LEVEL OF KNOWLEDGE AND UTILIZATION OF FORTIFIED MAIZE FLOUR BY PRIMARY FOOD SHOPPERS IN MATHARE, NAIROBI COUNTY, KENYA

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A RESEARCH THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF DEGREE OF MASTER OF PUBLIC HEALTH (EPIDEMIOLOGY AND DISEASE CONTROL) IN THE SCHOOL OF PUBLIC HEALTH AND APPLIED HUMAN SCIENCES, KENYATTA UNIVERSITY

MAY, 2022

DECLARATION

This thesis is my original work and has not been presented for a degree in any other University."

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DEDICATION

This research is dedicated to husband Jamal Mwangi, my sons Nassir Cerere and Abdallah Gikuri, my parents Rehema Matukho, Nassir Hussein and Margaret Mwangi for their overwhelming support.

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LIST OF ABBREVIATIONS AND ACRONYMS

KDHS: Kenya demographic and health survey

KEBS: Kenya bureau of standards

KNFFA: Kenya National Food Fortification Alliance

SDGs: Sustainable Development Goals

MOH: Ministry of Health

MoPH: Ministry of Public Health and Sanitation

NACOSTI: National Commission of Science, Technology and Innovation.

SCUK: Save the Children UK

UNICEF: The United Nations Children's Fund

WFP: World Food Program

WHO: World Health Organization

DEFINITION OF OPERATIONAL TERMS

Fortified maize flour- this is maize flour that has been added several minerals and vitamins.

Knowledge – this is awareness, facts and information of fortified maize flour and was assessed by number of questions answered correctly then classified as low, moderate or high.

Primary food shopper- these are people who make the purchasing decision and they purchase food.

Utilization - using fortified maize flour and it was assessed by checking if the fortified flour was used and how frequently it was used.

ABSTRACT

Micronutrient malnutrition has a potentially huge public health implication hence it is very vital to treat and prevent it in the shortest time possible. Fortification of food has been lauded as a safe and effective means of preventing micronutrient deficiency. In spite of the attempts made by the Government of Kenya to fortify food, micronutrient malnutrition is still a public health concern. This is evidenced by the increasing cases of disorders for instance, iodine, vitamin A and iron deficiency anemia characterized by stunting and wasting among other features of general poor health among children. Little has been documented about the level of knowledge of fortified foods and its utilization in Kenya's urban areas, especially among the urban poor. The purpose of the study was to explore the knowledge and utilization of fortified maize flour among Mathare residents in Ruaraka sub-county, Nairobi County. Primary food shoppers were selected from Mathare valley in Nairobi County because it is the second largest recognized slum in Nairobi, it is classified as a worse off slum category with high poverty index, increased malnutrition with poor and low access to social amenities such as water, sanitation and health services. The study adopted a cross-sectional research design with qualitative and quantitative methods of data collection, analysis and presentation. Research administered questionnaires and key informant interview guides were used to collect information from the participants. Cluster sampling was used to target 318 households in Mathare Valley. Random sampling was used to select villages and the households were selected using systematic random sampling method. The data generated from pretested questionnaires for both primary food shoppers and shopkeepers was edited, organized and coded. Data was analyzed using SPSS version 21. The data was summarized using descriptive statistics such as frequencies, mean, percentages and standard deviation. The significance level was $P < 0.05$, the association between variables was established using binary logit. The mean age of primary food shoppers was 33 years, 66% were married and the average income was 3,000-5,000 Kenya shillings. Slightly above half 55%, of the primary food shoppers knew about fortification but only 25% understood its meaning. Fortified maize flour was consumed by more than 80% of primary food shoppers hence it was widely accepted though utilization frequency was low. In conclusion factors that were significantly associated with utilization of fortified maize flour included; knowledge on fortified maize flour ($p=0.00$), household size ($p=0.005$), preference of fortified maize flour ($p=0.000$) and level of fortification knowledge ($p=0.002$). Availability and price were ranked as the most important factors that influence utilization of fortified maize flour at 58% and 55% contrary nutritional value was ranked the least important at 37%. The findings showed that hospitals were among the least considered sources of fortification information and suggests The Human Nutrition and Dietetics unit in the ministry of health should increase and maintain awareness on fortification.

CHAPTER ONE: INTRODUCTION

1.1 Background to the study

The knowledge and utilization of fortified foods has played a very important role in fighting micronutrient malnutrition. Lack of minerals and vitamins predisposes individuals to “hidden hunger” which is not immediately experienced but resulting into adverse long-term effects. According to Meenakshi et al. (2010), over 2 billion people globally are affected by this form of malnutrition. Food fortification is the addition of minerals and vitamins such as folic acid, vitamin B complex and iron to food. It often is difficult to meet micronutrient needs in some populations of developing countries through consumption of locally available food; this is because foods are often seasonal, (Serdula, 2010). This has led to an increased tendency to seek to resolve micronutrient deficiency by promoting supplementation and Food fortification (Black et al., 2008). Universally, 87 nations have a bill that makes it compulsory to fortify at least one cereal grain that is milled in the industry, eleven of these nations fortify more than 50% of at least one cereal grain that is milled in the industry. The Food, Drugs and Chemical Substances Act of the Laws of Kenya CAP 254, Notice No. 157 was revised to embrace fortification standards for wheat flour, maize flour and edible oil and fats (GoK, 2015). A report made by Maize Flour Fortification Landscape Kenya in 2016 states that 40% of maize flour in Kenya is fortified.

Lack of knowledge and non-utilization of fortified foods adversely affects health contributing to increased and recurrent infections, clinical signs of malnutrition such as paleness, stunting and deformities such as cleft lips. The national nutrition action plan 2012 -2017 stated one of the programmatic challenge experienced in food

fortification as; health service providers and general population lacking sufficient knowledge in importance of micronutrients hence a strategic objective was developed to minimize the occurrence of micronutrient malnutrition in the population. Therefore, one of the priority areas was to advocate and create awareness on food fortification as it would help build confidence and preference and increase utilization of the product. Hence, it's precisely in this context that the research aims to determine the level of knowledge and utilization of fortified maize food in particular maize flour among primary food shoppers in Mathare. There are no comprehensive statistics or studies on the level of knowledge of fortified maize flour and its utilization in Kenya's urban areas, especially among the urban poor a study by Pambo et al., (2014) corroborates there is a gap in availability of the afore mentioned statistics. Mathare has a high malnutrition and poverty index as such it would be an ideal area to carry out the research, (Samuel Kirichu, 2014). Knowing and understanding the barriers that primary food shopper in Mathare face and determining the level of knowledge and utilization will help to offer the best solutions to the problems. Given the above discussion it's evident that the knowledge and utilization of fortified foods can lead to micronutrient malnutrition and it's because of this reason that it is important to determine the level and utilization of primary food shoppers in Mathare, Nairobi County.

1.2 Problem Statement

In spite of the attempts made by the Government of Kenya to fortify food, micronutrient malnutrition is still a public health concern. This is evidenced by the increasing cases of disorders for instance, iron deficiency anaemia, iodine deficiency disorders and Vitamin A deficiency. These deficiencies in children are characterized

by stunting, delayed milestones, poor immunity and infections due to micronutrient malnutrition, whereas lack of vital micronutrients can be fatal to expectant mothers, increasing the risk of birth defects, low birth weight, stillbirth, and worse off death.

According to KDHS (2014), 26 per cent of children ages 6-59 months are stunted, 11% are underweight and 4% are wasted. Stevens et al., (2015) states 49% of children in Kenya have vitamin A deficiency while a report by UNICEF in 2013 stated Vitamin A supplementation full coverage was at 19%. KDHS (2014) further revealed 33 per cent of children of the age 6-23 months fed on iron rich foods the day or night before the survey. In Nairobi only 46 per cent of children consumed iron-rich foods. The percentage of women who took iron tablets daily for 90 day or more during the pregnancy of the last birth was at 8%. More so 25% of women of reproductive age are anaemic (Stevens et al., 2013). However, consumption of iron-rich foods increases with increase in mother's education and household wealth. Conversely, little has been done to determine the level of knowledge and utilization of fortified maize flour among the urban poor.

There are few studies on food fortification in Kenya and public health impact of fortified foods, especially among the urban poor. Studies indicate that food fortification is an essential plan in combating micronutrient malnutrition in the developing nations (Klemm et al., 2010). Fortified foods are among the staple foods consumed by the residents, food fortification is not intended to change the eating habit of the target population. The acceptance of fortified food is influenced by the level of awareness and knowledge of nutritional value of such foods. Commercial production of fortified foods can therefore succeed only when there is a significant demand created by increased preference and consumption of such foods. However, in Kenya

there is scarcity of documentation on consumer purchasing decision, awareness and usefulness of fortified sugar (Pambo et al., 2014).

1.3 Justification

Micronutrient malnutrition is a global concern. According to a study by UNICEF (2015), approximately 16% of children in Kenya are underweight. In 2011 Concern Worldwide, a humanitarian organization admitted 2,839 children in Kenya with severe malnutrition micronutrient malnutrition related diseases. This stems from the fact that most foods consumed by children are lacking in the essential nutrients highly needed by the body. As a result, to reemphasize the need for food fortification is important because fortification prevents micronutrient malnutrition. There are no comprehensive statistics on the level of knowledge of fortified foods and its utilization in Kenya's urban areas, especially among the urban poor. Mathare valley in Nairobi County was suitable area for the study because it’s an informal settlement and the second largest recognized slum in Nairobi, it is classified as a worse off slum category high poverty index and increased malnutrition with poor and low access to social amenities such as water, sanitation and health services. Shopkeepers were questioned as key informants in order to help ascertain which flour is consumed more between fortified and fortified.

1.4 Research Questions

i. What is the level of knowledge on fortification of maize flour among Primary food shoppers in Mathare?
ii. What is the level of utilization of fortified maize flour over non-fortified maize flour among Primary food shoppers in Mathare?
iii. What are the factors influencing knowledge of fortified maize flour among primary food shoppers in Mathare?

iv. What are the factors determining utilization of fortified maize flour among primary food shoppers in Mathare?

1.5 Hypotheses

i. Ho1 Primary food shoppers' level of knowledge of fortified maize flour does not influence utilization.

ii. Ho2 The socio-demographic factors of Primary food shoppers do not influence the knowledge and utilization of fortified maize flour.

1.6 Objectives of the Study

1.6.1 Broad Objective

To explore the level of knowledge and utilization of fortified maize flour among Mathare residents, Nairobi.

1.6.2 Specific Objectives

i. To determine the level of knowledge on fortification of maize flour among Primary food shoppers in Mathare.

ii. To research the level of utilization of fortified maize flour among Primary food shoppers in Mathare.

iii. To identify the factors influencing knowledge of fortified maize flour among primary food shoppers in Mathare.

iv. To investigate the factors determining utilization of fortified maize flour among primary food shoppers in Mathare

1.7 Significance and Anticipated Output

Vitamin and micronutrient fortification of essential foodstuff is a rather inexpensive strategy to reduce micronutrient malnutrition. This study's findings contribute to

current body of knowledge on consumption of fortified foods in Kenya and also offer useful insights on what factors need to be addressed so as more.

Fortified foods are eaten making fortification process successful in Kenya. Moreover, the study helped educate and made the residents of Mathare aware of the importance of fortified maize flour in the management of micronutrient malnutrition and improving their nutritional status and quality of life.

This study therefore sheds more light on the level of knowledge of fortified flour among Mathare residents and the utilization of such foods. It is also expected to inform policy making in terms of establishing regulations for food fortification as an attempt to combat micronutrient deficiency. It was also anticipated to increase knowledge of the residents on micronutrient requirements and the most appropriate way to prevent its deficiency. Mathare was suitable for the study as it was among the largest recognized slums in Nairobi and classified under stratum 2 or worse off slums category.

1.8 Delimitation

This study only targeted the primary food shoppers in each household as these were the members who made the purchasing decision and purchased the flour.

1.9 Limitation

In order to assess the level of knowledge and utilization of fortified maize flour, this study assumed the maize flour was fortified by checking the fortification logo and nutrition information on the packet. Verifying fortification in the food laboratory for each packet of maize flour the primary food shoppers used was constrained by resources.

1.10 Conceptual framework

This study has modified the conceptual framework from Pambo et al., (2013) Fan and Brzeska, 2011, (Nair, 2012). On factors associated with knowledge and utilization of fortified maize flour (Figure 1.1).

A primary food shoppers Demographic and Socio-economic characteristics can influence knowledge of fortified maize flour in addition to these two factors fortification knowledge and characteristics of fortified maize flour influences utilization of fortified maize flour by primary food shoppers. Household size also determines whether a family will utilize the fortified maize flour or not. Large families will need a lot of fortified maize flour as opposed to non-fortified maize flour to be able to reach satiety level. Characteristics of maize flour such as taste and nutritional value also determine whether a primary food shopper will utilize fortified maize flour or not.

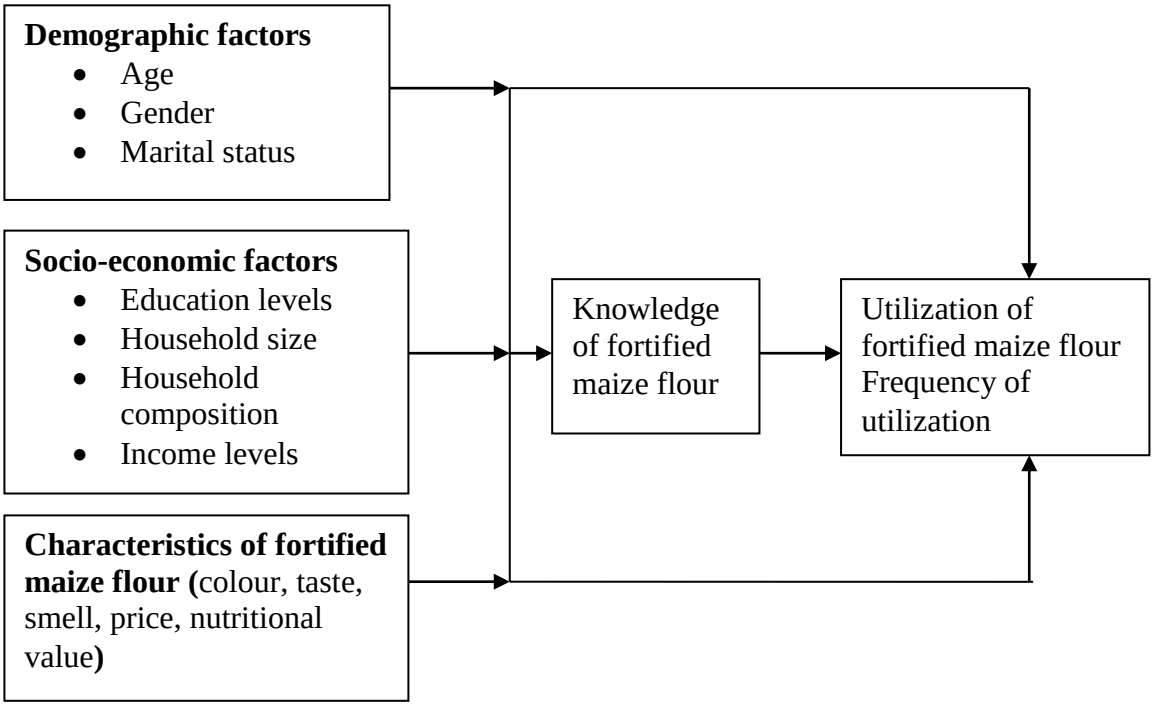

Figure 1. 1: Conceptual framework on factors influencing knowledge and utilization of fortified maize flour

CHAPTER TWO: LITERATURE REVIEW

This chapter explores literature supporting the role of food fortification in alleviation micronutrient malnutrition. It describes the strategies involved in fortification and their challenges as well as the need for food fortification in delivering essential micronutrients.

2.1 Overview of food fortification

Fortification is the adding of non-nutrient bioactive ingredients or nutrients to supplements, foods or food components. Its beneficial to Fortify food as it easily reaches a large scope of vulnerable people through available food distribution channels without interfering with their feeding behavior thus making food fortification a useful and practical public health technique (Best et al., 2011; Serdula, 2010b). Food fortification is affordable and the nutrient body stores of the population can be maintained through frequent consumption of fortified foods (Serdula, 2010b).

Food fortification interventions are roughly widespread in the developed countries and progressively tried in many middle-income and developing nations. In the developing countries, however, few of these interventions have been sufficiently appraised to assess the users' perception to food fortification, the consumption of the fortified foods, and their impact on population health (Allen et al., 2006).

Food Fortification Initiative Reports states that Africa as a continent has made significant progress in the last decade, African nations are making great advancement in food fortification. As part of their broad nutrition plan nations are fortifying salt, sugar, cooking oil, fats, maize and wheat flour. In addition, the population in 18 African nations can consume at least 75 grams of fortified rice daily. Wheat flour,

maize flour, sugar, and vegetable oil fortification was made compulsory in Nigeria in 2002, (Ogunmoyela, 2013).

Moreover, the food advisory consumer service reports that in 2003 South Africa made the fortifying of specific types of wheat flour and maize meal mandatory. In 2002, elevated numbers of malnutrition in East, Central and Southern Africa region lead to the ministers of health in the East, Central and Southern Africa (ECSA) Health Community approving a decision instructing the secretariat to join effort with nations in fortification of staple foods in the region, (EAC, 2011). In 2012 Uganda mandated maize meal fortification by July 2013 in all mills with a capacity of 20MT/d (Fiedler et al., 2013).

2.2 Fortification for maize flour in Kenya

The Food, Drugs and Chemical Substances Act of the Laws of Kenya CAP 254, Notice No 62 of June 2012, Kenya, was modified to include fortification of fats and vegetable oils with vitamin A (retinol) as well as the fortification of maize and wheat flour with zinc, vitamin A (retinol), and iron among other micronutrients (GoK 2012). A second revision was made in July 2015 under CAP 254, Notice No. 157 to embrace fats, edible oils, maize and wheat flour fortification standards (GoK 2015)

In Kenya there are two categories of maize flour, the sifted flour and the loose flour, with loose flour owning a quarter share of the market. A study by Pambo and Okello in 2014 reported 62.8% of households in Nairobi where aware of fortified sugar while 29.4% understood the importance of vitamin A in their food. Consumption of hammer milled maize flour was at 59% while sifted maize flour was at 33% (Fiedler et al., 2013). Maize is consumed by 78.8% of women and 77.3% of children and it’s eaten

across the entire population. Fortification Standards were developed between, 2005 to 2008 for wheat flour and maize flour, sugar, oils and fats (MOH, 2013).

A report by Maize Flour Fortification Landscape Kenya (MOH, 2016) states that 40% of maize flour in Kenya is fortified. So far 37 mills fortify maize flour, 23 large mills certified by KEBS and concentrated in large cities and towns they distribute their flour to retail shops and supermarkets country wide, 12 certified medium mills distribute to schools, hospitals other institution and some to retailers while 2 small mills not certified but are assisted by WFP provide flour for 21 schools in Kakuma refugee camp feeding 73,000 learners. A six-year program for food fortification was launched in April 2017 by the ministry of health to be run by Jomo Kenyatta University of Agriculture and Technology and domestic partners in order to deal with gaps in fortification of food. The project targets areas where levels of malnutrition are higher by improving the ability of manufacturers to fortify maize flour and other staples eaten by poor households (MOH, 2017).

2.3 Food Fortification and Micronutrient Deficiency

Micronutrient malnutrition has a potentially huge public health implication hence it is very vital to treat and prevent it in the shortest time possible. Micronutrient malnutrition has specific clinical manifestations more so it causes a broad variety of unspecified physiological destruction which leads to low immunity, metabolic problems and late or abnormal physical and psychomotor development, (WHO, 2006). Increased incidences of micronutrient deficiencies are linked to morbidities and mortalities from pneumonia, diarrhea, malaria, and measles (Bhutta, 2008). Micronutrient deficiencies have far-reaching consequences apart from health

outcomes, affecting even the physical, psychological, and economic development of the individuals (Black et al., 2008).

Micronutrient deficiencies has led to Numerous plans have been dedicated so as to curb it, especially among the at-risk population of women and children (Serdula, 2010a; Bhutta et al., 2008; Dewey, Yang & Boy,2009; Best et al., 2011). These strategies include health education, food rationing, dietary changes, supplementation, and fortification. Among these strategies, food fortification has been lauded as a safer and effective means of preventing micronutrient deficiency. Analysis of health outcomes as a result of food fortification has been done by several studies. A review by Gera et al. (2012) on iron fortification in the general population indicated a decreased anemia prevalence marked by an increased level in serum hemoglobin. Even with the persistent analysis of micronutrient and vitamin fortification, perception on food fortification and consumption of fortified foods among the urban poor has been inadequately researched, especially in the developing countries.

The World Health Organization recognizes that future interventions need focus on methods of delivering essential micronutrients via food vehicles (Dewey, Yang & Boy, 2009). Food fortification is, therefore, a convenient and cost-effective approach in improving the nutritional status and immunity of the at-risk population, mainly infants and women (Best et al., 2011).

2.4 Factors affecting utilization of fortified foods

Utilization of fortified food is the least expensive and most effective way of eliminating micronutrient deficiency (WHO, 2006). However poor utilization of fortified foods has become a barrier in achieving this goal. There are several factors that hinder utilization of fortified foods such as income, consumers age and, gender,

where they shop, confidence in safety of the fortification process, information on the benefits of micro-nutrients in the food and knowledge of fortification programmes, availability, health status and also seeking nutrition information of fortified food prior to purchase (Pambo and Olila, 2014)

More chances of consuming fortified foods were expected from Consumers who earn more income. This is because of the expectation of fortified foods having an extra charge to be paid by the customers; this perhaps could readily be accepted by those who earn more. (Pambo, 2013). However, studies suggest that caloric intake is not increased by household income neither does it make the nutritional status better. Addition household income especially if acquired unexpectedly or irregularly will not always be spent on food, (Fan and Brzeska, 2011).

Furthermore, many peoples' decision while choosing food is influenced by their level of knowledge, the more the education; the more knowledgeable they are about nutrition. Individuals who are highly expected to consume fortified foods are the ones with information about the benefits of micronutrients in their meal. This is because micronutrients have a very important part in improving human health, (Pambo, 2013). Also, individuals who search for nutritional information of fortified food prior to purchase, either from relatives, friends or an alternative source, are expected to have higher probability of eating fortified foods. This is because knowledge of fortified foods is likely to increase by inquiring from others as reported by Pambo (2013)

Moreover, the Archaeology of Food Preference by Smith (2006) describes food preference as an idea that was socially made by those who consume and produce are the ones who define what is "good to eat." Staple and daily foods are vital element of

these definitions, as the frequent consumption of certain foods reinforces norms of identity. However, a barrier to intake of enriched food is still lack of realistic information on consumers' awareness for fortified foods (Pambo, Otieno, Okello, 2014).

In addition, where Supermarkets are the frequent point of purchase there is an expectation of increase in consumption of fortified foods (Neven and Reardon, 2004). This is because of the extra information shared by these purchase outlets through regular advertisement of products via a number of media and professional exhibition of goods. While those individuals who regularly visit other outlets such as retail stores, shops and open markets are expected to have a lower consumption of fortified foods (Lupin and Rodriguez, 2012).

Then again, age of an individual also plays a role in utilization of fortified foods. Due to the experience, they have gained overtime in terms of good nutrition, older consumers may be expected to have more up take of fortified foods. However due to contact with latest technology and affinity to readily adopt it, younger consumers may eat more fortified foods (Nair, 2012).

The trust of consumers for the process of fortifying food is vital for them to accept and consume the fortified foods. This includes trusting the safeness of fortified foods; trusting the companies that take part in fortification and delivering of food as well as trusting the inspection of the value and safeness of fortified foods done by respective government departments. Familiarity of the fortified food influences the purchasing decision most, even in a situation where the fortified food is readily available and genuinely affordable. Connection made by a consumer with foods that are familiar and had been eaten since tender age can be over ruled by sociocultural forces. For the potential of food fortification to be appreciated, the respected bodies should execute

their duties diligently because if consumer lack trust for the process, they will not consume the fortified food, (Pambo, 2013). Moreover, the uptake chances are likely to be greater in individuals who trust the food fortification institutions. This is because purchasing decision of the fortified foods is used to show their confidence in it, (Pambo, 2013). In Denmark 2004, the legislation restricted foods fortified with extra vitamins and minerals due to food safety worries. Products banned included: Rice Crispies, Shreddies, Horlicks, Ovaltine and Marmite (Bruno, 2011). Food fortification poses a health risk when intakes are both very little and very much. Hence micronutrient risk assessment consists of looking for an adequate scope of intake for every vitamin and mineral. Food authorities in the country are tasked with the responsibility of managing risk such as the Kenya National Food Security and Nutrition Policy focus, which in partnership with health authorities propose and execute food rules (HelleMmeltzer*et al*., 2006).

Food fortification has been accepted and adopted globally as a method of fighting micro nutrient deficiency. Maize flour being a staple food in Kenya can successfully be used to fight vitamin A and iron deficiency. Hence it beneficial to consider the factors discussed above in order to improve utilization of fortified foods so as to curb micronutrient malnutrition.

CHAPTER THREE: MATERIALS AND METHODS

This chapter focuses on the research design, target population, sample and sampling procedures, research instruments, instruments validity and reliability, data analysis procedures, and ethical consideration.

3.1 Research design

The study adopted descriptive cross-sectional design to investigate knowledge and utilization of Fortified maize flour by household heads in Mathare. Descriptive design was relevant because it provided the real picture about the variables in question and the factors responsible without manipulating the variables. According to Orodho (2009), most frequently used method for gathering information about individuals "habits, opinions, attitudes, or any of the variety of social issues is the descriptive survey."

3.2 Variables

3.2.1 Independent variable

The independent variables were socio-demographic characteristics, knowledge and characteristics of fortified maize flour that affect utilization such as colour, taste, smell, price, availability, nutritional value.

3.2.2 Dependent variable

The dependent variable was the utilization of fortified foods.

3.3 Location of the study

This study was carried out in Mathare valley, which is a slum area, found in Ruaraka Sub-County of Nairobi County. Mathare valley lies approximately 6 kilometers to the north east of Nairobi's central business district and is bordered by Thika road to the north and Juja road to the south. This area was relevant to the study since Mathare is among the largest recognized slums in Nairobi. Based on the stratification using the review of literature on the socio-economic, health and sanitation situation of the slums, the slums were classified as Better-Off Slums (Stratum 1) and Worse-Off slums (Stratum 2) (Samuel Kirichu, 2014). Mathare was classified under (Stratum 2), as it has a high poverty index and increased malnutrition compared to other urban areas in Nairobi. In addition, Mathare valley is more accessible due to its closeness to the city. It was also expected that the study will impact the behavior of the people, especially the neighboring slums and other low-income areas in the country.

3.4 Study population

The study population included all the primary food shoppers in Mathare valley whereas the target population covered all primary food shoppers in the selected households. As per the population census of 2009, these settlements in Mathare Valley had 27,503 households with a population of 80,309 persons. However, current enumeration by the area chief estimates the population at 188,183 persons and number of households at 27,821.

3.5 Inclusion and Exclusion Criteria

The inclusion criteria were households with primary food shoppers who gave consent to take part in the study. The exclusion criteria included households with non-consenting primary food shoppers.

3.6 Sampling technique

This study utilized cluster sampling method. Cluster sampling was used to

Select villages for the survey and the households were selected using systematic random sampling method. The entire population in Mathare was divided into different clusters (villages). Then the villages were randomly selected by writing the names of all 13 villages on separate pieces of paper then the papers were folded and put in a jar, after shaking the jar vigorously so that the papers are well mixed the first 5 villages selected were used. The selected villages were Mathare 4A, Gitathuru, Kosovo, Mabatini and Mashimoni.

The households were selected through systematic random sampling. The first household was randomly picked. The sample size was divided by the total population of the 5 clusters, and then the fraction acted as the constant difference or interval which resulted in each cluster having an equal sample representation.

Sample size =380

Total of the 5 clusters:

Mathare 4A 5627 + Gitathuru 1243+ Kosovo 2850+ Mabatini 383 +Mashimoni 1692= 11, 795

Proportionate fraction

380/11795 = 0.03222

Through the utilization of systematic randomization, this sampling technique guaranteed that every household in the Mathare Valley Slum had an equal opportunity for selection. It also guaranteed the absence of both systematic and sampling bias ensuring that the sample was representative of the target population. In order to realize the desired sample size whenever a targeted Participants was not available or not interested in participating, they were replaced by the next household.

Lastly, purposive sampling was done to draw a sample of shopkeepers for face-to-face interviews. The interviews for shop keepers stopped when no newer information was being generated, that is saturation point had been attained.

3.7 Sample size determination and Sample size distribution

3.7.1 Sample size

The Cochran formula was used to determine sample size:

$$n = \frac{z^2pq}{d^2} \qquad n = \frac{(1.96)^2(0.55)(0.45)}{(0.05)^2} = 380$$

Where;

n = the desired sample size when the population is greater than 10,000

z = the standard normal deviate at the required confidence level

p = the proportion in target population estimated to have characteristic being measured

The study by **Pambo**, **Otieno** and **Okello** on Consumer awareness of food fortification in Kenya: The case of vitamin-A-fortified sugar found that about 55% of

the households were aware of fortified sugar and that awareness levels were statistically higher for urban consumers.

q = 1-p

d = the level of statistical significance set (Mugenda & Mugenda, 1999).

n = 380.

Therefore, the sample size was 380.

1.7.2 Sample Size Distribution

In each study area, the sample size was determined using the proportional method of sample size distribution (table 1).

Table 3. 1: Sample size distribution in Mathare valley.

Village	**Population**	**Proportionate fraction**	**Sample size**
Mathare 4A	5627	5627 x 0.03222	181
Gitathuru	1243	1243 x 0.03222	40
Kosovo	2850	2850 x 0.03222	92
Mabatini	383	383 x 0.03222	12
Mashimoni	1692	1692 x 0.03222	55
Total	**11795**		**380**

3.8 Research Instruments

The study used two sets of instruments, which were a researcher administered questionnaire for the primary food shopper (appendix 2) and the shopkeeper (appendix 4) which provided the primary data. The primary data was collected face to face so that the participants can ask questions and got information on fortified foods. Likert scale, open ended and close ended questions and a 24-hour recall (appendix 3) were used. Secondary data was provided by analysis of research papers on food fortification and map of Mathare (appendix 10).

3.9 Pre-testing of Instruments

10% of participants in Mathare 4B which was not selected for research were involved in the pre-test. The participants had same characteristics with those of the main study. The main study did not involve those who took part in the pre-test. The pretest helped to adjust the research instruments in language and in wording**.**

3.10 Validity and reliability

3.10.1 Validity

University supervisors assisted to validate the questionnaires. The pre-test was also conducted to ensure that the questions were clear, simple and collected information that they were intended to collect.

3.10.2 Reliability

The reliability of the instruments was established using test re-test method. During pre-testing, data was collected two times from the same individual at an interval of two days. A Cronbach's alpha reliability test was calculated and the questionnaire yielded a Cronbach's alpha value of 0.811 this was considered adequate as it was be above 0.7, as endorsed by Mugenda and Mugenda, (2003).

3.11 Data collection techniques.

Both qualitative and quantitative data was collected from the sample population in the community through use of questionnaires (appendix 2). The data collection procedure started by creating a rapport with the participant through exchange of greetings. Introduction of the study followed in order to humbly request their participation. In cases where the participant gave a positive response then consent was sought and he/she was issued with the consent forms (appendix 1) to sign. After signing the consent form, the interview was commenced and the responses were filled in the

questionnaire (appendix 2) and after completion the participants were thanked for their time. In case the participant decided against participating in the study, they were thanked for their time.

3.12 Data Analysis

The data collected using interview questionnaires, were grouped into manageable subjects and arranged then sorted and analyzed using Statistical Package for Social Science Programme (SPSS) version 21. Quantitative data collected on demographic, socio economic and utilization of fortified maize flour was analyzed using descriptive statistics such as means, percentages and frequencies. Whereas qualitative data collected was organized into themes such as use of fortified maize flour, reasons for utilization both socio-economic and in regards to characteristics associated to the fortified maize flour. The qualitative data was then analyzed using content analysis and the findings were presented inform of frequency tables. The data were presented in visual displays that helped to bring out underlying patterns and trends which were used to answer research questions and test hypothesis by deciding whether to accept or fail to accept the null hypothesis after comparing the p-value from results with the significance level of 0.05. Knowledge and utilization were assessed using descriptive statistic and analyzed using binary logit model. Level of fortification knowledge was assessed by number of questions answered correctly, a correct answer was graded as one point while a wrong as was graded as zero in a total of 14 point. The original Bloom's cut-off points, 80.0–100.0%, 60.0–79.0%, and ≤59.0%, were adapted and modified from the KAP study conducted on dengue fever prevention among the people of Male, Maldives and Bangkok in 2007.The responses were classified into three levels; High knowledge level (80.0% - 100%) 14-12 points; Moderate

knowledge level (60.0% - 79.9%) 11-8 points; Low knowledge level (≤59.0%) < 8 points. Utilization was assessed by checking if the fortified flour was used and how frequently it was used. Whereas multiple regression analysis was used to establish the predictors of knowledge and utilization of fortified foods. Data integration was done by writing about the data in a discussion wherein the results of quantitative analysis were discussed.

3.13 Ethical Considerations

The proposal was authorized by Kenyatta University graduate school (appendix 5) and ethical approval was pursued from Kenyatta University Ethics and Review Committee (appendix 6). Authorization to conduct research was granted by National Commission of Science, Technology and Innovation (NACOSTI) (appendix 7and appendix 8) and Ministry of Education State Department of Early Learning and basic Education (appendix 9). This study ensured confidentiality of information and that of the participants by ensuring the name of the participant was not documented in the questionnaire. The filled questionnaire was stored in a locked cabinet for protection of the information hence everything was kept private.

Most importantly, informed consent was sought from willing Participants and permission was obtained from area local authority. Research participants were protected by involvement of community health volunteers for Mathare valley accompanied them in the villages that they are well known.

CHAPTER FOUR: RESULTS

This chapter presents results of the study. Results of demographic characteristics, knowledge of fortification and utilization of fortified maize flour are presented.

4.1 Socio-demographic characteristics

The socio-demographic characteristics of primary food shoppers are presented in table 4.1. A total of 380 Participants were interviewed. 25% of the Participants were male while 75% of the total Participants were female. The average age of the Participants was 33 years.

Most Participants were married at 66.3% while the least of the Participants were widows/widowers at 6.8%. Nearly all Participants were educated, 53.7% reached secondary level however 3.7% did not attend school. Self-employment was the most common form of employment at 44.5%. Casual labour was also frequent at 33.9%. Majority of the primary food shoppers have household income between KSh 3,000 – 5,000. The average household size was 5 members more so majority of the houses were made of iron sheet and stone while mud houses were the least at 7.1 %.

Table 4. 1: socio-demographic characteristic of primary food shoppers

Variables		Male	Female	Mean	Std dev	Total
Average age (years)		36	32	33	7.94	
Gender of Participants (%)		25	75			100
Marital Status (%)	Single	17.9	19.6			19.2
	Widowed	1.1	8.8			6.8
	Married	73.7	63.9			66.4
	Separated/Divorced	7.4	7.7			7.6
Education Level (%)	No Education	2.1	4.2			3.7
	Primary Level	21.1	40.4			35.5
	Secondary	67.4	49.1			53.7
	Vocational Training	7.4	5.3			5.8
	University	2.1	0.7			1.1
	College	0	0.4			1.1
Occupation (%)	Self Employed	41.1	45.6			44.5
	Casual	28.4	35.8			33.9
	Student	2.1	0.4			0.8
	Employed	28.4	14			17.6
	Other	0	4.2			3.2
Type of house (%)	Iron Sheet	40	51.2			48.4
	Stone	53.7	41.4			44.5
	Mud	6.3	7.4			7.1
Average household size		5	5	4.5	2.37	5
Residence	Gitathuru	16.8	8.4			10.5
	Kosovo	27.4	23.2			24.2
	Mathare 4A	35.8	51.6			47.6
	Mabatini	4.2	2.8			3.2
	Mashimoni	15.8	14.0			14.5

4.2 Knowledge of fortified maize flour

Awareness of fortified maize flour was established. 55.3% primary food shopper had at least heard of fortification however only 25.5% understood its meaning (Table 4.2). Furthermore 25.5% of the primary food shoppers felt that maize flour fortification wasn't important while the rest felt it was. More over 69.8% of the Participants felt it was important because it helps boost immunity.

Level of fortification knowledge was determined by the number of correct answers given. The responses were classified into three levels; High knowledge, Moderate knowledge and low knowledge.

Only 2.1% had high level of fortification knowledge, whereas 10.8% had seen the fortification logo. Similarly, 11.6% Read nutrition information on the fortified maize flour packet before purchasing it. The most common source of fortification information was the television.

Table 4. 2: Fortification knowledge of primary food shoppers

Variable	Male	Female	Total
Heard of fortification (Yes %)	56.8	54.7	55.3
Understand definition of fortification (Yes %)	29.5	24.2	25.5
Heard of fortified maize flour (Yes %)	11.6	11.9	11.8
Know importance of fortification (%)			
Not aware	0	0.4	0.3
Not important	29.5	24.2	25.5
Little important	11.6	11.9	11.8
Moderate important	18.9	16.8	17.4
Important	18.9	21.1	20.5
Very important	21.1	25.6	24.5
Importance of fortification			
Boost immunity	62.1	72.3	69.8
Improve appetite	23.2	21.4	21.8
Improve vision	6.3	4.2	4.7
Increase blood level	2.1	4.9	4.2
Level of knowledge			
Low knowledge	51.6	56.8	54.2
Moderate knowledge	46.3	41.1	43.7
High knowledgeable	2.1	2.1	2.1
Read nutrition information before purchase (Yes %)	2.9	8.7	11.6
Seen fortification logo (Yes %)	2.4	8.4	10.8
Source of fortification information (%)			
Television	12.6	34.5	47.1
Radio	7.3	27.2	34.5
Packet	4.2	17.4	21.6
Newspaper/poster	7.3	4.9	12.2
Social media	2.4	5.9	8.3
Hospital	0	5.7	5.7
Relatives/neighbors	0.5	3.3	3.8
Known Maize flour Fortificants (%)			

Vitamin A	13.3	58.6	71.9
Vitamin B	7.1	22.5	29.6
Iron	4.6	17.3	21.9
Folic acid	0	3.1	3.1
Zinc	0.5	0.5	1.0

Most common sources of information included television at 47.1% and radio at 34.5%. Majority of the primary food shoppers had not seen the fortification logo on the packet of fortified maize flour more so 88% did not read nutrition information on packet before purchase. Brands of fortified maize that were most common were brands 1 and 2 at 87.8% and 78.2% respectively (Figure 1).

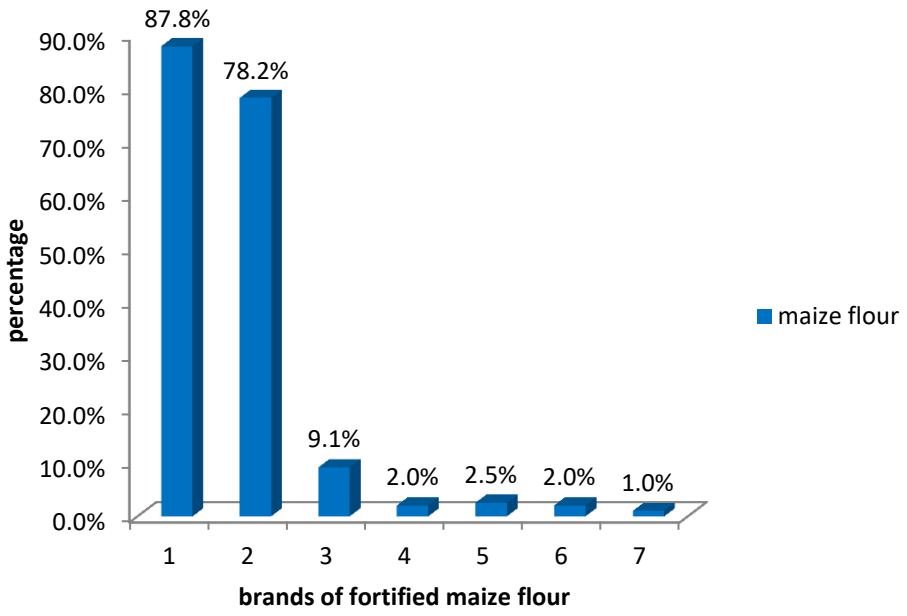

Figure 4.1: percentage of maize flour brands.

4.3 Utilization of fortified maize

Utilization of fortified maize flour was quite common, 83% of primary food shoppers use fortified maize flour, and 39% use it daily while 10% use it monthly (Figure 2) more than 80 per cent reported having consumed it in the past 24 hours. Majority of

the shopkeepers reported fortified maize flour to have a higher demand compared to the non-fortified maize flour.

For 49% of the Participants, fortified maize flour was the most common used maize flour while 46 % stated that fortified maize flour was the flour they were currently using.

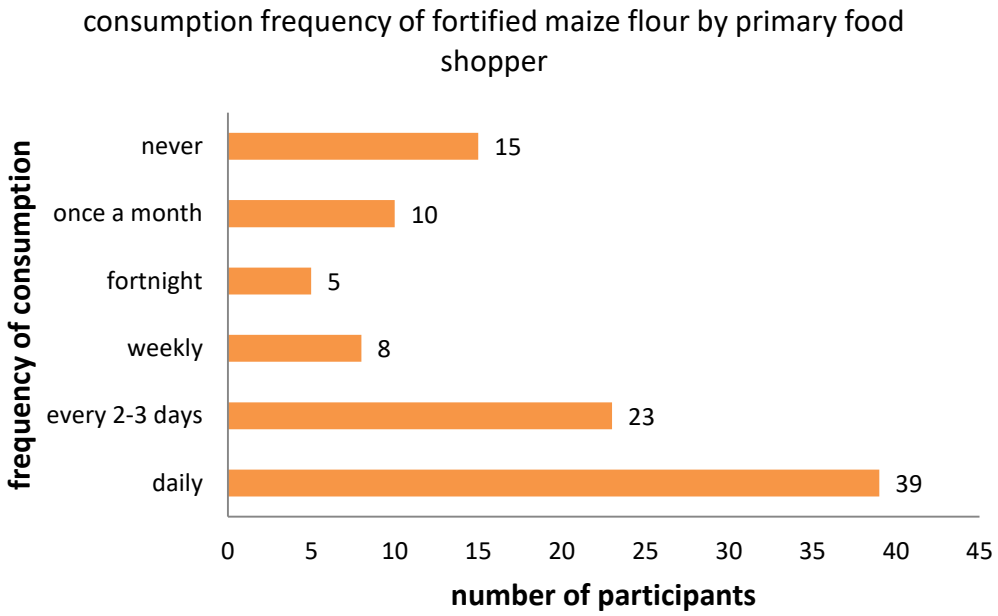

Figure 4. 2: Consumption frequency of fortified maize flour by primary food shopper

Fortified maize flour was preferred by 64 % of the Participants, most common reason for Preferring fortified maize flour over non-fortified maize flour was because it is easy to cook hence consuming less time and fuel.

Point of purchase was mainly the shops at 74% while 7% bought their maize flour from the supermarket, 67% paid for the maize flour with cash while 32% got the maize flour on credit.

4.4 Factors influencing knowledge of fortified flour

Multiple Regression analysis was used to analyse these factors. Fortification knowledge had higher odds of outcome when associated with education level (table 4.3).

Table 4. 3: Factors influencing knowledge of fortified maize flour.

Independent variables	B	S.E.	Wald statistic	P-value	Adjusted odds ratio	Odds ratio 95% C.I. Lower	Upper
Purchase Point	-0.467	0.216	4.687	**0.030**	0.627	0.411	0.957
Gender	0.141	0.302	0.217	0.641	1.151	0.637	2.081
Age	-0.032	0.015	4.404	**0.036**	0.968	0.940	0.998
Education level	0.427	0.182	5.504	**0.019**	1.532	1.073	2.188

Purchase point, education level and age were determinants of knowledge of fortified maize flour, meaning there was a statistical significant association with the knowledge of fortified maize flour in the analysis of purchase point ($p = 0.03$), education level ($p = 0.019$) and age ($p = 0.036$)

The knowledge of fortified maize flour has a higher chance of occurrence when exposed to education level. When the education level increases by 1 probability that the primary food shopper has knowledge of fortified maize increases by 1.532 times.

4.5 Factors influencing utilization of fortified maize flour

Knowledge of fortified maize flour determines its utilization, there is significant statistical association in analysis of utilization of fortified maize flour, knowledge of fortified maize flour had a p value = 0.00. When the level of knowledge on fortified maize flour increases by 1 the probability of utilization of fortified maize flour increases by 4.332 times, (table 4).

Table 4. 4: Influence of knowledge on fortified maize flour on its utilization.

Independent variable	B	S.E.	Wald statistics	P-value	Adjusted odds ratio	Odds ratio 95% C.I.	
						Lower	Upper
knowledge	1.466	.289	25.646	**.000**	4.332	2.456	7.640

Household size, preference of fortified maize flour and level of food fortification knowledge were factors that determined utilization. This indicates that analysis of House hold size (P = 0.005), preference of fortified maize flour (P = 0.000) and level of food fortification knowledge (P = 0.002) had a significant statistical association to utilization of fortified maize flour. Level of fortification knowledge had higher odds of occurrence when associated with utilization of fortified maize flour. When the level of knowledge increases by 1, the probability of utilization increases by 2.021 times, (table 5).

Table 4. 5: Factors influencing utilization of fortified maize flour

Independent variable	B	S.E.	Wald statistics	P-value	Adjusted odds ratio	Odds ratio 95% C.I.	
						Lower	Upper
Age	-.008	.024	.100	.752	.992	.947	1.040
Gender	-.592	.414	2.044	.153	.553	.246	1.246
Household size	-.250	.090	7.734	**.005**	.779	.653	.929
Education level	-.313	.258	1.479	.224	.731	.441	1.211
Purchase point	-.338	.303	1.239	.266	.713	.394	1.293
Preference of fortified maize flour	-2.513	.434	33.565	**.000**	.081	.035	.190
Fortification Knowledge Level	.704	.229	9.471	**.002**	2.021	1.291	3.165

To determine the most important factors that influence utilization of fortified maize, primary food shoppers were asked to rate six factors (price, taste, children's preference, nutritional value, known/trusted brand and availability) according to their level of importance before buying it, using a Likert scale ranging from not at all important (1) to very important (5). According to Gonzalez et al. (2010), the meaning of the ''most important factor'' was derived from the sum of customers who responded to the top (4–5) scale levels, that is, fairly important and very important, as reported below in Table 4.6.

Table 4. 6: Factors influencing utilization of fortified maize flour

Factor (%)	Does not	Slightly	Influences	Moderately influences	Extremely influences
Price	30	5.5	9.5	9.5	45.5
Taste	29.2	10	17.6	12.4	30.8
Nutritional value	37.6	9.7	16.1	15.3	21.3
Children's preference	41.6	5.3	11.6	10.3	31.3
Known/trusted brand	39.2	7.9	15.8	9.5	27.6
Availability	32.6	2.4	7.4	5.3	52.4

Three most important factors influencing utilization of fortified maize flour were availability, price and taste of fortified maize flour at 57.7%, 55.0% and 43.2% respectively whereas nutrition value was the least influential.

CHAPTER FIVE: DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

This chapter discusses and compares the results of this study with results of other studies, draws the conclusions and makes recommendations of the study. The following research Questions were answered; the level of knowledge on fortification of maize flour, level of utilization of fortified maize flour and factors influencing utilization of fortified maize flour among Primary food shoppers in Mathare.

5.1 Discussion

5.1.1 Socio-demographic characteristics

A total of 380 primary food shoppers were interviewed. 25% of them were male while 75% were female. This shows the female population plays a major role in the decision to use fortified maize flour hence should be targeted more in creating awareness on the importance of using fortified maize flour so as to help promote the nutritional states of the population.

The Participants' age was between 60 years and 18 years with the average age being 33 years and most common age being 32. This shows that the responsibility of primary food shoppers is mainly executed by persons over the age of 18 years, as it is assumed persons under the age of 18 years don't have shopping experience (Pambo et al, 2013). More primary food shoppers below the age of 32 years used fortified maize flour compared to primary food shoppers above 32 years this is can be attributed to the fact that younger primary food shoppers have contact with latest technology and affinity to readily adopt it, therefore younger consumers may eat more fortified foods (Nair, 2012).

Nearly all Participants went to school with only 3.7% never having attended school. Majority of the Participants at least went up to secondary level at 53.7% however, only 1.1% went up to university of which 25% were women. With this high education level, it is expected the primary food shoppers should have increased level of awareness as education should translates to more information.

Majority of the primary food shoppers have household income between KSh 3,000 – 5,000. Household size ranged from 1 person to a maximum of 25 per household, most common size being 5 members per household. This low household income and high household size translates to consumption of foods that have low prices as this would be affordable and would ensure at least each household member gets a portion to consume (Pambo et al, 2013). This explains the results why only 39% of households consume fortified maize flour daily.

5.1.2 Knowledge of fortified maize flour

Majority of primary food shoppers had heard of fortification at 55.3% however, only 25.5% understood the meaning of fortification. 11.8% of primary food shoppers had heard of fortified maize flour. Low information seeking behavior of primary food shopper was established as very low percentage of primary food shoppers read the nutrition information before purchase at 11.6% in addition only 10.8% had ever seen the fortification logo on the packet of fortified maize flour. More emphasis needs to be made on creating awareness on the meaning and importance of fortified maize flour. Increase in information would lead to increase in utilization. This study corroborates a study where 62.8% of household heads in Nairobi were aware of fortified sugar (Pambo et al., 2013).

The trust of consumers for the process of fortifying food is vital for them to accept and consume the fortified foods. This includes trusting the safeness of fortified foods; trusting the companies that take part in fortification and delivering of food as well as trusting the inspection of the value and safeness of fortified foods done by respective government departments (Bruno, 2011). The most common reason that was associated with importance of using fortified maize flour was that it boosts immunity, 69.8% of primary food shopper felt that utilization of fortified maize flour helped to stay healthy.

Vitamin A was the Most common fortificant mentioned by 71.9% of primary food shopper, Stevens et al., (2015) stated 49% of children in Kenya had vitamin A deficiency, this led to increased tendency to resolve micronutrient deficiency problem by promoting supplements and Food fortification making vitamin A a popular micronutrient among the primary food shoppers.

Individuals who search for nutritional information of fortified food prior to purchase, either from relatives, friends or an alternative source, are expected to have increased probability of eating foods that are fortified. This expectation is because knowledge of fortified foods is likely to increase by inquiring from others as reported by Pambo (2013). Television was the most used source of fortification information at 47.1% followed closely by radio 34.5% while relatives/neighbors happened to be the least common source of fortification information 3.8%. This communication channels need to be exploited more in order to disseminate fortification information to a large target audience.

5.1.3 Utilization of fortified maize flour

The maize flour consumed by primary food shoppers in Mathare is mainly fortified, 83% of primary food shoppers use fortified maize flour 25.2% male while 74.8% female, this statistic corroborates to a nutrition survey by MOH that states 80.9% of maize flour that is consumed from the urban slums of Nairobi is fortified and mainly bought from supermarkets and shops. As such, fortified maize flour is useful in fighting micronutrient malnutrition in the urban slums of Mathare as it is widely consumed. This statistic differs from a study that reported Consumption sifted maize flour in Kenya was at 33% (Fiedler et al., 2013) evidence that a lot of progress has been made in increase of utilization levels of fortified maize flour since 2013.

The frequency of consuming fortified maize flour was low as 39% of primary food shoppers used it daily while 10% used it monthly. These results corroborate the report by KDHS (2014) which revealed 33 per cent of children of the age 6 months to 23 months had eaten foods that were rich in iron the night or day preceding the survey hence corroborating this study. However, 15% of primary food shopper reported to never consuming fortified maize flour and attributing this to its high price hence cannot feed their large families, low satiety value and perceived poor nutritional value were the main excuses given. For 49% of the Participants fortified maize flour was the most commonly used maize flour while 46% stated that fortified maize flour was the flour they were currently using.

5.1.4 Factors influencing knowledge and utilization of fortified maize flour

Knowledge of fortified maize flour determines its utilization, there is significant statistical association in analysis of utilization of fortified maize flour, knowledge of fortified maize flour had a p value = 0.00. When the level of knowledge on fortified

maize flour increases by 1 the probability of utilization of fortified maize flour increases by 4.332 times. Individuals who are highly expected to consume fortified foods are the ones with information about the benefits of micronutrients in their meal. This is because micronutrients play a very vital role in improving human health, (Pambo, 2013). More emphasis needs to be made to create awareness on the need and importance of using fortified maize flour so as to fight micronutrient malnutrition using locally available fortified maize flour. Hence the null hypothesis is rejected, as knowledge of fortified maize flour does influence its utilization. Primary food shoppers with knowledge of fortified maize flour are more likely to use fortified maize flour.

Household size is one of the factors that determined utilization of fortified maize flour. This means that analysis of House hold size (P = 0.005) had a significant statistical association to utilization of fortified maize flour. Larger households would need to use a lot of money in order to purchase enough flour to satisfy their high number more so its low satiety value proved uneconomical to households with many members. Thus, the null hypothesis is rejected, the larger the household size the less the chances of utilization of fortified maize flour.

Preference of fortified maize flour determined its utilization, with P value = 0.000 preferences had a significant statistical association to utilization of fortified maize flour. Hence the null hypothesis is rejected as it is evident that the preference of fortified maize flour indeed does influence utilization. Primary food shoppers who preferred maize flour were 64% utilized it more, most common reason for preference being ‘it cooks easily and faster hence consuming less fuel.

The more knowledge a primary food shopper had concerning fortified maize flour the more the chances of its utilization. Analysis of level of food fortification knowledge (P = 0.002) had a significant statistical association to utilization of fortified maize flour. These results lead to rejection of the null hypothesis since the level of food fortification knowledge influenced primary food shoppers to consume it. These results are similar to the results from a study which reported that 'many peoples' decision while choosing food are influenced by their level of knowledge, the more the education; the more knowledgeable they are about nutrition' (Pambo et al.,2013).

To determine the most important factors that influence utilization of fortified maize, primary food shoppers were asked to rate six factors; price, taste, children's preference, nutritional value, known/trusted brand and availability. The most important factor that influenced utilization of fortified maize flour was its availability. 57.7% of primary food shoppers ranked availability of fortified maize flour as the most important factor that made them utilize it this is because even when there is power blackout/ no electricity they can still get the fortified maize flour unlike those purchasing loose maize flour from posho mill. Point of purchase was mainly the shops at 74% while 7% bought their maize flour from the supermarket; fortified maize flour was readily available in Mathare slum. This result contradicts a study by Lupin and Rodriguez (2012) that states individuals who regularly visit alternative outlets for instance open market, retail stores and shops are expected to have a lower consumption of fortified foods.

Fortification of food is a convenient and low-cost approach in improving the nutritional status of the at-risk population, mainly infants and women (Best et al., 2011). Price was ranked the second most important factor influencing utilization of

fortified maize flour to 55% of the primary food shoppers. Inflation of the price of fortified maize flour hinders many primary food shoppers from utilizing it.

Its beneficial to Fortify food as it easily reaches a large scope of vulnerable people through available food distribution channels without interfering with their feeding behavior thus making food fortification a useful and practical public health technique (Best et al., 2011; Serdula, 2010b). Utilization of fortified maize flour by 43.2% of primary food shoppers was influenced by taste, maize flour being a staple food in Kenya is used to fight vitamin A and iron deficiency. Primary food shoppers considered the good taste of fortified maize flour a very important factor that makes them utilize it, fortified maize flour is readily accepted because the fortificants did not alter its original taste.

Children's preference was a most important factor influencing utilization of fortified maize flour to less than 50 per cent of primary food shoppers. Adult's preference was more influential than the children's preference when it comes to utilization of fortified maize flour, 41.6% of primary food shoppers reported their children's preference of fortified maize flour as the main reason behind its utilization in their households.

Known or trusted brands of fortified maize flour was ranked as the fifth most important factor as it influenced utilization of fortified maize flour as reported by 37.1% of primary food shoppers. Primary food shoppers didn't mind purchasing unpopular brands of fortified maize flour as long as it was available. This result contradicts a study that reports the uptake chances of fortified maize flour are likely to be greater in individuals who trust the food fortification institutions since purchasing decision of the fortified foods is used to show their confidence in it, (Pambo, 2013).

A barrier to intake of enriched food is still lack of realistic data on the consumers' knowledge of foods that are fortified (Pambo, Otieno, Okello, 2014). Nutritional value was the least important factor for primary food shoppers as only 36.6% of primary food shoppers reported it as being most important factor that influenced its utilization. Advertisements about fortified maize flour in the media mainly focus on its taste rather than its nutritional value hence leaving many primary food shoppers with little to no nutritional information of the value and importance of the fortified maize flour.

5.2 Conclusion

This chapter will conclude the research by summarizing the key research findings in relation to research aims, research questions as well as contribution. Limitations of the research will also be reviewed and future research opportunities will be proposed.

This research aimed to explore the level of knowledge and utilization of fortified maize flour among Mathare residents, Nairobi. The results indicate more than half of primary food shoppers in Mathare are aware of fortified maize, but unfortunately its only 25.5% that understand it meaning. Furthermore house hold size, preference of fortified maize flour and level of food fortification knowledge were factor that determined utilization of fortified maize flour. Most of primary food shoppers utilize fortified maize flour as compared to non-fortified maize flour hence it is a food choice for many primary food shoppers in Mathare making it the right choice for fighting micronutrient malnutrition in Mathare.

In addition, knowledge on fortification influences utilization of fortified maize flour; the more knowledgeable a primary food shopper is about fortification the higher the chance of utilizing the fortified maize flour. Likewise household size, preference of fortified maize flour and level of food fortification knowledge influence utilization of fortified maize flour. Also, price and availability were ranked the most important factors influencing utilization of fortified maize flour by primary food shoppers whereas the nutritional value of fortified maize flour was ranked as the least important influencer. The research also showed that hospitals were among the least considered sources of fortification information for primary food shoppers in Mathare yet micronutrient malnutrition is diagnosed in the hospital. Moreover, large household sizes and primary food shoppers with low income preferred loose flour which was not fortified.

Unfortunately, verifying fortification in the food laboratory for each packet of maize flour the primary food shoppers used, was constrained by resources, hence this limited the research. Future researchers can do similar studies by verifying if the flour is fortified, assess the anthropometric status and the micronutrient status of the primary food shoppers by checking their blood samples.

5.2.1 Conclusion on Hypotheses

Null hypotheses Ho1 is rejected, knowledge of fortified maize flour does influence its utilization.

Null hypotheses Ho2 is rejected, socio demographic factor such as household size influence utilization of fortified maize flour.

5.3 Recommendations

5.3.1 Recommendations from the study

i. Due to the high number of primary food shoppers who do not understand the meaning and importance of fortification, the Human Nutrition and Dietetics unit in the ministry of health should increase and maintain awareness on fortification.

ii. Majority of primary food shoppers are female yet very few reported the hospital as their source of fortification information, hence Ruaraka sub-county nutrition officer should ensure nutrition education is linked to programs that promote gender such as merry go rounds and also promote consistent nutrition education (that include fortification topic) to be given to mothers during antenatal and post natal visit in the health centers.

iii. Additionally, fortified loose flour should be milled and sold to primary food shoppers, who were more concerned about the low satiety value of sifted flour, those with low household income and large household size as this would enhance more acceptability of fortified maize flour.

5.3.2 Recommendation for further research

i. Future researchers should do similar studies by verifying if the flour used by primary food shoppers is fortified.

ii. Similar studies should be carried out on primary food shoppers by assessing the anthropometric status and the micronutrient status by checking their blood samples so as to assess if utilization of fortified maize flour has an impact on the health and nutrition status of its consumers.

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APPENDICES

Appendix 1: Informed Consent Form

I am Samira Hussein, a post graduate student in Kenyatta University studying Masters in Public Health. I am undertaking a study on the knowledge and utilization of fortified food among household heads in Mathare, Nairobi: the case of vitamin A and iron fortified maize flour.

Procedure to be followed

In order to participate in this study, I will be required to ask you several questions. Taking part in the study is voluntary, at any one time you are permitted to make enquiries associated with the study, decline to reply any question or discontinue the interview at any moment without any repercussions.

Discomforts and risks

You can decline to respond to any question that may make you embarrassed or lead to any kind of uneasiness. You are allowed to end the interview at any instance. The interview may last roughly half an hour.

Benefits

If you partake in this study, you will assist us to understand the level of knowledge and utilization of fortified food among household heads in Mathare.

Rewards

Through accepting to take part in this particular study you will not get any kind of reward.

Confidentiality

Your name will not be written on the questionnaire. A locked filing cabinet will be used for protection of the information at Kenyatta University. Everything will be kept private.

Contact information

In case of enquiries, you may contact me on 0720 771 246 or Dr. Eunice Njogu on 0722 862 052 or Dr. Drusilla on 0721 262 355 or the Kenyatta University Ethical Review Committee Secretariat on chairman.kuerc@ku.ac.ke or secretary.kuerc@ku.ac.ke

Participant's statement

I have certainly understood the data provided above concerning my contribution to the study. An opportunity for asking questions was provided and my concerns have been addressed satisfactorily. My contribution towards this study is completely willingly. I am aware that my information will be well-kept under safe custody and that I can stop taking part in the interview at any instance.

Name of participant …… …….

Signature/thumb print …… Date ……

Investigators statement

I, the signatory, have used a language the volunteer comprehends to clarify the benefits and risks involved and the steps to be taken in the study.

Name of the interviewer……

Interviewer's signature…… Date…….

Appendix 2: Questionnaire

STRUCTURED QUESTIONNAIRE

INTERVIEWEES: primary food shoppers

Questionnaire No.……

Date of Interview…….

Name of Interviewer……

Name of sample area……

SECTION A: SOCIO-DEMOGRAPHIC DETAILS

1. What is your age? _____

2. Gender_____

3. What is your marital status?

a) Single

b) Widowed

c) Married

d) Separated/Divorced

4. What type of family are you from?

a) Nuclear

b) Single parent

c) Sibling household

d) Extended

5. How many do you live in your household? _____

6. What is your level of education? (Indicate if complete or not)

a) No education

b) Primary

c) Secondary

d) Vocational Training

e) University

7. What is your primary occupation?

a) Self employed

b) Casual

c) Student

d) Employed

e) Other (Specify)…….

8. What is your household income?

a) Less than KES 3000

b) Between KES 3000 and 5000

c) Between KES 5001 and 10000

d) Over 10000

e) don’t know

9. What is your religion?

a) Christian

b) Muslim

c) Other……

10. How many members are in your household?.....

11. What type of a house does the interviewee live in?

a) Mud wall

b) Stone wall

c) Storey house

d) Iron sheets

e) Other…….

12. Where do you purchase the foods, you consume in your households?

a) supermarkets

b) retail stores

c) shops

d) open markets

SECTION B: KNOWLEDGE OF FOOD FORTIFICATION

1. What type of maize flours do you know?
    a) Roller mill/sifted flour
    b) Hammer mill/loose flour
2. What type of maize flour are you currently using?
    a) Roller mill/sifted flour
    b) Hammer mill/loose flour
3. What type of maize flour do you use commonly?
    a) Roller mill/sifted flour
    b) Hammer mill/loose flour
4. Have you heard of food fortification?

a. Yes

b. No

5. Do you understand what food fortification entails?
    a) Yes
    b) No

6. Have you heard of fortified maize flour?

   a) Yes

   b) No

7. Do you use fortified maize flour?

a) Yes

b) No

c) Not sure

8. Name 2 brands of fortified maize flour_____ _____

9. If yes to question 6, tick (√) the minerals and vitamins being added to flour

a) Iron

b) zinc

c) Vitamin A

d) Folic acid

e) sodium

f) all

g) none

h) not sure

10. If yes to question number 3above, tick (√) your information source

a) Television

b) Radio

c) Newspaper

d) Social Media

e) Posters

f) Other Specify _____

g) All

h) none

11. Is maize flour fortification of importance to the society, rank 1-5?

a) Not important (1)

b) Of Little Importance (2)

c) Moderately Important (3)

d) Important (4)

e) Very Important (5)

12. What are the benefits of fortifying maize flour with iron and vitamin A?

a) …….

b) …….

c) …….

d) ……

e) …….

13. What other fortified food products do you know?

a) …….

b) …….

c) …….

d) …….

f) Not aware

14. Have you ever seen the fortification logo? (alama ya kuboresha afya)

a) Yes

b) no

15. Where is the logo located on the packet?

a) Top

b) underside

c) side

d) front

e) back

f) not sure

g) all sides

h) underside, front and back

16. Do you read the nutrition information of a product before purchase?

a) Yes

b) No

17. Where is the nutrition information written on the packet?

a) Top

b) underside

c) side

d) front

e) back

f) not sure

g) all sides

18. Do you have a specific shop where you buy from?

a) Yes

b) No

19. Is fortified maize flour stocked in the shop where you buy from?

a) Yes

b) No

20. What is the distance from your home to the shop that stocks fortified maize flour?

_____

SECTION C: UTILIZATION OF FORTIFIED FOOD

1. Do you prefer fortified maize flour over non-fortified maize flour?

a) Yes

b) No

2. How do the following influences your preference of fortified maize flour?

Rank 1-5 where 1-does not,2-slightly,3-influences,4-moderate,5-extremely

Influencers	**1**	**2**	**3**	**4**	**5**
Price					
Taste					
Nutritional value					
Children preference					
Known or trusted brands					
Availability					
Others (specify) _____					

3. Do you use fortified maize flour?

a) Yes

b) No

4. How do the following influences your utilization of fortified maize flour? Rank 1-5 where 1-does not,2-slightly,3-influences,4-moderate,5-extremely

Influencers	**1**	**2**	**3**	**4**	**5**
Price					
Taste					
Nutritional value					
Children preference					
Known or trusted brands					
Availability					
Others (specify) _____					

5. If yes to question 3 above, how often do you use the fortified maize flour? tick (√)

a) Every day

b) Every 2- 3 days

c) Weekly

d) Fortnightly

e) Once a month

6. Is the fortified maize flour bought on credit or cash? _____

7. What is your opinion about food fortification?

……

Observation Checklist

Observed Practices	**Yes**	**No**
Distinguishes between fortified and non-fortified maize meal:		
Stocks a packet of fortified maize meal:		
Recalls the consumption of fortified maize meal in the last 48 hours:		
Able to identified types of fortificants listed on a packet of maize meal:		

Appendix 3: 24 Hour Recall

TIME	FOOD OR BEVERAGE CONSUMED	COOKED HOME OR BOUGHT COOKED

Appendix 4: Shopkeepers questionnaire

SHOPKEEPERS QUESTIONNAIRE

Date of Interview_____

Age in Years_____

Gender_____

Position_____

1. Have you heard about food fortification? _____
2. What does fortification entail?

   _____

3. What fortified food products do you know?

   _____

   _____

4. What fortified food products do you stock?

   _____

   _____

5. Which brands of fortified maize flour do you know?

   _____

6. Which brands of fortified maize flour do you stock?

   _____

7. What is the stock turn over between fortified and non-fortified maize flour?

   _____

8. What factors make food shoppers utilize fortified maize flour?

9. _____

   _____

   What are some of the challenges that prevent the primary food shoppers from consuming maize flour?

   _____

   _____

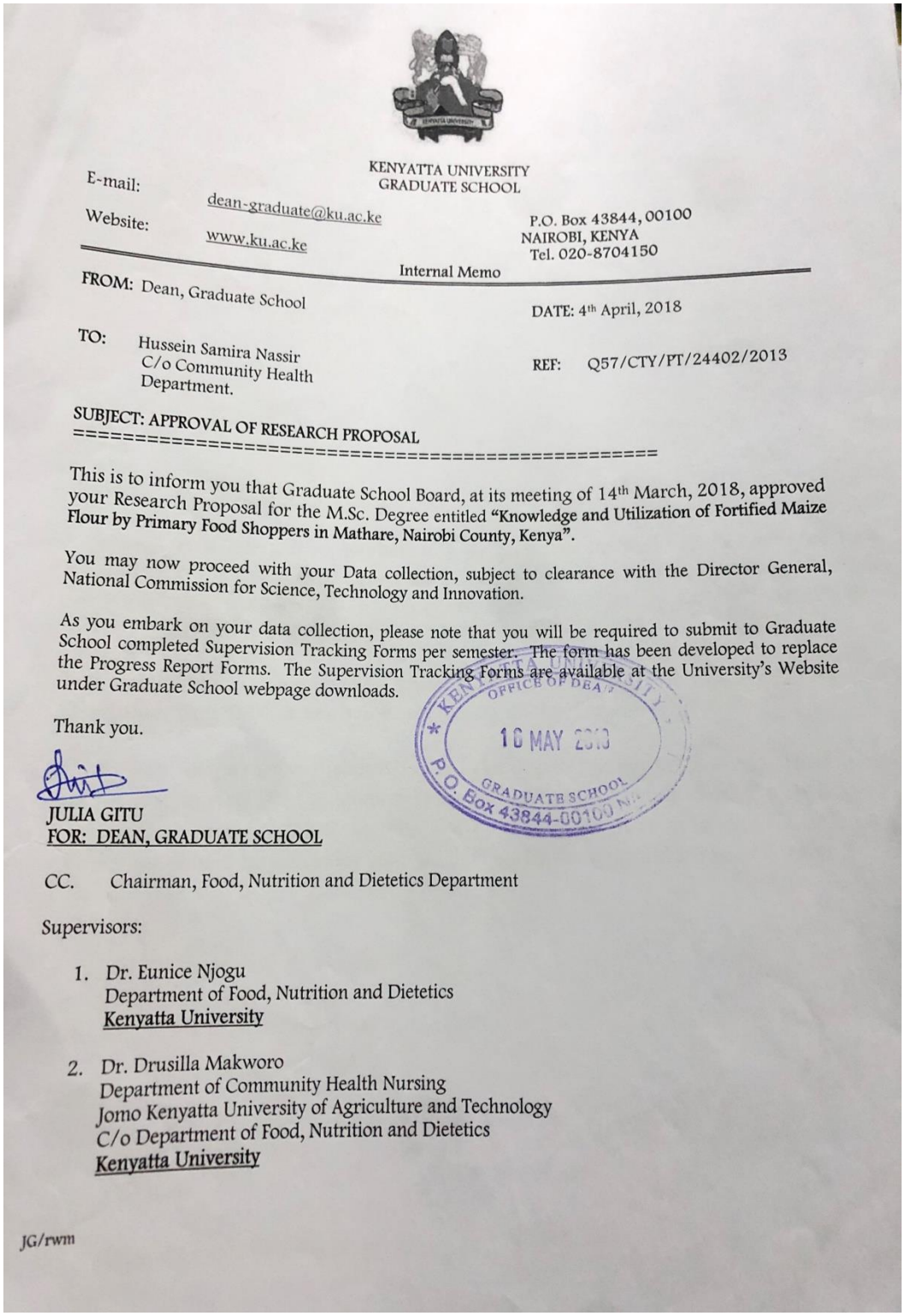
10. Do you use fortified maize flour over non fortified maize flour and why?

    _____

    _____

Your perception and the information you shared will be of much assistance to me. I appreciate the time you have accorded me.

Appendix 5: Approval of research proposal



KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 020-8704150

Internal Memo

FROM: Dean, Graduate School

DATE: 4th April, 2018

TO: Hussein Samira Nassir
C/o Community Health
Department.

REF: Q57/CTY/PT/24402/2013

SUBJECT: APPROVAL OF RESEARCH PROPOSAL

This is to inform you that Graduate School Board, at its meeting of 14th March, 2018, approved your Research Proposal for the M.Sc. Degree entitled **"Knowledge and Utilization of Fortified Maize Flour by Primary Food Shoppers in Mathare, Nairobi County, Kenya".**

You may now proceed with your Data collection, subject to clearance with the Director General, National Commission for Science, Technology and Innovation.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed Supervision Tracking Forms per semester. The form has been developed to replace the Progress Report Forms. The Supervision Tracking Forms are available at the University's Website under Graduate School webpage downloads.

Thank you.

OFFICE OF DEAN
16 MAY 2018
GRADUATE SCHOOL
P.O. Box 43844-00100

JULIA GITU
FOR: DEAN, GRADUATE SCHOOL

CC. Chairman, Food, Nutrition and Dietetics Department

Supervisors:

1. Dr. Eunice Njogu
   Department of Food, Nutrition and Dietetics
   Kenyatta University

2. Dr. Drusilla Makworo
   Department of Community Health Nursing
   Jomo Kenyatta University of Agriculture and Technology
   C/o Department of Food, Nutrition and Dietetics
   Kenyatta University

JG/rwm

Appendix 6: Graduate school approval

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 8710901 Ext. 57530

Our Ref: Q57/CTY/PT/24402/2013

DATE: 4th April, 2018

Director General,
National Commission for Science, Technology
& Innovation
P.O. Box 30623-00100,
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR HUSSEIN SAMIRA NASSIR – REG. NO. Q57/CTY/PT/24402/2013

I write to introduce Ms. Hussein Samira Nassir who is a Postgraduate Student of this University. She is registered for M.Sc. degree programme in the Department of Food, Nutrition and Dietetics.

Ms. Nassir intends to conduct research for an M.Sc. Proposal entitled, "Knowledge and Utilization of Fortified Maize Flour by Primary Food Shoppers in Mathare, Nairobi County, Kenya".

Any assistance given will be highly appreciated.

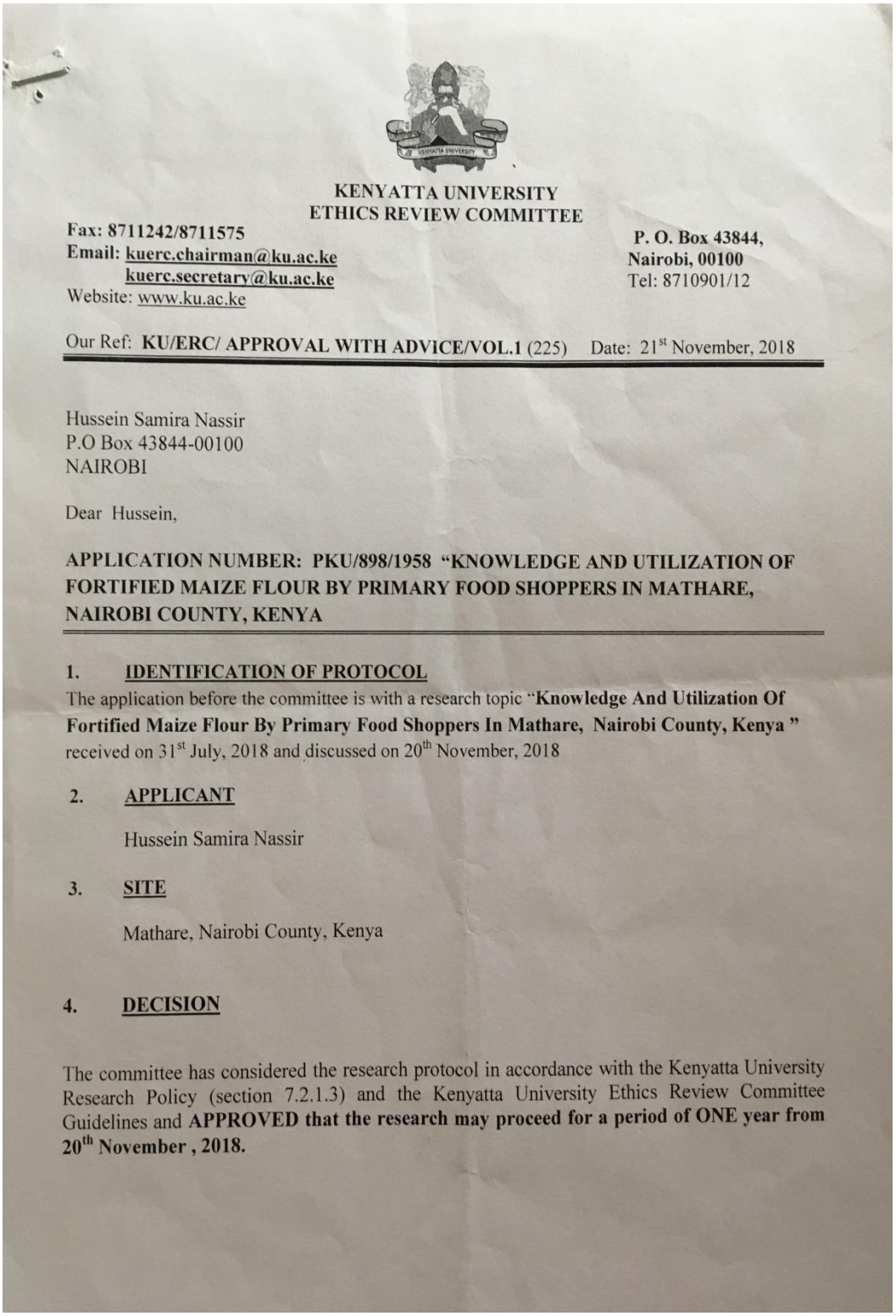
Yours faithfully,

MRS. LUCY N. MBAABU
FOR: DEAN, GRADUATE SCHOOL

KENYATTA UNIVERSITY OFFICE OF DEAN 18 MAY 2018 GRADUATE SCHOOL P.O. Box 43844-00100 NAIROBI

JG/rwm

Appendix 7: Kenyatta University Ethics and Review Committee



KENYATTA UNIVERSITY
ETHICS REVIEW COMMITTEE

Fax: 8711242/8711575
Email: kuerc.chairman@ku.ac.ke
kuerc.secretary@ku.ac.ke
Website: www.ku.ac.ke

P. O. Box 43844,
Nairobi, 00100
Tel: 8710901/12

Our Ref: **KU/ERC/ APPROVAL WITH ADVICE/VOL.1** (225) Date: 21st November, 2018

Hussein Samira Nassir
P.O Box 43844-00100
NAIROBI

Dear Hussein,

APPLICATION NUMBER: PKU/898/1958 "KNOWLEDGE AND UTILIZATION OF FORTIFIED MAIZE FLOUR BY PRIMARY FOOD SHOPPERS IN MATHARE, NAIROBI COUNTY, KENYA

1. **IDENTIFICATION OF PROTOCOL**

The application before the committee is with a research topic "**Knowledge And Utilization Of Fortified Maize Flour By Primary Food Shoppers In Mathare, Nairobi County, Kenya "** received on 31st July, 2018 and discussed on 20th November, 2018

2. **APPLICANT**

Hussein Samira Nassir

3. **SITE**

Mathare, Nairobi County, Kenya

4. **DECISION**

The committee has considered the research protocol in accordance with the Kenyatta University Research Policy (section 7.2.1.3) and the Kenyatta University Ethics Review Committee Guidelines and **APPROVED that the research may proceed for a period of ONE year from 20th November , 2018.**

5. **ADVICE/CONDITIONS**

Scientific design and conduct of the study; Data analysis methods are inadequate. Use cross- sectional analytical design.

Care and protection of research participants; Low risk study

Protection of research participant's confidentiality; Not mentioned how confidentiality will be assured

YOU MUST ALWAYS ENSURE

i. Progress reports are submitted to the KU-ERC every six months and a full report is submitted at the end of the study.
ii. Serious and unexpected adverse events related to the conduct of the study are reported to this committee immediately they occur.
iii. Notify the Kenyatta University Ethics Committee of any amendments to the protocol.
iv. Submit an electronic copy of the protocol to KUERC.

When replying, kindly quote the application number above.
If you accept the decision reached and advice and conditions given please sign in the space provided below and return to KU-ERC a copy of the letter.

KENYATTA UNIVERSITY OFFICE OF THE CHAIRMAN 08 JAN 2019 ETHICS REVIEW COMMITTEE P.O. BOX 43844 - 00100 NAIROBI

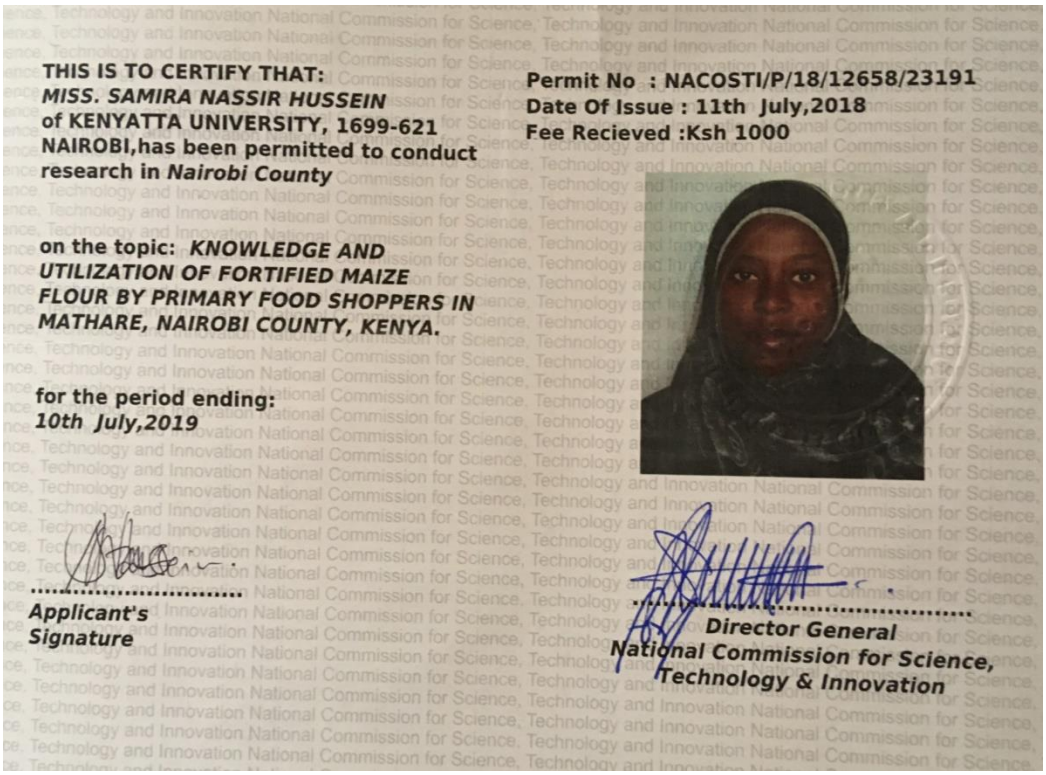
PROF. JUDITH KIMIYWE
CHAIRMAN ETHICS REVIEW COMMITTEE

I Samira Nassir Hussein accept the advice given and will fulfill the conditions therein.

Signature..... Dated this day of 8th Jan 2019 2018.

cc.
DVC-Research Innovation and Outreach

Appendix 8: National Commission of Science, Technology and Innovation Permit



THIS IS TO CERTIFY THAT:
MISS. SAMIRA NASSIR HUSSEIN
of KENYATTA UNIVERSITY, 1699-621
NAIROBI,has been permitted to conduct
research in *Nairobi County*

on the topic: *KNOWLEDGE AND UTILIZATION OF FORTIFIED MAIZE FLOUR BY PRIMARY FOOD SHOPPERS IN MATHARE, NAIROBI COUNTY, KENYA.*

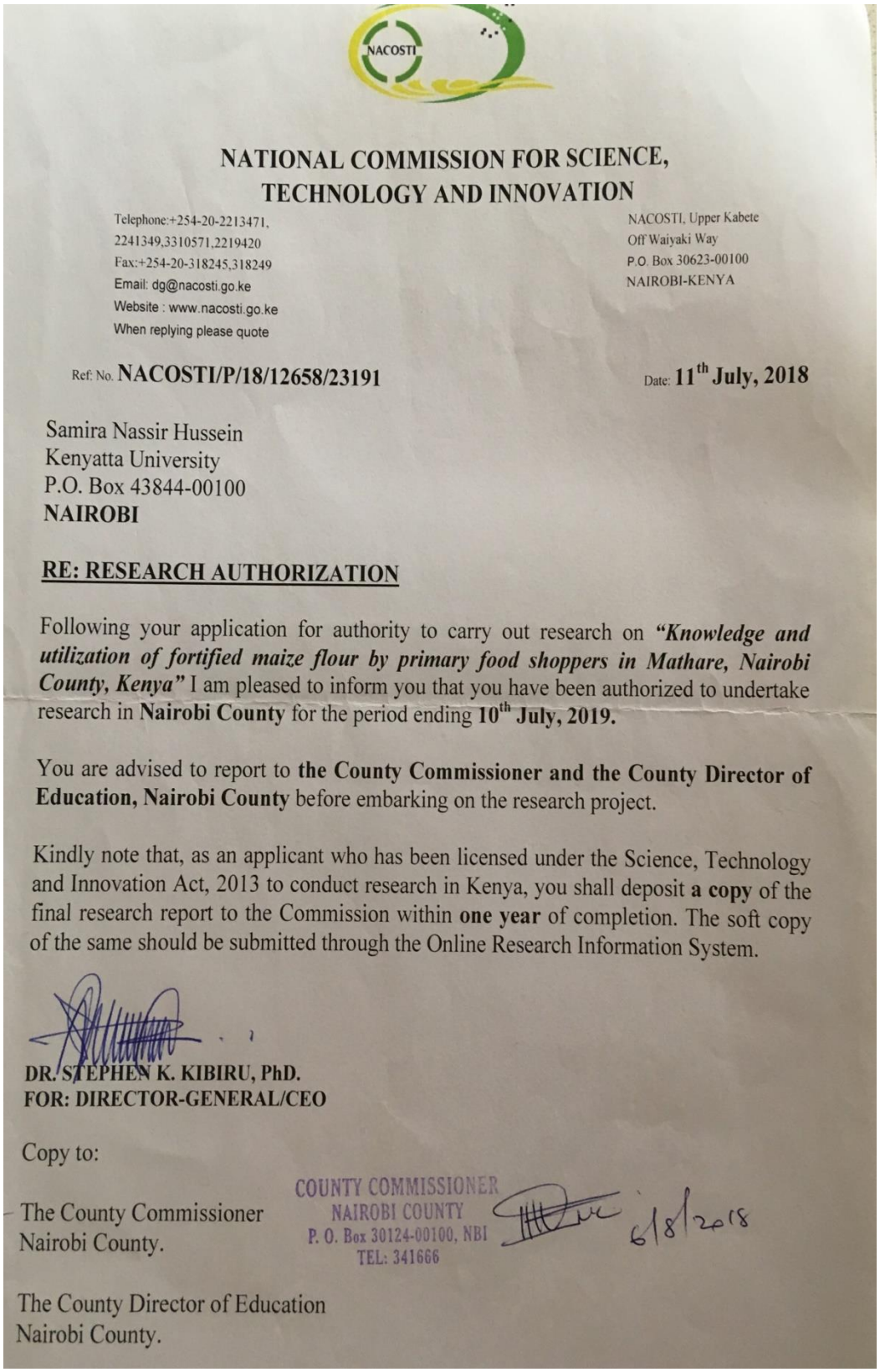
for the period ending:
10th July,2019

Permit No : NACOSTI/P/18/12658/23191
Date Of Issue : 11th July,2018
Fee Recieved :Ksh 1000

.....
Applicant's Signature

.....
Director General
National Commission for Science, Technology & Innovation

Appendix 9: National Commission of Science, Technology and Innovation Approval



NACOSTI

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone:+254-20-2213471, 2241349,3310571,2219420
Fax:+254-20-318245,318249
Email: dg@nacosti.go.ke
Website : www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/18/12658/23191**

Date: **11th July, 2018**

Samira Nassir Hussein
Kenyatta University
P.O. Box 43844-00100
NAIROBI

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Knowledge and utilization of fortified maize flour by primary food shoppers in Mathare, Nairobi County, Kenya"*** I am pleased to inform you that you have been authorized to undertake research in **Nairobi County** for the period ending **10th July, 2019.**

You are advised to report to **the County Commissioner and the County Director of Education, Nairobi County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

DR. STEPHEN K. KIBIRU, PhD.
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Nairobi County.

COUNTY COMMISSIONER
NAIROBI COUNTY
P. O. Box 30124-00100, NBI
TEL: 341666

6/8/2018

The County Director of Education
Nairobi County.

Appendix 10: Ministry of Education State Department of Early Learning and basic Education approval

Republic of Kenya

MINISTRY OF EDUCATION

STATE DEPARTMENT OF EARLY LEARNING AND BASIC EDUCATION

Telegrams: "SCHOOLING", Nairobi
Telephone; Nairobi 020 2453699
Email: rcenairobi@gmail.com
cdenairobi@gmail.com

When replying please quote

REGIONAL COORDINATOR OF EDUCATION
NAIROBI REGION
NYAYO HOUSE
P.O. Box 74629 – 00200
NAIROBI

Ref: RCE/NRB/GEN/VOL.1

DATE: 6th August, 2018

Samira Nassir Hussein
Kenyatta University
P. O. Box 43844 - 00100
NAIROBI

RE: RESEARCH AUTHORIZATION

We are in receipt of a letter from the National Commission for Science, Technology and Innovation regarding research authorization in Nairobi County on "*Knowledge and utilization of fortified maize flour by primary food shoppers in Mathare, Nairobi County, Kenya".*

This office has no objection and authority is hereby granted for a period ending 10th July, 2019 as indicated in the request letter.

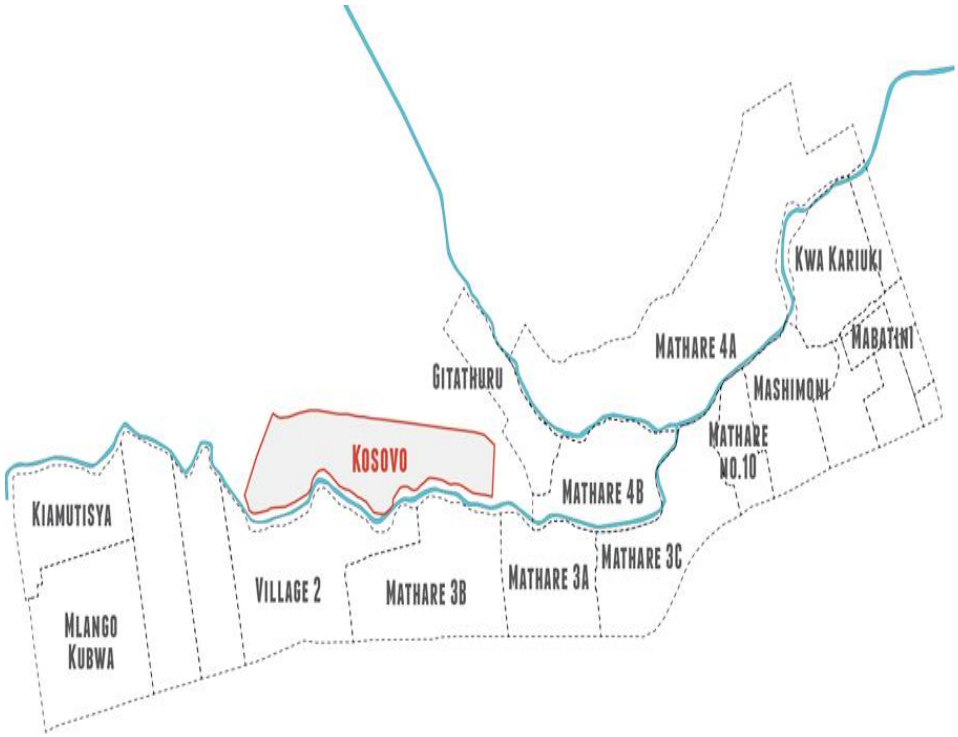
Kindly inform the Sub County Director of Education of the Sub County you intend to visit.

06 AUG 2018

JAMES KIMOTHO
FOR: REGIONAL COORDINATOR OF EDUCATION
NAIROBI

Copy to: Director General/CEO
National Commission for Science, Technology and Innovation
NAIROBI

Appendix 11: Map of the Study Area



Map of Mathare Valley:

Source: Google Maps