animal sources. Animal products contain more ratios of amino acids than plant products (Britton, 2003). Demand for livestock products is rapidly increasing in sub Saharan Africa (Delgado et al., 1999). The incremental demand has been associated with the "livestock revolution" (Delgado, 2003; Thornton, 2010). Eggs have a potential to position themselves as a major source of proteins hence averting the malnutrition problem that characterizes most of the sub Saharan countries. This is due to its low price compared to other sources of proteins. In Kenya, consumers exhibit high preferences for indigenous chicken (IC) eggs and are willing to pay 41.53% more compared to other egg types (Bett et al., 2012). The increase in consumer preferences for IC eggs is attributed to the fact that they have both nutritional and health associated benefits. Kenya has an estimated population of 40 million people who need a daily protein requirement of 55 grams per person according to the world health organization (WHO). The growing population and purchasing power aggravated by increase in income levels are spurring demand for chicken products especially eggs in Kenya's urban and rural areas. The livestock sector contributes to 12% of Kenya's GDP, 40% to the agricultural GDP and 50% of employment in agricultural sector (MoLD, 2010). In 2010 the total number of chickens in Kenya stood at 37.3 Million distributed as follows: - 84% indigenous, 5.7% broilers, 8.3% layers and 1.7% other birds (USAID, 2010). Indigenous chicken (IC) contributes to 71% of the total egg and poultry meat production and therefore influencing significantly on the rural trade, welfare and food security of the smallholder farmers (Nyaga, 2007; Ndenga et al., 2017). Indigenous chicken eggs are regarded as familiar, nutritious, economical and easy to prepare food as they provide balanced sources of nutrients for humans of all ages (Matt et al., 2009). As Kenya transforms to middle level income by 2030 (Kenya Vision 2030), food consumption patterns are expected to shift from meeting basic dietary needs to a keener interest in health, convenient and superior value foods. Indigenous chicken eggs are expected to play key role during this transition face by supplying proteins and maintaining healthier lifestyles. However, consumption of eggs in Kenya is low compared to the world average consumption. For instance, per capita consumption of eggs in Kenya is 40 per year compared to the world average percapita consumption of 200 eggs per year (Hans et al., 2013). The low consumption levels leads to low performance of the egg value chain making it uncompetitive. Assessment of factors influencing egg consumption levels and preferences would therefore inform value chain players and the government on the possible interventions to realize full potential and benefits of the egg value chain. In Kenya however information on determinants of egg demand and egg type preferences is scanty. The study sought to fill this void in information

through across sectional survey design carried out in the counties of Nairobi and Makueni. The objectives of the study were to; characterize egg consumption, rank various egg types in the market based on consumer preference and to determine socio-economic factors influencing egg demand in the study area.

Several studies on food demand focused on chicken meat and other meat types in the market by employing almost ideal demand systems (AIDS) model. For instance, Bett et al. (2012) analyzed the demand for meat in rural and urban areas of Kenya by employing Linear Approximate almost ideal demand system (LA/AIDS). Gamba (2005) characterized consumption of meat products and eggs in the city of Nairobi. Apart from food expenditures, other studies have analyzed household food consumption levels; Issa et al. (2015) investigated home consumption of local chickens and found that price and taste are the main determinants of indigenous chicken consumption in Chad's N'Djamena city. The study found that households headed by women consumed more chickens than those headed by men. Upadhyay et al. (2014) employed regression analysis in determining consumption patterns of fish in urban area of Tripura. Results revealed that fish price; number of adult members in a family, quantity of consumption of chicken and mutton affected the quantity of fish purchase. Delgado et al. (2003) found that the demand for fish is positively related to income indicating that as peoples' purchasing power (disposable income) increases, they demand more quantity of chicken. Toluwase et al. (2017) established that the demand for chicken meat in Nigeria was influenced by own price, household size, income and price of close substitutes (turkey and fish).

The above studies show that both socio-economic and demographic factors influence household demand for food. Evaluating determinants of household egg demand in Kenya would facilitate redefining strategies for consumption and marketing and would provide insights into policies targeting the poultry sector.

2.0 MATERIALS AND METHODS

2.1 The study area and Sampling

This study was conducted in Makueni and Nairobi counties of Kenya. Makueni county lies between latitude 1°35' South and longitude 37° 10' East (Makueni county integrated development plan (CIDP), 2013). Nairobi county on the other hand lies between latitude 1° 17' south and longitude 36° 49' East and has nine sub counties. The target population for this study consisted of all consumers of indigenous chicken eggs in Nairobi and Makueni counties. Multistage sampling technique was used and 174 consumers selected. Makueni was purposively selected because it represents both production and consumption region of indigenous chicken eggs whereas Nairobi represents a major consumption and terminal market for IC eggs in Kenya having consumers with varied socio-demographics.

2.2 Data collection and Analysis

Primary data was collected with the aid of structured questionnaires administered by trained enumerators in a cross sectional survey design conducted between August and October 2015. Primary data collected included socio-economic factors; age gender, education, income, household size, price, quantity, county and types of eggs in the market. The vehicle for analysis was Kendall coefficient of concordant test that was used to rank various egg types and determine the level of agreement among the rankers/consumers. The Kendall's test is mostly used to rank constraints or problems from the most pressing to the least pressing and then measure the degree of concordance among respondents involved. The eggs were ranked using the numbers, 1, 2, 3,n from the most important to the least important type based on the consumers' own assessment. The total rank score computed was used to calculate concordance coefficient, W.

The range of coefficient W is between zero (0) and one (1) where w=1 means same ranking for all respondents and w = 0 mean maximum disagreement between all the respondents. The formula for coefficient of concordance is;

$$w = 12 \left[\frac{\sum T^2 - \frac{(\sum T)^2}{n}}{nm^2(n^2 - 1)} \right] \dots \dots \dots (1)$$

- Where $\sum T$ = sum of ranks for eggs types being ranked
- W = coefficient of concordance
- n = number of egg types being ranked
- m = number of respondents (consumers)

The significance of coefficient of concordance was tested using the F – test. The null hypothesis stated that there is no significant agreement among consumers on the ranking of egg types.

Ordinary least square estimation methods (OLS) in STATA version 11.0 statistical package was used was used to analyze factors that influence demand for IC eggs in Kenya. The dependent variable was quantity of IC eggs bought while independent variables included both socio-economic; age, education, income, gender, household size and price of eggs. More specifically, the method that was used for econometric analysis was multiple regression model as stated below;

$$Y = \beta_0 + \beta_1 GEN + \beta_2 INC + \beta_3 AGE + \beta_4 EDU + \beta_5 HS + \beta_6 PRICE + \epsilon_i \dots \dots \dots (2)$$

TABLE 1: Definition of variables used in the model

Variable	Definition
GEN	Gender: 1 – Male, 0- Female
AGE	Age in years
EDU	Education 1 - up to primary school 2 - Secondary school 3 – Tertiary level
HS	Household size (continuous)
INC	Income earned per month in Kenya shillings (Ksh.) 1- Less than 10,000 2- Between 10,000 and 30,000 3- Greater than 30,000
PR	Price of indigenous chicken egg in Kenya shillings(Ksh.)

3.0 RESULTS AND DISCUSSION

3.1 Descriptive results

Socioeconomic characteristics of indigenous chicken eggs consumers are presented in tables (2&3) below. Based on the findings, the average age of age consumers was 35 years implying a youthful age bracket. The youngest consumer was 17 years old while the oldest was 85 years. The number of household members averaged four where the lowest household had one member only and the largest household had 20 members. In the study area, majority of the IC egg consumers were male at 56.32% compared to women at 43.68%. The probable reason for men's dominancy in purchase and consumption of eggs can be attributed to flexibility and ease of preparation of eggs compared to other sources of proteins (Matt et al., 2009). Majority of the egg consumers had secondary level of education at 48.28% while only 21.84% had primary level. This implies that consumers are enlightened on both nutritional and health benefits associated with consumption of IC eggs. Table 3 revealed an even distribution of income among the IC eggs consumers implying that IC eggs are consumed almost equally across different income groups. Consumers who earned less than Ksh. 10,000 per month were 37.93% which is almost the same as those earned Kh. 30,000 and above (33.33%). The average number of eggs consumed in the study area was 14 eggs while 1 and 60 eggs were the minimum and maximum eggs consumed respectively. This indicates an even distribution in consumption patterns of IC eggs as demonstrated by distribution in income levels. Market prices indicated that eggs were sold at an average price of Ksh. 17.90 per egg while they ranged from Ksh. 10 per egg to Ksh. 35 per egg (Table 2). These results agrees with the findings of Matt et al. (2009) that eggs are among the least expensive sources of proteins for humans of all ages.

Table 2: Socio-economic characteristics of the consumers

Variable	Definition	Mean	Std Dev.	Minimum	Maximum
AGE	years	35.8103	12.9986	17	85
HS	No.	4.2931	2.6293	1	20
PRICE	Ksh	17.9023	3.6488	10	35
QTY	Number	14.1092	15.6343	1	60

SOURCE: Authors computation (2017)

Table 3: Household demographics

Variable	Definition	Frequency	Percent
GEN	Male	98	56.32
	Female	76	43.68
EDUC	Primary	38	21.84
	Secondary	84	48.28
	Tertiary	52	29.89
INC	1<10,000	66	37.93
	15,000-30,000	50	28.74
	>30,000	58	33.33

3.2 Preferences for Egg types

Kendall coefficient of concordant was used to rank eggs of indigenous chicken, exotic chicken, quails, turkey and guinea fowls from the most important to the least important and ascertain the degree of agreement among the consumers in the ranks computed. Based on this, an attribute with the highest sum of ranks was ranked least whereas that with the least sum of ranks was ranked first. The results of Kendall ranking are presented in Table 4. Results indicated that there was 42% level of agreement among the rankers which was significant at 99%. Thus the null hypothesis of no significance agreement among the rankers was rejected. Consumers were in agreement in ranking indigenous chicken eggs as the most important (Table 4). Exotic chicken eggs, quail eggs, turkey and guinea fowl eggs were ranked in the second, third, fourth and fifth positions respectively (Table 4). The popularity and preference for indigenous chicken eggs can be attributed to the perception by majority of consumers that IC eggs are highly nutritious, economical and easily available when needed (Matt et al., 2009). When compared to exotic chicken eggs, there is perception among consumers that IC eggs are organically produced with less chemical contaminants.

Table 4: Ranking of preference egg types

Egg type	Rank	Sum of ranks
Indigenous chicken	1	284.5
Exotic chicken	2	522
Quail	3	646
Turkey	4	758.5
Guinea fowl	5	789
W	0.42***	
F	144.96	

3.3 Determinants of IC eggs demand

Table 5: Factors affecting demand for indigenous chicken eggs

Variable	Coefficient	Std Error	t-statistic	P-value
Constant	-5.3151	7.6705	-0.69	0.489
GEN	1.7391	2.3745	0.73	0.465
AGE	0.1837*	0.0954	1.92	0.056
EDU	4.9202***	1.7442	2.82	0.005
HS	0.7716*	0.4534	1.70	0.091
INC	1.4195	1.5010	0.95	0.346
PR	-0.2489	0.3336	-0.75	0.457
R ²	10.00%			
F	3.09***			

Significant levels: * (10%), ** (5%), *** (1%)

Multiple regression model was employed to determine factors influencing demand for IC eggs in the study area. Socioeconomic variables were used as independent variables while quantity of eggs bought was the dependent variable upon which the effect of independent variables was evaluated. Table 5 above indicates the coefficients of variables, standard errors, t-statistics p-values which show the significance level and R² which indicates that 10% of the variation in IC eggs demanded is attributed to the variables in the model (Gujaratti, 1995). Results indicated that independent variables in the model significantly ($P < 0.01$) influenced demand for IC eggs in the study area. According to the results, gender of the household head is positively but not significantly ($P > 0.1$) related to demand for IC eggs. This implies that there is no difference in IC eggs consumption between males and females. These results are inconsistent to those of Kostakis (2013) who established that gender of the household head significantly influenced food expenditures. Age of the consumer significantly ($P < 0.1$) influences the demand for IC eggs. *Ceteris Paribus*, an increase in age by one unit will result in a corresponding increase in demand for IC eggs by 0.1 units. These results imply that older consumers tend to demand more IC eggs than their young counterparts probably because of the perceived health and nutritional benefits. The findings corroborates with those of other studies. Kostakis (2013) found that income, age, gender, marital status and place of residence had an impact on household food expenditures. Mehmet et al. (2015) found that age of the respondent was a significant predictor for fish consumption frequency.

Education level of the household head significantly ($P < 0.01$) influenced demand for IC eggs. *Ceteris paribus*, an increase in education level increases demand of IC eggs by one unit. The results indicate that educated consumers tend to demand more of IC eggs than the less educated ones. The probable reason for this is that education is correlated to acquisition of information on both health and nutritional aspects of IC eggs. Educated consumers are hence more empowered with this knowledge and tend to balance their demand levels with nutritional body requirements. These findings are consistent with those of Kostakis (2013).

Household size significantly ($P < 0.1$) influences the demand for IC egg. The demand will increase by 0.7 units for a unit increase in household size holding other factors constant. The results connotes that households with more family members will demand more IC eggs in order to satisfy the utility levels of additional members. Accordingly, fewer family members will have to content with fewer amounts of IC eggs. The findings corroborates those of other researchers; Moni (2014) reported that household size positively and significantly influenced the consumption of chicken, beef and pork in central Kenya while Toluwase et al. (2017) found that own price, household size, income and price of close substitutes were important determinants that influenced demand for chicken meat in Nigeria. Income level of the consumer did not significantly ($P > 0.1$) influence demand for IC eggs but had the expected positive sign. Price of IC eggs did not significantly ($P > 0.1$) influence its demand but had the expected negative sign. This is consistence with the economic theory of inverse relationship between price of a good and its demand in the market. The findings are in tandem with Oczkowski et al. (1998) who found that eggs prices did not influence the quantity of eggs demanded but contradicts studies by Issa et al. (2015) who established that taste and price were the main determinants of indigenous chicken consumption in ND'jamena.

4.0 CONCLUSION AND IMPLICATIONS

Demographic and Socio-economic characteristics are major determinants influencing product demand for IC eggs across households. Results of egg type ranking indicate that IC eggs are more preferred than all other eggs in the market. Consumers also agreed with the rankings a factor attributed to the positive perceptions on the nutritional and health benefits associated with IC eggs. Furthermore, IC eggs are easily available, relatively cheap and tastier compared to other eggs. Results of multiple linear regression indicated that the variables in the model were statistically significance ($P < 0.01$) in explaining demand for IC eggs in the study area. Individual independent variables that influenced demand for IC eggs were; age at $P < 0.1$, education ($P < 0.01$) and household size ($P < 0.1$). Older and educated consumers tend to demand more IC eggs than their younger and less educated counterparts. This is attributed to acquisition of knowledge on the nutritional benefits of IC eggs consumption among these groups. Accordingly, households with large family members demand more IC eggs in order to satisfy utility levels for all individuals.

The results of this study can inform policy deliberations by public organizations. For instance, the need for extension to focus on promoting production of IC eggs and knowledge and awareness creation on the health benefits associated with IC eggs consumption in the region across consumers of different ages, gender, education level and income groups will enhance demand levels of IC eggs. Marketers of IC eggs on the other hand, can use the important socio demographic variables in formulating strategies that will enhance performance of the IC eggs value chain.

Acknowledgement

The authors are grateful for the financial support provided by the Kenya Agricultural Productivity and Agribusiness Programme (KAPAP) through the Indigenous Chicken Value Chain Project (ICVCP) towards data collection and analysis of this work.

REFERENCES

- Bett, H. K., Musyoka, M. P., Peters, K. J. and Bokelmann, W. 2012. Demand for Meat in the Rural and Urban Areas of Kenya: A Focus on the Indigenous Chicken. *Economics Research International*. vol. 2012, doi:10.1155/2012/401472.
- Britton, A., 2003. Animal Protein Issues. Speed Way Publishers, USA.
- Delgado, C. L. 2003. "Rising consumption of meat and milk in developing countries has created a new food revolution." *Journal of Nutrition* vol. 133, no. 11, pp. 3907S–3910S.
- Delgado, C., Rosegrant, M., Steinfeld, H., Ehui, S. and Courbois, C. 1999. Livestock to 2020: the next food revolution. IFPRI. Food, Agriculture, and the Environment Discussion Paper 28. Washington, D.C. (USA): IFPRI. <https://cgspace.cgiar.org/handle/10568/333>.
- Gamba, P. 2005. *Urban Domestic Consumption Patterns for Meat: Trends and Policy Implications*. Working Paper. Tegemeo Institute of Agricultural Policy and Development. Egerton University. http://ageconsearch.umn.edu/bitstream/202626/2/tegemeo_workingpaper_17.pdf.
- Gujarati, Damodar (1995). *Basic Econometrics*, 3rd Edition. New York: McGraw-Hill.
- Hans-Wilhelm, Windhorst, Barbara Grabkowsky & Anna Wike (2013). International eggs commission. Atlas of the global egg industry.
- Issa Y., Mopate L.Y., Louassouabe G., Ayssiwede S.B., Missohou A., 2015. Consommation hors-foyer de poulets traditionnels dans la ville de N'Djaména (Tchad). *Revue Scientifique du Tchad* Janvier – 2012. Volume 11 – Numéro Spécial 1 (42-52)
- Kostakis, I. (2013). The determinants of households food consumption in Greece. *International Journal of Food and Agricultural Economics*, 2(2):17-28.

- Mehmet, F.C., Aytakin, G. and Hayriye, Y.C. (2015). Fish consumption preferences and factors influencing it. *Food Science and Technology (Campinas)*, 35(20).
- MOLD. (2010). *Livestock Annual report 2009: Ministry of Livestock and Development, Animal production Division*. Nairobi, Kenya: Government Printers.
- Moni, A.N. (2014). An assesment of demand for meat in rural and peri-urban areas of central Kenya. Msc. Thesis, Nairobi University, Kenya.
- Ndenga, C., Eric, K.B. and Lucy, W.K. (2017). Consumers' preference attributes for indigenous chicken in Kenya. *Journal of Agricultural Economics and Development*, 6(1):001-011.
- Nyaga, P. (2007). *Poultry sector country review*. FAO animal production and health division, emergency centre for transboundary animal diseases, socio-economic production and Biodiversity unit, ROME, Italy: FAO.
- Oczkowski, D & Murphy, T. (1998). *Modelling the determinants of domestic egg demand. A report for the rural industries research and development corporation*. Charles Stuart University.
- Upadhyay, A.D., Pandey, D.K. and Jackie, S.Y. (2014). Socio economic determinants of Consumption pattern of fish in urban area of Tripura. *Economic Affairs*, 59(3):355-362.
- USAID. (2010). *partnerships for safe poultry in Kenya(PSPK) Programme: regional poultry value chain analysis*. Nairobi: USAID.
- Matt D, Veromann E, Luik A (2009). Effect of housing systems on biochemical composition of chicken eggs. *J. Agron. Res.*, 7: 662-667.
- Thornton, P. K. 2010. "Livestock production: recent trends, future prospects," *Philosophical Transactions of the Royal Society* vol. 365, no. 1554, pp. 2853–2867.
- Toluwase,S.O.W and Kolapo, *Economic Analysis of Consumer Demand for Chicken Meats in Rural and Urban Household of Ondo State*. *Global Educational Research Journal*: Vol. 4(3): pp 531-535.