CONSUMER WILLINGNESS TO PAY FOR DAIRY GOAT MILK IN SIAYA COUNTY, KENYA

REBECCA JEROP

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DECLARATION AND RECOMMENDATION

Declaration

I declare that this thesis is my original work and has never been submitted in this or any other university for the award of a degree.

Rebecca Jerop

KM17/2403/09

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Signature Date

Recommendation

This thesis has been submitted with our approval as the official University Supervisors.

Dr. George O. Owuor, PhD.,

Department of Agricultural economics,

Egerton University, Njoro, Kenya.

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Signature

Date

Prof. Isaac S. Kosgey, PhD.

Laikipia University College, Nyahururu, Kenya.

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Signature Date

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ABSTRACT

The demand for animal products is projected to increase progressively due to extensive urbanization, rapid growth of human population and income dynamics. Despite the potential expansion of beef and dairy production, dairy goat production as an option for enhancing food security and income generation in Kenya is likely to benefit from this prospect. Essentially, goat milk is nutritionally superior to the cow milk. Although the importance of goat milk is empirically known, its valuation from the potential consumers' point of view, together with the associated price performance, is not well known. The purpose of the current study was to assess consumption and willingness to pay for dairy goat milk. Multistage sampling was used to obtain 131 consumers at households. Primary data was collected using a structured interview schedule. Data collected was on household consumer characteristics, responses to different bid levels for goat milk and socio-economic factors. The study used double-bounded dichotomous choice CVM to assess consumers' mean WTP for goat milk and logit model to determine socio-economic factors influencing consumers' WTP. Results indicated that consumers were willing to pay an average premium of 38% above the current prevailing price of cow milk. Age, number of years in schooling and number of children (18 years of age and below) present in a household had a positive and significant effect on WTP. Awareness, gender and the number of adults aged between 19 and 59 years present in a household negatively influenced WTP. The study recommends policy intervention aimed at facilitating development of marketing infrastructure, creation of awareness of important nutritional and health benefits of goat milk, and boosting the development of goat milk dairy processing plants and systems that can add value to goat milk, so as to capture existing market opportunities. This would enhance food security and income generation of the small-scale resource-constrained farmers.

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ANOVA	Analysis of Variance
CVM	Contingent valuation method
FAO	Food and Agricultural Organization of the United Nations
GDP	Gross domestic product
GM	Genetically modified
HPM	Hedonic Price Model
HIV/AIDS	Human Immunodeficiency Virus
KES	Kenya Shillings
MoLD	Ministry of Livestock Development
MoLFD	Ministry of Livestock and Fisheries Development
NGOs	Non-Governmental organizations
SDDP	Siaya District Development Plan
WHO	World Health Organization
WTA	Willingness to accept
WTP	Willingness to pay

CHAPTER ONE
INTRODUCTION

1.1. Background information

The demand for animal products in the world is projected to expand by the year 2020 due to increase in urbanization, human population and income growth, which will create markets for animal products (Delgado *et al*., 1999). Dairy goat production as an emerging sub-sector in Kenya is likely to benefit from this prospect. However, commercialization of animal products will be determined by consumption behaviour of consumers. Tastes and preferences of consumers, among other socio-economic factors that influence the consumers' WTP, will determine the development of the livestock sector (Juma *et al*., 2010), and the goat sub-sector in particular.

In Kenya, the livestock sub-sector accounts for about 12% of the total GDP and 40% of the agricultural GDP, and employs 50% of agricultural labour force. The share of livestock related exports comprise 13% of the total export revenue of the country (MoLD, 2008-2012). The livestock population is approximately 60 million head, comprising indigenous, exotic breeds and crossbreds. The major livestock species consist of 9 million Zebu and 3.5 million exotic and grade cattle, 8 million sheep, 11 million goats, 850,000 camels, 330,000 pigs, over 29 million chicken and 470,000 rabbits (MoLD, 2008-2012). Goats, therefore, form an integral component of the livestock sector and play an important role in the economic and social life of many Kenyans, contributing meat, milk and skins (MoLFD, 2007).

Dairy goats have been introduced in most parts of Kenya through the efforts of various development and non-governmental organizations, among them the Heifer Project International-Kenya (HPIK), which implemented a community-based dairy goat project to improve the nutrition security and incomes of small-scale resource-poor farmers (Ogola *et al*., 2009). The drastic increase in human population pressure, land scarcity and diminishing production resources (Bett *et al*., 2009) have also stimulated the use of dairy goats in rural development efforts (Josserand, 1984). Generally, dairy goat production is becoming an important economic activity for the target farmers because they can easily adapt to the environment compared to cattle, require a small piece of land, multiply quickly and can feed on a variety of plants (FAO, 2005).

The total annual milk produced in Kenya is about 5.31 million litres of which approximately 83% is produced by cattle and the rest by goats and camels (MoLD, 2008-2012). The HPIK and other development organizations have helped farmers to increase goat milk production through the

use of high value exotic genotypes (breeds) like the Saanen, British Alphine, Anglo-Nubian and the Toggenburg (Ogola *et al*., 2009). Although dairy goats have been introduced in various parts of the country by development organizations, the enterprise still remains at the subsistence level (Ogola *et al.,* 2010) and, therefore, not sustainable in the end (FARM-Africa, 2005). This has been majorly attributed to lack of well designed and executed breeding programmes, low commercialization of dairy goat milk and milk products, poor housing and lack of extension services, amongst other factors (Kosgey *et al*., 2006).

Dairy goat farming is emerging as an important economic activity in some parts of Siaya County, where land fragmentation has resulted in small pieces of land that cannot support dairy cattle farming. The landholdings are 0.5-2 hectares, on which maize, beans, cassava, sweet potatoes and other crops are concurrently grown. Smallholder farmers in this County, therefore, have few options to increase their incomes and improve their livelihood. Dairy goat farming, introduced by the HPIK, can be an option to small-scale resource-poor farmers in this area because it is more sustainable on small pieces of land.

Essentially, goats' milk is more nutritive and has medicinal value over that of the cow; it has smaller fat globules size which is more digestible compared to cow milk. Goat milk proteins are also believed to be more digestible and their amino acids are absorbed more efficiently, than those of cow milk (Haenlein, 2004). It has particular benefits in the diet of children and adults who show sensitivity or allergic reactions to cow's milk (Park, 1994). It has also been found to be beneficial to HIV/AIDS victims. However, strong flavour of goat's milk, and issues connected with witchcraft and lower social status are said to prevent people from consuming goat and sheep milk (Manyenga, 1987). The situation is currently changing due to urbanization, change in dietary habits and awareness of the nutritional value of goat milk (Kosgey, 2004). However, the question arising was, how much a consumer would be willing to pay for goat milk? This is important as the ability of goat's milk to fetch premium price may have a strong impact on the profitability of this emerging sub-sector and, consequently, its commercialization.

1.2. Statement of the problem

Scarcity of land due to increased human population in Kenya is becoming a serious impediment to agricultural production, necessitating change in land use systems to accommodate the food demands from the diminishing land parcels. This has stimulated the use of dairy goats in rural development efforts to play a role in food security and income generation. Although dairy

goats have been introduced in various parts of the country by development organizations, the enterprise still remains at the subsistence level and has not been commercialized in most of the trial areas. Land scarcity, poverty and rapid spread of HIV/AIDs are major challenges in Siaya County. HIPK implemented a community-based dairy goat project to improve on nutrition and health security and incomes of the vulnerable small-scale farmers. Despite all these there is still low preference of goat milk and, thus low commercialization and, consequently, dilemma of how much consumers would be willing to pay for the new product in the name of goat milk which is being promoted in the area. This is important as the ability of goat milk to fetch premium price may have a strong impact on the profitability of this emerging sub-sector.

1.3. Objectives of the study

The overall objective of the study was to assess consumption and willingness to pay for dairy goat milk with a view to initiating appropriate interventions, including informing dairy goat development initiatives and policies. To achieve this, and with reference to Siaya County, the specific objectives were:

(i) To characterize the households' willing and not willing to pay for goat milk.
(ii) To assess how much consumers were willing to pay for goat milk.
(iii) To determine social-economic factors influencing consumers' willingness to pay for goat milk.

1.4. Research questions

To achieve the objectives of the study the following research questions were asked:

(i) What were the characteristics of households willing and not willing to pay for goat milk?
(ii) How much were household consumers willing to pay for goat milk?
(iii) What socio-economic factors influence consumers' willingness to pay for goat milk?

1.5. Justification

Goat milk has a far greater quality compared to cow milk therefore, this study attempted to assess how much consumers were willing to pay for goat milk compared to cow milk. The ability of goat milk to fetch a premium price have strong impact on the profitability of this emerging sub-sector and, consequently. its commercialization. The focus of most studies on dairy goat industry has been on production side but has given inadequate attention to demand side. The introduction

of new production and processing technologies in the dairy goat sub-sector requires sufficient information to ease planning and implementation. Besides to potential price performance, stakeholders need to know the likely impact of socio-economic and cultural factors on demand because the success of the new technologies depends on whether there is a market for their products. The current study focused on consumer WTP for goat milk, demand side in dairy goat industry and socio-economic factors that could influence WTP. The study was intended to provide information to emerging farmers on domestic demand for goat milk products; provide producers and retailers in the goat milk supply chain and policy makers with relevant information that is expected to contribute to the increased production from and commercialization of this emerging dairy goat industry. Consumer awareness was improved during data collection period of the study in view of the fact that, medicinal and nutritional benefits of goat milk were outlined during the exercise. With these, consumers may have better understanding of goat milk.

1.6. Scope and limitations

The study was conducted on goat milk potential consumers at households. The study focused on demand for goat milk and drew an emphasis on consumers' WTP for goat milk and the analysis of factors influencing WTP for the milk. The factors that were used for the analysis were limited to some of the socio-economic factors and the level of awareness regarding the benefits of goat milk. Siaya County was purposively selected for the study owing to its comparative advantage for the HIPK dairy goat project. The study did not capture the production of as well as the quantity of goat milk available in the study area.

1.7. Operational definition of terms

- **Contingent valuation: -** refers to a "stated preference" method because it asks people to directly state their values or the amount they are willing to pay. (USDA–NRCSNOAA, 2000).
- **Household:** - is an independent male or female and his/ her dependants who must have lived together for a period not less than six months. The members are answerable to one person as the head and share the same eating arrangement.
- **Potential consumer:** - is an individual or a household unit that is willing to consume goat milk.
- **Price premium: -** is the additional percentage charged for products with more beneficial

attributes like goat milk compared to other products like cow milk.

- **Willingness to pay: -** is the desire to give a certain amount of money to acquire a certain product, in this case, the goat milk and milk products.

CHAPTER TWO
LITERATURE REVIEW

2.1. Overview of the dairy goat production

Dairy goats are kept in most parts of the world, their numbers in the developed and developing countries accounting for 30.9% and 19.1% of the total goat population, respectively (Olivier *et al*., 2005). Goats can do well in a wide range of agro-ecological zones. They are particularly important in marginal agricultural land, especially in the arid and semi-arid areas (Rege and Lebbie, 2000) and are kept for meat, milk, fiber and skins (Kosgey, 2004). Dairy goats play a vital role in food security and income generation for the resource-poor farmers. They are important milk producers in several parts of the tropics and contribute significantly to human nutrition in the developing countries. Of the total world population of goats, 94% are said to be found in the developing countries, supplying 73% of the milk produced by goats (Devendra 1987a). The development of dairy goat industries depends on competition with cow milk production. Though most of the world human population has access to goat milk, an informal survey, conducted by Dubeuf *et al.* (2004) in developing countries show that, probably less than, 5% of the total goat milk produced is traded. That study further concluded that production of goat milk produced is generally home consumed at home, given to neighbours or sold within the villages and some is used for feeding kids. There is no organised and controlled production sector as is the case with cow milk.

The milk yield of goats varies from 0.5 to 5 litres per day, with an average butter fat content of about 4.5%. High yielding breeds like the Toggenburg, Saanen and the Alphine that have been developed in temperate countries yield up to 15 liters per day. A crossbred animal (three quarter Toggenburg and one quarter local goat) proved to be the most preferred genetic composition for the small-scale resource-poor farmers in Kenya, producing about 0.5- 4.5 liters of milk per day (FAO, 2010).

2.2. The value of goat milk

Goat milk differs from that of the cow in amino acid content and composition of the proteins (Quiles *et al*., 1994). It is composed of small suspensions of fat globules, making it easier to be assimilated and, therefore, have particular benefits in the diet of children and adults who show sensitivity or allergic reactions to cow's milk. It has also been found to be beneficial to HIV/AIDS victims as its high protein molecules are better absorbed than other proteins and

strengthen antibodies. Also for mothers who opt not to breast feed, goat milk is an ample substitute. Goat milk is associated with alleviating or controlling some diseases (Haenlein, 2004).

Table 1: Dairy products with special properties

Attribute	Value of goat milk
Digestibility	Considered more easily digestible
Milk fat globules	Smaller in goat's milk than cow's milk
Calcium content	Higher in goat's milk than cow's milk
Allergies	Ideal to children than cow's milk
Iron content	Lower in goat's milk than cow's milk
Vitamin A	Higher in goat's milk than cow's milk
Vitamin B1	Higher in goat's milk than cow's milk
Vitamin B6 and B12	Lower in goat's milk than cow's milk
Vitamin C	Same in both goat and cow milk
Vitamin D	Same in both goat and cow milk
Natural fluorine	Higher in goat's milk than cow's milk
Glycerol ethers	Higher in goat's milk than cow's milk
Short chain fatty acids content	Smaller in goat's milk than cow's milk

Source: Farnworth (2002).

Typically the type of symptoms that goat milk can be helpful in overcoming can be categorized into, gastrointestinal, respiratory and dermatological. Gastrointestinal problems include vomiting, diarrhoea, abdominal discomfort, colic and constipation. Respiratory problems include asthma and bronchitis while dermatological problems include eczema, dermatitis and rashes (Park, 1994). More so, goat milk greatly improves the diet of many rural families who do not access cow milk, and is traditionally valued for the elderly, the sick, babies, children who are allergic to cow's milk and patients with ulcers. However, the strong flavour and taste of goat milk and other cultural factors are said to prevent people from consuming goat's milk. The situation is currently changing due to change in dietary habits, income and population growth and awareness of nutritional and medicinal values of goat milk. Although research has provided useful insights on the production of goat milk and its important contribution to alleviation of

poverty and food insecurity, several gaps still exist. Firstly, there is dearth of information on whether consumers would be willing to pay for goat milk and how much are they willing to pay. This is important as the ability of goat milk to fetch premium price may have a strong impact on the profitability of this emerging sub-sector. Secondly, there is a lot of research on the production side of goat milk but its marketing and processing have received far less attention.

2.3. Consumer WTP for a product

The consumer is assumed to choose among all the available alternatives in such a manner that the level of satisfaction derived from consuming commodities is the highest (Henderson and Quandt, 1980). Grunert *et al.* (1997) consider product attributes as one of the perspectives to increase understanding of consumer or buyer choice. Several classifications of attributes for food exist (Grunert *et al*., 1997), which include price, colour, experience (taste and flavour) and credence like health and safety (Sloof *et al.*, 1996). Several studies have addressed consumer WTP for food products with quality product attributes (Jordan *et al*., 1985; Episona and Goodwin, 1991; Hayes *et al*., 1995; Akankwasa, 2007). Aarker (1991) found out that consumers consider five important attributes, namely, product quality, brand name and reputation, freshness and guarantee before they purchase a product.

2.3.1. Determinants of consumer WTP for a product

Literature on economics indicates that WTP for a product depends on product quality attributes, as well as the type and socio-economic characteristics of the buyer. Among the socio-economic characteristics of the buyer are gender, age, income, education, household size, knowledge and place of residence. The type of buyer includes wholesaler, processor, retailer and final consumer (Bruhn, 1995). Socio-economic studies on willingness to purchase and pay for food products indicate that women, youth, high-income class and educated people were willing to pay additional premium for a product perceived to have good quality characteristics (Carlos *et al.*, 2005).

The relationship between income and WTP offered controverted and contradictory empirical evidence. Some studies have found direct association between income and WTP for food products. According to Senturk (2009), the probability of WTP for GM food decreases with an increase in income. Several other studies have found the income variable to be statistically significant and positively influence WTP. According to Carpio and Isengildina (2008) income

was an important driver of WTP for local attributes in animal produce. Piyasiri and Ariyawardana (2002) showed that an increase in income increases the probability of WTP for organically produced vegetables in Kandy.

Educational level turns out to be the most controverted socio-demographic predictor of WTP. Misra *et al.* (1991) obtained a negative correlation between education and consumption of fresh organic products. Groff *et al.* (1993) observed that those consumers with lower educational instruction considered fresh organic products as of higher quality than conventional ones and, therefore were willing to pay higher prices for them. Govindasamy and Italia (1999) also obtained an inverse relationship between WTP and education.

Akgungor *et al*. (2007) estimated a representative sample of Turkish urban consumers' for chemical reduced residues in food and trade-off they make between cosmetic quality and food safety. The study revealed that educated and high-income individuals have increased interest on organic product purchases. According to the results, the reason for choosing organic products was that consumers perceived that organic products have higher nutritional value and carry low health risk. Goat milk were compared with organic products because of the more natural methods employed by the dairy goat farmers.

2.4. Analytical methods used in understanding WTP

Consumer demand for a product is measured by the WTP for the product. Several analytical methods have been used in measuring consumer's acceptance and WTP for particular products. Some of the appropriate models include; the Analysis of Variance (ANOVA) (Mead *et al*., 1993), Hedonic Price Model (Shannon, 2001), Contingent Valuation Method (Loureiro and Umberger, 2003) and the Conjoint analysis (Kohli and Manjan, 1991).

Loureiro and Umberger (2003) used the contingent valuation method to study "Certified US" labeling of three different meat products: beefsteaks, pork chops and chicken breasts. The continental US consumers surveyed were only willing to pay average premiums of 2.5-2.9% over the original market price. Juma *et al*. (2010) used contingent valuation in analyzing WTP for indigenous small ruminant meat quality. Of the households that consumed small ruminant meat, 70% were willing to pay, revealing a mean price bid of KES 11.40, which was 7.6% extra for the prevailing price of small ruminant meat. The current price of meat, income, number of adult members in a household and consumer's perception of meat qualities were factors found to influence the WTP.

Rodriguez *et al.* (2007) estimated consumer WTP for organic food products available in Argentinean domestic market using the CVM to estimate WTP. The products selected for the study were regular milk, leafy vegetables whole-wheat flour, fresh chicken and aromatic herbs. The results of the study indicated that organic products were positively valued in Argentina, since consumers affirm to be willing to pay price premiums to acquire these products. According to the results high income level respondents were willing to pay higher prices for organic products: 12.2%more for regular milk, 87% more for leafy vegetables, 7.5% more for whole-wheat flour, 20% more for fresh chicken, and 110% for aromatic chicken.

The Hedonic Price Model (Lancaster, 1991) has also been used in the analysis of WTP for a product. The concept underlying the HPM is that the price of a heterogeneous good is a function of attributes of that good (Larue *et al.*, 1991). Its application tries to capture the relative importance of each of the attributes to price. The model has been used in several analyses among them; determining the attribute values of cotton (Bowman and Erithridge, 1987), rice (Brosen *et al*., 1984), wheat (Episona and Goodwin, 1991) and tomatoes (Jordan *et al*., 1985). Akankwasa (2007) used the HPM to study consumer acceptability and WTP for the introduced desert bananas and identified that some of the socio-economic characteristics like education, household size, income, and desert banana attributes like taste and skin colour significantly influenced the WTP for the bananas.

Conjoint analysis is designed to determine the trade-offs among product attributes. It is usually based on rankings or ratings on product profiles. Each profile is defined as a set of attributes, including price. The CVM is selected for the current study because it can easily estimate how much a consumer is willing to pay for goat milk. The approach asks people to report directly their WTP to obtain a specified good.

2.5. Theoretical framework

2.5.1. Consumers' utility theory and measures of welfare change

Consumer utility provides the basis for measuring WTP in terms of change in welfare. Consumer utility is defined as a function of both market goods, denoted as *x*, and non-market items which is to be valued, denoted as *q*. The utility function for an individual may be written as $u(x,q)$.The corresponding indirect utility function depends on prices of market goods, *p*; an income of an individual, *y*; individual characteristics, *s*; and stochastic component, *e*, representing the notion of random utility maximization. Indirect utility function can be written as: $v(p,q,y,s,e)$.An individual maximizes utility subject to income y. The indirect utility function $v(p,q,y,s,e)$ is as shown in equation 1 below:

$$v(p,q,y,s,e) = \max\{u(x,p) \mid p,x \le y\} \quad (1)$$

The minimum expenditure function $m(p,q,u)$ is dual to the indirect utility function as presented in equation 2 below:

$$m(p,q,u) = \min(p.x \mid u(x,q) \le u\} \quad (2)$$

The properties of both the indirect utility and expenditure function are well known (Deaton and Muellbauer, 1980). The derivative of the expenditure function yields the Hicksian or utility-constant (compensated) demand function, with the subscript indicating the partial derivative. The negative of the ratio of derivatives of the indirect utility function yields the Marshallian or ordinary demand curve as depicted by equation 3 below:

$$u_i(p,q,u) = mp_i(p,q,u) \quad (3)$$

The decision on WTP is based on the utility derived from consumption of a good or a service. Formally, WTP is defined as the amount that must be taken away from the person's income while keeping his utility constant (Alberini and Cooper, 2000). The utility function normally reflects the good or a service together with social and demographic characteristics that contribute to the utility of the respondent as presented in equation 4 below:

$$u = v(p,q,y,s) + e = v + e \quad (4)$$

where u represents utility of individual choosing a product, v the deterministic component of indirect utility, y the level of individual's income, s the factors that could affect the utility of

individual and e the random component of the utility function. WTP measures the maximum amount of income the individual will be willing to pay for an improvement in their circumstances (utility maximization) or maximum amount an individual is willing to pay to avoid a decline in circumstances. Willingness to pay is defined using the indirect utility function as shown in equation 5 below:

$$v(p, q^{*} s, y - WTP) = v(p, q, y) \quad (5)$$

where v denotes the indirect utility function, y the level of individual income, p a vector of prices faced by the individual, and q^{*} and q are the quality indexes or alternative levels of good with $q^{*} > q$, and increases in q^{*} is advantageous since $\frac{\partial v}{\partial q} > 0$, implying that higher consumption level of q^{*} leads to higher utility.

2.5.2. Contingent valuation method

A contingent valuation (CVM) approach was used to evaluate the consumers' response in the absence of a real purchasing situation. The CVM approach allows a direct estimation of WTP by means of different elicitation techniques (Alberini and Cooper, 2000). Several concerns regarding its reliability have been raised (Buzby *et al*., 1995; Fox *et al.*, 1995; Caswell, 1998). For example, consumers may take a theoretical scenario less seriously than a real one and, therefore, they may tend to bias their true WTP (Blumenshein *et al.*, 1998). Nevertheless, the selection of appropriate survey and elicitation methods can reduce and minimize these biases.

2.5.3. Elicitation methods of WTP

Willingness to pay is elicited through many approaches. The most often used formats are; open-ended approach in which the respondent is presented with alternatives of the product together with the price and he/she is requested to choose the product together with the maximum amount he/she would be willing to pay for a product or a service. This approach may result to a large number of zero responses and few positive responses. If the respondent is not interested, he/she may give no responses or zero responses; if he/she thinks that the information on WTP will be used to set the price for the product, a disadvantage associated with this format (Alberini and Cooper, 2000).

Bidding game format is another approach for eliciting WTP for a product. In this approach, the respondent is asked if he/she would be willing to pay a given amount; a "yes" response is followed by a higher amount until the respondent answers no; and a "no" response is subsequently followed by a lower amount until the respondent answers yes; maximum WTP is then elicited (Randall *et al*., 1974). This method has the disadvantage that once the respondents note the pattern of the questioning, they tend to give strategic answers. To eliminate such bias, use of the discrete choice questions has been recommended.

In the payment card approach, the respondent is presented with a card, which depicts a list of different amounts. The respondent is then asked to pick the amount in a card that he/she would be willing to pay for the product or a service (Mitchel and Carson, 1981). The payment card approach is a popular way of eliciting WTP because it fits most statistical models that allow one to obtain the parameters of the distribution of WTP, and to make prediction about a respondent expected WTP amount. However, under an interpretation, WTP is not directly observed; the problem with this format is the dependence of estimates on the amount used in the card (Alberini and Cooper, 2000).

The most widely used approach is the dichotomous choice payments. In this approach, the respondent is given a single payment and answers with a yes or no. The yes and no answers are used along with the required payment to estimate the discrete model from which expected WTP is then calculated. The dichotomous choice approach apes behaviour in regular markets where people usually purchase or decline to purchase at a given price. This method has a considerable advantage of reducing the strategic responses. The double-bounded dichotomous choice approach is employed in this study. It was first proposed by Hanemann, (1985) and (Carson, 1985). Carson and Hanemann *(*1986) used it for the first time in determining demand for public goods.

In this approach, which is similar to the single-bounded, the first bid is determined exogenously. However, the second bid is endogenous as it is determined based on the responses of the respondents to the first bid. The level of the second bid is contingent upon the response to the first bid. If the response to the first bid is positive, the second bid is higher than the first bid; if it is negative, the second bid would be lower than the initial bid. A hypothetical description of goat's milk was presented to the respondent. This willingness included the attributes of goat milk compared to that of cow's milk. This was then followed by asking the respondent questions to

determine how much he/she was willing to pay for goat milk if confronted with the opportunity to obtain it. The validity of those responses was tested by relating WTP responses to respondent's socio-economic characteristics (e.g, age, education, gender, household income, attitudes, taste and preference).

If the payment question is open-ended, ordinary least squares model can be used to explain the variation in the dependent variable. However, in the dichotomous choice responses, different statistical models are required. Appropriate models are logit, probit and tobit. Probit and logit models are non-linear and use the principle of maximum likelihood to estimate the parameters. The underlying distribution of the probit model is normal, whereas logit follows logistic distribution. The Logit model is widely used because it has a higher density mass at the margins and allows for logical distribution of responses where the respondents are not normally distributed in respect to their attributes. In this study, the logit model was adopted.

2.5.4. Contingent valuation analysis of WTP

In dichotomous choice CVM, the respondents are offered specific amounts, B, and asked whether they are willing to pay that amount or not, to secure some improvements. The respondent answers with a "no" or "yes". The yes-no answers are then used along with the required payment to estimate a discrete model from which expected WTP is calculated. The probability of obtaining a "yes" or "no" is a function of the amount of the bid B offered, and the consumers maximum WTP. For instance, the probability of a no response can be presented as shown in equation 6 below:

$$\Pr(No\,\mathrm{Re}\,sponse) = \Pr(B \succ \max WTP) \tag{6}$$

Mathematically, the distribution of maximum WTP can be expressed as a cumulative density function (CDF) of the bid B and a vector of parameters $\theta, G(B;\theta)$, where $G(\bullet)$ represents an appropriate statistical distribution function (Hanemann *et al.*, 1991), representing a down sloping S-shaped curve, from 1 to 0. The probability that her/his maximum WTP is less than B or as indicated in equation 7 below:

$$\pi^n \left(B \right) = \Pr \left(B \succ \max WTP \right) = G(B;\theta) \tag{7}$$

The probability of a consumer accepting the bid is the reverse of equation (7), as depicted in equation 8 below:

$$\pi^{y}(B) = \Pr(B \prec \max WTP) = 1 - G(B;\theta) \tag{8}$$

Using an appropriate functional form of $G(\bullet)$, the probabilities of the two outcomes can be expressed mathematically, the likelihood function can be constructed, and the parameters estimated. A convenient and conventional function is the logistic, mathematically expressed as in equation 9 below:

$$G(\bullet) = \frac{1}{1+\exp(-v)} \tag{9}$$

The logistic function has the advantage of a closed-form cumulative distribution function $G(\bullet)$, which then represents the proportion of the population whose WTP lies below a certain value B, v is an index function, usually linear in the bid B, it follows that of equation 10 depicted below:

$$G(B) = \Pr(B \succ \max WTP) = \frac{1}{1+\exp(-(\alpha - \rho B))} \tag{10}$$

The coefficient ρ is necessarily positive, to form a downward sloping S- curve, ranging from 1 to 0 (a negative rho would result in an upwards sloping WTP, which would contradict economic theory. The proportion of the population whose willingness to pay is greater than a certain value B, is represented as show in equation 11 below:

$$1 - G(B) = prob(B \prec \max WTP) = 1 - \frac{1}{1+\exp(-(\alpha - \rho B)} \tag{11}$$

2.6. Conceptual framework

In consumer behaviour theory, consumers make their own decisions to balance the marginal health utility and marginal price of one unit of quality-food products. Consumers' willingness to purchase and pay a premium price for goat milk is a function of consumer socio-economic factors, which include consumer education, age, household size and income, along with goat milk attributes that influence their attitude and preference to buy the product.

High income levels of consumers make them to be much concerned about their diets, which largely contributes to purchase of products with quality attributes. Education of the consumer can be a driver of WTP, because the more a consumer is educated the more he/she is aware and likely to have more information on nutritional values of various products, and may be willing to pay more for a product like goat milk, which is more nutritious compared to cow milk. Older people are concerned about their health and may be willing to pay higher prices than young individuals. Conversely, female consumers on the other hand, are considered to give more importance to the nutritional values of the family and, besides, they are the major food shoppers in households and, consequently, can pay more attention to products with nutritional values like goat milk. Presence of adults in a household may have a negative impact on WTP because an increase in the number of persons increases the food requirements in a household and, therefore, decreases the ratio of disposable income available per person. Consumer awareness forms the basis for product familiarity and may be positively associated with WTP because the more consumers are aware about the positive attributes of a product the more likely to pay more. The study conceptualizes that high consumer WTP results to high demand for the goat milk product and, consequently, commercialization of the milk and, for this reason, those dairy goat farmers are likely to have improved incomes, which then feeds back to improving some of socio-economic and other factors (e.g, education, income, and awareness).

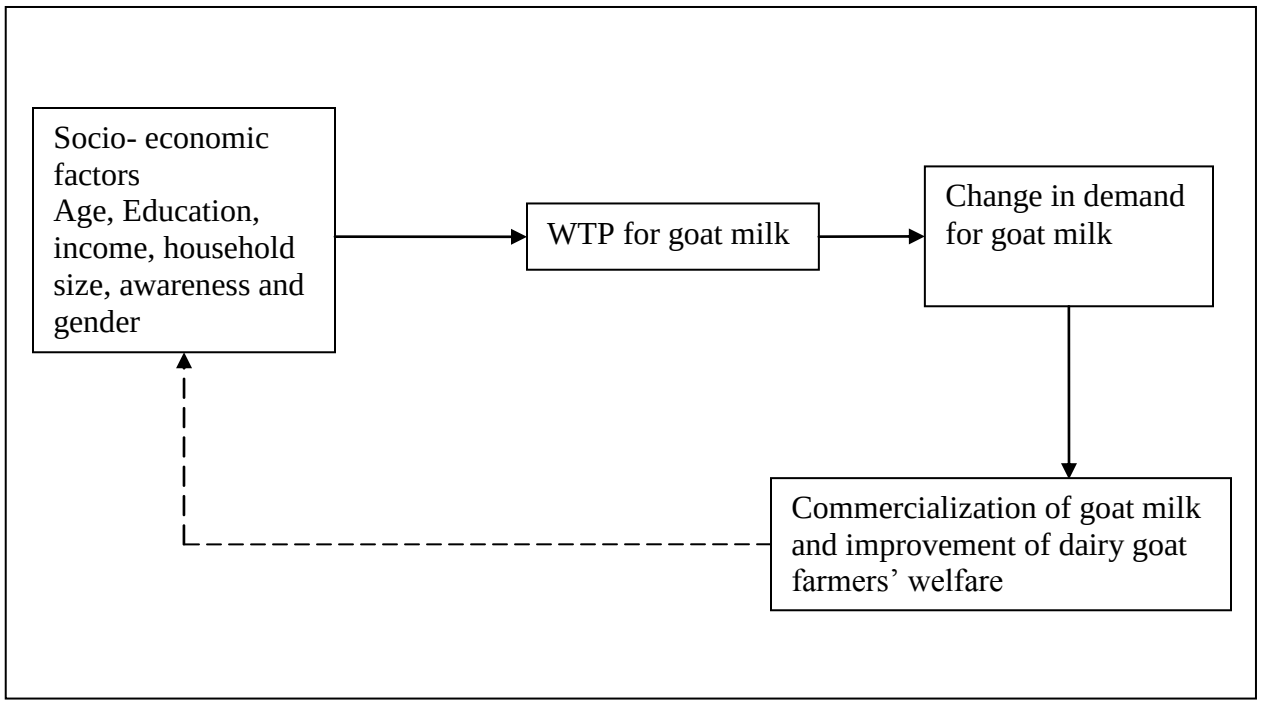

Figure 1: Conceptual Framework on Consumer Willingness to Pay

CHAPTER THREE
METHODOLOGY

3.1. Description of the study area

The research study was conducted in Siaya County in Western Kenya. The County is one of the counties in Nyanza Province. It covers an area of 1773 km^2; of this, 1263 km^2 is agricultural land and 253 km^2 is covered by water. The County is bordered by Busia County to the north, Vihiga and Butere/Mumias to north-east, Bondo to the south and Kisumu County to the south-east (SDDP 2002-2008). It is divided into seven administrative divisions, namely; Yala, Wagai, Karemo, Ukwala, Ugunja, Boro and Uranga.

Though there are many development initiatives, for example, the HPIK project in the area poverty is still a major challenge. Most families live on less than a dollar a day (SDDP, 2002-2008). The dominance of the agricultural sector is also observed in the study area, where by many crops are widely grown. Livestock in this area are mainly local breeds, especially cattle. The land size is increasingly becoming small and cows are tied up to graze in small grassy areas or kept at home for zero-grazing.

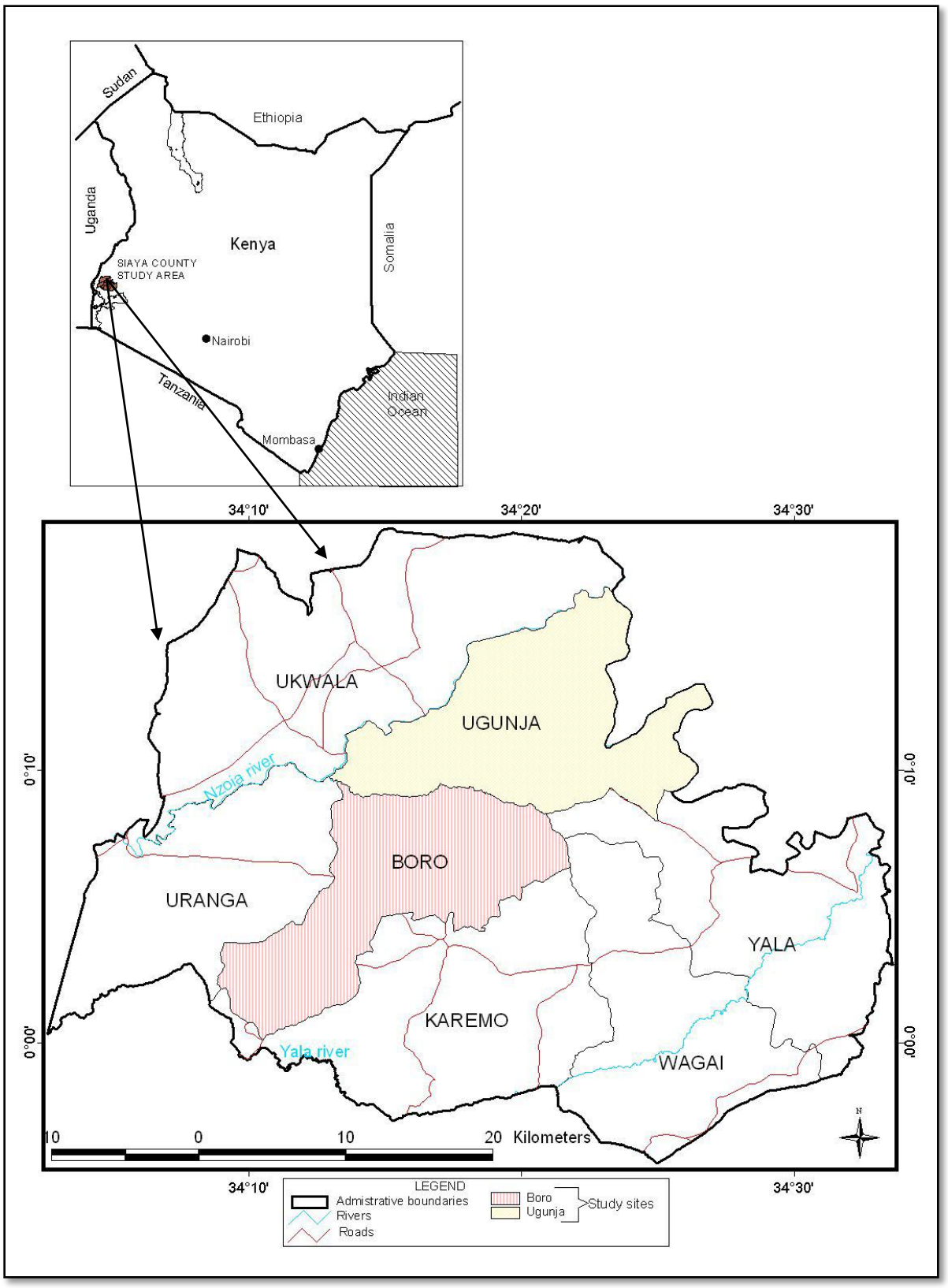

Figure 2: Map of the study area (Siaya County)

3.2. Sampling procedures

The target population of this study was the potential consumers of goat milk at households. Multistage sampling was used to get a representative of respondents. Firstly, the County was purposively selected owing to the comparative advantage of the HPIK dairy goat project which has been on for the last 10 years. Secondly, simple random sampling was used to select two divisions (Ugunja and Boro) from the County. Thirdly, two locations in each selected division were purposely selected in favour of the HPIK dairy goat project. Finally, simple random sampling was used to select potential consumers of goat milk at household from each location.

3.3. Sample size

In this study the target proportion of the population assumed to have the characteristics of interest are the potential consumers of goat milk which is infinite. To determine a sample size from the population, the author recommends the formula by Kothari (2004), presented in equation 12 below:

$$n = \frac{z^2 pq}{e^2} \tag{12}$$

where,

n= the desired sample size,

z= 1.96, the standard variant at a required confidence level,

p= 0.5, the proportion in the target population (potential consumers of goat milk q= 0.5, (1-p) and

e= acceptable error of 8.95%.

The sample size was therefore, calculated as;

$$n = \frac{(1.96^2)(0.25)}{0.0895} = 120$$

Additional 11 respondents were included in the sample to take care of incomplete responses and increase the robustness of the results. Consequently, a sample of 131 respondents was interviewed.

3.4. Data types and sources

The study used both primary and secondary data. A scheduled interview served as a key survey instrument composed of both open and closed ended questions, and was used for primary data collection from the respondents. The data collected included the socio-economic factors (age, gender, number of children 18 years of age and below, education, income, household size and awareness of household to goat milk and, in order to assess how much consumers were willing to pay for goat milk. Respondents were asked to state their WTP using the current prevailing price of cow milk as the initial bid. A follow up bid, either a premium or discount was then presented to potential consumers in response to the initial bid. If the respondent accepted the first bid, the follow up bid was higher than the initial bid and vice versa. The follow up bids offered were 10%, 20%, 30%, 40% and or more than 50% premium or discount randomly distributed. Secondary data was obtained by reviewing the literature from selected documented book chapters, annual reports, journals, newsletters and other published sources relevant to the study.

3.5. Analytical techniques

To achieve objective one of this study, descriptive statistics were used. Mean, standard deviation, frequencies, tabular summaries, percentages and differential statistics were used to summarize the characteristics of the households willing and not willing to pay for goat milk.

The double–bounded contingent choice model was used in analyzing WTP. The model aggregated all the consumer responses to price (bid) levels for goat milk and eventually gave a basis for calculating the mean WTP. The double-bounded contingent model was appropriate because it takes into consideration the two responses simultaneously.

The respondent was presented with two bids, i.e., the initial and the follow-up bids. The level of the second bid was higher than the initial bid if the responses were positive and lower than the initial bid if the responses were negative. The second bid plays an important role in placing an upper and lower bound on the respondents unobserved true WTP (Alberini and Cooper, 2000). There were four possible outcomes from the double-bounded dichotomous choice presented in interval YY, YN, NY and NN, where YY implies that both answers were “yes”, WTP is higher than the upper bid, YN first answer is “yes” followed by “no” WTP is between the initial bid and the upper bid, NY a “no” answer followed by “yes” WTP is between the lower bid and the initial bid, and NN both answers are “no” WTP is between zero and the lower bid (Vanit and Schmidt,

2002). The probabilities of these outcomes are denoted as π^{yy}, π^{yn}, π^{ny} and π^{nn}. The set of bids may be represented as B_I for the initial bid, B_L for the lower bid and B_U for the upper bid. Building on dichotomous choice model, the probabilities of these four outcomes is expressed as follows: accepting the first bid the consumer WTP was greater than the bid. If the consumer rejects the first bid, then his WTP is less than the initial bid. The probabilities of those outcomes may be expressed as in equations 13 to 16 below.

$$\pi^{yy}(B_I B_U) = \Pr(B_I \leq \max WTP \geq B_U = \Pr(B_U \leq \max WTP) = 1 - G(B_U;\theta). \quad (13)$$

$$\pi^{yn}(B_I B_U) = \Pr(B_I \leq \max WT \leq B_U) = G(B_U;\theta) - G(B_I;\theta) \quad (14)$$

$$\pi^{ny}(B_I B_L) = \Pr(B_I \succ \max WTP \leq B_L) = G(B_I;\theta) - G(B_L;\theta) \quad (15)$$

$$\pi^{nn}(B_I B_L) = \Pr(B_I \geq \max WTP \prec B_L) = \Pr(B_L \succ \max WTP) = G(B_L;\theta) \quad (16)$$

where *WTP* is the maximum WTP, $G(B,\theta)$ the CDF, with parameter vector θ to be estimated (Hanemann *et al*., 1991). In this study, the CDF was assumed to be logistically distributed and therefore, $G(B_\bullet) = [1+e^{v}]^{-1}$ where $v = (\alpha - \rho B_\bullet)$. The parameters of the index function α and ρ were estimated by maximizing the likelihood function.

The log likelihood function becomes as depicted in equation 17 below.

$$LnL(\theta) = \sum_{n=1}^{N} d^{yy} \ln \pi^{yy}(B_I, B_U) + d^{yn} \ln \pi^{yn}(B_I, B_U) + d^{ny} \ln \pi^{ny}[G(B_I, B_L) + d^{nn} \ln \pi^{nn}(B_I B_L)\} \quad (17)$$

where $d^{\bullet}$ is the binary indicator function that assumes the value of 1 when the respective responses were chosen and 0 otherwise. The mean WTP was then derived by calculating α/ρ, the mean of the logistic distribution function with given specifications.

The key factors that explain the consumers' WTP for goat milk was identified and analyzed using the logit model by adjusting the index function *v* to include a set of explanatory variables x_i. Formally, the probability of consumer *i* buying a new product, when offered at a certain price, B_I, can be hypothesized to be a function of a vector of cognitive and socio-economic factors x_i. The probability of the consumer accepting bid B_I is derived as shown in equation18 below:

$$\pi^{y}(v_i) = v_i = \alpha - \rho B_I + \beta x_i + \varepsilon_i \quad (18)$$

where v_i is the index function with predetermined relationship between B_i *and* x_i, assumed to be linear and ε_i a random term. As in the basic model of the previous section, the probability of a bid (price) being accepted taking into account other consumer characteristics, is as expressed in equation 19 below.

$$prob(B \prec \max WTP) = 1 - \frac{1}{1 + \exp(\alpha - \rho B_i + B_i x_i)} \quad (19)$$

The LIMDEP econometric software was used for the logit estimations. Overall probabilities were calculated at the variables' mean values using estimated intercepts and coefficients (α, ρ, β). The final model, selected to analyze the dependence of WTP on socio-economic characteristics, is as shown in equation 20 below.

$$WTP = B_0 + B_1 AGE + B_2 GEN + B_3 EDUC + B_4 INC + B_5 CHILD \leq 18 + B_6 ADULTS 19-59 + ADULTS \geq 60 + B_8 KNW \quad (20)$$

Table 2: Description of the variables and expected signs

Variable name	Variable definition	Expected sign
Dependent variable		
WTP		
1=YES0=NO	Consumers' willingness to pay	
Independent variables		
AGE	Age of the respondent	+
GEN	Gender of the respondent: 0=female 1=male	-
CHILD≤18	Number of children below the age of 18	+
ADULTS19-59	Number of adults between 19 and 59 years of age	+/-
ADULTS≥60	Number of old members 60 years of age and above	+
EDUC	Education of the potential consumer in years spent in school	+
INC	Total household income per month in KES	+
HHSIZE	Total household size (in the last 12 months)	-
KNW	Awareness of the household potential consumer Yes =1 No=0	+

CHAPTER FOUR
RESULTS AND DISCUSSION

4.0. Introduction

The purpose of the current study was to assess how much consumers were willing to pay and to determine socio-economic factors influencing consumer WTP for goat milk. The characteristics of consumers willing and not willing to pay for goat milk were also investigated. The findings are discussed below.

4.1. Socio-economic characteristics of the potential consumers of goat milk

The characteristics of the households like age, education, household size, income and gender are important in conducting product market acceptance studies because they influence consumption patterns and WTP (Campiche *et al.,* 2004). The results revealed that there were significant differences between some socio-economic characteristics of households' who were willing to pay for goat milk relative to those not willing to pay.

Overall, 77.1% of the interviewed potential consumers expressed their WTP for goat milk, while only 22.9% indicated that they were not willing to pay. The bidding process was done after thorough explanation of the important medicinal and nutritive value of goat milk. Those consumers unaware of attributes of goat milk were read short explanations and, subsequently, asked about their interest in consuming and buying the product. The largest percentage of the respondents turned out to be willing to pay for goat milk. This implies that the factors that prevented people from consuming goat milk, as mentioned earlier, were vanishing and the demand for goat milk was increasing.

Table 3: Description of consumer willingness to pay for goat milk

Variable	Response	Frequency	%	cumulative %
Willingness to pay	No	30	22.9	22.9
	Yes	101	77.1	100

Majority (57.3%) of the respondents were farmers, with only 8% being civil servants or formally employed. Normally in a natural set up, majority of the households living in rural areas are farmers who depend entirely on agriculture for sustaining their livelihood. The policy makers should, therefore, consider commercialization of the agricultural sector because it is a major

source of income and food security to the rural households. The respondents willing to pay for goat milk who were formally employed were 89% compared to those not willing to pay 11%. Formal employment is an important source of steady income which is not subject to environmental factors and, therefore, consumers with formal employment were likely to pay compared to those potential consumers with other forms of occupation. The importance of occupation on WTP has been confirmed by Jolly and Dhesi (1989) and Jolly (1991). Both studies found that buyers of organic poultry and organic produce were respondents with formal employment.

Table 4: Occupation of the respondents willing and not willing to pay

Occupation	Willingness to pay			
	No		Yes	
	Frequency	%	Frequency	%
Farming	26	35	49	65
Business	3	11	25	89
Civil servant	1	9	10	91
Retired with pension	0	0	4	100
Retired without pension	0	0	5	100
Student	0	0	3	100
House wife	0	0	5	100

Most of the consumers who were willing to pay for goat milk had an average family size of six persons, which is slightly above Kenya's national mean of five persons per household (CBS, 2005). This was higher compared to households not willing to pay, with an average family size of five persons. Generally, household size has an effect on the household consumption and WTP. Household size can be correlated with total food expenditure because the larger the household the more food required to feed it. Smaller households have less expense, on average, than larger households. This is because food requirements in the household increases with the number of persons and, consequently, larger families may have less disposable income to use for additional premium, especially if the dependency ratio is proportional to the household size. Studies are divergent on the influence of household size on WTP. For instance, Feng *et al*. (2009) found out that household size was negatively related to WTP for organic products; on average, a household

with one member was willing to pay $0.05 less per pound. A study by Akankwasa (2007) on consumer acceptability and WTP for introduced dessert bananas reported a positive association between household size and WTP. The divergence could be linked to the disproportionate household members' participation in income generating activities.

A significant difference between the means of the number of children present in the households of respondents willing and not willing to pay for goat milk in this study was revealed in table 5 below. The mean number of children for the households willing to pay was approximately three relative to households not willing to pay with only an average of two children. This significant difference may imply that households with more children were more concerned about the nutritional aspect of the food they consume. Since children are more vulnerable to various diseases, consuming a product like goat milk, which is rich in a number of nutrients, can boost their immunity against some diseases and, consequently, reduce the cost of health services in a household. Thompson and Kidwell (1998) reported that families with children were more likely to buy organic produce than those without children.

Table 5: Test of the difference between consumers' household size willing to pay and those not willing to pay

Variable	Not willing to pay		Willing to pay			
	Mean	SD	Mean	SD	*t*- test	P value
Household size	5.90	2.70	6.59	2.47	5.57*	0.000
No of Children< 18 years	1.73	1.418	3.38	1.42	-4.72*	0.000
No of Adults 19- 59 years	3.60	2.08	2.20	1.18	2.30**	0.023
No of adults > 60 years	0.60	0.770	1.03	0.932	1.79	0.188

* and ** indicate significance at 1% and 5% confidence levels, respectively.

Ages of the respondents willing and not willing to pay for goat milk were similar (Table 6). The mean age for both respondents was 45 years. Age variable on WTP has been found to have contradicting results. For example, Feng *et al*. (2009) observed that the age variable was negatively associated with WTP. In Northeast Thailand, Wilatsana *et al.* (2007) indicated that older consumers were more concerned with health issues and were more willing to pay for produce that was guaranteed to be under pesticide residue limit.

In the current study, about 90% of the female respondents were willing to pay for goat milk; this was higher compared to males (64.1%) as shown in Table 7. As expected, it reflects a greater participation of females in shopping for foodstuffs in the family. Female were also more sensitive to nutritional value of the family. Thomson (2000) suggested that gender was a poor predictor to purchase food products but several studies have proved the opposite. Huang (1993) noted that females were more likely to have higher risk aversions to pesticide residues than their male counterparts. Groff *et al.* (1993) also reported that females were more likely than males to pay for organic than conventionally grown produce.

Table 6: Description of age of the consumer willing and not willing to pay

Variable	Willingness to pay					
	No		Yes			
	Mean	Std. Dev	Mean	Std. Dev	t-test	P value
Age of the respondent	45.8	13.96	45.74	14.53	1.32	0.000

Table 7: Gender of the respondent willing and not willing to pay

Variable	Willingness to pay (%)	
Gender	No	Yes
Female	10.4	89.6
Male	35.9	64.1

Of the respondents not willing to pay for goat milk, only 10% indicated that they had a household income between Kenya shillings 10,000 and 15,000 (Table 8). Also, 10% had a household income between KES 5,000 and 10,000. The remainder of respondents indicated that their income were KES 5,000 or less. Among the respondents that were willing to pay for goat milk, 39.6% had a household income of less than KES 5,000, 39.6% had a household income between KES 5,000 and 10,000, and the rest above 10,000. The average income for potential consumers was KES 5,000 and below. This could explain the involvement of a large percentage (50%) of the respondents in farming as their major occupation and source of income, probably at subsistence level to cater for the needs of the family.

Table 8: Description of the income level of the respondents

Variable	Not willing to pay (%)	Willing to pay (%)
Income categories		
< 5,000	80	39.6
5,001-10,000	10	39.6
10,001-15,000	10	14.9
15,001-20,000	0	5.0
20,000	0	1.0

Consumer awareness creates an environment for consumers to develop product familiarity, which forms the basis for evaluating different alternatives available for satisfying the deficit. For instance Zellner (1991) observed that familiar foods were generally liked more than unfamiliar ones. Furthermore, observations by Krishnan *et al.* (1999) on consumer WTP for seafood and domestic market development indicated that good knowledge and awareness by consumers have a positive influence on WTP for sea food and domestic market development. In the present study, consumer awareness of goat milk was investigated and it was found that about 69.5% of the consumers had heard about goat milk being produced in some parts of the country for human consumption (Table 9).

Table 9 : Description of respondents' awareness of goat milk

Awareness of goat milk	Frequency	Percent
Yes	91	69.5
No	40	30.5
Total	131	100.0

Figure 3 reveals that most of the respondents in the two groups of consumers became aware of goat milk through neighbours or friends. Better understanding of the important nutritional and medicinal values of a product can subsequently change in dietary habits as cited earlier. Awareness has increasingly made people to make right decisions as to what to eat (Lawal, 2007).

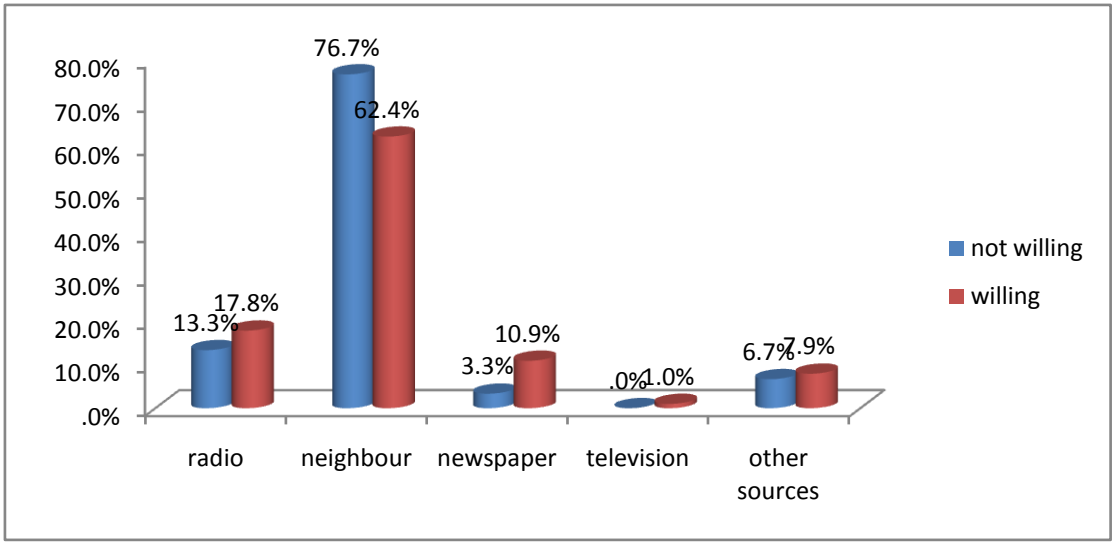

Figure 3: **Sources of information for consumers who are aware of goat milk**

Table 10 indicates years of schooling of the respondent interviewed. The average level of formal education attained by the potential consumers willing to pay for goat milk was approximately 10 years. This was slightly above the number of years of primary education. The average level of formal education attained by the respondents not willing to pay for goat milk was 5 years, which is lower than the 8 years required for primary education in Kenya. Consequently, those who were more educated were likely to have more information about the important attributes (medicinal and nutritive value) of goat milk and willing to pay relative those who had spent few years in acquiring formal education. This could be explained by the fact that education is expected to influence the awareness of consumers as regards the important attributes of goat milk on consumer health. In Turkey, a study by Akungor *et al.* (2007) on consumer WTP for food safety suggested that people who were educated knew more about organic production and were willing to pay more. Preliminary results of a customer intercept survey of Ohio (USA) food consumers on WTP for locally produced food, as cited earlier, reported that Ohio consumers with greater education were willing to pay than those with less education (Batte *et al.*, 2005).

Table 10: Education of the respondents in years

	Not willing to pay		Willing to pay		P value
Education of the respondent in years	Mean	Std. Dev	Mean	Std. Dev	
	5.33	3.54	9.15	3.98	0.00

4.2. Analysis of consumer willingness to pay for goat milk

Table 11 shows the description of the potential consumers' response to different premium and discount levels. Only 14.5% of the potential consumers interviewed indicated that they were willing to purchase goat milk at a discount while 8.5% were not willing to pay anything. The remaining 77.1% were willing to pay some premium on goat milk over that of cow milk. Among the consumers that were offered 10% premium bid, 64.7% accepted the bid, while 58.3% of those who were offered the highest bid of 50% and above, accepted the bid. This is consistent with economic theory because the percentage of the respondents willing to pay fell as the price they were asked to pay increased.

Table 11: Consumer response to different premium and discount levels

		% Response				
Price	Willingness to pay	10% bid	20% bid	30% bid	40% bid	50% bid
Premium	Yes	64.7	80.8	80.8	55.0	58.3
	No	35.3	19.2	19.2	45.0	41.7
Discount	Yes	100.0	100.0	80.0	33.3	45.5
	No	0.0	0.0	20.0	66.7	54.5

Willingness to pay for goat milk was obtained by indicating the prevailing price of cow milk in the study area as the base value. The findings indicated that potential consumers in Siaya County, on average, were willing to pay KES 19 more per litre of goat milk over the price of cow milk. This indicates that consumers were willing to pay KES 69 per litre for goat milk, which was 38% premium over cow milk (Table 12). This finding is consistent with expectation because goat milk offers more nutritional and medicinal values than cow milk as cited in earlier sections of this study. This indicates that people were appreciating the nutritional and medicinal value of goat milk and it was apparent, therefore, that goat milk could be highly valued by consumers and, subsequently, consumption levels could increase drastically in case of its

availability. It was also clear from the results obtained that goat milk production could be a feasible means to improve the incomes and nutrition of resource constraint-farmers since dairy goat production could be a profitable enterprise.

Table 12: Parameters estimates for willingness to pay model for goat milk

Parameter	Estimates
Constant α	4.69
	(0.63)
Bid ρ	0.07
	(0.97)
Mean WTP (α⁄ρ)	69.0
Current market price of cow milk	50.0
Average premium consumers are willing to pay for goat milk	19.0
Number of observations	131

The results obtained have implication to different practitioners in the milk industry which include dairy goat farmers, actors along milk supply chain, NGOs, policy makers and other stakeholders. There is need to increase goat milk production to capture the potential market demand. To achieve this, the government and NGOs should team up together to initiate dairy goat production in most parts of the country, especially in marginal and densely populated areas because dairy goats can adapt to different agro-ecological zones, feed on a wide variety of plants, require small space and can multiply quickly. This enterprise could be an important element in poverty alleviation among the resource constrained-farmers, if the government collaborates with the existing development organizations like HPIK, Farm-Africa, and GIZ, among others, to supply crossbred and exotic dairy goat genotypes to the farmers. Ogola *et al*. (2010) mentioned that crossbred and the exotic dairy goats produced large amounts of milk and sustained milk production for a longer period of 9 to 10 months.

Dairy goat production in most parts of the country is still at the subsistence level as cited earlier in this study. Ogola *et al*. (2010) reported that more goat milk was consumed in the households than sold, and further concluded that the large consumption may be attributed to difficulties in marketing the milk. To realize full potential in this emerging dairy subsector, dairy goat farmers should be linked to the market. One way of establishing this is by initiating

the development of farmers' organizations and marketing groups that will encourage distribution and marketing of dairy goat products. The government should facilitate development of marketing infrastructure, creation of awareness of important nutritional and health benefits of goat milk, and boosting the development of goat milk dairy processing plants and systems that can add value to goat milk, so as to capture existing market opportunities.

4.3. Determinants of consumer willingness to pay for goat milk

A Logit model was used to identify socio-economic factors likely to affect consumer WTP for goat milk and its products. The model revealed that the probability of WTP for goat milk was positively influenced by individual education, the number of children in the household and the age of the respondent (Table 13). Conversely, it is negatively affected by gender, income and awareness of the respondent. The marginal effects of the variables were also estimated; these represent a percentage change in WTP for goat milk given a one unit change in any of the independent variables. Predicted probabilities from the logit results were further obtained to give a clear comparison between characteristics of the respondents with higher probability of being willing to pay for goat milk and those with low probability.

Estimated coefficient for education was positive and significant ($P<0.01$). The positive sign on education indicated that those respondents with a higher level of education were willing to pay more for goat milk. The marginal effect indicated that a unit increase in the number of years spent in school increased the probability that consumers were willing to pay for goat milk by 1.7%. This implied that the more consumers were educated the more they were knowledgeable about the important attributes of goat milk. It is also believed that education favours positive attitude towards change. This finding is in agreement with Huang (1993) who found out that more educated consumers were willing to pay more for organic products. The finding is also consistent with the findings of Du Toit and Crafford (2003) that showed that respondents with a higher level of education were willing to purchase organic food. However, Boccaletti and Nardella (2000) reported an inverse relationship between education and WTP for pesticide–free fresh fruits and vegetables in Italy. Senturk (2009) studied WTP for genetically modified foods in Turkey and found out that a marginal increase in education decreased the probability of WTP the highest price.

Table 13: Logit marginal effects estimation of socio- economic factors influencing consumer willingness to pay

Variable	dy/dx	Std. Err	P>|z|	[95% Conf. I]		X
Education	0.017	0.201	0.002*	0.234	1.023	8.275
Gender	-0.104	0.946	0.002*	-4.791	-1.081	0.489
Children ≤18 years old	0.026	0.288	0.001*	0.438	1.569	3.000
Income	0.014	0.624	0.367	-0.66	1.786	1.748
Awareness	-0.059	0.946	0.017**	-4.108	-0.4	1.305
Age of the respondent	0.003	0.043	0.059 ***	-0.003	0.164	45.756
Adults 19 to 59 years old	-0.029	0.382	0.003*	-1.88	-0.381	2.519
Adults≥ 60years old	0.0142	0.523	0.301	-0.484	1.565	0.931
Constant		2.734	0.346	-7.933	2.7841	

*, ** and *** denote significance at 1%, 5% and 10% confidence level.

Age variable was statistically significant and positively influenced the decision to purchase goat milk at a premium and at a marginal effect of 0.003. This implies that each additional year of age from the mean increases the probability of the respondent to pay more for goat milk by 0.3%. The reason why older respondents were willing to pay more for goat milk in this study could be attributed to the desire of the older group of potential consumers wanting to consume goat milk for purposes of deriving the medicinal and nutritional value outlined during the survey exercise. Nutrition of the elderly person presents many challenges due to natural changes that occur in the body overtime. Goat milk has properties that can meet these challenges to provide elderly adults with nutritional and medicinal requirements.

The findings in the current study are in contrast to that of Govindasamy and Italia (1999) that older respondents were less willing to pay for organically grown produce than young individuals. The reasons given were that older respondents were less likely to deviate from their routine diet, and that most of the older individuals were retired and earned less than the young ones, and, subsequently, had less income for additional expense. A study by Carlberg *et al*. (2007) on WTP for branded beef in Canada showed that as people grew older their WTP for four beef brands that were being investigated dwindled. A study by Loureiro and Hine (2002) on consumer WTP for organic products revealed that the age of the consumer had a negative effect on WTP for

organic products, i.e., young individuals were willing to pay a premium for organic products than the older consumers. However, the findings in the current study are in agreement to those of Vanit and Schmidt (2002) that older respondents expressed greater WTP for environmentally friendly vegetables than young ones. Misra *et al.* (1991) indicated that individuals older than 60 years of age were more likely to pay a higher price for pesticide–free fresh produce than not to choose to pay a premium.

Logit results indicated that payment of a premium for goat milk is significantly and positively influenced by the number of children in a household below the age of 18 years. The marginal effect was 0.026. This finding implies that an additional child below the age of 18 years in a household raises the probability of respondents WTP by 2.6%. This showed that households with young children may be willing to pay more for goat milk than households with fewer or no children. This indicates that parents were concerned about the health of their children. Furthermore, parents had the responsibility of providing nutritive and safe food for the children, which means that they may be less concerned about the relatively higher price of nutritive food like goat milk.

The spread of HIV/AIDs globally is a major challenge today; a certain percentage of child-bearing women were infected with HIV. Transmission of HIV through breastfeeding has been well documented (Nduati *et al*., 1994). One of the interventions recommended by WHO to prevent postnatal HIV transmission is complete avoidance of breastfeeding, which is usually replaced by other foods or by commercial infant formulas which are expensive. Goat milk has been proven to be closest to breast milk as a supplement and, consequently, can be used by households with babies being bottle fed from birth (Haenlein, 2004). Children are also vulnerable to many diseases, and goat milk being more nutritive and medicinal makes most households opt for it to prevent such diseases, since prevention is better than cure. The effects of the number of children present in a household on WTP has been found in past studies to be contradicting, probably because different families may value a particular food attribute differently. The findings of the current study are in agreement with those of Feng *et al.* (2009) showing that households with young children were willing to pay a higher price for organic tomatoes than those without young children. Conversely, a study by Loureiro and Hine (2002) found that the presence of children in the household reduced the probability of paying a premium for organic products.

The presence of adults aged between 19 and 59 years in a household had a negative effect on WTP for goat milk. The marginal effect indicated that an increase in the number of household adults by one person reduced the likelihood of WTP by 3%. This negative effect could be explained because larger families tended to have less disposable income to pay for additional expenses due to the fact that food requirements increased with the number of persons in a household

The effect of awareness on WTP was negative and significant, which is confusing. An increase in awareness on goat milk decreased the probability of WTP by 5.9%. Since data for the present study did not have any further details on the nature of prior information received by respondents on the attributes of goat milk, the issue may be attributed to cultural attachments or beliefs as cited earlier in this study. One of the beliefs about goat milk is that it has unpleasant odour and taste. The problem is mostly produced by the presence of a buck, especially at the time the does are being milked because milk produced at the absence of a buck does not have the odour (Bihaqi and Jalal, 2010). To overcome this problem, goat milk farmers should be trained on procedures of clean milk production.

The type of information available to respondents usually has a great impact on their WTP. A study by Rousseau and Vranken (2011) on the impact of information on WTP for labeled organic apples showed that after the provision of information on the actual environmental and health effects of organic apple production, consumers were willing to pay for the organic apples more than without the information. This implied that information about the product being marketed was crucial because it has a greater impact on consumer WTP. However, it depends on what kind of information was available to the potential consumer. In Italy, awareness of the negative effects of pesticides had no significant effect on WTP for pesticide-free fresh fruits and vegetables (Boccaletti and Nardella, 2000).

The findings of the present study also showed that payment of a premium for goat milk was significantly and negatively influenced by gender. The gender variable, which was a dummy (1 = male and 0 = female), had a negative but significant coefficient ($P < 0.01$). The negative sign on gender implies that females were more likely to be willing to pay more for goat milk relative to the males. This was expected from the results of similar studies. The findings conform to that of Njeri (2007) who argued that in African societies women were responsible for feeding the family while men were responsible for providing cash for the family. Carpio and Isengildina (2008) made similar

observations, that female consumers were willing to pay an additional premium for local characteristics in animal products relative to male consumers.

From the logit model, predicted probabilities were generated, and these were used to compare the characteristics of individuals at the top 20% and those at the lower 20% category of the probability of WTP. The results indicate that there was a significant difference between the characteristics of respondents at the top 20% and those respondents at the lower 20% probability of WTP (Table 14 and 15). The findings showed that respondents with high level of education, female respondents and those households with more children had a higher probability of WTP.

Table 14: Gender of the respondents at high and low probability of willingness to pay

Gender of the respondent		Frequency	%
Respondents at top 20%	Male	9	34.6
	Female	17	65.4
Respondents at lower 20%	Male	22	84.6
	Female	4	15.4

The mean number of years of schooling for top 20% respondents with high probability of WTP was 12 (Table 15). This implied that education was a key element in promotion of this nutritive product. Education is perceived to provide individuals with information to guide them in making correct decisions on which food to consume. People with high level of education presumably had more access to information on nutritional and health issues.

Respondents at the top 20% with high probability of WTP had an average of four children of 18 years of age and below, with the majority of the respondents being females. Those respondents in the high category were 49 years old, on average, whereas those at the lower category had a mean age of 46 years. In Kenya, many people are gaining access to education, human population is growing, consumers are changing their dietary habits and the markets are expanding; these cumulatively result to a widen market base for goat milk. These socio-economic dynamics over time have created potential consumption opportunities for goat milk, uplifting the possibility of goat milk to be a tool for fighting poverty among resource constrained-farmers.

Table 15: Age, educational and number of children 18 years of age and below of the respondents with high and low probability of willingness

Variable		N	Min	Max	Mean	Std.Dev
Education of the respondent	Top 20%	26	7	16	12.84	1.87
	Lower 20%	26	0	12	5.30	3.89
Age of the respondent	Top 20%	26	30	69	49.00	13.90
	Lower 20%	26	23	74	46.00	14.42
Number of children 18 years of age and below	Top 20%	26	3	6	4.00	0.92
	lower 20%	26	0	5	2.00	1.14

CHAPTER FIVE
CONCLUSIONS AND IMPLICATIONS

5.1. Conclusions

Majority of the potential consumers interviewed (77.1%) revealed that they were willing to pay more for goat milk over that of cow milk. However, there were about 8.4% of the respondents who would not accept to purchase goat milk even at a discount price. The remaining 14.5% would purchase goat milk if price discounts were offered to them. Of those who were willing to pay; a greater proportion were females, had spent nine years in schooling on average and the households had more than three children (18 years and below). Similarly, about 69.5% of those who were willing to pay were aware of goat milk and they obtained information through different sources. Most of them became aware of goat milk through neighbours or friends. The use of other sources like the media in awareness creation of goat milk has not been embraced in Kenya.

The current study used CV technique to assess how much potential consumers were willing to pay for goat milk. The results of WTP analysis suggested that the price premiums the respondents were willing to pay for goat milk, on average, were 38% over that of cow milk. This was equivalent to KES 19 above the current prevailing price of cow milk in Siaya County. The WTP estimates obtained indicated that goat milk could be positively valued in Siaya County, since majority of the potential consumers affirmed to be willing to pay more than the price of cow milk to acquire this product of better (nutritional and medicinal) attributes.

A Logit model was used to estimate socio-economic factors that influenced WTP for goat milk. Among the eight predicted factors, six of them had a significant effect on WTP. Age, number of years in schooling and number of children (18 years of age and below) present in a household had a positive and significant effect on WTP. Interestingly, awareness about goat milk had a negative effect on consumer WTP, and because this was not explored further, it can be postulated that prior information received by the respondents concerning goat milk might have been wrong. Gender and the number of adults aged between 19 and 59 years present in a household also negatively influenced WTP. Surprisingly, the income variable was not significant in predicting consumer WTP, an observation not consistent with most studies cited earlier. Marginal effects of the estimated variables revealed that number of children present in a household

had a strong impact on WTP and that an additional child in a household increased the likelihood of WTP by 2.6%.

5.2. Implications of the findings

Programmes that suit the illiterate need to be put in place to educate them on important medicinal and nutritional benefits of goat milk and, consequently, widening market base for goat milk. The government could form partnerships with NGOs organization to supply resource constrained-farmers with dairy goats to increase the production of goat milk to exploit the existing market opportunities, especially given that it fetches a higher price than cow milk. This would improve the food and nutrition security and incomes of the small-scale resource-constrained farmers. Other actors in the milk value chain need to venture into the goat milk industry because it is profitable. Sensitization programmes on important attributes of goat milk should be regularly aired through the mass media (e.g., television and radio) to improve on awareness and, subsequently, provide correct information to potential consumers so that they can make informed decisions.

5.3. Suggestions for further research

The focus of the current study was to assess how much consumers were willing to pay for goat milk and to determined socio-economic factors that influenced WTP for goat milk. There is still a lot of work to be done as far as commercialization of goat milk is concerned. Constraints of goat milk marketing and value addition of the product have to be investigated. There are other methods that can be used to determine WTP. This may be considered by future researchers so as to evaluate what method can be considered as the best given that each method has its own strength and weaknesses. It is also important to conduct studies considering the side of the dairy farmers, like their willingness to accept to shift from dairy cow to dairy goat production. Better understanding can be made when farmers' willingness to accept (WTA) and consumers' willingness to pay are studied.

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APPENDIX I

SIAYA COUNTY (potential consumers at household) Questionnaire

No……

Dear sir/ madam

I am a postgraduate student at Egerton University, Njoro Campus. In partial fulfillment of the requirements for the Master of Science in Agricultural and Applied Economics, I am conducting a research entitled: **"***Consumption and Willingness To Pay for Dairy Goat Milk in Siaya County, Kenya".*

I would like to kindly request your assistance to provide information, by filling in the questionnaire provided below, as your views are considered important to this study.

Please note that your participation is voluntary and that any information given will be treated with utmost confidentiality and will only be used for the purpose of this study.

Thank you.

Yours faithfully,

Rebecca Jerop

APPENDIX II

Survey Questionnaire

TITLE; ASSESSING CONSUMER WILLINGNESS TO PAY FOR GOAT MILK AND MILK PRODUCTS

SERIAL NO……..

ENUMERATOR NAME……. DATE OF INTERVIEW……...

NAME OF HOUSEHOLD HEAD ……

SECTION A: DEMOGRAPHIC CHARACTERISTICS

A.1. Respondent's name (if not the household head) ……..

A.2. Respondent's gender 1= male 2= female. [……]

A.3. Respondents age ……..years

A.4. Relation to the household head (tick where appropriate)

1=head 2=spouse 3= sibling 4=worker 5= other (specify)……

A.5. Education of the respondent in years……..

A.6. Provide detail characteristic of the household head

Sex	Age	Education in years	Working condition
1= male 2= female			1= farmer (specify) 2= businessman 3= civil servant (specify) 4= retired with pension 5= retired without pension 6= housewife 7= student 8= others(specify)
[……]	[……]	[……]	[……]

A.7. Give the number of the household members (including HH head) living permanently on the compound and their details as indicated below.

Number	**First name**	**Gender** 1=male 2=female	**Age (years)**	**Education level** 1=none 2=primary 3=secondary 4=university	**Relation to head** 1=head 2=spouse 3=child 4= parent 5= niece 6= nephew 7= worker 8= other
1					
2					
3					
4					
5					
6					
7					
8					

A.8. In which of the following groups do you estimate your total household income in KES/Month? (farm, employment, business income, pensions and remittances from elsewhere from all working members:

HOUSEHOLD INCOME CATEGORIES

1=<5000

2=50001-10,000

3=10001-15000

4=15001-20000

5=> 20000

SECTION D. GOAT MILK POTENTIAL CONSUMER

D.1. Is milk important in your daily life? [ ] 1=yes, 2=no

D.2. In what form do you usually take the milk ? [ ] 1= tea 2=mala 3= fresh

D.3. How many times in a week do you buy fresh cow milk for your family use? [ ]

D.4. How do you usually obtain your cow milk supply? .....

D.5. If there are any milk purchases, what is the average amount of fresh milk consumed by the household in litres? [....]

D.6. Who makes decisions on food (milk) purchasing in your household?

D.7. Have you ever heard that goat milk is being processed and packaged for sale to buyers in some towns in this country? [ ] 1= yes, 2= no.

D.8. If yes, from which source? [ ]

D.9. 1. radio 2. neighbour 3. newspaper 4. television 5. others (specify)…….

(Explanation of attributes goat milk). Goat milk is said to have higher protein, energy and fat contents. It has adequate amino-acid content. Goat milk is an excellent source of calcium, phosphorus and chlorine. The higher proportions of short- and medium-chain fatty acids are of greater significance for ease of digestion. It has particular benefits in the diet of children and adults who show sensitivity or allergic reactions to cow's milk. It has also been found to be beneficial to HIV/AIDS victims. Given these attributes of goat milk, would you be willing to buy goat milk if it will be offered to you at a price as that of cow milk? […..] 1=yes, 2=no.

(For question 10 and 11 obtain the correct percentage and ask in terms of KES)

D.10. If yes, are you willing to buy goat milk if it was offered at a price of:

KES…..5%.....10%.....15%.....20%.....25%.....30%.....35%.....40%.....

45%.....50%?

premium?

D.11. if No, would you be willing to buy goat milk if it was offered at a price of:

KES…..5%.....10%.....15%.....20%.....25%.....30%.....35%.....40%.....

45%.....50%?

discount (tick the minimum price)?