Consumer valuations of the quality and safety attributes of milk and meat in Kenya

Mohamadou L Fadiga*
International Livestock Research Institute, PO Box 30709, Nairobi 00100, Kenya. E-mail: m.fadiga@cgiar.org

Stella Makokha
Kenya Agricultural Research Institute, Nairobi, Kenya. E-mail: stellamakokha@yahoo.com

* Corresponding author

Abstract

This study assesses the importance of the quality and safety attributes of dairy and meat products to identify strategies for value addition. It uses product profiles generated by conjoint experiments in a consumer survey applied to 287 households in Nairobi and Eldoret. The results indicate the respondents' willingness to pay more for improved safety and quality attributes for meat and milk products, and also show that consumers value hygiene more than packaging and colour, and are willing to pay a higher premium for clean milk compared to sealed and creamy milk. They value smell more than any other attribute, given the high premium not smelly commands compared to clean, creamy or sealed package. For meat, the premium paid for each attribute varies, with the presence of an official stamp commanding the highest premium, followed by clean, soft texture and low fat content. The valuation of these attributes varies across income strata and between the two cities.

Key words: milk, meat; quality; safety; preference; willingness to pay

1. Introduction

Consumer demand for better quality and safer livestock products has increased in various developing countries because of higher income and increased urbanisation. Sustaining this demand, however, rests on livestock producers and market agents, whose expected responses to the price premium these desired attributes may command in the marketplace could lead to higher and more stable incomes for smallholder producers and be a pathway to the development of the livestock sector in many developing countries.

Significant technical and institutional barriers are preventing smallholders from fully exploiting the opportunities for value addition. Neven *et al*. (2009) found that, in the case of fresh fruit and vegetables, minimum levels of physical, financial, human and organisational capital endowments are necessary for producers to be able to penetrate existing supermarket channels. The required quality, availability and competitive cost structure that supermarkets seek from their suppliers may lock smallholders out of these opportunities. Staal (1995) and Staal *et al*. (1997) made similar observations with respect to smallholder dairy production and marketing, which they found were hampered by high transaction costs, significant seasonal variations, and lack of easily measurable quality standards. Lapar *et al*. (2003) argued for counteracting policies and interventions that would generate more equity in the process, thus allowing smallholders to take advantage of these opportunities as well.

Some forms of contracting, known as "resource-provision contracts", have been used in a few instances to mitigate smallholders' difficulties in penetrating supermarket channels (Reardon *et al*. 2009). Tschirley *et al*. (2009) argued that smallholders' vulnerability to these supply chain requirements may be overstated, especially in Kenya, where the shares of supermarket channels amount to 4.7% for fresh fruit and vegetables, 4.3% for meat and meat products, and 15% for dairy products. The dairy market is relatively more formalised compared to the other two because of institutional innovation, such as producers' cooperatives. Cooperatives represent a low-cost avenue that addresses the difficulties smallholder producers face at the individual level, increases their participation in more formalised markets, and accelerates the transformation of traditional dairy production systems into agro-industrial systems (Holloway *et al*. 2000). These types of collective action are at various stages of development in Africa and their impacts on livestock sector transformation have been limited.

The retail sector in Kenya remains dominated by informal markets with heterogeneous actors. The continuous reliance of Kenyan consumers on informal outlets to procure foodstuffs for household consumption is generally attributed to their suitability for local population tastes and the convenience that these outlets are able to provide. A significant number of Kenyan consumers from both wealthy and poor households prefer raw milk, despite the public health hazards it poses (Omore *et al*. 2003). Raw milk is found in informal outlets that operate under locally-defined standards not consistent with the official norms of quality and safety. Omore *et al*. (2003) advocated for a more proactive approach that seeks to reconcile the public health hazards posed by informal channels and to craft policy that ensures consumer safety while allowing market agents to operate under more realistic and enforceable regulatory measures. This study was carried out to (1) generate empirical knowledge about the underlying quality and safety attributes that shape Kenyan consumers' preference for dairy and meat products; (2) assess how these attributes are valued by consumers; and (3) define strategies for value addition in the milk and meat product markets in Kenya.

2. Data collection procedures

In the collection of data, a rapid market assessment (RMA) first was conducted, during which the actors along the dairy and meat supply chains were interviewed to gauge the quality and safety attributes they perceived as being important for consumers. The interview process was conducted primarily using a checklist with closed and open-ended questions. The results are shown in Table 1. The information gathered through the RMA was used as input in conjoint experiments to generate various product profiles based on the identified quality and safety attributes for fresh meat and milk, as well as their associated prices. Second, a detailed consumer survey was conducted in which the respondents were asked questions relating to the identified quality and safety attributes, their consumption patterns, and the factors that influence their buying decisions, in order to assess the consumers' preference in relation to dairy and meat products. This is important because the identification of key entry points for a livestock-based product development strategy requires a good understanding of consumers' preferences for each of these product profiles.

The study was conducted in Nairobi, the capital city of Kenya, and in Eldoret, a large city located within an agriculturally rich area. For the household survey, the primary respondents were the heads of households. In some cases the persons in charge of food purchases, primarily the spouses of the heads of households, were interviewed. The questionnaire was applied to 287 randomly selected households, 168 in Nairobi and 119 in Eldoret, to seek information on consumers' socio-demographic profiles, household consumption patterns, emerging patterns in consumption of processed meat and milk products, and how these patterns relate to the consumer profiles. Furthermore, how a consumer rates and ranks an individual attribute or a combination of attributes

was also investigated. The sampling procedure was conducted as follows: a list of at least fifteen residential areas was initially put together for each city. These residential areas consisted of upmarket housing, middle-market housing, and low-market housing, defined on the basis of the professional occupations of the people who live there, the nature, size and values of the residences, the availability of utilities such as electricity, washrooms and garages, and whether the households in these locations owned at least one car.

Table 1: Selected quality and safety attributes for milk and meat based on the RMA

Milk			**Meat**		
Class	**Levels**	**Values**	**Class**	**Levels**	**Values**
Hygiene	2	Clean and Unclean	Hygiene	2	Clean and Unclean
Packaging	2	Sealed and Unsealed	Fat content	2	Low and High
Colour	2	White and Creamy	Official stamp	2	Present and Absent
Smell	2	Smelly and Not Smelly	Tenderness	2	Soft and Hard
Price	3	10, 30 and 60	Price	3	140, 210 and 280

Note: The price values represent the average prices of milk at the low-, middle-, and high-income levels collected in the survey, and are in KES per litre for milk and KES per kilogram for meat.

Two locations were randomly selected for each of the three types of residential areas, from which transects were obtained using major landmarks (churches, schools, community centres, etc.) as starting points. For instance, a location with four landmarks contained six transects in total. Two transects were selected randomly for each location, followed by a random selection of households on alternate sides of each transect. The initial target was set at 60 households per location, i.e. 180 per city. Overall, 93% of the sampling goal was reached in Nairobi and 66% in Eldoret.

3. Consumer survey results

The structured survey had two parts: the first explored the households' patterns of consumption of livestock products, while the second looked at the preference for various profiles of these products, defined over various levels of quality and safety attributes, to the different households. This section summarises the results based on the consumption patterns of household in Kenya.

3.1 Patterns of consumption of milk and meat products

A total of 16 different milk products were consumed across all households. The milk products consumed the most were packed pasteurised milk (21%), raw fresh milk (17%), fermented packaged milk (12%), and yoghurt (13%). In Eldoret, fresh milk was the most popular dairy product, while in Nairobi packed pasteurised milk and yoghurt were the most popular. Although butter and ghee were consumed by fewer than 5% of the respondents, their frequency of consumption in the last 30 days was quite high (18 times). Yoghurt was the most popular milk product consumed away from home (27%), followed by packed pasteurised milk (23%), ice cream (13%), fresh boiled milk (9%) and raw fresh milk (7%). Cheese and pasteurised butter were consumed mainly by high-income[1] households, and fresh milk was consumed mainly by low-income households. Consumers at the higher end of the low-income bracket and lower end of the middle-income bracket mainly consumed packed pasteurised milk, ultra heat-treated (UHT) milk, packed pasteurised low-fat milk, homemade fermented milk and skimmed milk. Consumers at the higher end of the middle-income bracket mainly consume fermented packed milk, yoghurt, milk powder, ice cream and camel milk.

[1] The average household income was KES 46 000 in Nairobi and KES 30 000 in Eldoret. The income categories were aggregated into three groups: low-income households, which earn below KES 30 000 per month, middle-income households, comprised of households earning between KES 30 000 and 75 000 per month, and high-income households, which included households earning KES 75 000 and above.

The most frequently purchased meat products were beef with bones (14%), chicken (13%), fish (12%) and goat meat (7%). Turkey and minced meat were consumed mainly by the high-income group, while duck was consumed mainly by the group with the lowest income. A greater proportion of respondents at the higher end of the low-income bracket and lower end of the middle-income bracket consumed beef with bone, cattle offal, goat meat, mutton, chicken and fish. The higher end of the middle-income group mainly consumed beef fillet, steak, T-bone, corned beef, sausage and pork. This shows the wide range of meat products consumed by this income subgroup. These results illustrate some dynamism in household consumption patterns over the years, which can be attributed to increased availability and affordability of different products, as well as improved quality and safety of the products that are being offered. Overall, 25% of the respondents indicated the availability of products as the major reason for consuming new products and, to a lesser extent, affordability and better quality and safety.

3.2 Household attitudes towards quality and safety of milk and meat products

Seventy-five percent of the respondents indicated their belief in the safety of the meat they consumed, 15% were not sure, and 10% said the meat was not safe for eating. Sixty-three percent of the respondents expressed their willingness to pay more for improved quality, and a similar result was obtained for safety. Sixty-three percent also said the milk purchased was safe for consumption, and 67% said they were willing to pay more for improved safety and quality of the milk they are consuming. Overall, while a majority of the consumers believed the meat and milk products they were consuming were safe and of good quality, they also were willing to pay more for improved safety and quality of these products.

On average, the respondents rated the milk attributes as follows: hygiene (8.8), smell (8.6), colour (8.0) and packaging (7.9). The mean rating of each attribute was consistently higher in Nairobi than in Eldoret. The difference is most striking for packaging, rated 8.8 in Nairobi compared to 6.6 in Eldoret. The respondents in the highest income bracket had the highest mean rating for each attribute.

The order of mean rating of meat attributes was hygiene (8.7), tenderness (8.1), official stamp (7.6) and fat content (6.5). The respondents in the highest income bracket gave the highest mean rating to hygiene, tenderness and fat content, while all income groups rated official stamp almost equally. The lowest ratings for tenderness and hygiene were from the low-income group. The mean rating for each of the meat attributes was higher in Nairobi than in Eldoret.

A summary of the mean ratings and their respective standard deviations over the entire sample and across the two cities and income strata is provided in Tables 2 and 3. While the results outlined thus far provide some indications of the relative importance of each attribute, a detailed model that uses the profiles of each product and its respective price is required to quantify the contribution of each of these attributes to overall utility, as well as their underlying respective marginal values.

Table 2: Mean rating of milk attributes by city, and across income strata

Variable	Sample	Eldoret	Nairobi	Low income	Middle income	High income
Packaging	7.9 (2.4)	6.6 (2.3)	8.8 (2.1)	7.5 (2.5)	8.1 (2.5)	8.8 (1.9)
Hygiene	8.8 (2.0)	8.5 (1.8)	8.9 (2.1)	8.4 (2.4)	9.1 (1.5)	9.4 (1.2)
Colour	8.0 (2.2)	7.3 (2.1)	8.5 (2.1)	7.9 (2.3)	8.2 (2.1)	8.4 (2.2)
Smell	8.6 (2.2)	8.1 (2.4)	8.9 (2.1)	8.4 (2.3)	8.7 (2.1)	9.1 (2.1)
Sample size	253	100	153	142	57	51

Note: The individual samples may not add up to 253 because of undeclared city or income brackets.
Standard deviation in parentheses.

Table 3: Mean rating of meat attributes by city, and across income strata

Variable	Sample	Eldoret	Nairobi	Low income	Middle income	High income
Official stamp	7.6 (2.9)	7.3 (2.9)	7.8 (2.9)	7.5 (3.1)	7.8 (2.5)	7.7 (3.0)
Hygiene	8.7 (1.8)	8.4 (1.6)	8.9 (1.9)	8.5 (1.9)	8.8 (1.7)	9.2 (1.5)
Fat content	6.6 (2.6)	5.8 (2.5)	7.0 (2.7)	6.5 (2.6)	6.1 (2.6)	7.0 (2.9)
Texture	8.1 (2.1)	7.7 (1.9)	8.4 (2.1)	7.8 (2.2)	8.2 (1.9)	8.6 (1.6)
Sample size	252	99	153	140	57	51

Note: The individual samples may not add up to 253 because of undeclared city or income brackets.
Standard deviation in parentheses.

3.3 Generation of product profiles

Table 4 shows the orthogonal design generated from the conjoint experiments using the attributes and their respective levels presented in Table 1. The profiles are the results of orthogonal transformations of full factorial design. A full factorial design looks at all possible combinations of attributes; thus using five attributes (four with two levels and one with three levels) would yield 48 possible profiles, which would be difficult to manage in a consumer survey. Thus, while exhaustive, it contains a great deal of redundancy and does not improve design efficiency. To remedy the problem, a design that precludes collinearity between attributes was generated, which was done through orthogonal transformation that yields independent profiles. The resulting number of profiles is much lower compared to the full design.

Table 4: The orthogonal designs for milk and meat attributes (milk price in KES/litre and meat price in KES/kg)

	Milk					Meat				
Profile	**Packaging**	**Hygiene**	**Colour**	**Smell**	**Price**	**Official stamp**	**Hygiene**	**Fat content**	**Tender-ness**	**Price**
1	Sealed	Clean	White	Smelly	10	Absent	Clean	High	Soft	140
2	Sealed	Unclean	Creamy	Not smelly	30	Present	Unclean	High	Hard	210
3	Not sealed	Clean	White	Smelly	10	Absent	Clean	Low	Soft	140
4	Not sealed	Unclean	White	Not smelly	10	Absent	Unclean	Low	Hard	140
5	Sealed	Clean	Creamy	Smelly	10	Present	Clean	High	Soft	140
6	Not sealed	Clean	White	Smelly	30	Absent	Clean	Low	Soft	210
7	Not sealed	Unclean	White	Smelly	30	Absent	Clean	Low	Hard	210
8	Sealed	Unclean	White	Smelly	60	Absent	Clean	High	Hard	280
9	Not sealed	Clean	Creamy	Smelly	10	Present	Clean	Low	Soft	140
10	Not sealed	Unclean	Creamy	Smelly	10	Present	Clean	Low	Hard	140
11	Sealed	Clean	White	Not smelly	10	Absent	Unclean	High	Soft	140
12	Not sealed	Clean	Creamy	Not smelly	60	Present	Unclean	Low	Soft	280

The orthogonal transformations enhance model efficiency by replacing these exhaustive and not easily manageable profiles with a reduced number of profiles, which were evaluated by consumers through the survey. It is important, however, to note that, while conjoint experiments can be used effectively to study consumer preferences in markets lacking well-defined quality and safety standards, they can be subjected to potential biases through cognitive limits. Overall, 12 profiles were generated for milk and meat and used in the consumer survey, during which the respondents were asked to rate them based on their preferences.

4. Empirical model

We applied a choice-based model derived from the McFadden (1974) random utility framework, in terms of which the utility function at the basis of consumer choice has a deterministic component, V_{ij}, and a stochastic component, ε_{ij}, that is $U_{ij} = V_{ij} + \varepsilon_{ij}$. The stochastic component accounts for uncertainty due to measurement errors, omitted attributes, discrimination errors and unmeasured preferences (McFadden 1986). We specified the deterministic component of the random utility model as a linear function of attributes and price. More formally, we can write:

$$V_{ij} = \sum\nolimits_n \beta_n x_{ijn} + \gamma_j P_{ij} \text{ with } n = 1, 2, ..., N;\ j = 1, 2, ..., J;\ \text{and } i = 1, 2, ..., I \quad (1)$$

where x_{ijn} represents any attribute in product profile j for consumer i, P_{ij} is the price of product profile j for consumer i, the parameters β_n are the marginal utilities, also known as part-worth utilities, and γ_j is the marginal utility of price. When an individual consumer choice set is represented by $C_i = \{1, 2, \ldots, J\}$, which contains J alternative profiles, each respondent is asked to assign a desirability score to each of these profiles. The respondent proceeds by assigning the highest score (say, M) to the most desired profile, and the lowest score (say, 1) to the least desired profile. The ordered response model, $y_{ij} = \{1, 2, \ldots, M\}$, is related to the previously defined latent random utility model U_{ij} in the following way:

$$\begin{cases} y_{ij} = 1 \text{ if } U_{ij} < \alpha_1 \\ y_{ij} = 2 \text{ if } \alpha_1 < U_{ij} \le \alpha_2 \\ \vdots \\ y_{ij} = M \text{ if } U_{ij} > \alpha_M \end{cases} \quad (2)$$

where $\alpha_1, \alpha_2, \ldots, \alpha_M$ are constant terms that indicate cut-off points. The conditional distribution of the ordered response model is derived by calculating the probability associated with each desirability level (Wooldridge 2002). More formally, the ordered response model can be specified as:

$$\Pr\left(y_{ij} = m \mid \mathbf{x}\right) = \Pr\left(U_{ij} > \alpha_m\right) \text{ with } \mathbf{x} = \left\{x_{ijn}, P_{ij}\right\} \text{ and } 1 < m < M \quad (3)$$

Equation (3) can be expanded further using the detailed specification of the latent random utility defined in Equation (1), which yields the following equation:

$$\Pr\left(U_{ij} > \alpha_m\right) = \Pr\left(\sum\nolimits_{n=1}^{N} \beta_n x_{ijn} + \gamma_j P_{ij} + \varepsilon_{ij} > \alpha_m\right) \quad (4)$$

Assuming that the stochastic component ε_{ij} follows a logistic distribution, the ordered response model becomes an ordered logit model, and Equation (4) can be written using the cumulative logistic distribution function $\mathbf{\Lambda}(.) = \exp(.)/1-\exp(.)$, as follows:

$$\Pr(y_{ij} = m \mid \mathbf{x}) = \begin{cases} \mathbf{\Lambda}\left(\alpha_1 - \sum_{n=1}^{N} \beta_n x_{ijn} - \gamma_j P_{ij}\right) & m = 1 \\ \mathbf{\Lambda}\left(\alpha_m - \sum_{n=1}^{N} \beta_n x_{ijn} - \gamma_j P_{ij}\right) - \mathbf{\Lambda}\left(\alpha_{m-1} - \sum_{n=1}^{N} \beta_n x_{ijn} - \gamma_j P_{ij}\right) & 1 < m < M-1 \\ 1 - \mathbf{\Lambda}\left(\alpha_{m-1} - \sum_{n=1}^{N} \beta_n x_{ijn} - \gamma_j P_{ij}\right) & m = M \end{cases} \quad (5)$$

The dependent variable in the ordered logit model (Equation (5)) was defined as three levels of preference for the 12 product profiles of milk or meat products derived from the conjoint experiments. Level 1 corresponds to the least preferred profiles, level 2 to the moderately preferred profiles, and level 3 to the most preferable profiles. These three preference levels are the values taken by the dependent variable in the choice-based conjoint analysis. The independent variables used in the models correspond to product attributes stated in Table 4 for milk and beef. Following Adamowicz *et al*. (1994), Sy *et al*. (1994) and Tano *et al*. (2003), the attributes were categorised in an effect-coded system in which the usual (0, 1) dummy system of independent variables was replaced by a (-1, 1) system for two traits, and a (-1, 0, 1) system for three traits. The effect-coding system renders empirical interpretation more tractable, especially when deriving the partial utilities that connect the estimated probability choice model to the underlying random utility framework that shapes consumer preference. Price was assumed to be continuous and was included in the model as an independent variable. The parameters β_n, γ_j and α_m were estimated under this framework and used for further empirical analysis.

With price in the model, the consumers' valuations of each quality and safety attribute and their importance (based on their relative contribution to the overall utility provided by each profile) was derived. This was achieved by taking the total derivative of Equation (1) with respect to that attribute, holding all remaining attributes constant. Setting the resulting equation to zero and solving for the marginal price yields, the estimated willingness to pay (WTP) for any attribute, say WTP_{ijn}, was defined as $dP_{ij}/dx_{ijn} = -\beta_n/\gamma_{ij}$. Moreover, the marginal WTP between two different attributes was obtained by simply calculating the difference between their respective estimated willingness to pay.

Another implication of the ordered logit model is the derivation of the relative importance of each attribute. Because of the effect-coded system, the estimated part-worth utilities are used to derive the utility ranges of each attribute. For price, we followed Baker (1999) and computed the part-worth utility of each price level by multiplying the estimated coefficients of price in the ordered logit models by the corresponding price level. The relative importance of each attribute, including price, was obtained by dividing its corresponding utility range by the sum of all utility ranges of all attributes. All estimations and derivations of the consumers' valuations of attributes were conducted at sample level, across cities and household income strata, to capture the underlying heterogeneity that shapes consumer demand for milk and meat products in Kenya.

5. Estimated ordered response model results

The results of the ordered logit models were used to derive the contribution of each quality and safety attribute of fluid milk (hygiene, packaging, colour and smell) and meat (hygiene, fat content, official stamp and tenderness), and price to the overall utility that consumers gain from consuming

these products. The relationship between the utility gained by consumers from consuming milk and meat products and the ordered logit model was established through Equations (1) to (5).

5.1 Estimates from the ordered logit

As Table 6 illustrates, the estimation based on the overall sample established that, at the sample level, consumers are not indifferent to hygiene, colour and smell. Clean, not smelly and creamy-coloured milk provides higher utility to consumers than not clean, smelly and white milk respectively. Packaging appears to be irrelevant at the sample level, as there was no significant difference between milk in sealed packaging versus that in unsealed packaging. While the estimations across cities (Table 5) and income strata (Table 6) yielded similar patterns, there was a significant difference for packaging between sealed and not sealed for Nairobi's consumers, who showed a preference for milk in sealed containers, compared to those in Eldoret, who were indifferent to whether milk was in sealed packaging or unsealed packaging, as the derived marginal utility was not significantly different from zero. With respect to income, it transpired from the results that low-income consumers were indifferent with respect to packaging, while consumers in middle- and high-income households showed a preference for milk in sealed packaging. For both categories of consumers, the marginal utility of packaging was positive. The estimated coefficients of price were negative and significant in all cases, as expected, thus conforming to the assumption of these products being normal goods.

For meat, clean, low fat content, presence of official stamp and soft texture had significant and positive impacts on utility derived from meat consumption at the sample level. Moreover, there was no difference in terms of direction between the two cities or income strata, as shown in Tables 7 and 8. As expected, the estimated coefficients of prices were negatives in all cases, confirming the disutility of high prices to consumers.

Table 5: Estimated ordered logit models and willingness to pay for quality and safety attributes of fluid milk over the sample and by city

		Sample			Eldoret			Nairobi		
Variable	**Level**	**Estimate**	**Std. error**	**WTP estimate**	**Estimate**	**Std. error**	**WTP estimate**	**Estimate**	**Std. error**	**WTP estimate**
Constant	Constant	0.390***	0.028	NA	0.476***	0.049	NA	0.336***	0.035	NA
Hygiene	Clean	0.601***	0.058	8.818	0.541***	0.091	8.746	0.668***	0.077	8.960
Packaging	Sealed	0.057	0.048	0.842	-0.118	0.073	-1.905	0.206***	0.066	2.757
Colour	Creamy	0.476***	0.052	6.985	0.299***	0.077	4.835	0.624***	0.071	8.369
Smell	Not smelly	1.301***	0.062	19.069	1.346***	0.094	21.745	1.312***	0.085	17.580
Price × 10^2	Price	-0.068***	0.003	NA	-0.062***	0.004	NA	-0.075***	0.004	NA
-2 × LogL		5680.769			2372.107			3298.384		
Wald		849.731			366.573			488.156		

Notes: The dependent variable represents three levels of choice for product profiles (strong preference, moderate preference, and weak to no preference); the superscript (***) indicates significance at the 1% level; -2 × LogL represents the log of the likelihood function; and Wald represents the Wald statistics of joint hypothesis on the parameters, which indicate that the parameters are jointly significant at the 1% level. NA indicates not applicable; Std. = standard.

Table 6: Estimated ordered logit models and willingness to pay for quality and safety attributes of fluid milk across income strata

		Low income			Middle income			High income		
Variable	**Level**	**Estimate**	**Std. error**	**WTP estimate**	**Estimate**	**Std. error**	**WTP estimate**	**Estimate**	**Std. error**	**WTP estimate**
Constant	Constant	0.427***	0.039	NA	0.388***	0.066	NA	0.358***	0.065	NA
Hygiene	Clean	0.420***	0.073	7.284	1.246***	0.151	13.660	0.749***	0.142	7.814
Packaging	Sealed	-0.092	0.062	-1.600	0.274***	0.116	3.002	0.454***	0.127	4.729
Colour	Creamy	0.258***	0.063	4.478	0.871***	0.142	9.555	0.950***	0.141	9.903
Smell	Not smelly	1.180***	0.074	20.452	2.101***	0.182	23.034	1.235***	0.163	12.876
Price × 10^2	Price	-0.058***	0.003	NA	-0.091***	0.007	NA	-0.096***	0.008	NA
-2 × LogL		3277.329			1230.422			1086.121		
Wald		503.553			179.896			166.393		

Notes: See Table 5

5.2 Relative importance of quality and safety attributes

The derived part-worth utilities quantify the contribution of each attribute level to the overall utility. These contributions are expressed in percent and indicate that, in the case of milk, price was the most important attribute in determining preference at the sample level, across cities and income strata, although its importance surpassed that of smell by only 2.5% for middle-income households. The results based on the overall sample indicate that price contributed up to 41% of total utility, followed by smell with 31%, hygiene with 15%, and colour with 12%. Packaging was found to be of no significant importance at the sample level. The results were similar in Nairobi and Eldoret, except for colour and smell. While both remain the second and fourth most important attributes in the two cities, we found a 6% positive gap for Nairobi regarding colour, and a 7% positive gap for Eldoret regarding smell. For packaging, a positive gap slightly above 1% was found for Nairobi, despite the fact that sealed packaging provides positive utility for consumers in Nairobi, while those in Eldoret were indifferent to sealed and unsealed packaging.

The relative importance of these attributes across income strata indicates some similarity in terms of patterns, except for the middle-income households, for which price and smell had similar weight in determining preference. The importance of price was less for the middle-income households, at 34%, compared to the low-income households with 43% and the high-income households with 41%. While one would expect price to be of lower importance for high-income households compared to lower- and middle-income households, the relative importance of price in all categories indicates that consumers always seek the best products they can get at affordable prices, regardless of income category. The importance of smell for low-income households (35%) was comparable to that of middle-income households (31%). Both were significantly higher than that measured in high-income households (21%). More affluent consumers are already buying their milk products from supermarkets, where hygiene is not a major issue because good practices are already being implemented, compared to the outlets where most of the less affluent consumers shop. The role of packaging in determining preference was found to be insignificant at the sample level. However, the results based on income strata showed some difference, with this attribute contributing more to the preference of high-income households than that of low- and middle-income households. Figures 1 and 2 provide an illustration of the relative contribution of each attribute to the overall utility at the sample level, in the two cities and across income strata.

Unlike for fluid milk, the importance of various attributes in determining preference for meat is more balanced, with price (25%), hygiene (20%) and official stamp (25%) having fairly similar weight based on the full sample, followed by tenderness (18%) and fat content (11%). While these patterns were also similar in the two cities, some differences were noteworthy across income strata.

For low-income households, price and official stamp were of comparable weight, followed by hygiene, tenderness and fat content. For middle-income households, price and official stamp had similar weight, as was also found for hygiene and tenderness, but for the high-income households, price (32%) was the most important attribute, followed by official stamp (22%) and tenderness (19%), hygiene (15%) and fat content (13%). The relative importance of price in its contribution to utility is indicative of the fact that consumers, regardless of income strata, would consume less meat if meat prices were to increase. These results are illustrated in Figures 3 and 4 and provided at the sample level, in the two cities and across income strata.

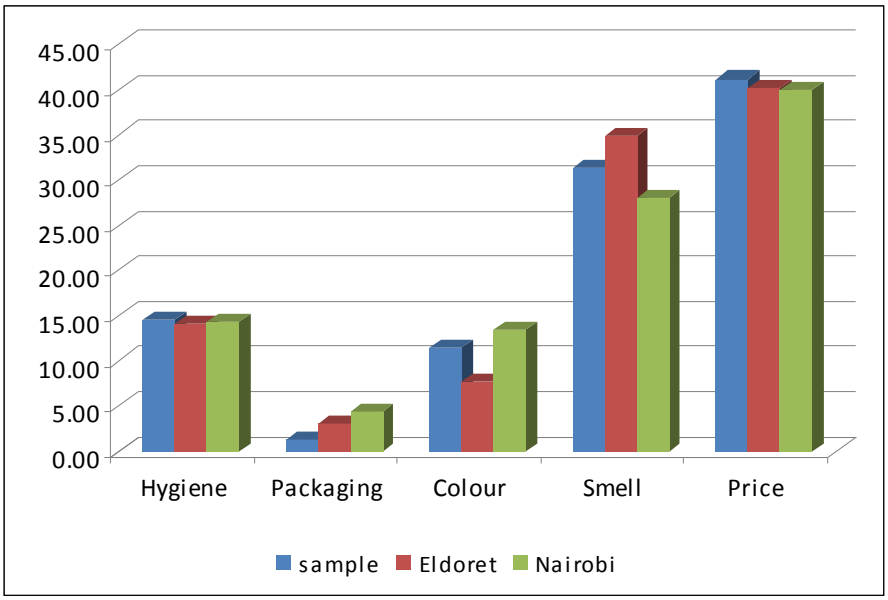

Figure 1: Relative importance (in percent) of quality and safety attributes of milk across the overall sample and in the cities

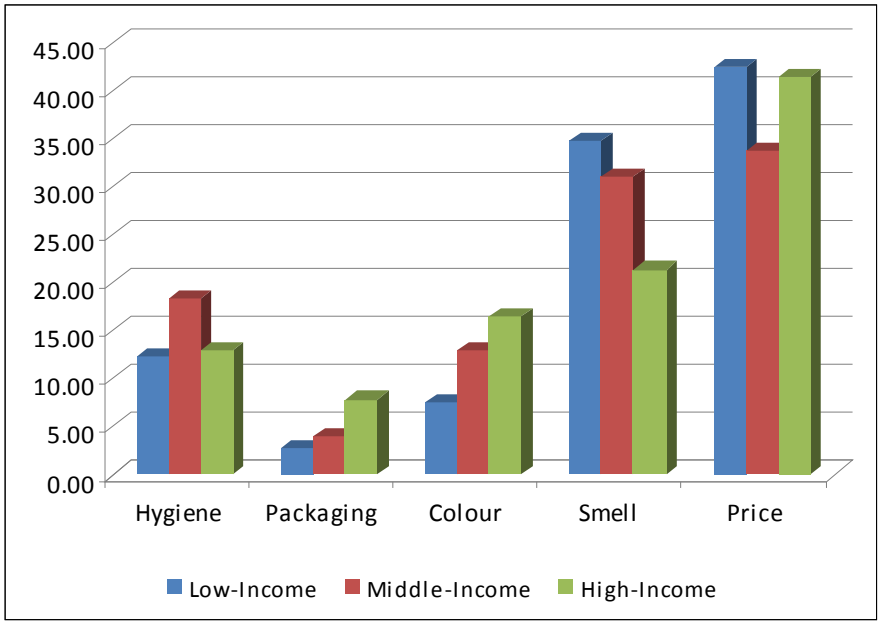

Figure 2: Relative importance (in percent) of quality and safety attributes of milk across income strata

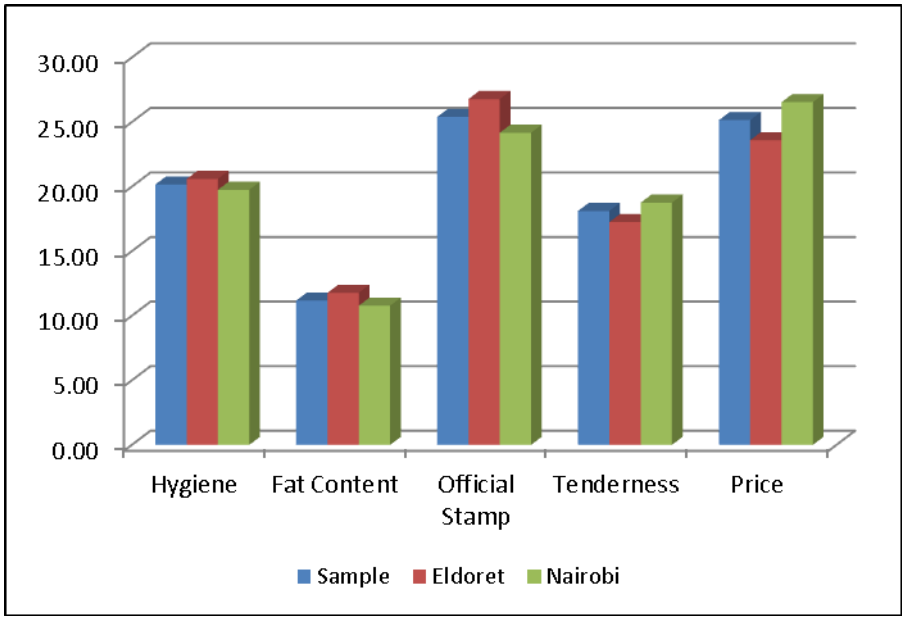

Figure 3: Relative importance (in percent) of quality and safety attributes of meat across the overall sample and in the cities

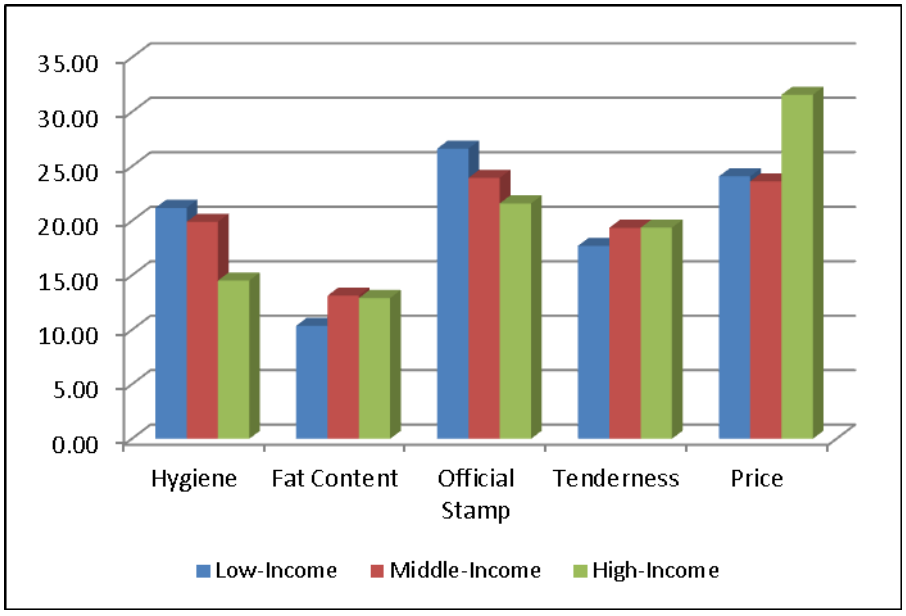

Figure 4: Relative importance (in percent) of quality and safety attributes of meat across income strata

5.3. Willingness to pay for quality and safety attributes

Total willingness to pay (WTP) was derived for each attribute level using the estimated ordered logit models. As Table 6 shows, for fluid milk, consumers were willing to pay a premium for not smelly milk, clean milk and creamy milk, but not for milk in a sealed package. Based on the overall sample, the premium for not smelly milk was three times higher than that for creamy milk and two times higher than that for milk produced and sold in a clean environment. There was a difference between Nairobi and Eldoret regarding the valuation of these attributes. While the estimate of premium for clean milk was similar in both cities, Eldoret consumers were willing to pay KES 4 per litre more in premium for not smelly milk, while Nairobi consumers were willing to pay about the

same amount more in premium for creamy milk. Moreover, while estimate of willingness to pay for sealed packaging was not significant for Eldoret, consumers in Nairobi were willing to pay a premium of almost KES 3 per litre for this attribute. These results are indicative of the profiles of the two cities, with consumers in Nairobi being more affluent and having access to a higher proportion of modernised grocery stores compared to Eldoret. For variation across income strata, the results indicate that middle-income households, more so than lower-income households, were willing to pay higher premiums for all tributes. Compared to high-income households, middle-income households were willing to pay higher premiums for not smelly and cleanliness and lower premiums for sealed packaging, while both groups placed the same value on milk with a creamy colour.

The estimated WTPs for meat quality and safety attributes are summarised in Table 7. The respondents were willing to pay a premium for cleanliness, low fat content, presence of official stamp and tenderness. Based on the overall sample, the presence of an official stamp commanded a KES 71 per kilogram premium, about one third of the median price of meat. The premium for cleanliness amounted to KES 56 per kilogram, followed by that for soft texture, at KES 50 per kilogram, and low fat, at KES 31 per kilogram. This pattern remained the same in Nairobi and Eldoret, although with different magnitudes. Except for soft texture, which was valued almost similarly in both cities, the price premium for cleanliness, low fat content and official stamp was 17, 21 and 22% higher respectively in Eldoret than in Nairobi. The general pattern of results changed across income strata (Table 8). For instance, low-income households' valuation of these attributes was, by and large, similar to the findings based on the overall sample. However, middle-income households valued soft texture and cleanliness similarly to but less than official stamp by nearly 21%, while high-income households valued cleanliness and low fat content equally, and also official stamp and soft texture.

Table 7: Estimated ordered logit models and willingness to pay for quality and safety attributes of raw meat over the sample and by city

		Sample			Eldoret			Nairobi		
Variable	**Level**	**Estimate**	**Std. error**	**WTP estimate**	**Estimate**	**Std. error**	**WTP estimate**	**Estimate**	**Std. error**	**WTP estimate**
Constant	Constant	0.818***	0.041	NA	1.093***	0.081	NA	0.684***	0.047	NA
Hygiene	Clean	0.662***	0.051	56.127	0.837***	0.085	61.095	0.568***	0.064	52.110
Fat content	Low fat	0.367***	0.048	31.119	0.479***	0.080	34.942	0.310***	0.060	28.440
Official stamp	Present	0.834***	0.045	70.686	1.088***	0.078	79.445	0.695***	0.057	63.761
Tenderness	Soft	0.595***	0.051	50.432	0.701***	0.087	51.182	0.539***	0.064	49.477
Price × 10^2	Price	-1.180***	0.038	NA	-1.370***	0.067	NA	-1.090***	0.045	NA
-2 × LogL		4101.537			1511.861			2550.476		
Wald		1153.580			492.056			659.232		

Notes: The dependent variable represents three levels of choice for product profiles (strong preference, moderate preference, and weak to no preference); the superscript (***) indicates significance at the 1% level; -2 × LogL represents the log of the likelihood function; and Wald represents the Wald statistics of joint hypothesis on the parameters, which indicate that the parameters are jointly significant at the 1% level. NA indicates not applicable; Std. = standard.

Table 8: Estimated ordered logit models and willingness to pay for quality and safety attributes pf raw meat by income strata

		Low income			Middle income			High income		
Variable	**Level**	**Estimate**	**Std. error**	**WTP estimate**	**Estimate**	**Std. error**	**WTP estimate**	**Estimate**	**Std. error**	**WTP estimate**
Constant	Constant	1.005***	0.064	NA	0.626***	0.080	NA	0.642***	0.075	NA
Hygiene	Clean	0.782***	0.070	61.598	0.749***	0.118	58.984	0.305***	0.102	32.188
Fat content	Low fat	0.383***	0.065	30.157	0.494***	0.111	38.921	0.271***	0.098	28.636
Official stamp	Present	0.983***	0.063	77.402	0.901***	0.103	70.921	0.453***	0.091	47.896
Tenderness	Soft	0.654***	0.070	51.480	0.729***	0.120	57.370	0.406***	0.101	42.949
Price × 10^2	Price	-1.270***	0.053	NA	-1.270***	0.088	NA	-0.946***	0.070	NA
-2 × LogL		2213.555			820.006			950.533		
Wald		682.036			241.191			202.191		

Notes: See Table 7

6. Conclusions and implications

This study was one of the first attempts to assess comprehensively the nature of the demand for the quality and safety of meat and milk products in Kenya. It employed various analyses to assess consumption patterns and views on quality and safety and their provision. An innovative approach based on RMA, in which market actors were asked about the attributes their buyers demanded, was conducted initially to gauge the importance to safety and quality attributes. All actors in the Kenyan meat and milk markets expressed strong and clear views on the quality and safety attributes demanded by their buyers. Moreover, these views were consistent across producers, middlemen, consumers and other actors. Such views provide a strong basis for the specification of choice experiments, and this study formally applied this method of definition of the explanatory variables in demand by means of a rapid market appraisal.

This study did not seek to define quality and safety attributes, but a delineation of these characteristics was possible based on the RMA. This, in turn, was utilised in the analysis of willingness to pay for variables that could be classified as safety or quality attributes. The study found that consumers were willing to pay more for safety than for quality of milk. This was found in both cities and across income strata, which for the most part followed a similar pattern in terms of ranking, but with different magnitudes. This heterogeneity in consumer valuation of safety and quality attributes might be useful to livestock marketing practitioners and development experts.

Some unexpected results emerged with respect to high-income households' consumption patterns: we found these to be less diversified than those of middle-income households. This might be due to sampling artefact with the delineation of the income strata. However, the lowest income group is also restricted to a few products, perhaps because of their lower purchasing power. The high-income households have access to non-livestock sources of protein and fat, and so consumption of livestock products was less diverse than for the middle-income households. In general, as income increased, consumers demanded more processed products and attached more importance to safety and quality, but the results that were generated appear to contradict this assertion for the high-income consumers, for whom hygiene had a lower weight. These consumers were already shopping in high-end grocery stores where these safety issues had been addressed in the procurement system, as well as in the systematic use of safer handling practices, and this could explain why this aspect is less salient for this group compared to middle-income households.

Income levels and urbanisation are believed to be the sources of significant differences in current consumption patterns and willingness to pay. However, the robustness across the entire data set of the models estimated indicated that preferences were somewhat uniform across consumers, and that

changes in income and urbanisation were associated with demand changes, as predicted by the increasing body of evidence concerning the consumption of livestock products throughout the developing world. The results also showed that the low-income households consumed fresh milk more than the other income groups, and that, except for smell, they did not rate the safety and quality of the products as highly as the middle- and high-income consumers. The reason for this may be found in the systematic practice of low-income consumers of boiling milk before consumption. For this reason the concerns about safety and quality are minimised, and this is how the informal milk market maintains its role as a major outlet in the milk distribution channel.

The ability of the Kenyan meat and milk market systems to deliver the quality and safety attributes identified in the RMA, and found to be important in the consumer surveys and significant in the conjoint experiment, is paramount for any potential value addition by smallholder meat and milk producers. Key quality (e.g. milk and meat colour) and safety attributes (e.g. freshness and cleanliness) are ready to be produced and supplied by these farmers. Two types of barriers might present themselves: first, that incentives are insufficient at the farm level and, second, that the attributes are not being preserved along the chain. In both cases, the transmission of incentives is at issue. The general agreement among actors at all stages in the chain on the desired attributes suggests that transmission problems are not due to a lack of information, but rather as a result of the behaviour of actors in the chain and the size and nature of transaction costs, which may overshadow the incentives identified here. This could be a matter for future research.

The extent to which trust in the trading partner influences trade volumes along the chain was not examined in this study. However, consumers overwhelmingly claimed not using trust as an indicator of product quality and safety. This indicates that, at the consumer level, there is a demand for objective measures of quality and safety, as evidenced by the high willingness to pay for official stamp and some willingness to pay for packaging by consumers from high- and middle-income households in Nairobi. Good packaging provides information about the quality of the product and assures the consumer of higher safety. Taken together, these factors indicate a role for grades and standards in the Kenyan meat and dairy industries.

The study has shown how income and location have influenced the perception of quality and safety. Subsequent consumer studies should include other factors, like education, age and gender, to acquire a comprehensive understanding of the consumer. As incomes increases, consumers become more wary of the safety and quality aspects and would buy more from particular places that meet these standards. The only way that suppliers can access these markets is to meet the standards.

This study relied primarily on visual attributes. The presence of antibiotics in products, although not mentioned among the attributes, is very important to safety. In this regard consumers should be made aware of the risk of consuming products with unseen and undesirable attributes by buying from informal sources. In formal channels, milk and meat products are inspected by regulatory authorities to address the unseen attributes. Consumers should be sensitised to demand certain levels of quality and safety. Areas where improvements are needed should be made clear to consumers in case they are sold sub-standards products.

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