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CONSUMER KNOWLEDGE OF HEALTH RISK ASSOCIATIED WITH MARKETED MILK: A CASE STUDY OF KIBERA DIVISION, NAIROBI-KENYA

BY

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MAY, 2005

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other university or any other award.

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DEDICATION

This dissertation is dedicated to my mother, Hannah Kibui Kigondu .Thank you for your unconditional love and support.

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LIST OF ABBREVIATIONS

GoK - Government of Kenya.

CBS - Central Bureau of Statistics

CI - Confidence Interval

WHO - World Health Organisation

FAO - Food Agricultural Organisation.

FGDs -Focus Group Discussions

APHRC - African Population and Health Research Centre.

NRAEF - National restaurant Association Education Foundation

KAP - Knowledge Attitude and Practices

Ksh - Kenya Shillings

SDP - Smallholder Dairy Projects

SE-D - Socio –Economic and Demographics

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1.8 DEFINITION OF TERMS

Pasteurisation: Heat treatment of milk aimed at destroying all pathogenic micro organisms.

Foodborne infections: These are infections that result when pathogens grow in the intestines of someone who has eaten food contaminated with those pathogens. Typically the symptoms of a food-borne infection such as fever do not appear immediately.

Foodborne intoxication: They are poisonous toxins caused by eating food that has been exposed to pathogens that emit these toxins such as enterotoxins (intestinal toxins that are produced by pathogens). A person does not need to eat live micro-organisms to become ill, just the toxins produced by them. Typically the symptoms of a food-borne intoxication appear quickly within a few hours. Many toxins are not destroyed by cooking.

Foodborne toxin-mediated infections: These are infections that result from eating food that containing pathogens. These pathogens grow in the intestines and produce toxins that can cause illness.

Food security: It is defined as adequate food that satisfies dietary and health needs.

Ugali: a cooked maize- meal slurry

Diarrhoea: refers to a disease condition in which one passes three or four loose stools per day.

ABSTRACT

Milk is the first food everybody ever eats and its nutritional value remains valuable throughout the life of a human being. Milk is a good medium for bacterial growth and its inherent danger of transmitting diseases like tuberculosis, paratyphoid, brucellosis and other diarrhoeal diseases makes hygienic handling critical. A cross-sectional survey targeting households was carried out in Kibera Division, Nairobi Province, Kenya. A combination of purposive-convenient sampling, probability proportional to size and simple and systematic random sampling were used to identify the households. The focus of the study was to establish some SE-D characteristics of consumers and the relationship amongst them, to determine consumers' level of awareness of safe milk handling, potential health risks associated with milk consumption and the relationship between knowledge and the SE-D characteristics. It also aimed at determining consumers' attitudes towards safety of the marketed milk and how these were related to knowledge and SE-D characteristics. It also aimed at identifying consumers brand choice, establishing consumers' post-purchase practices and how these practices were related to knowledge, attitudes and the SE-D characteristics. Respondents answered pre-tested closed questionnaires through self-administration or interviews with two focus group discussions. Statistical package for social sciences (SPSS) was used to process data, which was presented using frequency tables, bar charts and cross-tabulations. Chi-square test of independence at $P < 0.05$ was used to determine relationships between dependent and independent variables. Results showed that about 78% of the respondents were between 20 and 39 years, 63.7% earned Kshs. < 10,000 per month and about 77% had at least a secondary level of education. Those with higher education had better incomes and lived in the middle-upper income areas. Knowledge of potential risks and cross-contamination were moderate (58.7%) to low (41.3%) and was inversely associated with education, income levels and residential areas. Those with less education, low incomes and living in low income areas had medium knowledge as exemplified below; 72.5% with primary level of education had medium knowledge compared to 45% of those with a university education (χ^2=13.415, df=2, p = 0.001). Attitudes varied from positive (those who felt at risk) to negative (those that felt safe), with 13.2% having positive attitudes, 71.9% moderate and 14.9% negative attitudes. The study also showed that 95.4% of consumers preferred packaged milk but only 83.9% reportedly used it. About 74.1% preferred unpackaged milk due to the price while 87.8% preferred packaged due to safety. Milk was boiled in tea by 97.1% of the respondents even though only 57.7% were aware that it also prolonged the shelf life of milk. A good milk handling practice such as refrigeration and throwing away milk that sours in homes had more to do with ability to afford a refrigerator or incur the loss and was inversely related to knowledge. For example, of those earning an income of less than Kshs.10,000 per month 72.2% had poor storage practices while 94.6% with an income of Kshs.>40,000 had good storage practices (χ^2=79.610, df = 1, p = 0.0001) while about 60% of those with low knowledge had good storage practices compared to 43.6% of those with medium knowledge (χ^2 = 10.125, df=1, p =0.001). Attitudes influenced the brand of milk and spoilt milk practices. Income was the main factor that determined practices. The KEBS and milk processors in designing labels that have information on milk handling and safe practices can use this information.

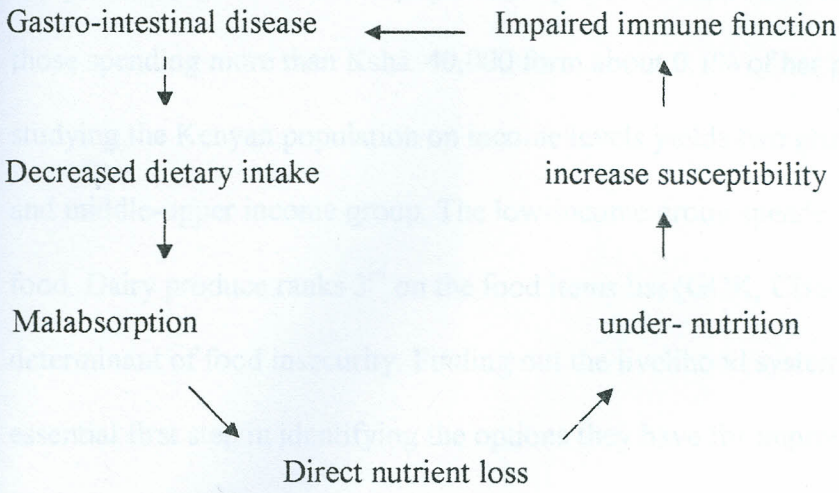
CHAPTER ONE: INTRODUCTION

1.1 Background information

The role played by milk as food cannot be over emphasized. It is the first food anybody ever eats and its nutritional value remains valuable throughout the life of a human being (Taylor, 1992). Milk as a food is highly nutritious. Its composition being: water 87%, sugar 3%, fat 4% and protein 4%. This makes it highly favourable for microbial growth. Food is one of the most important biological requirements for life and its importance to humans as a means of contact with microbes plays a crucial role in the battle for survival (Akinsanya, 1980). Food borne illnesses are caused by several factors, which can be placed into three broad categories: time-temperature abuse, cross-contamination and food-contact surfaces (NRAEF, 1999).

Worldwide, many people drink more milk than consume dairy products (Taylor, 1992). In Kenya, the urban population consumes milk mainly as a fresh product in making beverages such as tea, drinking and other meals. Milk is recommended for sale in its pasteurised form. This is because raw milk is known to transmit diseases like bovine tuberculosis, *E. coli: 0157*, brucellosis and paratyphoid. Poorly handled milk even if previously boiled is associated with some of the following food-borne diseases cholera, *salmonellosis*, *shigellosis*, *listeriosis*, *enterotoxicosis* (staphylococcal food poisoning), *yersiniosis*, hepatitis A, and *intestinal cryptosporidiosis*. Most food- borne illnesses present the following symptoms headache, abdominal pain, vomiting, nausea, fever fatigue and diarrhoea (NRAEF, 1999). Diarrhoea has other health implications especially related to malnutrition. The following diagram adapted from FAO, (2001) shows the relationship between gastro-intestinal disease and under nutrition. (Figure 1)

Figure 1: An illustration of relationship between gastro-intestinal disease and human malnutrition



Before 1992 milk was sold by one big processor, the Kenya Co-operative Creameries (KCC), but with the policy of market liberalisation other players are getting involved in its' production and marketing. The majority of these players are handlers of fresh raw milk, which now accounts for 88% of the total milk sold in Nairobi (Odhiambo, 2001). Evidence from a previous study (Omore *et al.*, 2002) showed that some marketed milk in Kenya is of poor microbial quality and is often adulterated with water, other solids and chemical substances. This is not only illegal but also poses the danger of using water of questionable quality, which may even contain heavy metals like lead and cadmium that are known to cause poisoning in humans (Ridley, 1999).

The challenge to the government is provision of food security by ensuring that everybody has access to safe food (FAO, 2000). According to the same report, Nairobi has 50% of its population classified as food insecure, most of these people living in informal settlements (slums). Diverse factors combine to produce different kinds of food insecurity, amongst them poverty, illiteracy, malnutrition, and environmental

degradation (FAO, 2001). According to (GOK,CBS,2002) report, income levels in Kenya shows that 80% of her population spend less than Kshs.10,000 per month ,while those spending more than Kshs. 40,000 form about 0.1% of her population. Thus studying the Kenyan population on income levels yields two groups: low-income group and middle-upper income group. The low-income group spends most of its income on food. Dairy produce ranks 3rd on the food items list (GOK, CBS, 2002). Poverty is a key determinant of food insecurity. Finding out the livelihood systems of poor people is an essential first step in identifying the options they have for improving their lot (FAO, 2001).

A comparative study of consumers' knowledge, attitudes and practices of health risks associated with milk, living in the same geographical area but differing on income will provide policyholders with information to reassess their approaches to addressing absolute poverty and food insecurity. This is in line with FAO, (2001) recommendation that governments and donors reassess their approaches to addressing absolute poverty and food insecurity by providing more resources and assistance to the poorest and most neglected low potential parts of their countries. It will also provide information on addressing public health concerns in line with the Public Health Act.

1.2 Problem statement

Milk as a food is highly nutritious. It is composed of water 87.5%, sugar 4.7%, fat 3.8%, protein 3.2% and minerals. 0.8%. This makes it highly favourable for microbial growth (Robinson, 1993). It has the potential of transmitting inherent diseases that may be present in raw-milk such as tuberculosis and brucellosis. Poor hygiene standard during

milking, transportation and handling at home increases microbial risk (Robinson, 1993). Dairy produce ranks 3rd on the food items list in Kenya. Nairobi with a population of 2.4 million is the main market for marketed milk in Kenya (GOK, CBS, 2002). According to FAO 50%, of them are affected by food insecurity. FAO recognised the need for global attention to problems of food insecurity and the need to promote effective and better-directed action on poverty and hunger reduction (FAO, 2000). According to the World Health Organisation (WHO 1996), food borne diseases are perhaps the most widespread health problems and an important cause of low or lack of productivity. They range from mild indisposition to life – threatening illnesses. It has been shown that food is responsible for up to 70% of all diarrhoeal diseases (WHO, 1996).Food borne diseases isolated in milk include: *Salmonellosis, Campylo bacteriosis, Listeria monoiglogenese ,and E .Coli 0157:H7* (WHO, 1996). Omore *et al.,* (2002) reported that some of the milk in the market is of poor microbial quality. More than 60% of raw milk samples and about 82% of pasteurised milk did not meet KEBS standards of total bacteria counts reflecting poor microbial quality. In the same study, handlers were found to adulterate milk with antibiotics, solids and water, without knowledge of the harmful effects this can have to the public health. Worldwide, milk is recommended for sale in pasteurized form, mainly to remove known risks of zoonotic diseases especially brucellosis and tuberculosis. Kenya has a liberalized market economy, food hawking and especially of milk pose even greater challenges to the implementation of the Public Health Act, that restricts the sale of food in designated premises. Raw milk sellers in Kenya use plastic containers and transport it in public vehicles and bicycles (Staal *et al.,* 1999). Public participation in developing effective intervention strategies is necessary. There is need therefore to

investigate the knowledge, attitudes and practice of consumers towards health risks associated with marketed milk within Nairobi. The knowledge, attitudes and practice of consumers are important components in addressing their protection in line with the public health provisions and providing stakeholders with information for formulating long-term strategies to address the problem of food insecurity.

1.3 Research questions

a) What are the consumers' level of income, age, educational attainment and residences?

b) How do consumers SE-D (namely age, education, income and residences) relate to each other?

c) What is the consumer's level of awareness of safe milk handling and likely health risks that may be present in marketed milk?

d) What is the relationship between consumer's knowledge of safe milk handling and likely health risks in marketed milk against and the named SE-D?

e) What are the consumers brand preferences, reasons for choosing the brand and the attitudes towards safety of the marketed milk?

f) What are the relationships between consumers' attitudes against knowledge and the named SE-D characteristics?

g) How do the consumers choose where to buy milk, and what are the post purchase practices?

h) How do consumers' SE-D, knowledge and attitudes influence milk handling in homes?

1.4 Null hypotheses

a) The named SE-D characteristics of the population are homogenous.

b) There is no relationship between consumers' socio-economic and demographic characteristics.

c) Consumers have no knowledge of safe milk handling and likely health risks in marketed milk.

d) There is no relationship between consumers' knowledge of safe milk handling and likely health risks in marketed milk against the named SE-D characteristics.

e) Consumers have no milk brand preference and have negative attitudes towards safety of the milk in the market.

f) There is no relationship between consumers positive attitudes towards health risks associated with milk against their knowledge and the named SE-D characteristics.

g) There are no factors affecting consumers' milk brand choice, and consumers have similar post purchase milk handling practices.

h) There is no relationship between consumers' practices against their knowledge, attitudes and SE-D characteristics.

1.5 Objectives of the study

1.5.1 General objectives

To establish the knowledge, attitudes and practices of consumers to the health risks associated with marketed milk in Nairobi.

1.5.2 Specific objectives

a) To establish the socio-economic and demographic characteristics (namely age, education, income and residences) of the study population

b) To establish the association between study populations SE-D characteristics.

c) To determine consumers' level of knowledge of safe milk handling, and likely health risks in marketed milk.

d) To determine the association between consumers knowledge of health risks against their SE-D characteristics.

e) To determine consumers' milk brand preference, and attitudes towards safety of the milk in the market.

f) To establish the relationship between consumers attitude against knowledge and their SE-D characteristics.

g) To identify the factors influencing consumers brand choice and post purchase milk handling.

h) To determine the relationship between respondents' practices against knowledge, attitudes and SE-D characteristics.

1.6 The significance of the study and anticipated outputs

To quote Ginzberg (1991), "Society cannot act on social problems until it knows it has them, and it often does not know it has them until it can count them." The role of health survey as a tool to influence policy lies with documentation, which is gathering, cataloguing and correlating facts that depict the state of the world that policymakers hope to change. The findings of this study can be utilised by the government and other stakeholders to; design intervention strategies in regulation of milk marketing. This study showed that the existences of both raw and pasteurised milk markets are responses to consumer demand. Most respondents would prefer a milk- market regulated system and would like informal traders (hawkers) licensed hopefully with the incorporation of hygienic food handling. Knowledge of likely health risks and safe milk handling was

low to medium and it is prudent to incorporate this information on labels to raise consumer awareness. It should be enhanced with consumer education programmes to increase level of awareness of health risks associated with milk, cross contamination routes, storage and handling. The consumers reported that the quality of raw milk and pasteurised milk was nearly the same. Chi square results showed there was no significant relationship between milk that sours at home and type of package (χ^2=2.205 ,df=2 p =0.06). The expected results would be that pasteurised milk having had a reduction of bacterial load would have a better keeping quality.(Robinson ,1993) .This may therefore indicate that milk comes from the farmers with a very high bacterial load making it difficult for processors to reduce the counts significantly as only 1% of total load is destroyed by pasteurisation. Intervention to improve milk quality should therefore target the farmer. The possibility that traders use laboratory chemicals to improve the shelf life of hawked milk should be further explored. Most consumers reported consuming on average one litre per day, mode and median being one. This means that demand does not increase with income. Possible explanation is that milk is considered as an essential commodity. However, since most of respondents preferred pasteurised milk and increased incomes showed increased usage of this brand, the potential for improved processed milk demand lies in improving incomes.

1.7 Limitations of the study

The study assumed a homogeneous society and did not consider the cultural diversity that exists in the Nairobi population, which may have had a bearing on the results.

CHAPTER TWO: LITERATURE REVIEW

2.1 Traditional milk handling practices

From folk tales the different Kenyan tribes had their ways of preserving milk. Amongst the Agikuyu, the milk was preserved in special gourds (*gitete*) used only for this purpose. The preservation process involved the introduction of smoke from specific trees such as 'Muteta' (*strychnos henningsii*) into the gourd followed by fresh milk. This process resulted in fermented milk. Fresh milk was then continuously added to the old stock. The milk would be served to neighbours and visitors.

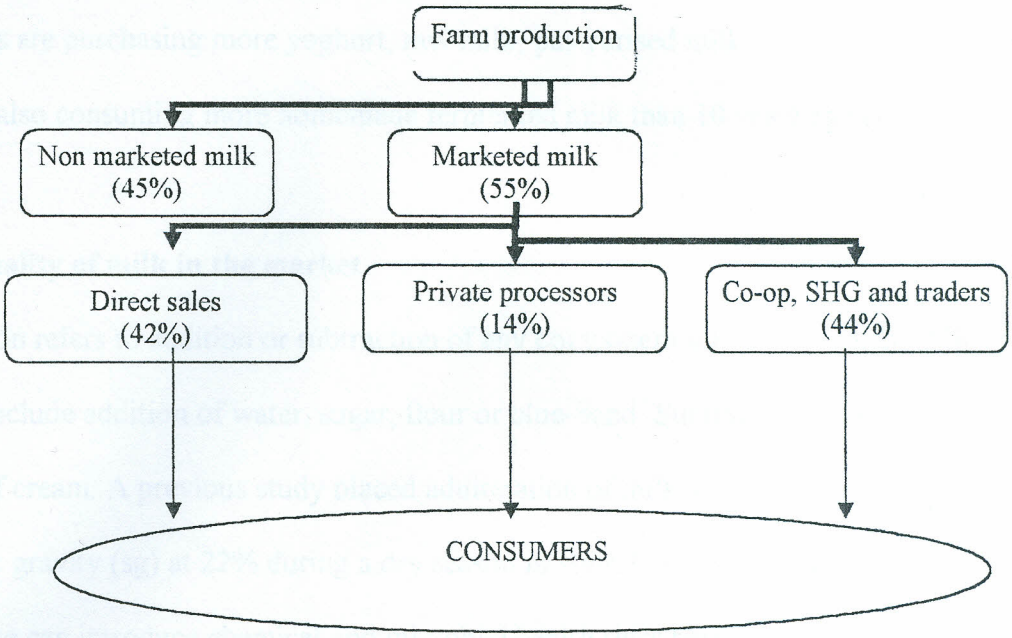
2.2 Historical background of the dairy industry in Kenya

Kenya has relatively well developed dairy industry. The development of the industry spans over 90 years and has undergone various evolutionary changes. In the first 60 years it was dominated by large-scale farmers, while in the last 30 years small holders have dominated it. The marketing system has also undergone through three marketing periods. For the period up to 1969, it operated as an open market with various dairies being market participants. The government created a monopolistic market situation between 1969 and 1992 and Kenya Cooperative Creameries was the only player. Since May 1992, the market has been liberalised (Ministry of Agriculture and Livestock Development, 2001).

2.3 Present milk-marketing channels

It is estimated that 2.5 million metric tonnes of milk is produced annually (Ministry of Agriculture and Livestock Development, 2001). Of this, on farm consumption accounts for 45 %. The rest is marketed as shown below in Figure 2.

Figure 2: Marketing and domestic consumption of milk in Kenya (SDP, 2004)



Co-op= cooperative societies SHG= Self Help Groups

Some traders boil and cool milk (pasteurisation) before sale but farmers sold most milk raw. Milk was transported by the use of public transport, bicycles or pick-up trucks (Staal *et al.*, 1999).When Kenya Cooperative Creameries (KCC) has excess milk, it is processed into powder, later reconstituted, and sold during periods of low milk supply (Ministry of Agriculture and Livestock Development, 2001).

2.4 Consumption patterns of dairy products in Kenya

The two main milk products consumed are pasteurised and raw milk (Ouma *et al.*, 2000). According to the same study, Nairobi consumes about 23% raw milk and 64% of pasteurised milk. *Mala* (fermented milk) constitutes 13% of milk sold. Raw milk in Nairobi is sold by informal trader (40%), shops and milk bars (59%) and 1% is bought directly from producers (Ouma *et al.*, 2000).The most common containers for purchasing raw milk are plastic containers and polythene bags, which account for 69% of raw milk sales. The common brands of pasteurised milk in Nairobi are namely: Brookside dairies,

Spin Knit Dairies (Tuzo), Aberdare Creameries, Limuru Dairies and Ilara. Most households are purchasing more yoghurt, raw milk, pasteurised milk, mala (fermented milk) and also consuming more homemade fermented milk than 10 years ago (Ouma *et al.*, 2000).

2.5 Quality of milk in the market

Adulteration refers to addition or subtraction of any component into a product. In milk, this may include addition of water, sugar, flour or blue-band. Subtraction includes removal of cream. A previous study placed adulteration of milk with water as determined by specific gravity (sg) at 22% during a dry season in Nairobi (Omore *et al.*, 2002). Such interference can introduce chemical and microbial health risks besides reducing nutritional value and palatability of the product. The same study identified 5.9% of samples in consumer households to have been adulterated with other solids. The total solids of milk were found to be higher than the expected 12% (Omore *et al.*, 2002).

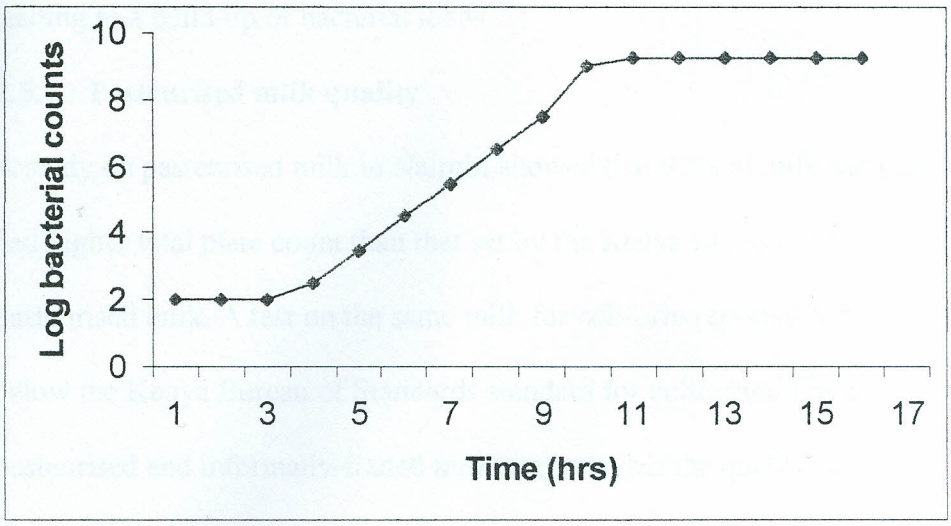
2.5.1 Butter fat

In the study by Omore *et al.*, (2002), low butterfat was more common in milk sampled in Nairobi. However, 10% of samples taken in Nakuru had butterfat greater than 6 %. (Mean whole milk butter fat=3.8) (KEBS, 1996).

2.5.2 Milk bacteriological quality

Bacteria counts in milk reflect the temperature of milk; time elapsed since milking and level of hygiene during handling. Coliform counts are especially associated with level of hygiene (FAO, 1979). Figure 3 below shows how bacteria multiply in milk after milking.

Figure 3: Multiplication of bacteria in milk after milking (FAO, 1979)



Kenya Bureau of Standards (KEBS) sets the upper limit for bacteria quality at 2 million cells (KEBS, 1996).This is quickly achieved if milk is not chilled or if poor hygiene standards prevailed during milking, transportation and at collection and retail centres. Common sources of coliforms (spoilage and pathogenic bacteria) are human or animal faeces from personnel, water and containers. A high bacterial count reduces shelf life and increases the risk of milk-borne bacteria infections and intoxications if milk is not properly heated or if thermally, injured pathogens recover under suitable temperatures (Andrew and Russel, 1984; Kayihura *et al.*, 1998).

2.5.3 Raw milk quality

Milk in Nairobi was found to be of very poor microbial quality (Omore *et al.*, 2002). According to the study, 61 – 84% of the samples had total bacteria plate count higher than the standard set by the Kenya Bureau of Standards and 39 – 69% of samples were below coliform standards set by the Kenya Bureau of Standards. Kenya Bureau of Standards coliform standard is 50, 000 coliforms per ml. A higher count than this is a reflection of poor hygiene at farm level, during transportation and sale in urban areas.

Informally-traded milk was transported in plastic containers that are difficult to sanitise leading to a build-up of bacterial loads.

2.5.4 Pasteurised milk quality

A study on pasteurised milk in Nairobi showed that 82% of milk samples in the market had higher total plate count than that set by the Kenya Bureau of Standards for pasteurised milk. A test on the same milk for coliform reported 59% of the samples were below the Kenya Bureau of Standards standard for coliforms. The comparison of pasteurised and informally-traded milk suggests that the quality of milk in both pathways does not meet the Kenya Bureau of Standards standard (Omore *et al.*, 2002).

2.5.5 Specific diseases associated with raw milk

2.5.5.1 Brucellosis

Brucellosis is a contagious diarrhoeal disease associated with cattle (Chukwu, 1987). It is more common in extensively grazed herds especially among the Maasai (Muriuki *et al.*, 1997). In the study conducted in Narok, 5.5% of morbidity among hospital cases were shown to be suffering from brucellosis and 21% among those with flu like symptoms in health facilities.

2.5.5.2 E. coli 0157:H7

This is a newly recognised bacterium of *Escherichia* family that poses a threat to human health. Dairy cows in many countries are known to harbour this bacterium (Youko Muyao *et al.*, 1988; Aloysio *et al.*, 1999; Cobbuld & Desmarchelier 2000). This strain is acknowledged as an important food-borne zoonosis. Its presence can lead to kidney failure (Riley *et al.*, 1983; Flowers *et al.*, 1992; Jay 1992). Tests by Omore *et al.*, (2002)

on milk in Nairobi and Nakuru isolated the pathogen and hence consumers are at risk of the same.

2.5.5.3 Bovine tuberculosis

This was shown to be absent in Kenya but it is important to note that it is endemic in neighbouring countries (Omore *et al.*, 2002).

2.5.5.4 Camylobacteriosis

This is transmitted by the bacterium *Camylobacter jejuni* and illnesses through infections. The symptoms are diarrhoea (watery and bloody), fever, nausea, vomiting, abdominal pain, headache and muscle pain. It is normally transmitted through un-pasteurised milk and dairy products (National Restaurant Association Educational Foundation, 1999).

2.5.6 Antimicrobial residues

Antimicrobial residues can occur in milk if there is no adequate withdraw time from the time of treatment of an animal or by their intentional addition by unscrupulous businesspersons. The presence of antimicrobial residues in milk is undesirable because they expose individuals to health risks such as hypersensitivity, drug resistance and specific tissue damage (Schultz *et al.*, 1963; Moffit *et al.*, 1974; Oslon and Sanders, 1975; Nijsten *et al.*, 1996). Omore *et al.*, (2002) found 9.4% of samples of informally traded milk to contain antimicrobial residues as well as in 8.2% of pasteurised milk. This is a risk not eliminated on heating. Transmission of drug resistant bacteria from animal to community through food has been reported to occur in Kenyatta National Hospital in Kenya. Escherichia coli have been shown to be resistant to sulphamethoxazole (Ombui *et al.*, 1995).

2.6 How milk becomes unsafe

Milk illnesses are caused by several factors, which can be placed into one of three categories of: time- temperature abuse, cross contamination or poor personal hygiene (NRAEF, 1999).

2.6.1 Time- temperature abuse

This occurs if milk is allowed to remain for too long at temperatures favourable to growth of microorganisms. The common ways include failing to store milk at required temperatures, failing to cook or reheat milk to temperatures that kill micro-organisms and preparing milk a day or more before it is served (NRAEF, 1999).

2.6.2 Cross contamination

Cross contamination occurs when microorganisms are transferred from one surface or food to another. For example, adding raw or contaminated ingredients to milk that receives no further cooking especially from; milk contact surfaces (e.g. equipment or utensils) that are not cleaned and sanitized before touching cooked milk. It can also occur if raw milk or other foods is allowed to touch or drip fluids onto cooked milk or hands that touch contaminated (usually raw) food and touch cooked milk or contaminated cleaning clothes that are not cleaned and sanitized before being used on other milk-contact surfaces (NRAEF, 1999).

2.6.3 Poor personal hygiene

Individuals with unacceptable personal hygiene can contaminate milk contact surfaces and cause illness. Common amongst these poor practices are failing to wash hands after using restrooms, coughing or sneezing on milk or touching or scratching sores, cuts, boils and then touching milk while preparing or serving (NRAEF, 1999).

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2.7 Diseases of poor hygiene

Most milk-borne diseases have symptoms of diarrhoea, fever, nausea, vomiting, abdominal pains, headache, muscle pains, fatigue, and dehydration (NRAEF, 1999). Acute diarrhoeal diseases account for most of infant and childhood morbidity and mortality in tropical developing countries (Simiyu *et al.*, 1998). Diarrhoeal incidences are highest in Nairobi and Nyanza (Kenya Demographic Health Survey, 1993). Several factors contribute to increased diarrhoea morbidity; including contaminated weaning foods, poverty, and lack of safe and adequate water supply, poor sanitation, measles infection (Gateneh *et al.*, 1997).Refer to Table 1 overleaf.

Table 1 Major illnesses caused by bacteria

Illness	Symptoms	Source	Contamination routes	Some of the diarrhoeal
Salmonellosis	nausea, diarrhoea fever, headaches	water, soil, insects, animals, human intestinal tract	cross-contamination, not thoroughly boiled milk, not properly cooled boiled milk, poor personal hygiene and milk contact surfaces	all populations susceptible but more severe in infants, infirm elderly, AIDS patients
Shigellosis	diarrhoea (may be bloody),abdominal pain, vomiting, fever, cramps, nausea ,fatigue, dehydration	human intestinal tract, flies frequently found in water polluted by faeces	Cross contamination from poor personnel hygiene, unsanitary water sources, un-controlled flies and not rapidly cooled milk.	infants, elderly, infirm, AIDS Patients
Listerosis	Septicaemia, meningitis, encephalitis, spontaneous abortions, headache, fever, nausea, vomiting, diarrhoea	soil, water ,animals, damp environments	Raw milk, not properly boiled milk, dirty unsanitary surfaces, and wet floors	pregnant women/foetus, sickly people, cancer and AIDS patients
Staphylococcal food poisoning	nausea, retching, abdominal cramps, diarrhoea, headache, muscle cramping, changes in blood pressure and pulse rate	skin, hair, nose, throat, infected sores, and animals	Poor personal hygiene, cuts and other skin infections, milk not rapidly cooled	all populations
Bacillus cereus (gastroenteritis)	nausea, vomiting, abdominal cramps, diarrhoea	soil and dust, cereal crops	Slow cooling of milk, time-temperature abuse, inadequate boiling	all populations

Continued : Major illnesses caused by bacteria

Illness	Symptoms	Source	Contamination routes	Susceptible Populations
Fever, abdominal pain, diarrhoea, headache, sore throat, vomiting	Fever, abdominal pain, diarrhoea, headache, sore throat, vomiting	Domestic pigs, soil, water, rodents and wild animals	Cross-contamination, poorly-boiled milk, dirty facilities and equipment, poor storage and dirty water	all populations
Hepatitis A	Mild or no illness, sudden onset of fever, general discomfort, fatigue, headache, vomiting, abdominal pain and jaundice	Human intestinal and urinary tracts and contaminated water	Poor personal hygiene, dirty and unsanitary equipments and dirty water	all populations
Intestinal cryptosporidiosis	Severe watery diarrhoea	Intestinal tracts of humans, cattle, and other domestic animals, contaminated water with run-off from farms or slaughter houses	Poor personal hygiene and use of dirty water	all populations
Cyclosporiasis	Watery diarrhoea, loss of appetite, weight loss, bloating gas, abdominal cramps, vomiting, muscle aches, mild or no fever and fatigue	Water, fish, raw milk, and raw produce	Poor personal hygiene and use of dirty water	all populations
Cholera	Mild to severe diarrhoea, fever, headache	Water, intestinal tracts of humans	Faecal contaminated water, cross-contamination from poor hygiene, cooking utensils	all populations especially AIDS patients

2.8 Fermentation of milk and safety

Fermentation is a catabolic process in which complex modules are broken down by micro-organisms with resultant changes in flavour, pH and nutritive value (Ashworth and Alizon ,1992). In milk, the major fermentation taking place is lactic acid fermentation. The production of these acids are known to suppress the growth of certain pathogenic micro-organisms including *Escherichia Coli* and *Shigella* species. In industrial fermentation of milk follows the following steps i) boiling of milk aiming, amongst other reasons at the destruction of pathogenic micro organisms ii) cooling to inoculation temperatures and iii) inoculation(Robinson, 1993).

However, fermentation is not a disinfectant and only partial elimination of bacteria occurs. It is also an indication of milk spoilage. Spoilage of milk is characterised by curdling and fermentation (Robinson, 1993).This differs from intended fermentation like in the process of making yoghurt in that the former is spontaneous and the bacteria responsible for the curdling are not defined. In yoghurt making selected strains of bacteria are used and the outcomes known. Spoilage may occur due to coliforms or other bacteria. The spoilage microorganisms are introduced during handling from dirty hands or utensils or may be passed to milk from a sick animal. Poor storage conditions may further aggravate spoilage by providing favourable temperatures for bacteria multiplication (NRAEF, 1999).

The three main factors that affect fermentation are composition of food, micro-organisms present and the conditions of fermentation such as PH and temperature (Tomkins *et al.*, 1990). Most fermentations as practised at the household level are spontaneous and uncontrolled. Fermentation can also have catastrophic effects if insufficient acidity

develops and contamination with *Pseudomonas cocovenenans* occurs. This organism produces a deadly toxin bongkrekic acid that induces hypoglycaemia through complex reactions in the liver (Tomkins *et al.*, 1990).

2.9 Improving the safety of milk

The key to serving safe milk is to handle it safely. The causes of most milk borne illnesses can be grouped into two categories: temperature abuse and cross-contamination (NRAEF, 1999).The control of these two factors is critical in ensuring milk safety.

2.9.1 Temperature abuse

Most disease causing microorganisms grow and multiply at temperature range of 5-60 degrees centigrade, which is why it is referred to as danger zone. Microorganisms grow much faster at the middle zone at 21-49 degrees centigrade. Whenever milk is held at this temperature, it is being temperature abused. Microorganisms also need time to multiply. For the above reasons it is recommended that, milk should never be left at room temperature for more than 4 hours. It should be cooled immediately after milking. It should also be cooled immediately after boiling. This is achieved through an industrial process referred to (**HTST** or high temperature short time) pasteurisation. It should be stored in a refrigerator or freezer and ensuring that the refrigerator and freezer are working properly (the refrigerator should operate at 5or below degrees centigrade, and the freezer at -18 or lower degrees centigrade)(NRAEF, 1999).

2.9.2 Cross-contamination

The other major hazard milk faces is cross contamination. Microorganisms attach themselves to anything in the kitchen, including preparation tables, equipment, utensils, cutting boards, dishtowels, sponges, hands or other foods. Cross-contamination occurs

when microorganisms from one source are spread to other milk. Prevention starts with the basic principle of creating barriers between milk and possible contamination sources. The following precautions though not exhaustive can aid in minimising cross contamination, washing hands thoroughly before handling milk and ALWAYS after handling raw meat, going to the toilet, blowing nose or handling animals including pets. Pets should also be kept away from milk and milk preparation surfaces. Keeping milk preparation surfaces and utensils clean, disinfected, and ensuring cloths or towels used for wiping milk spills are not used for any other purpose, prevents cross-contamination. Prepare and store raw meat and ready to eat food separately. Always keep raw and defrosting meat at the base of refrigerator, below everything else as this can drip into milk. Keeping milk in specific containers not used for other foods. It is prudent to check the use by dates on milk and ensure that milk is used before the date expires (NRAEF, 1999).

.2.10 The role of the government in ensuring milk- safety

Every country is involved in the development of health laws. This is done to ensure all establishments that serve the public with milk provide safe milk (NRAEF, 1999). This is irrespective of whether the milk is consumed on or off premises. The is done to evaluate the minimum sanitation and milk safety practices within the establishment in order to protect the public's health by requiring establishments provide milk that is safe, uncontaminated, and properly presented. It also provides the government the opportunity to convey new milk safety information to an establishment and written report noting deficiencies so that the establishment can be brought into compliance with safe milk practices (NRAEF, 1999).

2.10.1 The Kenyan milk policy environment

Various government bodies and departments are mandated to set policy and regulate milk marketing and standards. These bodies are, Ministry of Livestock and Marketing, The Kenya Dairy Board, Kenya Bureau of Standards, Ministry of Health, Municipal/Town Councils and Ministry of Trade and Industry. The Ministry of Livestock and Marketing is responsible for the development of the Dairy sector in the country. Some of its functions include ensuring adequate milk production and offering appropriate guidelines to the different players and stakeholders in the industry. The Kenya Dairy Board, Kenya Bureau of Standards, Ministry of Health, Municipal/Town Councils and Ministry of Trade and Industry have licensing and inspectorate activities. Some key activities being ensuring that milk and milk products are obtained, moved and handled in hygienic and sanitary conditions to render them safe for human consumption. Kenya is a signatory of World Trade Organisation, and therefore must strive to achieve international standards (ROK, 1997).

2.10.2 International food safety regulation systems

To ensure quality within and between borders there are some recognised international food standards. Some of these standards are:

2.10.2.1 Sanitary and photo-sanitary standards

This is an agreement between governments that recognise the individual government's rights to restrict trade in order to protect the health of its citizens but within available scientific evidence. This is important for export purposes. Trade between countries is to be restricted by tariffs imposed by the individual countries (FAO and WHO, 2002).

2.10.2.2 Hazard Analysis Critical Control Point System (HACCP)

This quality system was developed for astronauts and aims at identifying and eliminating hazards before they become critical. It targets both the food and the process, from the raw material to the finished products. (FAO and WHO, 2002).

2.10.2.3 ISO 9000 (Federation of international standards bodies)

It aims at facilitation of international exchange of goods and services. It also aims in developing cooperation in spheres of intellectual, scientific, economic and technological activities. It aims in meeting consumers' satisfaction and regulatory requirements through quality management (FAO and WHO, 2002).

CHAPTER THREE: MATERIALS AND METHODS

3.1 The study area

The study was carried out in Kibera Division of Nairobi Province. Nairobi lies at a height of 1670 metres. The longitude is $36^{0}50'$ East and latitude $1^{0}17'$ south just 140 Kilometres south of the equator. Being so close to the equator but being about 1700 metres above sea level. Nairobi temperatures are altitude modified. Mean annual temperature is $19^{0}C$ and mean daily maximum and minimum are $25^{0}C$ and $14^{0}C$ respectively. Rainfall is 1080 mm and falls in two distinct seasons: long rains March to May and short rains mid-October to December. The sun rises and sets between 6.30am and 7pm with only a slight variation throughout the year (Moss, 2000). This location has one of the largest slums in Kenya (APHRS, 2002) with an estimated population of 800,000 people. Nairobi district in Kenya is the largest 'consumer' of marketed milk in Kenya (Omore, *et al.*, 2002). Nairobi is a cosmopolitan city with a population from all around the country. Rae, (2001) states that the urban informal settlements are places where inhabitants move in with their cultural and social values. It can thus be taken as a general representation of the country. The consumers were drawn from Laini Saba and Olympic sub-locations to represent low-income group and Nyayo highrise and South C sub-locations to represent middle-upper income groups.

The sub- locations were purposively and conveniently selected for they are all within a radius of one kilometre and milk is consumed in most Kenyan households. (CBS, 2000) The climate in these four divisions is similar and variations are related to income and infrastructure provided.

Plate 1 shows a typical scenery of infrastructural dilapidation in Kibera.

3.2 The study Population

According to World Health Organisation, the rapid growth of predominantly low-income settlements (slums) in the cities of third world countries has come to constitute one of the most serious threats to health. One of the three major types of pathology emerging in these areas is infectious and gastrointestinal diseases. Drainage and other sanitation problems are prevalent leading to high cases of such related diseases. Infectious and gastrointestinal diseases account for about 44.4% of all deaths in children below 4 years (WHO, 1988). In Kibera slum the major cause of under five mortality are measles and diarrhoeal diseases (GOK, 1992). Under five years mortality rates in Kenyan slums is 151/1000live births compared to 60/1000 in Nairobi district (APHRS,2002).It is therefore necessary to understand the behaviour of populations in relation to incomes. It is located next to the lavish South C estate with ample sanitation facilities. The presence

of both low and middle-upper income earners in the test population provides a survey that is a general representation of the country as a whole.

3.2.1 Inclusion criteria

The respondents were men or women above 15 years and consented to the study.

3.2.2 Exclusion criteria

Any man or woman who refused to be interviewed and children below 15 years.

3.2.3 Ethical considerations

Permission to carry out research was sought from ethical committees at the ministry of Education, Science and Technology and Kenyatta University. Explanations were given to prospective participants on the nature and purpose of research. Only the participants who consented to the study were interviewed. The confidentiality and the identity of informants was protected as only the researcher had access to the data.

Ethical considerations were guided by the following principles as stated by Nuffield Council on Bioethics, (2002):

(i) The duty to alleviate suffering

(ii) The duty to show respect for other persons

(iii) The duty to be sensitive to cultural differences and

(iv) The duty not to exploit the vulnerable.

3.3 Research design

This was a cross-sectional study. The qualitative and quantitative methods of data collection were used. Data were collected at one point in time from a sample selected to describe some larger population at that time. In the words of Babbie (1973):

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"Surveys are very much like censuses, differing primarily in that a survey typically examines a sample from a population while census generally implies an enumeration of the entire population."

This type of research design has been suggested to be probably the best method available to social scientists and other educators who are interested in collecting original data for describing a population, which is too large to observe directly (Mugenda and Mugenda, 1999). It was suitable for this study as it enabled the researcher to derive extensive and reliable data from a large sample of respondents within a short period.

3.4 Sample size and sampling procedure

3.4.1 Sampling method

The study was carried out in four sub-divisions of Kibera Division in Nairobi province; namely, Laini Saba, Olympic, Nyayo Highrise and South C. This was for purposes of comparison on income levels. Purposive and convenient sampling methods were used to select Kibera division and the sub- locations for study. Probability proportional to size technique was used to determine number of consumer households in each sub-location. Systematic and simple random sampling was be used to identify the households. These methods provided an efficient method for selecting a sample that adequately reflected the variations that existed in the population (Ulin *et al.*, 2002).

Kibera division has 89,086 households distributed as follows:

South C	3948
Nyayo highrise	8621
Laini Saba	10150
Olympic	6542

Sample size proportional to population was:

South C 54

Nyayo highrise 118

Laini Saba 139

Olympic 89

3.4.2 Sample size determination

Determination of sample size was based on the need to answer the study objectives from a representative sample of the population (Kirkwood, 1989).

The sample size was determined from the following formulae as previously used by Fisher *et al.*, (1998)

$$N = \frac{Z^2 pqD}{d^2}$$

Z = standard normal deviate 1.96 which corresponds to 95% CI

p= proportion of the target population estimated to have particular characteristics. In this study, the target population is the whole population, since milk is widely used and therefore anybody is at risk of contracting diseases associated with milk consumption as observed by Fulton (1992)

q = 1-p

D=design effect =1 for one location was sampled.

d = degree of freedom

$\alpha = 0.05$

$N=\frac{1.96^2 x 0.5 x .0.5 x 1}{.05^2}=384$. A 10% contingency sample was added to cater for attrition.

A total of 409 questionnaires were adequately filled.

3.5 Data collection methods and Research instruments

3.5.1 Data collection methods

Prior to data collection, the questionnaires were pre-tested and research assistants trained in data collection procedures. In the middle-upper income group areas, questionnaires were self administered while in the lower income groups respondents' answers were recorded in the previously prepared interview schedule. Three focus group discussions were held. Two were drawn from the lower income group areas while one was from the middle-upper income group. Key informants were drawn from those respondents who were conversant with the topic as determined from the answers they provided in the questionnaires.

3.5.2 Pre-testing the instrument

The instruments were pre-tested to enhance their validity and reliability in Kawangware Division of Nairobi province. This enabled the researcher to identify vague questions, ensure the instruments measured the concept intended and check for flaws and bias (Mugenda and Mugenda, 1999). It also served to familiarize the researcher with interview items. Pre-testing was done on forty respondents with similar characteristics as those to be included in the study sample. These forty individuals were selected from the excluded clusters and did not form part of the final study sample.

3.5.3 Structured interview schedules

A structured interview schedule (Appendix A) was used to collect data on the socio-economic and demographic status, knowledge, attitude and practices of the respondents in relation to management of milk in the households. A closed questionnaire offers yes or no responses to questions. It is useful in obtaining quantifiable responses to pre-set

questions (Fulton , 1992).The respondent is made to concentrate on items of special interest to the survey, while it may also contain items that the respondent might not remember to mention if they had not been mentioned in the question list (Lockerbie , 1986). It is also preferred because it gives a higher response rate in comparison to other methods of data collection. The structured interview schedule provides quantative data that is objective, scientific, structured and reliable for hypothesis testing (Ong, 1993). It was most the appropriate tool in this study because it is easy to administer, cheap and collects large amount of data quickly.

3.5.4 Focus Group Discussions

Additional data were collected by use of focus group discussions (Appendix B). This instrument was used to enhance the quantative data. This type of instrument yields qualitative data. Qualitative data acknowledges that meanings are social and that morality may well be situational specific (Ong, 1993).From words of (Ulin *et al.*, 2002)'People differ in their experiences and understanding of reality; how participants define a situation may not reflect assumptions made by the researcher.' Employing this method within quantative research enriches the findings rather than contaminating its methodological quality (Ong, 1993).Using questions helps in grouping data. This is appropriate with limited resources and while qualitative data is a smaller component of a larger quantative study, conducted to provide further depth in predefined areas of interest. (Ulin *et al.*, 2002)

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3.6 Data analysis

Data was analyzed by computer using the Statistical Package for Social Sciences (SPSS). Descriptive statistics namely frequencies and percentages were used to describe, organize and summarize collected data. Chi-square tests were used to test the strength and direction of relationships between categorical variables at a significant level of 0.05 as is usually recommended for social sciences (Sproull, 1988).Responses from open-ended questions were analyzed qualitatively and used to supplement, explain and interpret quantitative data as recommended (Ulin *et al.*, 2002)). The responses were coded to allow for the extraction of distinct categories and themes that emerged during data collection. Once the themes, categories and patterns had been identified, then generalizations could be made.

3.7 Operational definitions of variables

Age: It was measured by asking the respondents to state their age in complete years.

Income per month: It was measured by asking the respondents to state their Monthly income within three income ranges.

Level of education: The levels of education were determined by asking the respondents the highest class he/she attended.

Knowledge: This was determined by use of closed questions to determine what the respondents knew about milk handling and the possible diseases and symptoms present in either raw or poorly handled milk.

Attitude: An attitude refers to a settled way of thinking that is reflected on ones behaviour.

This was measured using a Likert type scale with two points. Agree was one and disagree zero.

Type of practice: This was determined by asking the respondents the brand of milk bought, the uses of milk at home, storage at home and uses of sour milk at home.

Household: It included all people living together and sharing the basic needs in life such as food and shelter.

Household head: It referred to the person in the household who has final say in decision-making.

CHAPTER FOUR: RESULTS

4.1 Socio-economic and demographic characteristics

This section describes the socio-economic and demographic characteristics of the study population.

4.1.1 Respondents' position in the household

The respondents' position in the family determines the level of responsibility. This was expected to have an influence on their knowledge and attitudes towards potential health risks in milk.

Table 2: Frequency distribution showing respondents' position in the household

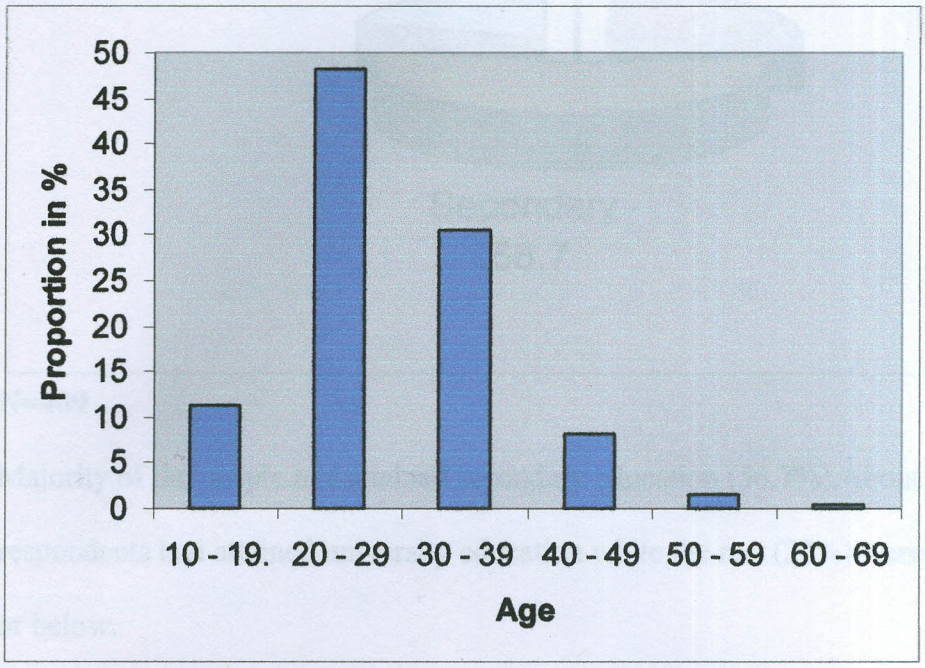
Position in the household	Frequency	Proportion (%)
Head	170	41.9
Spouse	107	26.4
Co-wife	14	3.4
Son or Daughter	44	10.8
Relative	53	13.1
Non-relative	14	3.4
Other	4	1.0
Total	**409**	**100**

Most respondents', 71.7%, were responsible members of the household consisting of head(41.9%),spouse(26.4%) and co-wives(3.4%).The other respondents(28.3%) consisted of son/daughter(10.8%), relatives(13.1%), non-relatives(3.4%) and others(1%).

4.1.2 Age distribution of the respondents

The age of respondents was determined by asking the respondents to state their age as per their last birthday.

Figure 4: Age (years) distribution of the respondents

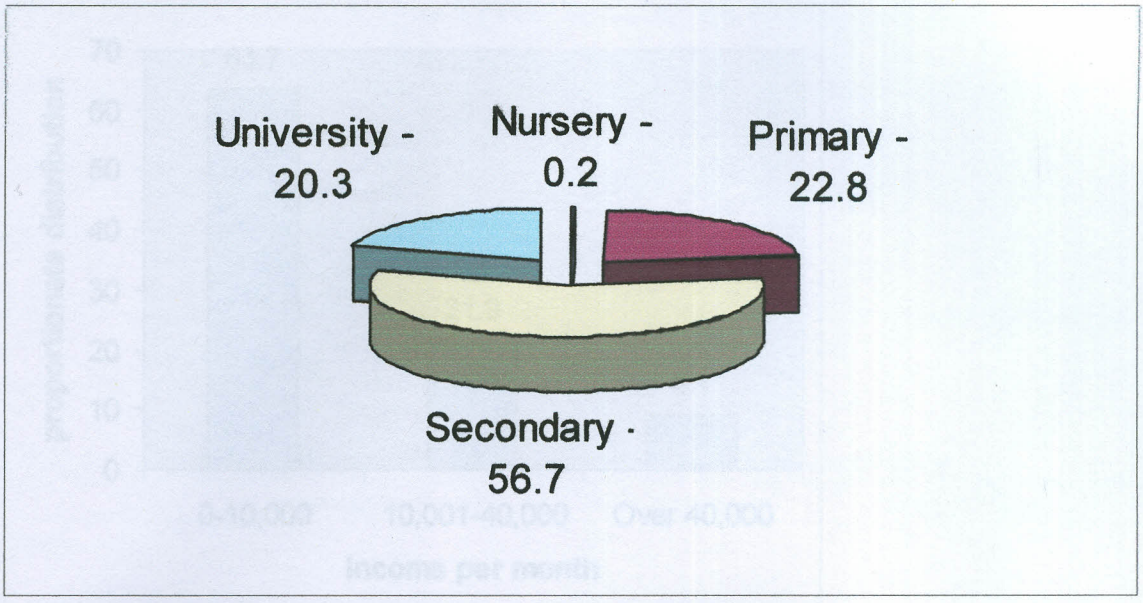


The respondents' ages varied from 16-63 years. The highest represented age category was that of age 21-30years (48.2%), followed by 31-40years (30.5%). Respondents below 20 years were 11.2%while those over 41years were 10.2%.

4.1.3 Educational levels of the respondents

It was expected that the level of education could relate to the levels of income and influence ones knowledge and attitudes of potential health risks in milk and hence ones practices. The educational level was obtained by asking the respondents to state the highest level attained.

Figure 5: Educational levels of the respondents



N=409

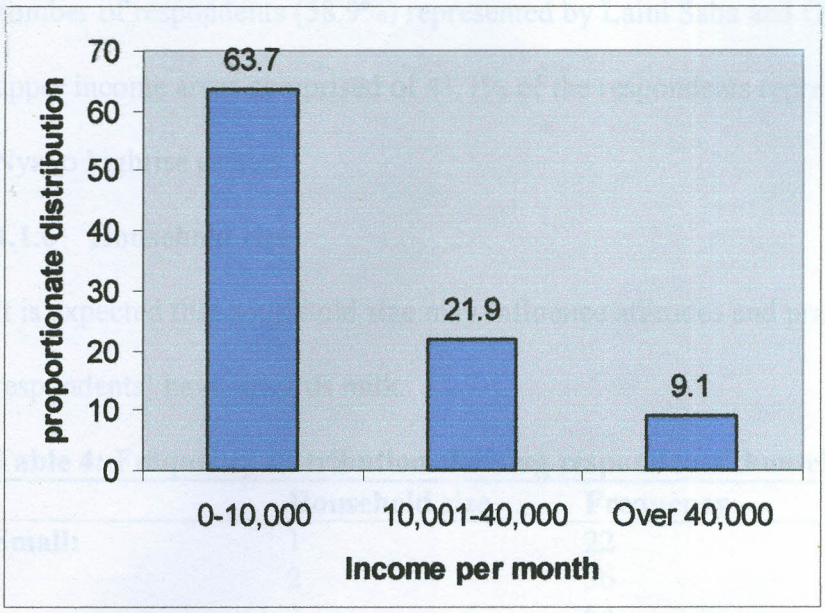
Majority of the people had attained secondary education (56.7%).About 20.3% of the respondents had attained university education while the rest (23%) were of primary level or below.

4.1.4 Income distribution of the respondents

The level of income may determine the brand of milk one buys. It may also influence attitudes and practices (uses and storage) towards the milk.

The income levels were obtained by asking respondents to group their incomes within pre-determined income levels.

Figure 6: Monthly income (Ksh) distribution of the respondents



About 63.7% of the respondents had a monthly income below Kshs. 10, 000. About 21.9% had an income above Kshs. 10, 000 but below Kshs. 40, 000 and only 14.4% had incomes above Kshs. 40, 000.

4.1.5 Respondents housing status

It is expected that the location will determine the suppliers of milk and the consumer attitudes towards the safety of the milk. respondents were asked to state their residences.

Table 3: Frequency distribution showing respondents residential areas

Estate	Frequency	Proportion(%)
South C	52	12.7
Nyayo Highrise	116	28.4
Laini Saba	141	34.5
Olympic	100	24.4
Total	**409**	**100**

The respondents were drawn from four estates. Low-income areas had the highest number of respondents (58.9%) represented by Laini Saba and Olympic estates. Middle-upper income areas comprised of 41.1% of the respondents represented by South C and Nyayo highrise estates.

4.1.6 Household size

It is expected that household size may influence attitudes and practices (uses and storage) respondents' have towards milk.

Table 4: Frequency distribution showing respondents' household sizes

	Household size	Frequency	Proportion (%)
Small:	1	22	5.4
	2	36	8.8
	3	64	15.6
Medium:	4	90	22
	5	72	17.6
	6	58	14.2
	7	30	7.3
Large:	8	15	3.7
	9	8	2.0
	10	6	1.5
	11	3	0.7
	12	3	0.7
	15	1	0.2
	20	1	0.2
	Total	**409**	**100**

4.2 Relationships between SE-D variables of the respondents

The selected socio-economic and demographic (age, income, residence and education) were first correlated against each other to establish the relationships between them. This is essential for the interpretation of findings presented later in this work (CBS *et al.*, 2004). Significant relationships were observed between all the SE-D characteristics; age and income ($\chi^2 = 22.166, df = 4$ $p = 0.0002$), age and educational level ($\chi^2 = 15.486, df = 4$ $p = 0.04$) and age and residential areas ($\chi^2 = 16.729$, $df = 2$ $p = 0.0002$). There was also a

significant relationship between educational level and income ($\chi^2 = 71.062, df = 4$ p = 0.0001) and residential areas and education level ($\chi^2 = 108.045, df = 2$ p = 0.0003). Income and residential areas ($\chi^2 = 142.093, df = 2$ p = 0.0001) also had a significant relationship. These significant relationships are presented Tables 3-5 below.

4.2.1 Relationship between income level and other demographic variables

The following table shows the significant relationships between income and other socio-economic demographic variables.

Table 5: Significant associations between income level and other SE-D variables

Factor	Income level per month (Kshs. '000)									
	< Kshs. 10		Kshs. 10 – 40		> Kshs. 40,		Total		Chi square	p value
	n	P (%)	n	P (%)	n	P (%)	n	P (%)		
Age										
< 30 years	87	72.5	26	21.7	7	5.8	12	49.8		
31 – 40 years	54	60.7	15	16.9	20	22.5	89	36.9		
> 40 years	12	37.5	11	34.4	9	28.1	32	13.3	22.166	0.0002
Education										
primary	45	90	3	6	2	4	50	20.2		
secondary	103	71	32	22.1	10	6.9	154	58.9		
university	12	22.6	18	34	23	43.4	53	21.4	71.062	0.0001
Residential areas										
Middle-Upper income	22	13.5	47	83.9	36	97.3	105			
Low income	141	86.5	9	16.1	1	2.7	151	59	142.093	0.0001

n = number of respondents P (%) = proportion in percentage

Table 5 shows significant relationship between income age, education and residential areas. The significance was highest between age and residential areas ($\chi^2 = 142.093$ p =0.0001) and least between age and education ($\chi^2 = 22.166$. p =0.0002).The relationship between income and age showed that 49.8% of respondents were below 30

years. A majority of them (72.5%) earned below Kshs. 10, 000 per month. The rest (27.5%) reported earning more than Kshs. 10, 000 per month (21.7% earn between Kshs. 10, 000- Kshs. 40, 000 and 5.8% earned over Kshs. 40, 000 per month). Of those over 41 years, 13.3% of the respondents, 37.5% earned below Kshs. 10, 000 while the remainder (63.5%) earned above Kshs. 10,000. The older people tended to earn more than the younger population. This was probably because the older people were better established in their income generating activities in comparison to the younger ones. There was also significant relationship between income and educational level. Of the total respondents, 20.2% had not attained beyond primary education. Of this, 90% earned below Kshs. 10, 000. Almost a similar percentage (21.4%) had been to university and 73.4% were earning above Kshs. 10, 000. This could be explained by the fact that a university education increases ones chances of getting a better paying job or performing better in business. Results also showed that there was a significant relationship between income and residential areas. Of the 63.7% of the population with an income of Kshs. 10, 000 and below, 86.5% lived in low-income areas. In comparison, 14.5% of the respondent s reported earning above Kshs. 40, 000. Of this 97.3% lived in middle-upper income areas. The results suggested that income determined the choice of residential area.

4.2.2 Association between education and residences

The following table shows there was a significant relationship between educational levels and residential areas (χ^2 =108.045, df=2, p=0.0003).

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Table 6: Chi-square results of relationship between Educational level and residential areas

Residences	Education			
	Primary	Secondary	University	Total
Middle- upper income areas	4 (4.4%)	89 (39.7%)	66 (82.5%)	159 (40.3%)
Low income areas	87 (95.6%)	135 (60.3%)	14 (17.5%)	236 (59.7%)
Total	91 (23%)	224 (56.7%)	80 (20.3%)	395 (100.0%)

$\chi^2 = 108.045$, df = 2, p = 0.0003

Table 6 showed that there was a significant relationship between education and residential areas. Of the 23% of the population with an education of primary and below, 95.6% lived in low-income areas. In comparison, 20.3% of the respondent s reported having been to university. Of this 82.5% lived in middle-upper income areas. Significant relationship was also observed between education and income (χ^2=71.062 df =2, p=0.0001) which suggested the level of education influenced the amount of income which then influenced the choice where one lived.

4.2.3 Association between age and other SE-D characteristics

This section shows significant relationships between age and other SE-D characteristics.

Table 7: Significant associations between Age and other SE-D characteristics

Factor	**Age**									
	<30yrs		**31-40yrs**		**>40yrs**		**Total**		**Chi square**	**p value**
	n	P (%)	n	P (%)	n	P (%)	n	P (%)		
Education										
primary	62	28.4	127	58.3	29	13.3	218	58.1		
secondary	19	16.1	68	57.6	31	26.3	118	31.5		
University	9	23.1	18	46.2	12	30.8	39	10.4	15.486	0.04
Residential area										
Middle-Upper	73	32.2	57	48.3	24	61.5	154	40.1		
Low income	154	67.8	61	51.7	15	38.5	230	59.9	16.729	0.0002

n = number of respondents P (%) = proportion in percentage

Table 7 shows of the respondents below 30 years (58.1%), only 13.3% reported having attained university education. In comparison, the respondents who were above 41 years (10.4%), 30.8% had been to university. The association between age and residences showed that the younger population was the larger proportion of respondents and most of them lived in low income areas. About 59.1% of the respondents were below 30 years and majority (67.8%) lived in low-income areas. Of the 10.2% of the respondents above 41 years, 61.5% of them lived in middle-upper income areas.

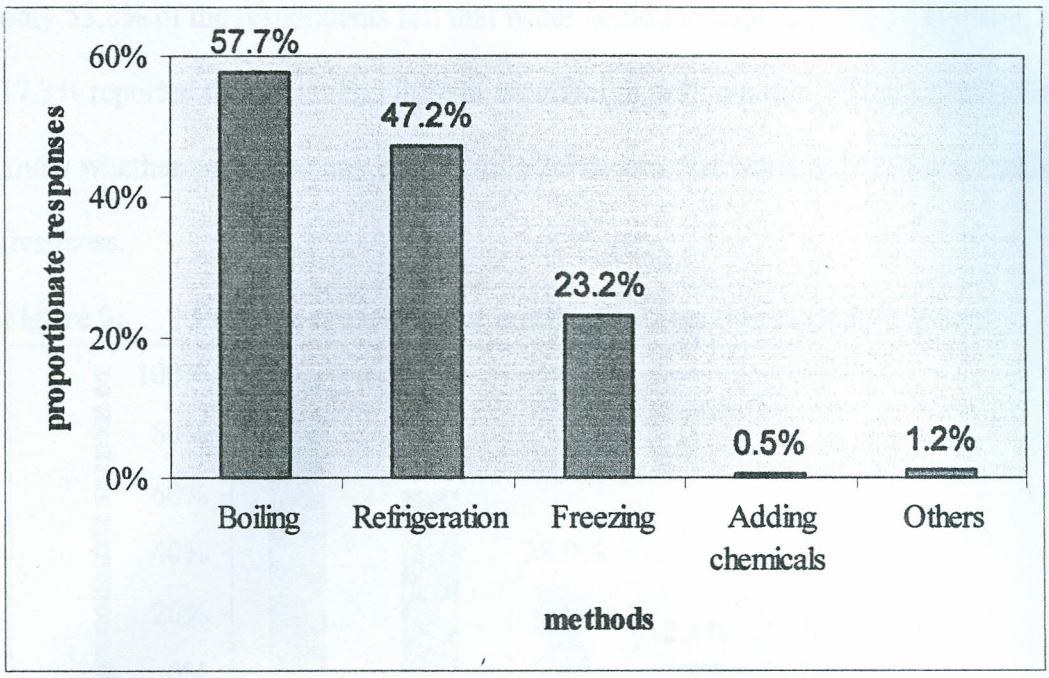
4.3 Respondents knowledge of safe milk handling and likely health risks in milk

The respondents were asked closed questions to gauge their knowledge of risk in raw milk, poorly handled milk and knowledge of safe milk handling. In focus group discussions, clarification of some observations on knowledge were also sought.

4.3.1 Knowledge of safe milk handling

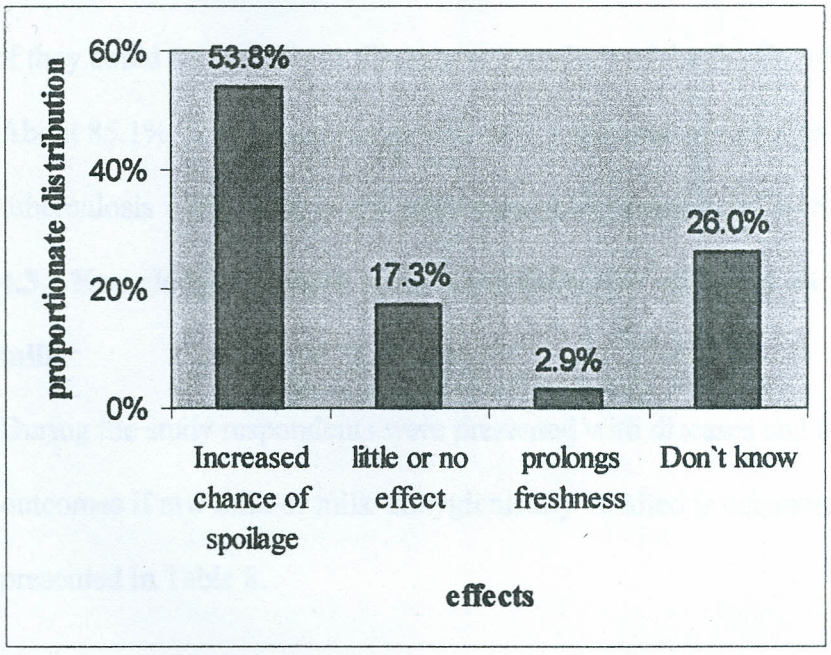
The respondents answered closed questions to 3 main themes: prolonging freshness, effects of adding water to milk and diseases transmittable through food. Of these, 87.5% reported knowing how to prolong milk freshness. Results are presented in Figures 7-9

Figure 7: Common methods of prolonging milk freshness



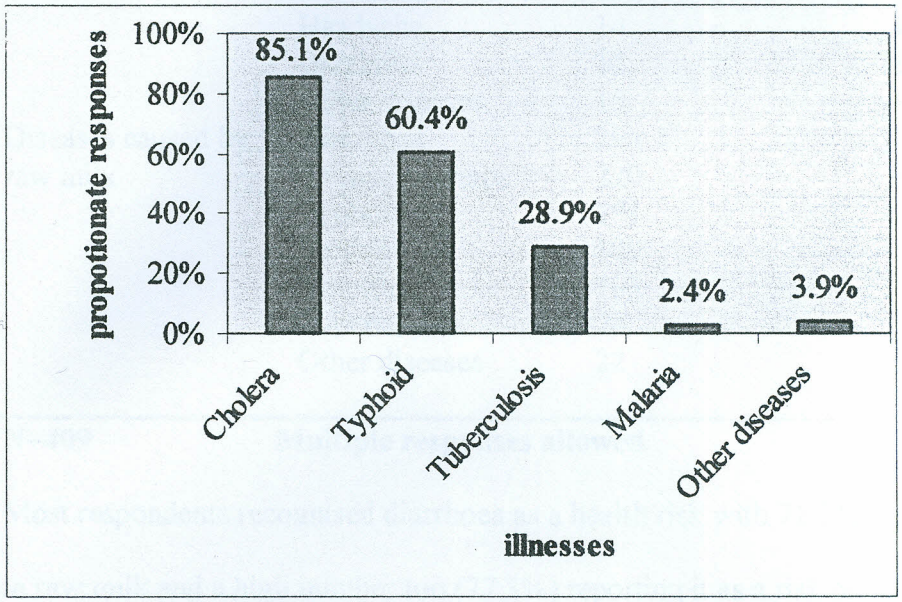
The most common way was reported as boiling (57.7%), followed by refrigeration (47.2%), freezing (23.2%), while adding chemicals and other methods were reported by 1.7% of the respondents.

Figure 8: Effects of adding water to milk



One of the common ways milk is adulterated is by adding water. Results showed that only 53.8% of the respondents felt that water could increase chances of spoilage, while 17.3% reported that water had little or no effect to milk quality. The rest (26%) did not know whether water had any effect while 2.9% said that water could increase milk freshness.

Figure 9: Possible cross-contamination illnesses due to poor hygiene



Common diseases that are prevalent in this region were presented and respondents asked if they could transmit these diseases to members of the family while preparing food. About 85.1% of the respondents said they could transmit cholera, 60.4% typhoid, 28.9% tuberculosis while malaria and other diseases were reported by 6.3% of the respondents.

4.3.1 Knowledge of health risks inherent in raw milk and unhygienically handled milk

During the study respondents were presented with diseases and symptoms of likely outcomes if raw milk or milk-unhygienically handled is consumed. The findings are presented in Table 8.

Table 8: Respondents knowledge of health risks inherent in raw milk and unhygienically-handled milk

Characteristic	Category	Frequency	Percentage
Diseases caused by unhygienically-handled milk	Is spoilt milk a health risk?	388	94.9
	Symptoms caused by spoilt milk:		
	Diarrhoea	316	77.3
	Stomach cramps	273	66.7
	Vomiting	133	32.5
	Nausea	128	31.3
	Headache	14	3.4
	Dizziness	12	2.9
	Other diseases	15	3.7
Diseases caused by raw milk	Diarrhoea	294	71.9
	Stomach cramps	220	53.8
	Typhoid	191	46.7
	Nausea	109	26.7
	Vomiting	103	25.2
	Tuberculosis	74	18.1
	Other diseases	22	5.4

N=409 **Multiple responses allowed**

Most respondents recognised diarrhoea as a health risk with 71.9% reporting it as a risk in raw milk and a high number too (77.3%) reporting it as a risk of unhygienically-handled milk. The other common risks reported were stomach cramps by 66.7% and 53.8% as a risk in unhygienically handled and raw milk respectively. Headaches and dizziness were reported by about 6% of the respondents.

4.3.3 Knowledge index

After respondents' answered all the questions on knowledge of milk handling, cross-contamination, and health risks inherent in raw and unhygienically-handled milk. A score of one was awarded for every correct answer and zero for every wrong response using the WHO standards (WHO, 1989; WHO 1996).The highest possible score was twenty eight (28) and the lowest was zero. Table 9 below shows the respondents scores.

Table 9: Frequency distribution of respondents' knowledge index

Knowledge index	Frequency	Proportion (%)
1	2	0.50
2	2	0.50
3	2	0.50
4	10	2.40
5	10	2.40
6	25	6.10
7	48	11.7
8	32	7.80
9	38	9.30
10	42	10.3
11	46	11.1
12	38	9.30
13	36	8.80
14	35	8.60
15	19	4.60
16	12	2.90
17	9	2.20
18	2	0.50
19	1	0.20
Total	**409**	**100**

The results were categorized as shown below.

Points	Level of knowledge
0-9 (< 30 %)	Low
10-19 (31 -70 %)	Medium
20-29 (> 70 %))	High

The knowledge index of the respondents' is summarized in Table 10.

Table 10: Frequency distribution of respondents' categorised knowledge index

Level of knowledge	Frequency	Proportion (%)
Low(0-9 points)	169	41.3
Medium (10-19)	240	58.7
High (20-29)	00	00.0
Total	**409**	**100**

N=409

Out of a possible 28 points, the results in Table 10 show that the knowledge of 41.3% of the respondents was low, while 58.7% had average knowledge. None of the respondents had a high-level knowledge. The mean was score 10.3 with a mode score of 7.

4.3.4 Relationship between Knowledge index and named SE-D Characteristics

To determine the relationship between knowledge of health risks that may be present in milk and knowledge of safe milk handling, the computed Knowledge index and the named socio-economic and demographic characteristics were correlated using chi-square test at significant level $p<0.05$. There was no significant relationship between age and knowledge index ($\chi^2=3.868, df=2$ $p = 0.145$). Significant relationships were obtained between knowledge and the rest of the SE-D; education($\chi^2=13.415, df=2$ $p = 0.001$), income ($\chi^2=13.419, df=2$ $p = 0.001$) and residential areas ($\chi^2=44.228, df=2$ $p = 0.0003$). The significant relationships are presented in Table 11.

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Table11: Significant associations between Knowledge index and SE-D Characteristics

Factor	knowledge index				Total		chi-square	p value
Education	**Low (N)**	**P (%)**	**medium**		**N**	**P (%)**		
			N	**P (%)**				
primary	25	27.5	66	72.5	91	23		
secondary	90	40.2	134	59.8	224	56.7		
university	44	55	36	45	80	20.5	13.415	0.001
Income								
<10,000	53	32.5	110	67.5	163	63.7		
10-40,000	31	55.4	25	44.6	56	21.9		
>40,000	21	56.8	16	43.2	37	14.5	13.419	0.001
Residences								
Middle-Upper income	102	60.7	66	39.3	168	40.1		
Low income	67	27.8	174	72.2	241	58.9	44.228	0.0003

N=number of respondents P=proportion in percentage

The association between knowledge and education, income and residences was strongest between knowledge and residences and almost similar at education and income. The respondents with low level of education also earned the least and lived in low-income areas. The result showed that this was the proportion of the respondents with low level of knowledge (Table 10). About 23% of the respondents had attained an educational level of primary or below. A majority of these respondents, 72.5%, had medium level of knowledge. In comparison, of the 20.3% of the respondents who had attained a university degree, 55% had low level of knowledge. On income basis, about 63.7% of the population earned less than Kshs. 10,000 per month. About 67.5% of them had medium level of knowledge. The respondents earning over Kshs. 40, 000 per month (14.5%), 56.8% had low knowledge of diseases associated with health risks in marketed milk. This relationship on knowledge and income was clearer when knowledge was compared to residences. Of the 58.9% of the respondents who lived in low income areas, 72% had

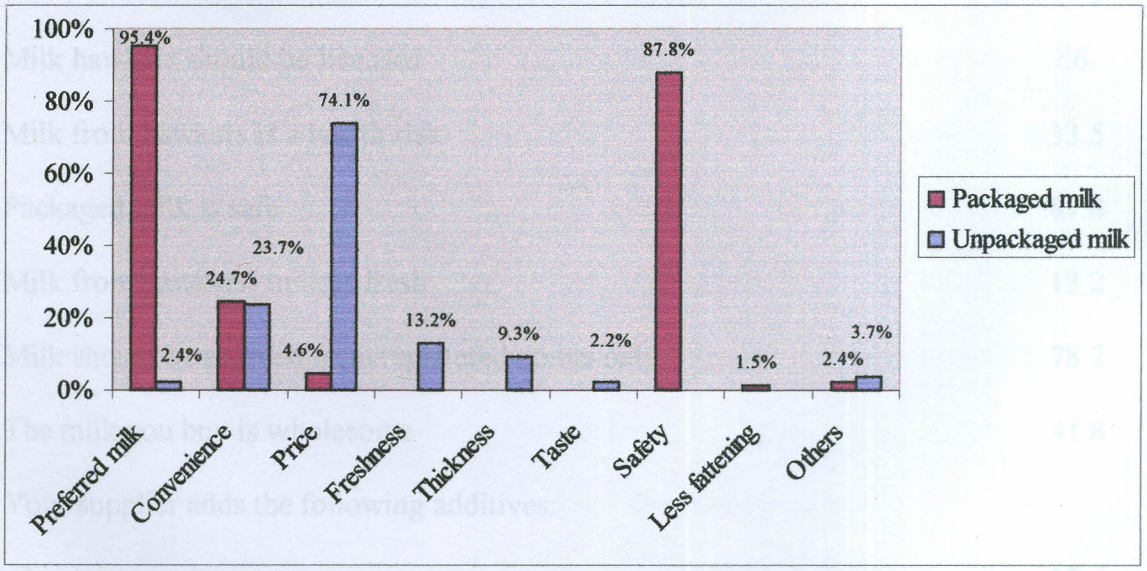
medium level of knowledge. The rest (41.1%) who lived in Middle-Upper income areas, 60.7% of them had low level of knowledge. In focus group discussions, it emerged that knowledge of health risks was gained from life experiences rather than high levels of education. Respondents in the lower income bracket group reported suffering more from poor hygiene related diseases. When asked to state common illnesses in their families, they reported the following diseases: diarrhoea, cholera, typhoid, skin diseases, tuberculosis, worms, malaria, and dizziness. Those in the middle-upper income groups who were also the more educated reported colds, coughs, malaria and typhoid to the same question.

4.4 The respondents brand preferences, and attitudes towards the safety of milk in the market

This section represents results of respondents brand preferences and the attitudes that may have led to these choices.

4.4.1 Brand Preferences and factors influencing choice

Figure 10: Graphical representation of milk brand choices and factors influencing them.



The brand milk of choice is pasteurised, as 95.4% of the respondents preferred it to the raw milk. This was based on the perception that packaged milk is safe as reported by 87.8% of the respondents. Other reasons for preferring this brand were convenience (24.7%), while price, less fat and other reasons constituted 8.5%. Most respondents (74.1%) said they would choose unpackaged milk because of price, being cheaper as shown in appendix I. Other reasons for choosing raw milk included freshness (13.2%), thickness (9.3%), while taste and other reasons accounted for 5.9%.(figure 5 shows graphic responses of these results.

4.4.2 Attitudes towards safety of the milk in the market

The respondents' attitudes towards health risks associated with marketed milk were obtained using Likert 2-point scale. Twelve statements were presented to the respondents and they either agreed or disagreed. Clarification of technical terms and common views on milk in market were sought at focus group sessions. The results are presented below.

Frequency distribution of respondents' attitude towards the safety of milk in the market

Statement	**Agree(%)**
1. Milk hawkers should be licensed	66
2. Milk from hawkers is a health risk	33.5
3. Packaged milk is safe	87.8
4. Milk from hawkers' milk is fresh	13.2
5. Milk should be sourced from registered points only	78.2
6. The milk you buy is wholesome	41.8
7. Your supplier adds the following additives:	
a)water	17.4

b)margarine 5.6

c)flour 3.2

d)milk powder 8.6

e)other chemicals(specify) 6.1

8. Milk traders should be trained on hygienic handling of milk 97.3

4.4.2.1 Attitudes towards packaged milk

In a previous study (Omore *et al.*, 2002) the quality of the milk in the market was found to be low irrespective of the market pathway. The same study also found that milk is not always wholesome as it is at times adulterated with water, antibiotics and other solids. This study sought views of consumers on their perception of milk handling, quality and wholesomeness. Packaged milk was perceived to be safe by 87.8% of the respondents thus depicting a negative attitude. Consumers reported using it even when it curdled (spoilt) reinforcing the attitude that packaged milk was safe. In focus group discussions, it was established that this confidence was not based on scientific knowledge. Most respondents were ignorant of the term pasteurisation and even the few who said it was a boiling process did not know it was aimed at destroying pathogenic microorganisms. The high level of confidence as emerged at focus group discussions was based on facts such as; *sell by date* was always indicated on the packet. That the processors were also more traceable, accountable and with better hygiene standards. Handling of packaged milk was also more convenient and the likelihood of retailers further adulterating the product was eliminated.

4.4.2.2 Attitudes towards licensing and government involvement

One of the reasons respondents felt that packaged milk was safe, was that the government

had a regulating function as all milk processors were assumed licensed. Most respondents favoured government involvement in the industry as it also emerged that about 66% would also like the informal sector (hawkers) to be licensed. This positive attitude is also in agreement with public health regulations (ROK, 1997). This positive view was emphasised by a further 78.2% who were in agreement with the Public Health Act (Cap 254) that milk should only be sourced from registered points. The licensing of traders should incorporate training as indicated by 97.3% of respondents who felt that milk traders should be trained on hygienic handling of milk.

4.4.2.3 Attitudes towards unpackaged milk

About 66.5% of the respondents felt hawkers' milk was a threat to their health; this negative attitude was discounted by a previous study (Omore *et al.*, 2002) that reported milk quality being poor irrespective of the market pathway. The concern was mainly on milk handling as exemplified by opponents to licensing of milk hawkers. Some comments captured this view very graphically, "Milk is not 'mitumba'" (referring to a common term for second hand clothes). They also said that licensing hawkers was 'to allow them to mess' meaning that they viewed hawkers as a risk to their health. The respondents viewed hawkers as dirty and reported; *"Flies in milk bars are worse than those from pit latrines."* There was also the feeling that milk that soured in milk bars was sold to the consumers as 'mala' (a common term for fermented milk).This brand of milk used because it was cheaper, the quantities bought were adjustable to amounts required and that delivery was regular and the doorstep.

4.4.2.4 Attitudes towards milk wholesomeness

The view that milk in the market is adulterated was across board. Only about 41.8% of

respondents thought the product they used was wholesome (negative attitude). The term was understood among respondents as most gave correct descriptions in focus group discussions. Common descriptions included absence of contaminants, foreign bodies and absence of spoilage. The feeling that processed milk was adulterated was based on the belief that this brand had a prolonged shelf life and *thin (*skimmed*).* The unpackaged milk raised more concerns. Only about 13.2% felt hawkers' milk was fresh. A term used to mean that the milk was whole and raw and hence had more nutrients. This negative feeling contradicted another group who described this brand of milk as being too watery and *thin*. Despite the feeling that milk was not wholesome, most respondents were ignorant to likely additives.

4.4.2.5 Attitudes to possible additives

Answers to common views on possible additives yielded the following results. About 17.4% said water was likely contaminant (a positive attitude), 5.6% reported margarine and 3.2% flour. These views agree with a report by Omore *et al.*, (2002) that found samples of milk with butterfat>6%, added water, antibiotics and other solids. Respondents also considered milk powder as a contaminant and about 8.6% said they occasionally find it in their milk. This negative attitude is despite the fact that processors reconstitute milk powder in times of milk shortages. Most of the respondents in focus group discussions felt that hawked milk was preserved with laboratory chemicals such as formaldehyde and hydrogen peroxide, and attributed a fall in spoilage rates in this brand, to this. Pressed for qualification they said that these chemicals are bought from school equipment suppliers.

4.4.3 Attitude index

This was obtained by creating a composite score by summing up responses to questions with Likert style wording. Only two levels of agreements were considered (Agree or Disagree). This type of scale assumes equal weighting to each question. (Dooley, 2001)

To compute an attitude index from the responses given, a score of zero was awarded for every response depicting a negative attitude and a score of one for every response depicting a positive response. A negative attitude denoted that the respondent did not view oneself at risk from the milk in the market, while a positive one was the extreme opposite. Moderate attitude implied the respondent was not sure if he was at risk. The scores of every respondent were summed up. The highest possible score was 12 while the lowest was zero.

The scores were then categorized as follows.

Scores	Attitude
0-4	Negative
5-7	Moderate
8-12	Positive

Table 12: Frequency distribution of categorised respondents' attitude index

Index	Score	Frequency	Proportion
Negative	2	4	1.0
	3	17	4.2
	4	40	9.8
Moderate	5	80	19.6
	6	142	34.7
	7	72	17.6
Positive	8	43	10.5
	9	5	1.2
	10	5	1.2
	11	1	0.2
Total		**409**	**100**

N=409

Table 12 shows that 14.9% of the respondents had a negative attitude depicting confidence in the milk in the market. 71.9% of the respondents had a moderate attitude and 13.2% had a positive attitude depicting low confidence in the milk in the market. The mean score was 5.93.

4.4.4 Relationship between Attitude index, the named SE-D characteristics and knowledge

To determine the relationship between attitudes towards health risks that may be present in milk, the computed Attitude index and the named socio-economic and demographic characteristics were correlated using chi-square test at significant level $p<0.05$. Attitudes were not influenced by knowledge or any of socio- economic and demographic characteristics as illustrated below .There was also no significant relationship between age and attitude index (χ^2=6.925,df=4, p = 0.140),or income and attitude index (χ^2=3.070,df=4 p = 0.546)). There was also no significant relationship between educational level and attitude index (χ^2 = 8.376,df=4, p = 0.079),or between residential areas and the attitude index (χ^2=0.708, df=2, p = 0.702). There was no significant relationship between knowledge and attitude. (χ^2=0.384, df=1, p = 0.535).

4.5 Respondents practices

This section summarises the consumers' practices. It includes the places where consumers buy milk, the factors that influence them to buy milk from those places and how they handle this milk before consuming it.

4.5.1 Sources of milk and factors influencing brand choice

The respondents' sources of milk and factors influencing the choice were determined by asking a set of closed questions.

Table 13: Sources of milk and factors influencing source and brand of milk bought

Characteristic	Category	Frequency	Proportion (%)
Brand of milk	Packaged	343	83.9
	Unpackaged	66	16.1
Source of milk	Kiosk	214	52.3
	Supermarket	148	36.2
	Hawker	44	10.8
	Don't buy	3	0.70
*Factors for selection on where to buy milk	Cleanliness	296	72.7
	Convenience	201	49.4
	Price	155	38.1
	Other	12	2.90
*Do you know where your supplier sources his milk?	Yes	162	39.6
	No	247	60.4
Duration with current supplier	1 day	59	14.5
	1 week	17	4.20
	1 month	23	5.60
	3 months	54	13.2
	More than 3 months	256	62.5
*Reasons for changing supplier	Price	103	25.2
	Milk souring	78	19.1
	Added water	70	17.1
	Quantity	38	9.30
	Other (relocating)	61	14.9

N=409 * multiple responses allowed

Most respondents (83.9%) use packaged milk. The majority of the respondents buy milk from kiosks at 52.3%, while those buying from supermarkets are 36.2% and only 10.8% buy from a milk hawker. A large number of the respondents (60.4%) do not know where the milk bought was sourced though a majority (75.7%) maintain the same supplier for three or more months. Some of the premises that sold milk were photographed and are presented in the plates 2 and 3 below.

Plates 2 and 3 illustrates some premises that sold unpackaged milk

Plate 2: The milk was transported using bicycles and in plastic containers and sold in the open-air on top of open sewer lines. Consumers bought the milk packaged in nylon bags.

Plate 3: Here, milk in plastic containers and meat were being sold in the same premises.

4.5.2 Milk Handling Practices

The following Table 14 shows how milk was handled in homes.

Table 14: Milk handling practices at home.

	Characteristic	Category	Frequency	Percentage
How milk is used in homes	Common uses of milk	Making tea	396	97.1
		Plain milk drinking	162	39.7
		Making dairy products	9	2.2
		Baking cakes	24	5.9
		Other (cooking vegetables and porridge)	27	6.6
	Who drinks plain milk in the home	Children only	162	39.7
		Entire family	117	28.7
		Adults only	29	7.1
		Cats	10	2.4
		Other (don't drink)	90	22.1
	Home fermented milk	Boiled milk	170	41.6
		Raw milk	66	16.1
		Either raw or boiled milk	58	14.2
		Don't ferment	115	28.1
	Home fermented milk practices	Good practices	170	57.8
		Poor practices	124	42.2
Storage	Time taken before using milk	Immediately	270	66
		1-2 hours	45	11
		1 day	73	17.8
		Other	21	5.2
	Daily frequency of milk purchase	Once	303	74.1
		Twice	83	20.3
		Thrice	11	2.7
		Other	12	2.9
	Storage conditions	Refrigeration	175	42.8
		In water	109	26.7
		Room temperature	112	27.4
		Freezing	39	9.5
		Other	39	9.5
	Storage practices	Good practices	171	49.3
		Poor practices	176	50.7
Milk spoilage	Milk that sours at home	Raw milk	129	32.3
		Previously boiled milk	72	18
		Both raw & previously boiled milk	190	47.5
		Doesn't sour	9	2.2
	Uses of milk that sours at home	Thrown away	272	67.3
		Ugali accompaniment	108	26.7
		As a drink	24	5.9
		Feed pets	23	5.7
		Other	35	8.7
	Spoilt milk practices	Good practices	253	62.5
		Poor practices	152	37.5

4.5.2.1 Uses of milk

Table 14 shows, common milk uses in homes are: making tea as reported by 97.1% of the respondents, plain milk drinking (39.7%) while making of dairy products and other cookings (cakes and enriching vegetables) was reported by 8.1% of the respondents. Those who reported using milk as a drink gave it mainly to children (39.7%), while adults and the entire family including pets formed 38.2% of the respondents. The other 22.1% of the respondents reported not using milk as a drink.

4.5.2.2 Storage practices

Most respondents buy milk frequently with 97.1% (Table 14) of the respondents reporting buying milk once or more times in a day. Majority of these respondents (77%) use the milk almost immediately with about 17.8% of the respondents storing milk for a day. Only 2.9% of the respondents buy milk to store. Storage of the milk is in refrigerators (42.8%), water (26.7%), room temperature (27.4%) and freezers (9.5%). According to NRAEF (1999), the storage conditions can be further grouped into good storage practices (refrigeration and freezing below 4^{o} C) and poor storage practices (storage at room temperature, storage in water and storage at temperatures $7/8^{0}$ C). By the use of the above categorisation, 49.3% had good storage practices while the rest (50.7%) had poor practices (Table 14).

4.5.2.3 Home fermentation practices

Occasionally people ferment milk in their homes. When information was solicited for home fermenting practices, about 41.6% of the respondents reported boiling milk prior to fermenting. About 16.1% of the respondents reported fermenting raw milk and 14.2% fermented either boiled or raw milk. One of the reasons milk is boiled prior to

fermentation is to destroy pathogenic microorganisms (Robinson, 1993). From the above, home fermentation practices were categorized as good home fermentation practices (using previously boiled milk) and poor home fermentation practices (using un-boiled milk or either boiled or un-boiled milk). The results were; 57.8% as having good home fermentation practices and 42.2% of the respondents having poor home fermentation practices (Table 14).

4.5.2.4 Uses of spoilt milk

Milk spoilage is characterised by souring and curdling (Robinson, 1993). Table 14 shows, almost half of the respondents, 47.5%, reported either previously boiled or raw milk souring in their homes, while 32.3% reported raw milk (not boiled) souring. Only 18% reported previously boiled milk as the milk that sours. Most of the respondents (67.3%) reported throwing away this milk. However, other uses like using it as ugali accompaniment was reported by 26.7% of the respondents, drinking the fermented milk by 5.9%. Other uses included enriching vegetables as stated by 8.7% of the respondents and feeding pets by 5.7%.Good spoilt milk practices included throwing away the spoilt milk all the time or further cooking it especially in vegetables. The rest of the practices; using it as a drink or as ugali accompaniment or feeding it to pets was classified as poor spoilt milk practices. About 62.5% had good spoilt milk practices while the rest 37.5 % had poor practices.

Table 15: Significant associations between Brand of milk and Respondents Attitudes and SE-D Characteristics

Factor	Brand of Milk							
	Packaged		unpackaged		Total		Chi square	p value
	n	P (%)	n	P (%)	n	P (%)		
Attitude index								
negative	49	80.3	12	19.7	61	14.9		
moderate	262	89.1	32	10.9	294	71.9		
positive	32	59.3	22	40.7	54	13.2	30.712	0.0002
Education								
primary	55	60.4	36	39.6	91	23		
Secondary	201	89.7	23	10.3	224	56.7		
university	73	83.3	66	16.7	80	16.7	44.484	0.0002
Residences								
Middle-Upper income	155	92.3	13	7.7	168	41.1		
low income	188	78	53	22	241	58.9	14.861	0.001
Income								
<10,000	134	82.2	29	17.8	163	63.7		
10-40,000	50	89.3	6	10.7	56	21.9		
>40,000	37	100	0	0	37	14.4	8.618	0.013

n = number of respondents P (%) = proportion in percentage

Table 15 shows that about 15% of the respondents had a negative attitude towards the milk in the market. Majority (80.3%) of them used packaged milk while the remaining 19.7% used unpackaged. In comparison, of the 13.2% who had a positive attitude the usage of the two brands was almost equal at 59.3% for packaged and 40.7% for the unpackaged. The positive association between education, income and residences followed a similar trend in their association with brand of milk. Education had the highest association and income the least. Most respondents (63.7%) earned less than Kshs. 10, 000 per month and 17.8% of them used unpackaged milk while no one earning over Kshs. 40, 000 (14.4%) bought unpackaged milk. Packaged milk was used by 86.3% of respondents. Prices of milk as shown in appendix 1 suggest small variation between the

two main milk brands. About 20.3% of the respondents had been to university. Majority of these (91.3%) use packaged milk. Of the 23% of the respondents who have attained an educational level of primary or below, 39.6% used unpackaged milk. However, unpackaged milk is mainly used in low-income areas. Of the 58.9% of those living in low-income areas, 22% use unpackaged milk compared to the 7.7% of the 41.1% living in the middle-upper income areas that use unpackaged milk .These results suggested a very high usage of packaged milk with about 83.9% using it. The choice of unpackaged milk had a strong relationship with income.

4.5.3.2 Relationship between Storage of milk and knowledge, attitudes and SE-D characteristics

Storage of milk should be in the temperature zone of below 4 degrees centigrade to minimise microbial growth (NRAEF, 1999). The respondents who reported storing milk in refrigerators and freezers were assumed to meet these storage conditions and hence had good storage practices. Those who reported storing milk in water and room temperature were assumed not to achieve the above storage temperatures and hence poor practices. Storage practices were correlated with knowledge, attitudes and SE-D characteristics to establish the association using chi-square at $p<0.05$. There was **no significant** relationship between attitude index and storage practices (χ^2=0.014, df=2, p = 0.993).

There were significant relationships between knowledge and storage practices (χ^2=10.125, df=1 p = 0.001), age and storage practices (χ^2=14.664, df=2, p=0.001). Other significant relationships were between income and storage practices (χ^2 = 79.610,df = 2, p = 0.0001) education level and storage practices (χ^2 = 73.156,df = 2, p = 0.0001)

residential areas and storage practices ($\chi^2 = 173.395$ df = 1 p =0.00001). The significant relationships are presented in Table 16 below.

Table 16: Significant associations between storage practices and Respondents Knowledge and SE-D characteristics

Factor	Storage Practices							
	Good		Poor		Total		Chi square	p value
Knowledge index	n	P (%)	n	P (%)	n	P (%)		
Low	97	60.2	64	39.8	161			
Medium	92	43.6	119	56.4	211	56.7	10.125	0.001
Age								
<30yrs	84	40.8	122	59.2	206	59.4		
30-40yrs	66	61.7	41	38.3	107	30.8		
>40yrs	21	61.8	13	38.2	34	38.2	14.664	0.001
Education								
Primary	10	14.5	59	85.5	69	19.3		
secondary	103	49	107	51	210	58.7		
University	67	84.8	12	15.2	79	22.1	73.156	0.0001
Income								
<10,000	39	27.3	104	72.7	143	60.6		
10-40,000	45	80.4	11	19.6	56	23.7		
>40,000	35	94.6	2	5.4	37	15.7	79.610	0.0001
Residences								
Middle-Upper income	148	88.6	19	11.4	167	44.9		
Low income	41	20	164	80	205	55.1	173.395	0.0001

n = number of respondents P (%) = proportion in percentage

Table 16 shows that the storage practices were strongly associated with types of residences. This was closely followed by income and education .The least association was between knowledge and storage practices. Of the 57.6% of respondents with medium level of knowledge, almost a similar proportion of them (56.4%) had poor practices. The relationship between level of knowledge and storage practices was inverse. Those with

low level of knowledge (43.3% of the respondents) had better storage practices as a majority (60.2%) had good storage practices.

Previously, education, age, income and residences were shown to be positively associated. This trend was repeated with storage practices.

Table 16 shows that 59.4% of the respondents were below 30 years. Of these, 40.8% had good practices and 59.2% had poor practices. Of those above 41 years, who were 9.8% of the respondents, (61.8%) had good practices and only 38.2% had poor practices. This was probably because the older population had better incomes and therefore in a position to afford a refrigerator or a freezer.

The association between education and storage practices shows that most (84.8%) of those with university education, who were 22.1% of the respondents had good storage practices. Almost a similar proportion (19.1%) of respondents was of primary education. About 85.5%of them had poor storage practices.

The association between income and storage practices showed those who earned Kshs.10, 000 and below about 61% of the respondents majority (72.7%) had poor practices. In comparison most (94.6%) of the 15.7% respondents earning above Kshs. 40, 000 per month had good storage practices.

The strong association between residences and storage practices showed a very high proportion (88.6%) of the 44.9% living in Middle-Upper income areas had good storage practices. Those living in low income areas who were 55.1% of the respondents about 80% of them had poor practices.

4.5.3.3 Relationship between Home fermented milk and knowledge, attitudes and SE-D characteristics

The respondents who always boiled milk prior to fermentation were considered to have good home fermentation practices. Those who fermented raw milk, raw or boiled had poor practices. There were **no significant** relationships between knowledge and home fermented milk (χ^2=0.009, df=1, p = 0.923), attitude and home fermented milk (χ^2=4.306, df=2, p = 0.116). age and home fermented milk (χ^2=2.694,df=2, p = 0.26) income and home fermented milk (χ^2=5.49,df=2, p = 0.064).

Significant relationships were obtained between educational level and home fermented milk (χ^2=11.271,df=2, p = 0.004) and residential areas and home fermented milk (χ^2 = 4.056 df = 1, p = 0.044).The significant relationships are shown in Table 17 below

Table 17: Significant associations between Home Fermented milk and knowledge, attitudes and SE-D characteristics

Factor	Home Fermented Milk							
	Good practices		Poor practices		Total		Chi square	P value
	n	P(%)	n	P(%)	n	P(%)		
Education								
Primary	21	38.9	33	61.1	54	19.1		
Secondary	107	61.1	68	38.9	175	61.8		
University	37	68.5	17	31.5	54	19.1	11.271	0.004
Residences								
Middle-Upper	76	65	41	35	117	39.8	4.056	0.044
Low income	94	53.1	83	46.9	177	60.2		

n=Number of respondents P (%) = proportion in percentage

Of the 19.1% of the respondents who had not completed primary schooling, 61.1% had poor practices of fermenting milk at home. On the other hand, 68.5% of those who had attained a university degree (19.1%) had good practices of fermenting milk at home.

Results also showed that 39.8% of the respondents lived in middle-upper income areas. Of this, 65% had good home fermented milk practices. Of the 60.2% living in low-income areas, 53.1% had poor practices (Table17).

4.5.3.4 Relationship between Spoilt milk Practices and knowledge, attitudes and SE-D characteristics

In this study respondents were considered to have good practices if they disposed off the spoilt milk or exposed it to further cooking like when using it to prepare vegetables. The ones who used it as a drink or as an accompaniment to ugali had poor practices.

There was **no significant** relationship between knowledge and the spoilt milk practices (χ^2=0.412, df=1 p = 0.521), educational level and uses of spoilt milk (χ^2=2.363, df=2 p = 0.307) and age and spoilt milk practices (χ^2=1.69,df=2 p = 0.557).

Significant relationships were obtained between attitudes and spoilt milk uses (χ^2=7.815,df=2 p = 0.02), income and uses of spoilt milk (χ^2 = 6.430,df = 2 p = 0.04) and residential areas and uses of spoilt milk (χ^2 = 10.569,df = 1 p = 0.0011).The significant relationships are shown in Table18 below

Table 18: Significant associations between Spoilt milk Practices and attitudes, and SE-D characteristics

Factor	Spoilt Milk Practices							
	Good practices		Poor practices		**Total**		**Chi square**	**p value**
	n	P(%)	n	P (%)	n	P (%)		
Attitude index								
Negative	41	67.2	20	32.8	61	15.1		
Moderate	170	58.6	120	41.4	290	71.6		
Positive	42	77.8	12	22.2	54	13.3	7.815	0.02
Income								
<10,000	91	56.2	71	43.8	162	63.8		
10-40,000	38	69.1	17	30.9	55	21.7		
>40,000	28	75.2	9	24.3	37	14.6	6.430	0.04
Residences								
Middle-Upper	118	72	46	28	164	40.5		
Low income	135	56	106	44	241	59.5	10.569	0.0011

n = number of respondents P (%) = proportion in percentage

The respondents defined the term-spoilt milk variously. There was a consensus that "just curdling" did not qualify milk as spoilt. It emerged that if milk curdled and had a smooth consistency then the milk was safe for use and was often used as *mboga (used as ugali accompaniment)*. Milk was considered spoilt if it separated (whey off) and with a pungent smell. This was what could be thrown away or used in vegetables.

Table 18 shows the factors that may have influenced these views. The association between attitudes and spoilt milk practices shows that 15.1% of the respondents had negative attitudes. Of this, 67.2% had good spoilt milk practices and 32.8% had poor spoilt milk practices. Almost a similar number of respondents (13.3%) had positive attitudes. Of this, 77.8% had good spoilt milk practices and 22.2% had poor spoilt milk practices.

There was also significant relationship between the income level and spoilt milk practices. Of the 14.6% of the respondents with a monthly income of Kshs. 40, 000, 75.7% had good spoilt milk practices. About half (56.2%) of those earning Kshs. 10, 000 or less had good spoilt milk practices.

Income and residences had a direct relationship and the association between residences and spoilt milk practices followed this trend. Results also showed that 40.5% of the respondents live in middle-upper income areas. Of this, 72% have good spoilt milk practices. Of the 59.5% living in low-income areas, 56% have good practices. Since knowledge and education had no significant relationship with the spoilt milk practices one can assume that the practices were influenced by income and attitudes.

4.6 Relationship between milk brands and other practices

To find out if the brand of milk used influenced other practices in homes, cross tabulations were done between the practice packaged/unpackaged milk against milk that sours at home, storage practices, and milk fermented in homes.

There was **no significant** relationship between the milk spoilt in homes and the type of package (χ^2=2.205, df=2, p =0.006) and between packaged/unpackaged milk and milk fermented at home (χ^2=1.597, df=1, p =0.2).

The only significant relationship shown in Table 20 below was between brand of milk and storage practices. (χ^2=8.174, df=2, p =0.004).

Table 19: Chi-square results of relationship between brand of milk and storage practices

Storage practices	Type of package		
	Packaged	Not packaged	Total
Good storage practices	173	16	189
	(53.7%)	(32.0%)	(50.8%)
Poor storage practices	149	34	183
	(46.3%)	(68.0%)	(49.2%)
Total	322	50	372
	(86.6%)	(13.4%)	(100.0%)

χ^2 = 8.174, df = 2, p = 0.004

Results showed that 86.6% of the respondents used packaged milk. Of this, 53.7% had good storage practices and 46.3% had poor storage practices. Of the 13.4% of the respondents who used unpackaged milk, 32.0% had good storage practices and 68% had poor storage practices.

CHAPTER FIVE: DISCUSSION

5.1 Sample characteristics

Figure 4 showed that most respondents were between the ages 21-30 years, followed by 31-40 years. These two age groups constituted 78.5% of the respondents. These form the economically productive age group. This trend is in agreement with (APHRC, 2002) assertion that the urban population consists mainly of men and women in 15-49 years age group. According to the same report, the urban population pyramid differs with the national one in that the latter migrates to towns in search of economic opportunities.

The distribution of respondents according to residences showed that 41.1% are in the middle-upper income group while those of the low-income group formed 58.9% of the respondents (Table 4). This differs slightly with the findings of (APHRC, 2002) that reports a 50.2%:49.8% ratio of low income to middle-upper group respectively. This is justified by the fact that the lower income group are more in need of intervention compared to the middle-upper group (FAO, 2000).

Income levels in the sample showed 63.7% of the respondents earn income below Kshs. 10,000 (Figure6). This differs with (GOK, CBS, 2002) report that says that 80% of the urban population spends less than Kshs. 10,000 per month. A possible explanation for this is that the CBS report covered more urban areas than this report. There were also a very high percentage of non-respondents (37.4%) due to feelings of inadequacy. Inflation rates in Kenya have been increasing peaking to 46% in the 1993 period resulting in more money being in circulation and a decline in real per capita income (Cbs, 2002).

Educational attainment amongst the respondents was high with 77% reporting having been to secondary school (Figure 5). APHRC, 2002, reports that residents of Nairobi

being migrants from other parts of Kenya seeking better opportunities have the highest educational attainment. At least 86% of the population have completed primary education. The findings of this report differ slightly because the respondents were not asked to state completed school years, as was the case with the APHRC (2002) report.

5.1.2 Significant Relationships between the SE-D characteristics

Tables 5-7 showed educational attainment had direct relationship with income and areas where one choose to live. The respondents with higher education had better incomes and had better living conditions. About 43.4% of the 21.4% of university graduates earned >Kshs. 40,000 compared to only 4% of the 20.2% of those with a primary education. Similarly, 82.2% of the university graduates lived in middle-upper income areas compared to only 4.4% of the primary school leavers. This could mean the higher the education the better the chances of finding a well- paying job or doing well in business. Choices of good living were dictated by income rather than any other considerations.

5.2.1 Consumer knowledge of safe milk handling and cross contamination

Knowledge of milk handling and subsequent illnesses was low. The highest score was 19 out of the possible 28 translating to 68% on the knowledge index scale. The mean was score 10.3 with a mode score of 7(Table 9). About 41.3% of the respondents had a low knowledge index and 58.7% had a medium knowledge index (Table 10). Figures 7-9 showed knowledge on milk handling and likely cross-contamination illnesses. Only 57.7% reported that the quality of milk could be improved on boiling. A smaller percentage 47.2% reported refrigeration as a means of prolonging freshness and only 53.8% reported that water could compromise the quality of milk. This then may mean that boiling milk in homes may not be adequate to kill pathogenic microorganisms and

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refrigeration temperature may not be low to discourage growth of microorganisms. The fact that water was not recognised as a possible contaminant to milk means that consumers may still use milk that they suspect to have water. This was also reported in focus group discussions. Respondents reported buying milk from informal markets despite the fact that this milk was "thin" and watery. They reported using the milk because the product was cheaper and could be sold in small quantities. A high knowledge of cross-contamination was reported. Majority of respondents (85.1%) reported that cholera could be transmitted to other family members while cooking. This is possibly due to the many public campaigns that targeted cholera in times of epidemics

5.2.2 Consumer knowledge of likely health risks in marketed milk.

Majority of respondents (94.9%) reported that they knew they could get ill from spoilt milk. An earlier report by Omore *et al* (2002) reported that 65% of Nairobi consumers knew they were at risk of disease if they consumed raw milk. However, the actual danger was not fully known. A disease like typhoid was only known as a risk to 46.7% and tuberculosis to 18.1% of respondents (Table 8). However, most respondents knew that diarrhoea was a risk in both raw and poorly handled milk. It was reported by 71.9% and 77.3% respectively. Alupo (2002) had also reported the high awareness of possible causes of diarrhoea as a disease of poor personal hygiene.

Stomach cramps was the next most recognised symptom at 53.8% and 66.7% in raw and poorly handled milk respectively. Most respondents did not recognise headaches nausea, vomiting, and dizziness as mild attacks of food poisoning. A combined total of 10% being the only respondents who were aware of these symptoms (Table8). This is likely to mean food poisoning may be un-noticed and the real risk is under estimated.

5.2.3 Relationship between consumer knowledge and the selected SE-D

Table 11 shows results of relationships between the selected social demographic characteristics and knowledge index. Age had no influence on knowledge (χ^2=3.868. df=2, p=0.145).The rest of the SE-D had significant relationship. Knowledge had an inverse relationship with income, education and residential areas. Those with low knowledge were the respondents with high levels of education, high incomes and lived in the middle-upper income areas. For example, about 67.5% of those earning Kshs. 10,000 or below had medium knowledge. Low knowledge was recorded in almost equal numbers in the income levels of Kshs. 10,000-40,000 and >Kshs. 40,000 being 55.4% and 56.8% respectively ((χ^2=13.419, df=2, p=0.001). The relationship between education and knowledge showed that about 72.5% of consumers with primary or below education level had medium knowledge while those with university education had a ratio of 55:45 of low: medium knowledge index (χ^2=13.415,df=2, p=0.001).The same trend was repeated in the relationship between residential areas and knowledge index. Majority (60.7%) of those living in Middle-Upper income areas had low knowledge while a majority (72.2%)of those living in low income areas had medium knowledge((χ^2= 44.228,df=1, p=0.0003). In focus group discussions, knowledge of illnesses was reported being from life experiences. The respondents living in the low-income areas reported suffering more from diseases of poor hygiene. Health care givers had transmitted the knowledge to them. This suggests that campaigns on food handling practices and likely health risks would be well received by respondents.

5.2.4 Relationship between knowledge and practices

Knowledge did not seem to influence practices as no significant relationship was

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observed between knowledge and packaged/unpackaged ((χ^2=0.384,df=1, p=0.535). It also did not influence how milk was fermented in homes (χ^2=0.009,df=1, p=0.923) or how consumers used milk that soured in homes(χ^2=0.412,df=1, p=0.923). However, a significant relationship was observed between knowledge and storage practices. There was an inverse relationship between knowledge and storage practices. Most (60.2%) of those with low knowledge having good storage practices compared with 43.6% of those with a medium knowledge (χ^2= 10.125, df=1, p=0.001).The respondents with good storage practices were the ones with higher incomes. This stresses the role played by incomes in good food practices. It was clear the consumers' knowledge did not improve their practices. This may therefore mean increasing level of awareness without subsequent improvement of incomes would not achieve desirable results.

5.3 Consumer brand preferences and factors influencing choice

Packaged milk is the preferred choice of milk. About 95.4%of the respondents would prefer to buy packaged milk (Figure 10). This preference could be based on the assumption that packaged milk is safe as 87.8% of the consumers reported buying packaged milk for safety. However, only 74.4% used packaged milk (Appendix 1, Table1) judging from their stated prices at which they buy milk. This agrees with Ouma *et al.,* (2001) who reported that only about 23% of Nairobi consumers use informally traded milk. Only 16.1% of the respondents admitted using un-packaged milk. The main reason for buying unpackaged milk was price and the flexibility of units sold. This high preference for packaged milk on assumed quality suggests that consumers would like a product that is minimally handled before they use it.

5.3.1 Consumer attitudes, and factors influencing them

The attitudes towards safety of the milk in the market showed that 14.9% of the respondents had confidence in the milk used in their homes. A majority of 71.9% of the respondents had moderate attitudes and only 13.2% were wary of the milk they used in their homes. Most of the respondents (87.8%) felt that packaged milk was safe; which was a negative attitude considering evidence of works by (Omore *et al.*, 2002) that showed the quality of milk in Kenya to be poor irrespective of the marketing pathway. Findings from this research also showed that the spoilage rates of milk in homes had no relationship with the market pathway as chi-square results showed no significant relationship between packaged/unpackaged and milk that sours at home ((χ^2=2.205,df=2, p=0.06). Majority of the respondents (97.3%) felt that traders should be trained on hygienic handling of milk. This is a genuine concern considering that some of the places where milk selling points captured in this report are atop of open sewer lines (Plates 3 and 4). Milk was also sold in butcheries and transported in plastic containers that were difficult to clean to proper sanitisation levels. Two-thirds of the respondents (66%) felt that hawkers should be licensed. This was reinforced by the 78.2% of the respondents who felt that milk should only be sold at registered points. This suggests that consumers would be more comfortable with the milk bought if there is a regulating body that monitors the activities of the traders.

Socio-economic and demographic characteristics did not influence attitudes as the following chi-square results showed no significant relationships between attitude index and the selected variables. (age and attitude index (χ^2=6.925, df=4, p=0.140), education and attitude index (χ^2=8.376, df=4, p=0.079), income and attitude index (χ^2=3.070, df=4,

p=0.546), residential area and attitude index (χ^2=0.708, df=2, p=0.702)). Knowledge of health risks and cross –contamination risks did not influence attitude (χ^2=0.384, df=1, p=0.535). Perhaps since the respondents were almost the same age and of almost equal education levels their life experiences had no influence on their attitudes. This therefore implies a campaign targeting consumers in Nairobi would be received almost uniformly across the income divide.

5.3.2 Attitudes and practices

Attitudes influenced the brand of milk used. Almost an equal number of consumers with a positive attitude used both packaged or unpackaged at 59.3% and 40.3% respectively (χ^2=30.712, df=2, p=0.0002). Attitudes had no influence on how milk was stored or fermented in homes. However, positive attitudes influenced how spoilt milk was used in homes. About 77.8% of those with a positive attitude threw away spoilt milk compared to 58.6% of those with a moderate attitude (χ^2=30.712, df=2, p=0.0002).

5.4 Consumer practices

Table 13 shows that even though most respondents (72.7%) considered cleanliness as a consideration when buying milk, about 52.3% of the respondents sourced their milk from kiosks. These shops though conveniently located near homes, lack basic facilities like toilets and are sometimes used as homes by their owners. Most respondents (62.5%) reported that they trust their suppliers and have not had reason to change their suppliers in the last 3months. Milk usage in homes was between 1-2 litres. About 70% of the respondents use up to 2 litres of milk daily with a mode of one (appendix 1 Table b). Most respondents (95.4%) reported using the milk for making beverages or tea. Some of the respondents use it for feeding children (39.7%). Most of the milk bought was used

immediately with about 94.4% of the respondents reporting buying milk once or twice in a day.

5.4.1 Consumer storage practices

Most of the respondents (77%) said they used milk within 2 hours of buying. This fast usage could imply reduced risk to the consumers. However, 23% of the respondents reported storing milk; with 42.8% of these storing it in refrigerators, 54.1% at room temperature and 26.7% in water (Table 14). Storage at room temperature and in water is within the temperature range of 21-49 degrees centigrade, which is the optimal temperature for microbial growth. Considering that, respondents had low knowledge of gains one makes on refrigeration there is no certainty that refrigeration temperatures of below 5 degrees are observed. This means that even refrigerated milk could be risky.

5.4.2 Uses of spoilt milk

Table 14 also shows almost half of the respondents (47.5%) reported that milk that sours (an indication of spoilage) in homes is either previously boiled or raw/un-boiled while 32.5% of the respondents reported that raw /un-boiled milk soured. This means that boiling at home does not destroy spoilage microorganisms. This could either be due to poor quality milk bought and that would agree with Omore *et al.*, (2002) assertion that most of the milk in the market is of poor quality. It could also be due to poor hygiene standards in homes or inadequate heat treatment. About 32.6% of the respondents are at risk of infection from drinking the milk souring in their homes. Majority of the respondents (67.8%) reported throwing away the spoilt milk while 8.7% cooked the fermented milk further in vegetables. Milk fermented at home can endanger health if not correctly done. Manufactures of fermented milk products boil the milk first to destroy

pathogenic microorganisms before fermenting the milk in controlled conditions. About 41.6% of respondents reported fermenting milk after boiling it, while 30.3% fermented milk that was either boiled or not boiled. there is need to educate consumers on safe methods of fermenting milk.

5.5 Factors affecting practices

Correlating some of the practices namely packaged/unpackaged, home fermented milk, spoilt milk practices and storage practices against SE-D characteristics showed all the practices had a direct or indirect relationship with income (Tables 15-18). Knowledge was only related significantly to storage practices, which too showed a very strong leaning on incomes. Despite knowledge, the good food practices are related more towards economic abilities of the respondents. Attitudes were significantly related to brand of milk and spoilt milk practices. This means that intervention strategies aimed at strengthening positive attitudes are more likely to improve milk practices.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 A Summary of Conclusions

a). Most respondents were young over 90% being less than 40 years with a high literacy level (77% had at least secondary education.) The more educated, had better incomes and lived relatively well .About 90% with primary education earned less than 10000 shillings and 95.6% of them lived in low-income areas. However, the high literacy does not seem to translate to high incomes because the majority (63%) of those living in the low-income areas (slums) have at least secondary education.

b) Knowledge of health risks that may be present in milk and food handling practices was low to medium as reported by 41.3% and 58.7% respectively. Though practices especially boiling milk in tea as reported by 97.1%may suggest knowledge of food handling, only 57.7% of respondents know that this also prolongs freshness. Most respondents did not know vomiting, nausea, headache and dizziness as symptoms of food poisoning. Only about 30% recognised the first two symptoms while 3% recognised the latter two. Knowledge of likely risks was from life experiences and very closely tied to income levels. Majority (72.2%) of those living in low income areas were more knowledgeable than those in Middle-Upper income areas ((χ^2=44.228,df=1 p=0.0003).

c) Attitudes towards safety of the milk were mainly moderate as reported by 71.9%.The respondents also tended to trust the milk bought. About 75.7% of respondents had sourced milk from one supplier for 3or more months. However, most respondents would like a market-regulated system with quality assurance.

About 97.3% of respondents would prefer that traders be trained in hygienic handling of milk and 78.2% preferring to source milk from registered traders.

d) Most respondents (97.1%) boiled milk especially in making beverages and this was mainly pasteurised milk as it was used by about 83% of the respondents. Almost equal number of respondents had good or poor practices in relation to, home fermented practices, and storage practices exemplified by ratios of 57.8:42.2 and 49.3:50.7 respectively.

e). Practices were not related to knowledge of health risks and safe food handling. The respondents with moderate knowledge also had poor practices .This is exemplified by storage practices where 60.2% with low knowledge had good storage practices ($\chi^2 = 10.125$, df = 1p = 0.001). About 60.7 % of those with low knowledge index also lived in middle-upper income areas ($\chi^2 = 44.228$, df = 1 p = 0.0003). Attitudes influenced the choice of brand used and uses of milk spoiling in homes. This means that practices are closely tied to incomes especially to whether one can afford a refrigerator or the loss of throwing away spoilt milk rather than safe food handling practices. Hence issues related to food insecurity especially poverty should be considered if everyone is to enjoy adequate and safe food.

6.2 Operational recommendations

a). Currently, the policy environment in Kenya is to allow hawking of milk. About 41.3% of consumers had low level of knowledge, while the rest (58.7%) had medium level of knowledge of health risks that may be present in milk. There is need for the government to carry out a health assessment impact on the milk

policy before implementing it for the obvious dangers of having a product that could have health implications on the population.

b). About 97.3% of respondents would prefer milk traders to be trained on milk handling, while 78.2% preferred to source milk from registered points. The government should consider setting up a body that specifically deals with setting standards of milk and other foods and ensuring that minimum safe standards are assured. This can be further enhanced by opening up food surveillance centres within estates to supervise the activities of food trade and take appropriate steps to improve food safety and sanitation.

c). Income rather than knowledge of health risks determined whether consumers had good or poor practices as exemplified by storage practices. About 60.2% of the respondents with low knowledge but living in the upper-middle income areas had good practices. This may imply that practices were related to the ability to afford a refrigerator or to throw away spoilt milk. There is need for government to address incomes of the people living in low-income areas.

d). About 41.3% of respondents had low level of knowledge while 58.7% had medium level of knowledge. Those with the higher level of knowledge (medium) also reported in FGDs suffering from hygiene related illnesses and had been counselled by health care givers. Universities and Non Governmental Organisations should educate consumers on health risks and safe milk handling.

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6.3 Suggestions for further research work

a). Social research should be done amongst the milk traders to find out whether they know the health risks associated with milk and what they do to protect their customers.

b). A research similar to this one should be carried out in the rural setting, to find out if cultural practices influence knowledge and handling of milk.

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Appendix I: Selected Statistical Results

Table 1: Prices of milk in the market

Frequency distribution of prices at which respondents' bought milk

Price (Kshs.)	Frequency	%
20-24	25	6.00
25-29	7	1.70
30-34	55	13.4
35-39	16	3.90
40-44	24	5.90
45-49	51	12.5
50-54	224	54.8
55-59	5	1.20
don't buy	2	0.50
Total	**409**	**100**

N= 409

Prices of milk ranged from Kshs. 20-60.This study included some respondents that doubled as milk sellers. The mean price was within the range of Kshs. 40-44, mode was within the range of Kshs. 50-54 and median was within the range of Kshs. 50-54. Majority of the respondents' (74.4%) bought milk at prices higher than Kshs. 40(that is 5.9% at Kshs. 40-44, 12.5% at Kshs. 45-49, 54.8% at Kshs. 50-54 and 1.2% at Kshs. 55-59). The respondents' buying milk at a price less than Kshs. 40 was 25.6%(that is 6% at Kshs. 20-24, 1.7% at Kshs. 25-29, 13.4% at Kshs. 30-34 and 3.9% at Kshs. 35-39.)The different prices reflect the different brands sold. The prices for raw and pasteurised milk are close and this agrees with findings of smallholder dairy project (SDP, 2004).

Table 2: Amounts of milk used by respondents

Frequency distribution of amounts of milk used by respondents in a day

Amount of milk(litres)	Frequency	Proportion(%)
0.5	1	0.20
1.0	172	42.1
1.5	39	9.50
2.0	74	18.1
2.5	2	0.50
3.0	18	4.40
4.0	2	0.50
5.0	96	23.5
6.0	2	0.50
25.0	1	0.20
75.0	2	0.50
Total	**409**	**100**

N=409

Milk usage in homes is low. About 70% of the respondents use up to 2 litres of milk daily with a mode of one. Those reporting using more than 25 litres in a day were milk retailers.

Appendix 2: Research Instrument 1- Structured Questionnaire

SECTION A: DEMOGRAPHY, MILK QUALITY, SOURCE AND DISEASES

Sub-loc _____ Household No _____

Name	Relationship	Sex	Religion	Age	Education		Income	Source of Milk			
A02	A03	A04	A05	A06	A07	A08	A09	A10	A11	A12	A13
Respondent's name	Relationship of <resp> to household head 1. Head 2. Spouse 3. Co-wife 4. Son or Daughter 5. Relatives 6. Non-relatives 7. Others	What is <resp>'s sex? 1 Male 2 Female	What is <resp>'s religion? 1.Catholic 2.Protestant 3.Muslim 4.Traditionalist 5.Atheist 6.Other (specify)	How old was <resp> at his/her last birthday?	Highest education level attained? 1. Nursery 2. Primary 3. Secondary 4. University 8. DK	What is the number of people living in your house?	What is the monthly Household Income? 1. 0-10,000 2. 10,000 to 40,000 Ksh 3. Over Ksh 40,000 9. NR	Where do you buy your Milk? 1. Kiosk 2. Hawker 3. Duka/ supermarket 4. Don't buy	Is the milk you buy packaged? 1. Yes 2. No	If yes in A11, type of package? 1. Tetrapaks 2. Sealed bottles 3. Sealed nylon 4. Nylon bags 6. Used bottles 7. Others	Do you know if your milk hwaker is licensed? 1. Yes, licensed 2. Yes, not licensed 3. DK
A02	A03	A04	A05	A06	A07	A08	A09	A10	A11	A12	A13

Quality of Milk		Freshness		Hygenic Milk				Water	Diseases	
A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24
Do you test the milk you buy for quality? 1. Yes 2. No	If yes in A10 what do you test for? 1. Freshness 2. Thichness 3. Additives 4. Water 5. Others	Do you know how to prolong the freshness of milk? 1. Yes 2. No	If yes to A12, How? 1.Freezing 2.Boiling 3.Refrigeration 4.Adding chemicals 5.Others (specify)	Do you consider spoilt milk a health risk? 1. Yes 2. No 3. DK	If yes to A14, list diseases caused by spoilt milk? 1. Vomiting 2. Diarrhoea 3. Stomach cramps 4. Nausea 5. Headache 6. Dizziness 7. Others	Should milk traders be trained on hygenic handling of milk? 1. Yes 2. No 3. DK	Should milk be sourced from registered points only? 1. Yes 2. No 3. DK	What is the effect of adding water to milk? 1. Prolong freshness 2. Increase chance of spoilage 3. Little or no effect 3. DK	Do you know of any disease caused by raw milk? 1. Vomiting 2. Diarrhoea 3. Stomach cramps 4. Nausea 5. Typhoid 6. Tuberculosis 7. Others	Which diseases can be transmitted to family members while preparing or cooking food? 1. Cholera 2. Malaria 3. Typhoid 4. Tuberculosis 5. Others(specify)
A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24

SECTION B: PRACTICE AND ATTITUDES

Sub-loc _____ Household No _____

Practices											
A25	A26	A27	A28	A29	A30	A31	A32	A33	A34	A35	A36
What type of milk would you prefer? 1. Packaged 2. Pasteurized 3. Hawked 4. All of them	What are the main reasons for buying milk from a hawker? 1. Convinience 2. Price 3. Thickness 4. Freshness 5. Taste 6. Others	Do you know where your supplier source their milk from? 1. Yes 2. No	At what price do you buy your milk per litre? (Kshs)	How much milk is used in your house per day? (litres)	How often do you buy milk in a day? 1. Once 2. Twice 3. Thrice 4. Others	How do you use your milk? 1. In tea/coffee 2. Drink it 3. Make diary products 4. Make cakes 5. Others (specify)	How long do you take before using milk after buying? 1. Immediately 2. 1-2 hours 3. One day 4. Others (specify)	Who drinks plain milk in the house? 1. Children 2. Adults 3. Everyone 4.cats 5. Others (specify)	How do you select where to buy milk? 1. Convinience 2. Price 3. Cleanliness 4. Others (specify)	How long have you had your current supplier? 1. A day 2. A week 3. A month 4. 3 months 5. >3 months	What are the reasons for changing your supplier? 1. Milk souring 2. Adding water 3. Price 4. Quantity 5. Others (specify)

Attitudes						Practices					
A37	A38	A39	A40	A41	A42	A43	A44	A45	A46	A47	A48
Occassionaly milk gets sour in the house. Do you .... 1. Throw away 2. Feed pets 3. Use it to eat ugali 4. Drink it 5. Others(sp)	The milk that gets sour in the house, is it..... 1. Previously boiled 2. Raw milk 3. Both	Do you think milk hawkers should be licensed? 1. Yes 2. No 3. DK	Do you consider milk from hawkers to be a health risk? 1. Yes 2. No	Do you think the milk you buy is wholesome? 1. Yes 2. No 3. DK	Does your supplier add any of the following additives to the milk? 1. Water 2. Blue band 3. Flour 4. Milk powder 5. Other chemicals (specify)	If yes in how often? 1. Daily 2. Weekly 3. Monthly 4. Others (specify)	Why do you buy milk from hawkers? 1. Convinience 2. Price 3. Thickness 4. Freshness 5. Others (specify)	Why do you buy packaged milk? 1. Convinience 2. Price 3. Less fattening 4. Safe 5. Others (specify)	How do you store your milk? 1. At room temperature 2. In a fridge 3. In a freezer 4. In water 5. Others	How do you boil milk? 1. In water for tea 2. By itself 3. Others	Sometimes you choose to ferment milk at home. Do you ferment ..... 1. Unboiled milk (raw milk) 2. Boiled milk 3. Both

RESEARCH INSTRUMEMT 2:

Focus Group Discussion on Health risks associated with milk

1. The majority of consumers may choose to buy milk from hawkers. In your opinion what are the reasons for this practice?
2. Do you encounter any problems with the milk used in your house? If yes list some of these problems.
3. Are you familiar with the term pasteurization? If yes, explain what it means.
4. Do you consider processed packaged milk superior to raw milk from hawkers? Give reasons for your answer.
5. Do you know that you can get diseases through milk? Name any disease that can be transmitted through milk.
6. What are the common illnesses that you experience in your household?
7. Do you know that you can transmit diseases to your family through milk or any other food? Name the diseases you know that you may transmit.
8. Do you know how you would prevent disease transmission to your family through food? State the ways that are familiar to you.
9. In your opinion, should milk hawkers be licensed? Give reasons for your answer
10. Define spoilt milk.
11. Define wholesome milk

APPENDIX 3: RESEARCH AUTHORIZATION DOCUMENTS

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NAIROBI
Tel. No. 810901/9 Ext. 57530
E-mail: kubps@yahoo.com

Our Ref: I57/7377/2002 **Date:** 5th Sept., 2003
Your Ref:

The Permanent Secretary,
Ministry of Education, Science & Technology,
P.O.Box 30040
NAIROBI.

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION:

I write to introduce Ms. Fidelis Gathoni Mbugua who is a Postgraduate Student of this University. She is registered for a Master of Public Health and Epidemiology (M.P.H.E) degree programme in the Department of Zoology.

Ms. Mbugua intends to conduct research for a project entitled, "Raw Milk Hawking as a Public Health Problem in Urban Areas: A Case of Nairobi Province, Kenya", as a partial fulfillment of the requirement of her degree programme.

Any assistance given to her will be highly appreciated.

KENYATTA UNIVERSITY
THE OFFICE OF THE DIRECTOR
10 SEP 2003
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P. O. Box 43844,

Yours faithfully,

J.K. LANGAT
FOR DIRECTOR, BOARD OF POSTGRADUATE STUDIES

C.C. Registrar (Academic)
Director, BPS - to see on file
Dean, School of Pure & Applied Sciences.
Chairman, Zoology Dept.

JKL:sa

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and date

JOGOO HOUSE "B"
HARAMBEE AVENUE
P.O. Box 30040
NAIROBI

19th September, 20 03

Fides Gathoni Mbugua
Kenyatta University
P.O. BOX 43844
NAIROBI

Dear Madam

RE: RESEARCH AUTHORISATION

Following your application for atuhority to conduct research on ' Consumer knowledge, Attitudes and practice towards Health Risks: associated with Marketed milk in Nairobi Province Kenya, I am pleased to inform you that you have been authorised to conduct research in Nairobi for a period ending 30th May, 2004.

You are advised to report to the Provincial Commissioner, the Provincial Director of Education Nairobi, and the Provincial Medical Officer of Health, Nairobi before commencing your study.

You are further expected to deposit two copies of your research findings to this Office upon completion of your research project.

Yours faithfully

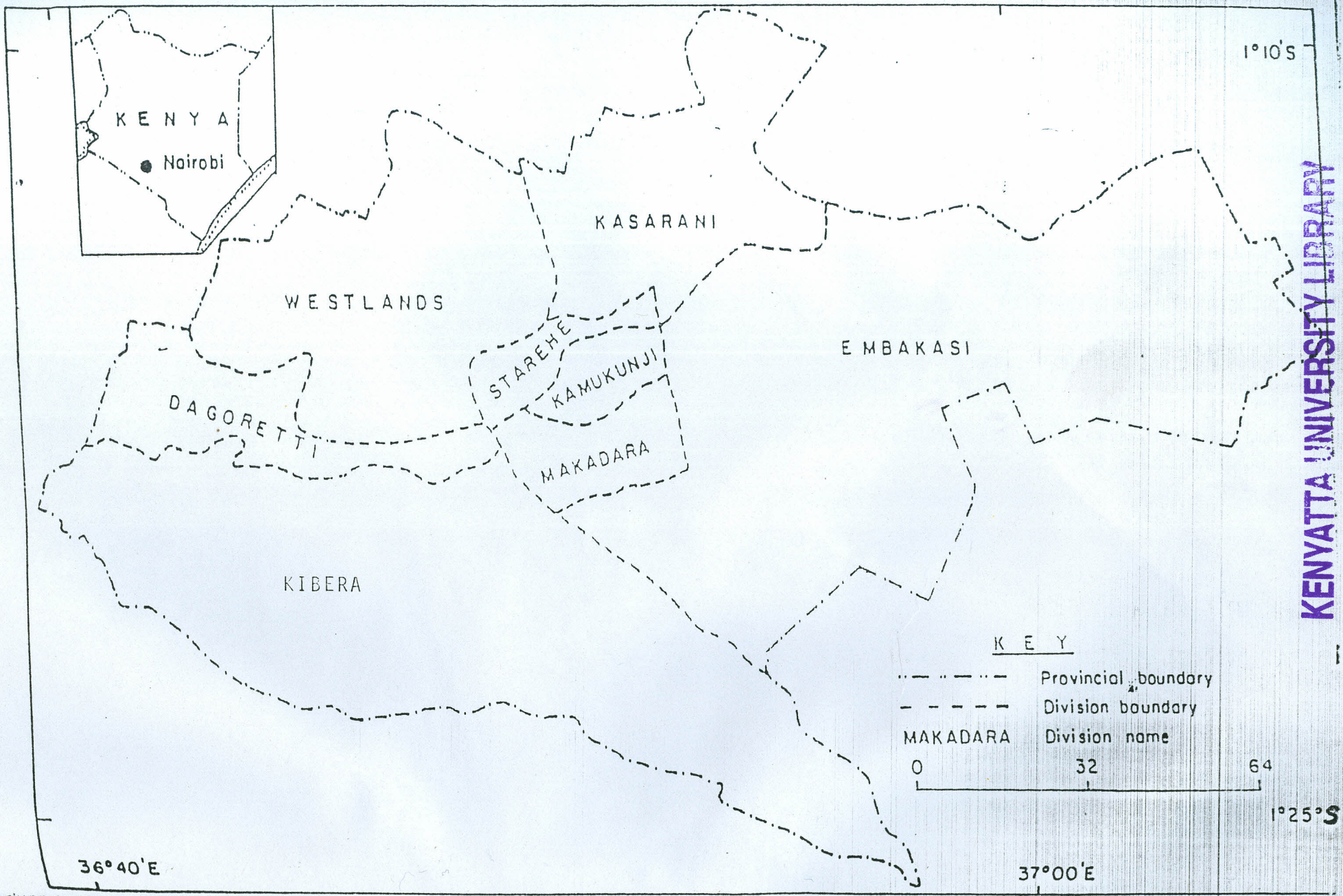
A. C. KAARIA
FOR: PERMANENT SECRETARY/EDUCATION

For Permanent Secretary
Ministry of Education Science
and Technology
P O Box 30040, Nairobi

CC The Provincial Commissioner
Nairobi

The Provincial Director of Education
Nairobi

The Provincial Medical Officer of Health
Nairobi



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