PREDICTORS OF PIGEON PEAS CONSUMPTION AMONG SCHOOL AGED CHILDREN IN KONGWA DISTRICT, DODOMA REGION

RUTH FRANK MREMI

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN HUMAN NUTRITION OF SOKOINE UNIVERSITY OF AGRICULTURE.

MOROGORO, TANZANIA.

2020

ABSTRACT

Protein energy malnutrition (PEM) and iron deficiency (ID) are global public health problems affecting developing countries with major consequences on human health as well as social and economic development. PEM at early childhood has serious long-term consequences because it impedes motor, sensory, cognitive, social and emotional development. Food-based strategies such as food production, dietary diversification and bio-fortification are the most sustainable and best approaches to increase the macro and micronutrient intake in a population. Despite these interventions, the adoption of foods resulting from introduced crops remains doubtful. People in Kongwa district have remained quite rigid in adopting new foods such as pigeon peas which are highly rich in protein and iron. This study aimed to investigate factors predicting consumption of pigeon peas among school-aged children living in Kongwa District. A cross-sectional questionnaire survey based on a combined model of the Theory of Planned Behaviour and Health Belief Model was undertaken, and reported here. A sample of 138 caregivers with school-aged children (5–12 years), preferably those involved in food preparations in households, was randomly selected from 4 villages in Kongwa. The selection also focused on those who were familiar with, or had consumed pigeon peas before. Intention to consume pigeon peas was significantly correlated with pigeon peas consumption (rs=0.263, P=0.002) while attitudes towards behaviour (stand. β=0.206, P=0.035) contributed significantly to the prediction of intention to consume pigeon peas. Perceived barriers appeared to be an important interaction term in the relationship between intention and behaviour (stand. β=-0.268, P=0.001). Health value (stand. β=0.485, P=0.000) contributed significantly to the prediction of health behaviour identity. In order to promote pigeon peas consumption, intention to consume pigeon peas could be increased by focusing on positive subjective

norms, health value and attitudes towards pigeon peas consumption. Finally, knowledge on the nutritive richness of pigeon peas should be emphasized so that people can appreciate the health benefits of consuming pigeon peas i.e. stimulate a positive attitude.

DECLARATION

I, RUTH FRANK MREMI, do hereby declare to the Senate of the Sokoine University of Agriculture that this dissertation is my original work done within the period of registration and that it has neither been submitted nor is being concurrently submitted to any other institution.

_____ _____

Ruth Frank Mremi Date

(MSc. Candidate)

The above declaration is confirmed by;

_____ _____

Prof. J. M. Msuya Date

(Supervisor)

COPYRIGHT

ACKNOWLEDGEMENTS

Firstly, I would like to express my special thanks to GOD the Almighty who gave me the strength, good health and ability to do my work and who made it possible for this work to come to completion regardless of all the challenges I encountered.

Secondly, I would like to express my deepest gratitude to my supervisor Professor John Msuya for his moral support, guidance, advice and comments which were the basis in preparing my research work from proposal to final research. Special thanks to Dr. Wanjiku Gichohi from International Crop Research Institute for Semi-arid Tropics for her support, comments and contribution to the study.

Thirdly, I would also like to give my sincere thanks to the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) for the financial support to accomplish my research project.

I owe my special and deepest gratitude to my father Frank Mremi, my mother Evamery Mremi my brothers Joel Mremi and Joshua Mremi. Not forgetting my beloved little sister Rebecca Mremi for their love, encouragement, social, economic and spiritual support and advice during my studies and report writing.

I would also like to thank my friends (Mr. Lufingo, John Byabato, Chidodo Simon, God bless Matowo and Monica Chande) for their cooperation, support and encouragement and to all the caregivers of Kongwa for their cooperation needed during data collection.

Finally, I also place in record, my sense of gratitude to one and all, who directly or indirectly participate on this study. May God bless you all abundantly.

DEDICATION

This thesis is dedicated to my beloved parents Mr and Mrs Frank Mremi who laid a very strong foundation for my education since day one. And my siblings Joel, Joshua and my baby sister Rebecca for their continued encouragement and unending support.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

CHWs	Community health workers
FGM	Female genital mutilation
HBM	Health Belief Model
ICRISAT	The International Crop Research Institute for the Semi-Arid Tropics
ID	Iron deficiencies
IQ	Intelligence quotient
MoHCDGEC	Ministry of Health, Community Development, Gender, Elderly and Children, Tanzania Mainland
NBS	National Bureau of Statistics
NMNAP	National Multisectorial Nutritional Action Plan
PEM	Protein energy malnutrition
SDG	Sustainable Development Goal
SPSS	Statistical Package for Social Sciences
ToTs	Training of trainers
TPB	Theory of Planned Behaviour
WHO	World Health Organization

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Protein energy malnutrition (PEM) and iron deficiencies (ID) are of major public health concern in most developing countries including Tanzania (WHO, 2015). Protein and iron requirements are particularly essential to school aged children (5-12) and women of reproductive age whereby millions of them in Tanzania continue to suffer from one or more forms of undernutrition, including, stunting, underweight, wasting, and anaemia (MoHCDGEC, 2015/2016).

PEM in early childhood has serious, long-term consequences because it impedes motor, sensory, cognitive, social and emotional development (WHO, 2015). Protein deficient children are less likely to perform well in school, and are more likely to become malnourished adults with greater risks of diseases and early death (Fanou-Fogny, 2011). Majority of children's deaths are caused by PEM since under-nutrition increases susceptibility to infectious diseases and poor dietary intake (UNICEF, 2018).

Anaemia among school-aged children (5-12 years) is defined as haemoglobin levels of less than 11g/dl (Mainasara *et al*., 2017). A study done by Oliveira (2015) in Southern Angola found that 21.6% of school aged children were anaemic and significantly associated with infections. Poor nutrition especially ID in school-aged children is associated with growth retardation, poor cognitive development, learning ability of children, lowered resistance to infectious diseases, and reduced physical work capacity and productivity of adults (Ruel and Alderman, 2013).

In order to prevent worsening of PEM and ID, there are different strategies that aim at addressing nutritional deficiencies such as supplementation, parenteral administration and food-based strategies (Poelman *et al*., 2014). Food-based strategies such as food production, dietary diversification and nutrient dense legumes are the most sustainable and best approaches to increase the macro and micronutrient intake in a population due to the associated multiple social, economic and health benefits (Hillenbrand and Waid, 2014). According to Thompson (2011), such approaches can bring about promotion of nutritional well-being and health of individuals through supporting incomes and livelihoods while providing the right to healthy food produced through ecologically sound and sustainable agriculture systems.

The Government of Tanzania has attempted to address the problem of poor dietary intake and diversification by providing nutrition education on proper dietary intake and encouraging farmers to plant different crop varieties (Huang *et al*., 2018). In supporting the government's efforts, development partners have also joined hands. The International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) through the Africa RISING Project has identified and pretested best management practices for integrating crops, livestock, land management and linking farming and marketing practices to nutrition and health (Pretty, Toulmin and Williams, 2011). The initiative has included cultivation of crops that are rich in macro and micro-nutrients by considering suitability of the environmental conditions (soils and weather conditions). In that respect, pigeon peas have been given high priority for semi-arid areas such as Kongwa in Dodoma (Bennett, 2014). However, despite the interventions, the adoption of foods resulting from the introduced crops remains doubtful. A study by Hillbur (2013) reported that people in Kongwa district have remained quite rigid in adopting new foods such as pigeon peas (Hillbur, 2013).

Other studies in Kongwa have been conducted on dietary diversity (Rajendran, 2017; Meena, 2015 and Ochieng, 2017), but none of them has focused on understanding the nutrition behaviour of the population. The studies focused more on dietary patterns, adequate supply of food, economic access and potential role of men in food diversification leaving the factors predicting ones' consumption.

Combined model of Theory of Planned Behaviour (TPB) and Health Belief Model (HBM) have been used worldwide to investigate nutrition behaviour, including examining how intention can influence one’s need to consume a particular type of food (Sun *et al.*, 2006). Considering that school-aged children is one of the most vulnerable population group prone to PEM and ID (Sengupta *et al*., 2019), and given the fact that pigeon peas have great potential to fight that kind of malnutrition, the current study was designed to use TPB and HBM to investigate factors predicting pigeon peas consumption among school-aged children (5-12 years) in Kongwa district.

1.2 Problem Statement and Justification

Pigeon peas are good source of protein and other nutrients. Pigeon peas has protein content of 21–26% and iron content of about 65% (Sharma, 2011). A study done by Seetha *et al* (2018) indicated that intake of legumes such as pigeon peas also provides access to all nine essential amino acids, as well as vitamin B group, ascorbic acid, carotene, iron and magnesium. These are all important nutrients for growth and development of school-aged children (Sharma, 2011). In that respect, dietary diversity involving pigeon peas if properly adopted can potentially contribute to addressing PEM as well as micronutrient deficiencies (Miller and Welch, 2013). Despite the fact that Dodoma Region is among the leading

producers of pigeon peas in Tanzania, people in the region do not have the habit of consuming this nutritious food crop (Teblick *et al*., 2017).

The crop is environmentally suited to the agro-ecological conditions of the area but the levels of PEM and ID are still high among school-aged children (Meena, 2015).

Majority of community members in Kongwa District are known to produce substantial amounts of pigeon peas but they do not consume them, but rather sell them for money (Seetha, 2018). In that sense, maize has remained to be their major staple food crop for feeding their children, especially for preparing porridge fed to infants and children. The major concern is that despite the high nutritive contents (and potential) of pigeon peas, the extent of consumption among school-aged children and general population of Kongwa is still low (Hillbur, 2013). Kongwa is one of the semi-arid districts in Dodoma Region which experiences frequent droughts and therefore prone to food insecurity and malnutrition including PEM and ID. However, the district is one among the leading producers of pigeon peas. This study therefore intended to identify factors that predict pigeon peas consumption in Kongwa District focusing on school-age children (5-12 years). The study is in line with strategies of the new 2016 - 2021 National Multisectorial Nutritional Action Plan (NMNAP) to increase dietary diversification and improve health of children. The study will also contribute in attaining the international agreements on nutrition improvement as addressed by the Sustainable Development Goal (SDG) II which aims to end hunger, achieve food security and improve nutrition. The findings are likely to help bring about a good understanding of the consumption dilemma that nutrition development workers and agencies tend to frequently face when trying to promote consumption of new non-staple foods or new food products for improving health and nutrition.

1.3 Study Objectives

1.3.1 General objective

The general objective of this study was to investigate predictors of pigeon peas among school-aged children (5-12 years) living in Kongwa District Tanzania.

1.3.2 Specific objectives

The above-mentioned general objective was attained by undertaking the following specific objectives:

i. To determine the association between caregiver's background and perception about pigeon peas and intention to feed them to school-aged children (5-12 years).
ii. To establish the association between caregiver's beliefs, attitudes and intention to feed pigeon peas to school-aged children (5-12 years).
iii. To assess among caregivers, the association between their intention of feeding pigeon peas to their school-aged children and the general consumption pattern of pigeon peas in Kongwa.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 An Overview of Pigeon PEAS

Pigeon peas (*Cajanus Cajan L*) is considered the most important grain legume for human nutrition in many of the protein-deficient tropical countries of the world because of its potential as a protein supplement to cereal-based diets (Pujiati and Primiani, 2016). Pigeon peas is a grain legume that is well adapted to low rainfall patterns and thrives in low fertility soils. It is therefore a crop that can reduce the hunger gap in semi-arid regions and help in solving the problem of protein energy malnutrition and iron deficiency anaemia among school aged children (Sharma *et al.*, 2011). Several studies have investigated on the different varieties of pigeon peas and their adoption rates (Otieno, 2010; Marathe *et al.*, 2011 and Otieno *et al*., 2011). However, there is no information on the consumption of pigeon peas among school-aged children, hence this study focused on factors predicting pigeon peas consumption among school-aged children of 5 - 12 years of age.

2.1.1 Different pigeon peas varieties commonly grown

Pigeon peas is one of the few crops with a high potential for poor farmers due to its complementary resource and high tolerance to harsh climatic conditions (Shiferaw and Kebede (2008). Lack of quality seeds have left the poor farmers with no option but to grow local landraces that are low yielding and late maturing (Waldma *et al.,* 2017).

New geno-types from breeding programmes in Tanzania, which were developed by the International Crops Research Institute in the Semi-Arid Tropics (ICRISAT), are medium

and short-duration Fusarium-resistant varieties. They can with stand soils of low nutrient availability, and have the best grain quality which can help the farmers to have increased yields. Study done by Hogh-Jensen, (2007) assessed the performance of six pigeon peas varieties on farmers' fields in Eastern and Southern Africa, the varieties were ICP 9145; ICEAP 00020, ICEAP 00053 and ICEAP 00068, traditional landraces a local variety called "Babati White. The main genotypes of pigeon peas used by farmers are traditional landraces that are prone to soil borne fungal diseases and grain yields are of low quality. Findings reviled that ICEAP 00040 variety outperformed all the other tested varieties. However, knowledge is still lacking about the performance of the introduced varieties across a large span of environments (Amare *et al.,* 2012)**.**

2.1.2 Agronomic characteristics of pigeon peas

Major agronomic factors influencing yield of pigeon peas include appropriate maturity, sowing time, seed rates, row arrangements and nutrition. The short-duration types (<140 days) are cultivated as a sole crop and harvested before the sowing of post-rainy-season crops (Saxena *et al*., 2018). In pigeon peas-based inter-cropping systems, very little agronomic or genetic innovation, apart from hybrids, has been introduced. Since the pigeon peas yields in such systems depend upon moisture that is present at the harvest of the companion crop, the 'decision support tools' based on crop simulation models could assist in maximizing and stabilizing the yield (Saxena *et al*., 2018).

2.1.3 Requirement for growing pigeon peas

The first and foremost pre-requisite for a good crop production is timely availability of quality seeds of the given hybrid parents for sowing where by the reliability of the seed source should be of the highest order (Saxena, 2006). For the growth and proper yield of

pigeon peas, few things should be kept under considerations including field preparation, sowing, weed control and insect management.

To select a field for large-scale seed production of pigeon peas, it is very important to ensure the recommended isolation distance from one crop to another for proper growth, and the field should have a known history of good soil fertility (Tikle, 2015).

Time of sowing should be at the onset of the rainy season, which will ensure good plant growth and development. For short-duration types, the row-to-row spacing of 30 cm at lower latitudes, and 45 to 60 cm at higher latitudes with plant-to-plant spacing of 10 to 20 cm is recommended. For this spacing, a seed rate of 25–30 kg per ha is sufficient (Saxena, 2006).

The seeds depth should be about 5 cm and covered properly with soil to ensure a good contact between seed and soil particles and ultimately germination. The slow initial seedling growth of pigeon peas makes it prone to weed competition particularly during the first six weeks of growth. In general, three hand weeding, the first at 25–30 days, the second about 50–60 days, and the third at 80–90 days after sowing are sufficient to get rid of most weeds (Talnikar *et al*., 2008).

2.1.4 Challenges of pigeon peas promotion

Medium- and late-maturing pigeon peas both Fusarium wilt and sterility mosaic diseases are two of the challenges faced by both medium- and late-maturing pigeon peas crops, ICRISAT’s strategy aimed to breed both pure-line and hybrid cultivars with genetic resistance to both these diseases, insects and waterlogging. Therefore, to breed such varieties and to attain the target sustainability, ICRISAT launched a strong breeding

programme in which several cultivars and hybrid parents were bred. This was possible because of an effective field screening technology invented at ICRISAT (Saxena, 2008).

2.1.5 Pigeon peas consumption

Pigeon peas can be consumed in different forms depending on the local culture in different parts of the country or world. In West Indies, pigeon peas was firstly used as birds feed which led to the name pigeon peas. Over 81.49% of pigeon peas in India is consumed as de-hulled split cotyledons of pigeon peas are cooked to make dal (thick soup) for eating with bread and and rice, while in southern and eastern Africa, and South America its whole dry seeds are used in a porridge like recipe and immature seeds are used as vegetables, fresh sprouts, tempe, ketchup, noodles and snacks, but is also cooked alone or with other vegetables (Karri and Nalluri, 2017).

In addition, the by-products of split and shrinked seeds are also used as a cheap livestock feed as a substitute to high cost animal feed sources such as bone meal and fish meal (Karri, 2017). Pigeon peas flour has been tested and found to be suitable for consumption as bread, cookies and chapattis due to its high levels of protein, iron (Fe) and phosphorous (P) content (Jeevarathinam and Chelladurai, 2020), therefore it has been recommended for school feeding programmes and to vulnerable groups. Pigeon peas consumption in Tanzania is very low as people use it as a cash crop for exporting to India. In few places in the country, it is considered as food for the poor, and in Dodoma and Singida, and the neighbouring regions, pigeon peas is mostly consumed as a relish to go with a staple meal of either rice or maize.

2.1.6 Factors for low pigeon peas consumption

Pigeon peas can sometimes be used instead of meat due to its high protein content (Karri and Nalluri, 2017). However, review of literature indicates that pigeon peas is not consumed by the majority due to several factors. Singh *et al.*, (1984) indicated that green seeds of pigeon peas genotypes are nutritionally better than their mature seeds, hence people miss the variety they prefer like green pigeon peas which cannot be found though out the year. Other factor for low consumption of pigeon peas include cooking time, whereby green and dried pigeon peas requires different cooking time. Processed whole grain pigeon peas was found to be reduced in the cooking time significantly compared to cooking of raw pigeon peas grains. Consumers need foods that are quick to cook and which do not consume much time or fuel (Ghadge *et al.*, 2008). Experience from Nigeria shows that pigeon peas is soaked in water before boiling so as to reduce cooking time and also to save fuel used for cooking (Onwuka, 2006; and Fasoyiro *et al.*, 2005). A study done by Sujithra and Subhash (2014) indicated that pigeon peas grains are more susceptible to pest attacks and therefore once attacked consumers loose interest of consuming them.

2.2 Nutrients Deficiency Among School-aged Children

Iron and protein deficiencies are among the leading nutrient deficiencies among school children (Mondal *et al*., 2015). These deficiencies can result in serious health problems as they increase the risks for death of children (WHO, 2015).The reasons for nutrient deficiency among school aged children is poor feeding practices, lack of access to protein and iron rich foods (Powers and Buchanan, 2014; Reinhardt and Fanzo, 2014).

2.2.1 Iron deficiency (ID)

ID among school children is very common in poor developing countries (Rao *et al.,* 2015). Direct effects of ID are anaemia, poor cognitive development, eating disorders and malnutrition (Miller, 2013). Iron-deficiency anaemia (IDA) occurs when the haemoglobin concentration is below 2 standard deviations (–2SD) of the distribution mean for haemoglobin in an otherwise normal population of the same sex and age. IDA is generally characterized by a haemoglobin level of less than 110 g/L, plus a measure of poor iron status (Achouri *et al.*, 2015).

A study done by Perignon *et al.* (2014) on stunting and poor iron status indicted that poor cognitive performance of school-children was multifactorial and significantly associated with long-term stunting and current nutritional status indicators (iron status), as well as parasite infections (Perignon *et al*., 2014). Scholastic Performance, IQ and Scores of Mental balance, Attention and Concentration, Verbal Memory and Recognition were lower in iron deficient children as compared to the non-deficient children (More *et al*., 2013). School-aged children are more susceptible to anaemia and ID because of high iron requirements during growth, low intake of iron from complementary foods, chronic blood loss and frequent episodes of infections (Perignon *et al*., 2014).

2.2.2 Protein deficiency among school-aged children

Protein is a macronutrient that is vital for child growth and development, yet research shows that one in seven school-aged children do not meet their daily protein intake (Elango *et al.,* 2011). Protein plays an essential role in many bodily functions, including recovery and repair of tissues in the muscles, skin, organs, blood, hair and nails (WHO, 2015). According to World Health Organization, protein energy malnutrition (PEM) refers to an

imbalance between the supply of protein and energy and the body's demand for them to ensure optimal growth and function (WHO, 2015). PEM is a major public health problem in Tanzania, which affects a child at the most crucial period of development, which can lead to permanent impairment in later life. PEM is measured in terms of underweight (low weight-for- age), stunting (low height-for-age) and wasting or low weight-for-height (Bhutia, 2014).

The determinants of PEM are classified under four distinct categories (Eze *et al*., 2018) as: environmental factors including the physical and social environment, behavioural factors, health-care service related and biological factors. The socio-cultural factors play an important role wherein, it affects the attitude of the caregiver in feeding and care practices.

2.3 Theories Guiding the Study

This study was guided by two theories combined together, namely the Theory of Planned Behaviour (TPB) and Health Belief Model (HBM). Each theory is briefly highlighted below.

2.3.1 Theory of Planned Behaviour (TPB)

TPB is a theory that links one's beliefs and behaviour. The theory states that an individual's behavioural intentions and behaviours are together shaped by attitude, subjective norms, and perceived behavioural control (Kashif *et al*., 2018). Appendix I gives a summarized details of the theory. The behavioural intention is the chief construct in the TPB and is assumed to be made up of several constructs. The key constructs making up the behavioural intention are four namely, attitude towards behaviour, subjective norm, external control belief, and behavioural intention. Each is describe here:

i. *Attitude towards behaviour*: It represents a person's evaluation of performing a behaviour. The attitude towards behaviour is assumed to be determined by beliefs about the positive or negative consequences of performing behaviour (behavioural beliefs). Each behavioural belief is weighted by the subjective value of the positive or negative consequences (outcome evaluation).
ii. *Subjective norm*: This reflects a person's perceived social pressure to perform, or not to perform, a behaviour.
iii. *External control belief*: This construct indicates a person's perceived ability to perform a specific behaviour
iv. *Behavioural intention*: This is an indication of how hard a person is willing to try, or how much effort a person is planning to make, in order to perform a behaviour.

2.3.2 Health Belief Model (HBM)

HBM is a tool used to predict health behaviours. The model is based on the assumption that a person is willing to change his/her health behaviours primarily due to four influencing variables or constructs (Glanz and Bisschop, 2010), namely: Perceived severity, Perceived benefits, Perceived barriers and Cues to action. Appendix II illustrates this model showing the different components as following:

i. *Perceived severity* - refers to the degree to which a person feels that a health problem has serious medical or social consequences. Health behaviour identity represents a person's evaluation of the effectiveness of health behaviour in reducing the perceived threat.
ii. *Perceived susceptibility*- refers to the degree to which a person feels vulnerable to a health problem.
iii. *Perceived barriers* - represent a persons' evaluation of psychological, or financial obstacles involved in a health behaviour.
iv. *Cues to action* - External trigger that stimulates a person to change his or her health behaviour.

2.3.3 Combined Theory of Planned Behaviour and Health Belief Model (TPB and HBM)

Theory of Planned Behaviour (TPB) and Health Belief Model (HBM) have been used worldwide in explaining influential variables in food-related behaviours (Sun *et al.,* 2006), something that has broadened the understanding of factors influencing dietary behaviour (Abizari *et al*., 2013). The constructs of the HBM, that is, perceived susceptibility, perceived severity, perceived barriers, health behaviour identity, and cues to action, when combined with the constructs of the TPB (attitude towards behaviour, subjective norm, external control belief, and behavioural intention) in a combined model (Abizari *et al.*, 2012), can present an overview of the suggested associations between the constructs. Appendix III shows that interlinkage.

2.4 Operationalization of the Study Approach

As a first step, measurement of the key study variables was made. The variables included were knowledge about pigeon peas, perceived severity and susceptibility to protein energy malnutrition and iron deficiency, and attitudes toward behaviour (behavioural outcome). Other variables included control beliefs, barriers, cues to action, intentions to consume pigeon peas, health value, and health behaviour identity. All these variables reliability were measured and found to be consistence. Caregivers and school aged children socio-demographic characteristics was measured (age, education, occupation, house hold size and economic status) Mann Whitney analysis was done among each construct and they were group as high and low intention. Intention was considered high if it was greater than the median intention score of the group and low if it was equal to or lower than the median score.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Description of the Study Area

Kongwa district is located in the eastern corner of Dodoma region and borders Kiteto district to the north, and covers a land area of 4041 square km (URT, 2003). The population at the time of the last census in 2012 was 309 973 corresponding to an annual growth rate of 2.2% during the period 2002-2012, which is well below the national average of 2.7%. It borders Kilosa district in the east, and other districts bordering Kongwa include Chamwino district in the west and Mpwapwa district in the south. The elevation of Kongwa district ranges from 900 to 1000 meters above sea level. Generally, the district lies on the leeward side of Ukaguru Mountains. The district is characterized by semi-arid conditions, with rainfalls of 450-700 mm/year, but with great variability and often distributed within a very short period. The main economic activities done by the people in the district include crop farming and livestock keeping. The crops which are grown include maize, pigeon peas, sorghum, millets and peas while the livestock kept include cattle, goats, sheep and pigs (URT, 2013).

In year 2018, the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) introduced some interventions in Dodoma region with an aim of introducing and popularizing improved pigeon peas varieties in central Tanzania. This was done though two techniques of adapting high yielding pigeon peas varieties and community seed banks as a seed delivery mechanism. The interventions worked quite well, the introduced pigeon peas varieties have increased yield up to 40% over the local ones (Munthali *et al.,* 2018). For ensuring sustainability of the programme, villagers from Moleti, Laikala, Mlali and Chitego villages were trained on seed production techniques aimed to improve their nutrition security and income for farming households.

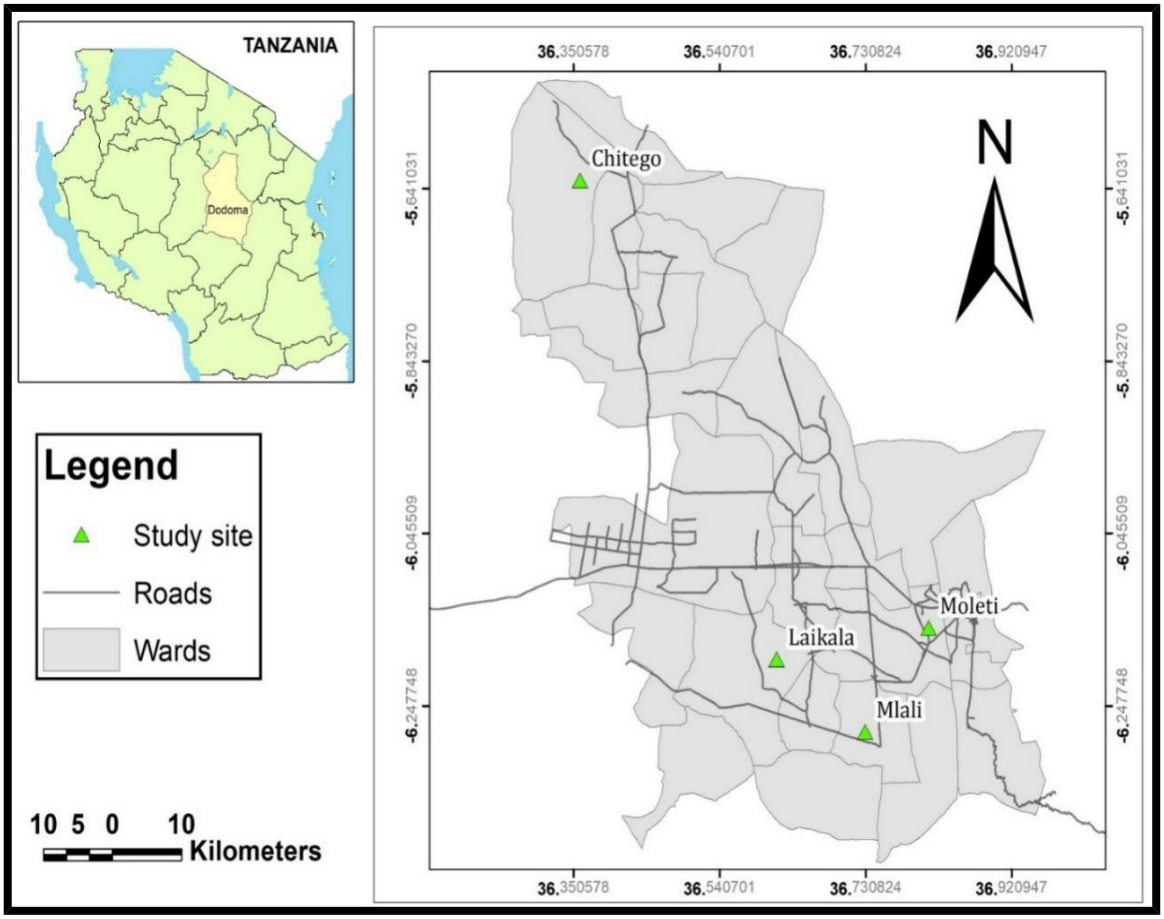


Figure 1: Map of Kongwa district in which the study area is located

3.2 Study Design

Descriptive cross-sectional study design was used in investigating predictors of pigeon peas consumption among school aged children (5-12 years) in Kongwa district.

3.3 Sampling Frame/ Population

3.3.1 Study population

Inclusion and exclusion criteria

The study population included caregivers with school-aged children of between 5 and 12 years of age living in four selected villages in Kongwa District. The inclusion criteria involved all such caregivers who were known to be familiar with, or to have consumed pigeon peas before, and who were willing to participate in the study. Furthermore, to be included, a respondent must have resided in Kongwa District for the past three years prior to the study (i.e. 2016-2018). On the other hand, the study excluded all caregivers who were not familiar with pigeon peas, or who had never consumed pigeon peas, and those who did not agree to participate in the study.

3.3.2 Sampling technique/ procedures

Both purposive and random sampling techniques were used. Kongwa district was purposively selected because of its long history of interventions to promote cultivation and utilization of pigeon peas. Four villages of Mlali, Moleti, Chitego and Laikala were purposively selected. Thereafter, simple random sampling technique was done to obtain 138 households as stated in section below and based on the required inclusion criteria.

Ultimately, the resulting distribution of the sampled households in each of the study village was 37 for Mlali village, 30 for Moleti village, 27 for Chitego and 44 for Laikala village.

3.3.3 Sample size determination

As a general rule for the TPB model, a sample size of 80 is considered to be minimum and 180 as maximum for acceptable and manageable statistical analyses (Francis *et al*., 2014). Given the available resources for conducting this study, especially for data collection, 140 relevant caregivers were aimed. Two decided to leave the study hence 138 participated.

3.4 Data Collection

3.4.1 Construction of questionnaires

Based on the Theory of Planned Behaviour and the Health Belief Model (Appendix III), a questionnaire (Appendix VIII) was developed by following the procedures recommended by Francis *et al*. (2014). The first part of the questionnaire included the socio-demographic and socio-economic status variables of the respondent (age, education, occupation, family size, and availability of electricity in households). The second part included 12 items based on the combined TPH & HBM model as recommended by Sun *et al.* (2006). The 12 items, which are depicted in Figure 5 are namely: knowledge, perceived susceptibility, perceived severity, health value, health behaviour identity, attitude towards behaviour, perceived barriers, behavioural intention, subjective norm, control belief, cues to action and behaviour.

The questionnaire also included a section to evaluate the frequency of consuming foods that are known to be rich in protein and iron. The intended foods included were made from pigeon peas. Respondents indicated how many times a specific food was consumed in the

last seven days prior to the day of interview (Appendix VII) and the questionnaire was administered face-to-face by well-trained research enumerators who were familiar with cultural settings in the study area.

3.4.2 Pre-testing of the questionnaires

The questionnaires were administered to 10 randomly selected households of caregivers with school aged children 5-12 years for pre-testing, with the similar characteristics with the sample of the other three villages (Moleti, Mlali and Chitego) in Kongwa district. This was done one day prior to data collection which enabled to contextualize the questionnaire.

3.6.3 Informed consent

Written informed consent to participate in the study was soughed from the caregivers of the children. This was after the study was fully explained to them. Each eligible caregiver was free to opt out of the study.

3.6.4 Administration of the questionnaire

Ten enumerators were selected who completed their degree in human nutrition and had some experience in data collection. Three days training was conducted to train enumerators on the tool for data collection procedures. They were taken through the questionnaire, by reading through question by question, the researcher ensured familiarization and clarity of the responses.

3.6.5 Dietary intake

Food frequency questionnaire was used to assess the dietary intake. This questionnaire consisted of 25 foods; for each item, type and frequency were assessed, for the last 7 days prior to data collection.

3.7 Data Analysis

Out of the sampled number of respondent 140 targeted for the study, selected children from two respondents were not of school-going age and therefore were dropped out during the analyses making a total of 138 respondents for analysis. Descriptive statistics were performed to examine socio-demographic characteristics of the caregivers, and to calculate the median scores of the constructs. Multiple item constructs were tested for reliability of the questionnaire and internal consistency using Cronbach α and item-total correlation. The items within a construct were regarded as consistent when Cronbach α was approximately 0.80 or higher and the corrected item-total correlation of all items in a construct was higher than 0.30. A Mann-Whitney test was used to examine whether the scores of caregivers with a high intention and those with a low intention to consume pigeon peas were significantly different, and it was used to obtain the P value for the constructs but the means presented on the tables were geometric means obtained by doing the natural log transformation and back transforming the data as the data was not normally distributed. Spearman's correlation *(rho)* between the constructs were computed to examine the bivariate correlation within the combined model of TPB and HBM. Multiple linear regression analyses were performed to examine the contribution of the constructs to intention to consume pigeon peas and to assess whether the perceived barriers was a significant interaction term in the relation between intention to consume pigeon peas and pigeon peas consumption. All models were

adjusted for age of the child, caregiver's education and interviewer's effect. All the statistical analyses were performed using SPSS (version 21.0). Overall, statistical tests were 2-tailed, and P values ≤ 0.05 were considered statistically significant.

CHAPTER FOUR

4.0 RESULTS

This chapter is organized based on key issues of the study objectives. Characteristics of the sampled respondents are presented first focusing on demographic and socio-economic variables. This is followed by association between background and perception about pigeon peas and intention to feed pigeon peas to school-aged children (5-12 years). Others include association between beliefs and attitudes of caregivers with intention to feed pigeon peas to their school aged children (5-12 years); and association between intention of feeding pigeon peas to their school-aged children and actual pigeon peas consumption.

4.1 Characteristics of the Sampled School-aged Children and Caregivers

4.1.1 Age and sex of the children

Half of the sampled children (50.7%) were male while the rest (49.3%) were female (Table 1). Overall, mean age of the male children was 7.46 years (range of 5-12) while for the female was 7.37 years (range of 5-12).

Table 1: Age and sex characteristics of respondents

Variables	Boys	Girls
Frequency	70	68
Percentage	50.7	49.3
Mean (age in years)	7.4571	7.3676
Standard deviation	2.21775	2.01416

4.1.2 Marital status and relationship with the index child

The biggest proportion of the children (Table 2) lived with their biological mothers (91.8%), while few were cared for by other relatives including grandmothers (4.6%),

sisters (2.4%) aunts (0.575%) or step mothers (0.575%). The majority of the respondents were in monogamous marriage (62.4%), while few were divorced (10.3%), polygamous marriage (8.6%), not married (7.4%), separated (4.65%), widowed (4.575%) or co-habiting (2.025%).

Table 2: Marital status and relationship with the index child

Variables	Mlali n= 37	Moleti n= 30	Laikala n= 44	Chitego n= 27	Overall n=138
Relationship with the caregiver					
Mother	94.6	90	86.4	96.3	91.825
Grandmother	2.7	6.7	9.1	0.0	4.625
Sister	2.7	3.3	0.0	3.7	2.425
Aunt	0.0	0.0	2.3	0.0	0.575
Stepmother	0.0	0.0	2.3	0.0	0.575
Marital status					
Married – monogamous	51.4	73.3	54.5	70.4	62.4
Married – polygamous	0.00	13.6	13.6	7.4	8.65
Widow	2.70	0.0	4.50	11.1	4.575
Divorced	13.5	6.7	13.6	7.4	10.3
Separated	8.10	0.0	6.8	3.7	4.65
Co-habiting	8.10	0.0	0.0	0.0	2.025
Never married	16.2	6.7	6.8	0.0	7.425

x

4.1.3 Education level and household size

The respondents were asked the level of education acquired as it may affect their economic status, the food choices and the food security status. It is also interesting to note that more than a half of caregivers did not attend any formal education (58.3%) (**Table 3**).

Table 3: Education level of the Caregivers

Variables	Mlali n= 37	Moleti n= 30	Laikala n= 44	Chitego n= 27	Overall n=138
No school	43.2	63.3	45.5	81.5	58.3
Primary school	48.6	26.7	40.9	7.4	30.9
Secondary school	5.4	3.3	11.4	11.1	7.8
Tertiary education	2.7	6.7	2.3	0.00	2.9

4.1.4 Income generating activity and ethnic group

The majority of the respondents (84.6%) were either engaged in farming or livestock keeping, few engaged themselves in self-employed off-farm (9.4%), causal labourers on farm (5%) and very few were salary employed (0.9%).Several different ethnic groups were represented of which Kaguru were the majority (61.9%) followed by the Rangi (26%) and Gogo (12%) (**Table 4**).

Table 4: Income generating activity and ethnic groupXVariables	**Mlali n= 37**	**Moleti n= 30**	**Laikala n= 44**	**Chitego n= 27**	**Overall n=138**
Income generating activity					
Farming (crop and livestock)	86.5	76.7	86.4	88.9	84.625
Salaried employment	0.00	0.00	0.00	3.7	0.925
Self-employed off farm	13.5	10	6.8	7.4	9.425
Casual labourer on farm	0.00	13.3	6.8	0.0	5.025
Ethnic group					
Rangi	0.00	30	0.00	74.1	26.025
Gogo	0.00	6.7	34.1	7.4	12.05
Kaguru	100	63.3	65.9	18.5	61.925

4.1.5 Living arrangements and Main consumer of pigeon peas

The majority of caregivers lived with their spouses and children (48.3%). The main consumer of pigeon peas among the surveyed households were reported to be all members of household reported by an overall proportion of 95.2% (Table 5).

Table 5: Living arrangements and reported main consumer of pigeon peas XVariables	**Mlali n= 37**	**Moleti n= 30**	**Laikala n= 44**	**Chitego n= 27**	**Overall n=138**
Living arrangements					
Husband with children	48.6	60	47.7	37.0	48.325
Husband, children and other relatives	5.4	20	11.4	25.9	15.675

Caregiver/mother and children	18.9	6.7	13.6	22.2	15.35
Caregiver/mother and children and other relatives	27	13.3	27.3	12.8	20.1
Main consumer of pigeon peas					
Self	0.0	3.3	4.5	0.0	1.95
School going children (5-12years)	2.7	3.3	0.0	0.0	1.50
All household members	94.6	93.3	93.2	100	95.275
The elderly(above 60years)	2.7	0.00	2.3	0.0	1.25

4.1.6 Housing Type

More than 60% of the respondents reported to be living in houses with bare floor, while only 24.3% were of concrete (Table 6). Roofing with corrugated iron sheets was highly adopted in almost every surveyed household (95.3%). Walls of the houses where respondents lived were made up of different materials including mud and wood (59.2%) which was observed from the majority of the houses, cement (23.8%) and burnt bricks (16.9%) as shown in Table 6.

Table 6: Housing type of the respondent XVariables

	Mlali n= 37	**Moleti n= 30**	**Laikala n= 44**	**Chitego n= 27**	**Overall n=138**
Type of floor material for the main house					
Terrazo/tiles	0.00	33.3	27.3	0.00	15.15
Cement/concrete	35.1	20	9.1	33.3	24.375
Bare floor	64.9	46.7	63.6	66.7	60.475
Roofing material for the main house					
Corrugated iron/aluminium sheets	89.2	96.7	95.5	100	95.35
Bamboo	5.4	0.00	0.00	0.00	1.35
Grass/leaf thatched	2.7	0.00	2.3	0.00	1.25
Tembe	2.7	0.00	2.3	0.00	1.25
Type of wall material					
Cement	35.1	20.0	6.8	33.3	70.2
Mud	64.9	53.3	81.8	37	59.25
Bricks	0.00	26.7	11.4	29.6	16.9

4.1.7 Main source of water and presence of a toilet facility

The majority of the respondents (Table 7) used piped water (84.8%) while others used water from other sources including protected dug out wells (6.5%), rain tank storage (1.4%), borehole (2.2%) and village tap water (1.4%). On the other hand, the majority of the respondents used pit latrines (86.9%), while others (11.3%) used shared toilets with neighbours and very few reported to have flushing toilets (1.8%).

Table 7: Main source of water and presence of toilet facility

Variables	Mlali n= 37	Moleti n= 30	Laikala n= 44	Chitego n= 27	Overall n=138
Source of drinking water					
Piped water	89.2	63.3	90.9	92.6	84
Protected dug out well	0.00	30.0	0.00	0.00	7.5
Rain tank storage	2.70	0.00	0.00	3.7	1.6
Borehole	0.0	6.7	0.0	3.7	2.6
Village tap water	8.1	0.0	4.5	0.0	3.15
Presence of toilet					
In house toilet	0.00	0.00	0.00	7.4	1.85
Use pit latrine	86.5	86.7	81.8	92.6	86.9
Use public toilet	13.5	13.3	18.2	0.00	11.25

X

4.1.8 Asset ownership

The findings as presented in Table 8 indicate that very few of the surveyed respondents owned a television set (7.75 %) or a refrigerator (0.9 %). Less than half of the respondents owned a radio (25.8%). Half of the respondents owned a mobile phone (52.5%) while (30.4%) reported to have one member in the household who owned a mobile phone. Majority of the respondents reported to have land for cultivation (95.9%) while a good proportion also owned houses (87.8%), only 10.3% reported to be living in rented houses.

Table *8*: Assets Ownership **XVariables**	**Mlali (n = 37)**	**Moleti (n = 30)**	**Laikala (n = 44)**	**Chitego (n = 27)**	**Overall (n =138)**
Television					
Owned	2.7	6.7	6.8	14.8	7.75
Radio					
Owned	10.8	36.7	22.7	33.3	25.875
Refrigerator					
Owned	0.00	0.00	0.00	3.7	0.9
Land for cultivation					
Owned	97.3	100	97.7	88.9	95.9
House ownership					
Owned	83.8	90	88.6	88.9	87.825
Rented house or for relative					
Owned	13.5	10.0	6.8	11.1	10.3
Household members with mobile phone					
None	70.3	56.7	56.8	29.6	53.35
One	16.2	40	25	40.7	30.475
Two	13.5	0	11.4	14.8	9.900
More than two	0.00	3.3	6.8	14.8	6.225
Mobile phone (caregiver)					
Owned	37.8	43.3	47.7	81.5	52.575

X

4.2 Reliability of Constructs

Cronbach's α is a measure of internal consistency between items which shows how closely related a set of items are as a group. It is also considered to be a measure of scale reliability (i.e. how well a test can measure what it is supposed to measure). Cronbach's α coefficients demonstrated high reliability of the constructs with values ranging from 0.70 to 0.88 Table 9. Three constructs (Control belief, Intention and Behaviour) consisted of only one item in each, and therefore the reliability analyses was not carried out for these constructs. The median score for each construct ranged from 3 (external control beliefs) to 69 (attitudes towards behaviour). The high value of a median score in comparison to the range of possible score showed that most respondents tended to agree with that particular statement.

Table 9: Internal consistence and Median score of the constructs (n=138)

Construct	Number of items	Cronbach α	Median Score	(25th-75th)	Range
Knowledge	12	0.851	24	(19;30)	12;36
Perceived susceptibility	4	0.756	5.5	(4;8)	4;12
Perceived severity	9	0.88	21	(15;24)	9;27
Health value	9	0.704	25	(23;27)	9;27
Health behaviour identity	7	0.7	17	(15;18)	7;21
Perceived barriers	17	0.78	30	(24;36)	17;51
Attitudes toward behaviour	27	0.775	69	(65;74)	27;81
External control beliefs	1	–			
Cues to action	10	0.834	16	(13;22)	10;30
Subjective norms	18	0.846	41	(35;48)	18;54
Intention	1	–			
Behaviour	1	–			

4.3 Correlation between the Intention to Consume Pigeon peas and Actual Pigeon peas Consumption

The findings on correlation between intention and actual consumption as presented in Figure 1 shows that 58.7% of the caregivers that feed pigeon peas to their school aged children two or more times a week in the last month before the survey, whereas 57.2% had the intention to feed pigeon peas to their school aged children two or more times a week in the coming month. In the same respect, 7.2% did not feed pigeon peas to their school aged children in the past month while 5.1% indicated to have no intention to feed pigeon peas to their school aged children in the next month. Results in Figure 4 also indicate that the intention to feed pigeon peas to their school aged children was significantly correlated with the actual pigeon peas consumption (rs = 0.263; P= 0.002).

The assessment of the frequency of consumption of pigeon peas based foods among the respondents revealed that pigeon peas based foods were in different forms, the common ones being eating pigeon peas as a relish or accompaniment to a main dish such as stiff

porridge (ugali) or rice; but pigeon peas could also be mixed with rice, a dish known as ‘mseto’, or cooked with maize grains in a dish known as ‘kande ya mbaazi’.

Results in Figure 2 shows the frequency of consuming pigeon peas based dishes. Consumption of pigeon peas as a relish only for 4-5 times in seven days was reported by 37.7% of the respondents compared to 21.7% and 14.5% of mseto and kande ya mbaazi, respectively. Comparison of the same dishes showed that 65.2% reported to have consumed kande ya mbaazi once in seven days while 62.3% and 23.2% consumed pigeon peas in form of mseto and relish respectively. Other frequencies of consumption are also shown in Figure 2.

For the sake of comparison with pigeon peas consumption, the frequency of consuming other foods that are sources of protein and iron was also assessed. The foods included meat, milk, eggs, beans, maize, rice, sunflower seeds, porridge with groundnuts or soy beans, and green vegetables. According to the results in Figure 3, other sources of protein and iron that are mostly consumed in the study area included beans, dairy foods, meats, rice, groundnuts and green vegetables.

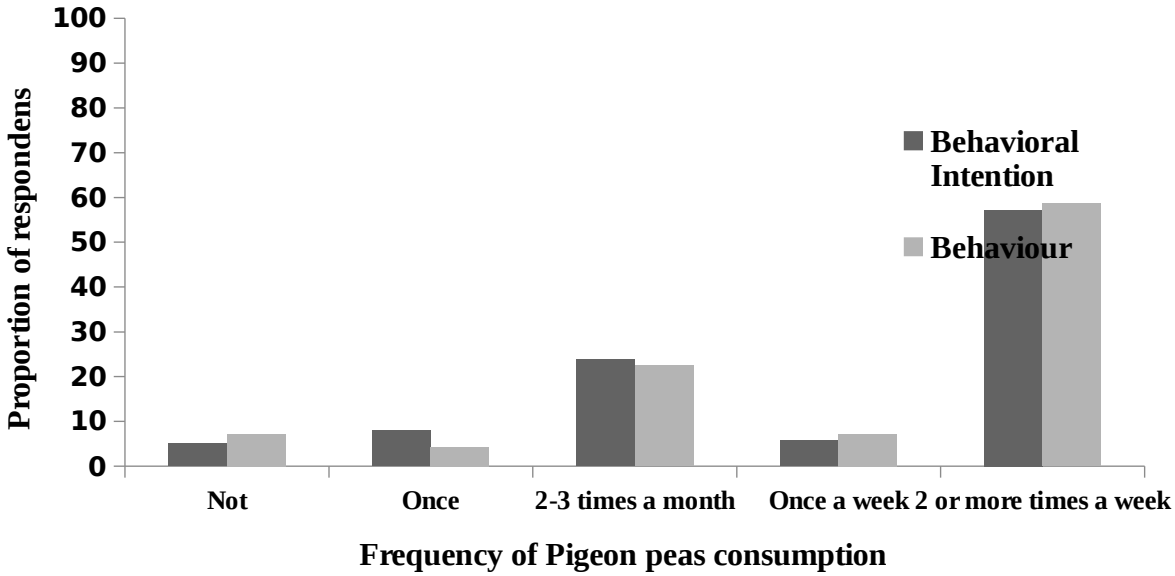


Figure 2: Comparison of intention to consume pigeon peas in the coming month and consumption behaviour (pigeon peas) in the last month (n=138)

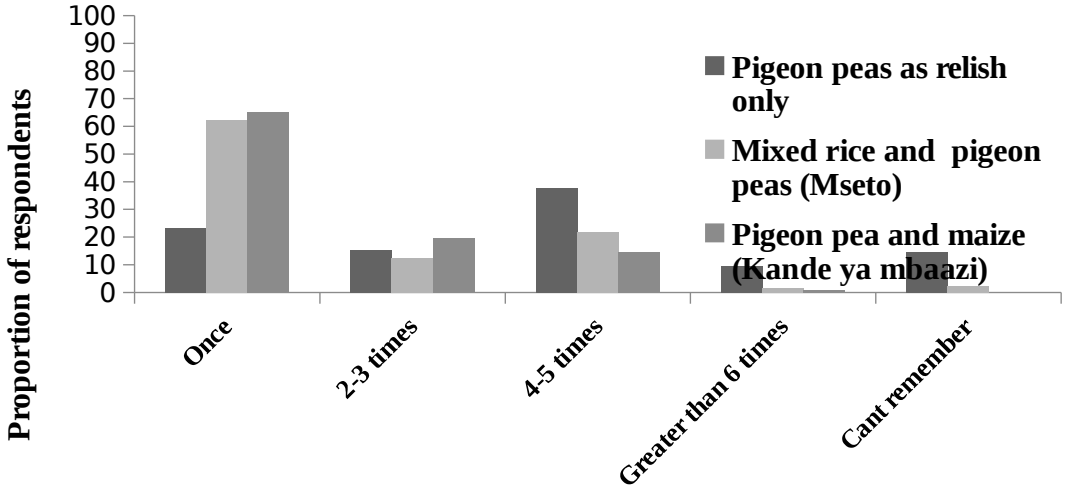


Figure 3: Consumption of Pigeon peas based foods in the past seven days before survey day

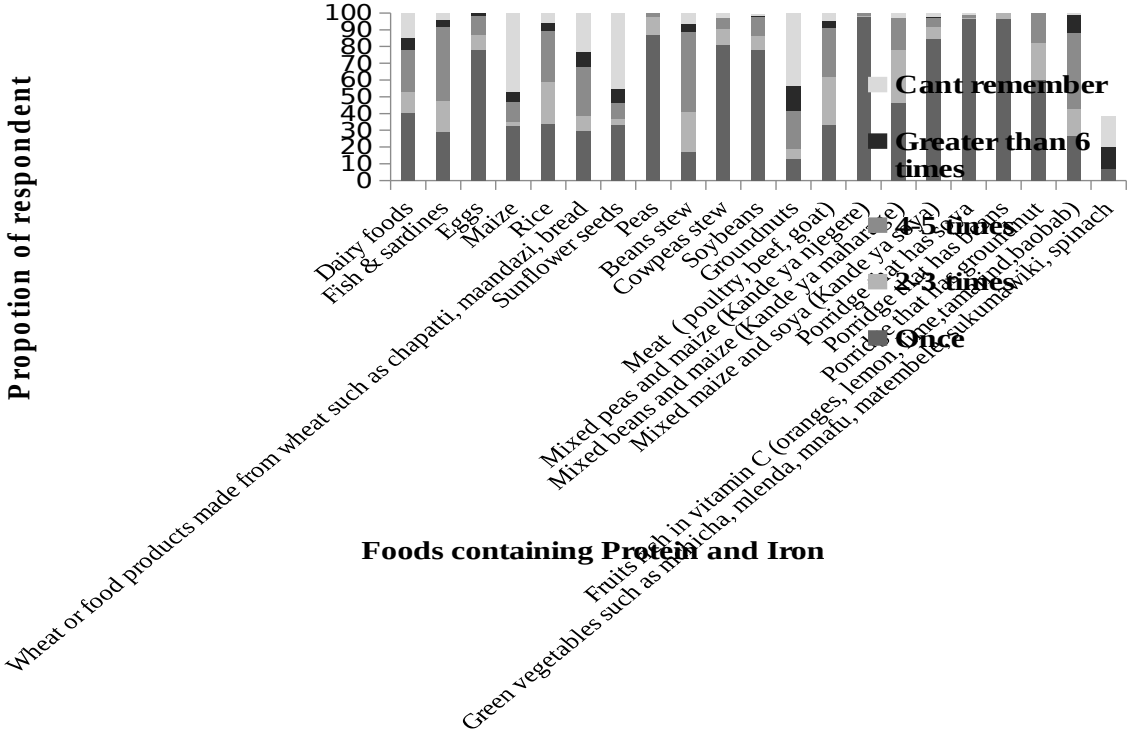


Figure 4: Consumption of foods that are sources of Protein and Iron in the past seven days before the survey day

4.4 Relationship of Various Constructs and Intention to Feed Pigeon Peas

Mann-Whitney test was used to compare mean scores between two groups of respondents one with low intention to feed pigeon peas to their school-aged children and the other with high intention. Items that are considered to be important in the constructs are the ones with significant P-values of P less than 0.05. According to the combined model of the TPB and HBM (Figure 5), three constructs were tested for their relationship with the intention to consume pigeon peas. The three constructs are namely the External factors, Beliefs and Attitudes and Background and Perception. The results for the tests of each of these aspects is reported in the following sub-sections.

4.4.1 External factors

The findings on external factors as presented in Appendix IV indicated that the three items out of ten items that were included for Cues to Action showed significant relationships with the intention to feed pigeon peas[1]. Under the Subjective Norms only two items were significant, both of which were related with advice from a medical profession (doctor or nurse advice) showing that doctors and nurses advices were highly valued.

4.4.2 Beliefs and attitude

The findings on the Belief and attitude construct consists of 3 sub-constructs, namely Health behaviour identity, Perceived barriers and Attitudes towards behaviour, revealed

1[1]The three items are namely: Illness/sickness of my child makes me want to use pigeon peas; My child suffering from anaemia makes me want to use pigeon peas; and a shortage of food makes me want to feed my child with pigeon peas.

that the respondents considered two items to be significantly important (P= 0.02) for the Health behaviour identity Appendix V. The two items are all related with recognizing the importance of consuming iron-rich foods and pigeon peas for improving child's cognitive development or intelligence. On the Attitude towards behaviour (consumption of pigeon peas), seven out of more than twenty items that were assessed, proved to have significant relationship with the intention of feeding pigeon peas to school-aged children. The items were related with pigeon peas having good taste, being nutritious, considered a traditional staple food, helps to attain adequate weight for age, stimulates bowels movement and therefore helps to avoid constipation, and that it requires shorter cooking time and therefore saves fuel. On the other hand, none of the included items of the Perceived barriers were considered to be important in influencing the intention of respondents to feed pigeon peas to their school-aged children.

4.4.3 Background and perception

According to the combined model of TPB and HBM (Figure 4) the Background and Perception construct consists of 4 sub-constructs, namely Knowledge, Perceived susceptibility, Perceived severity and Health value, which were all tested in this study for their relationship with the intention to feed pigeon pea to school-aged children. Results on background and perception as presented in Appendix VI show that none of the included items for Knowledge, Perceived susceptibility or Perceived severity constructs showed any significant relationship at $P \leq 0.05$ with the respondent's intention to feed pigeon pea to their school-aged children. However, one item of the Health value construct showed a significant relationship (Appendix VI). The item is based on the perception that iron is important for activeness of the child.

4.5 Interaction of Different Variables in Influencing the Feeding and Intention to Feed Pigeon peas

4.5.1 Bivariate correlation

Bivariate correlation is used to determine the relationship between two different variables, to show how much one variable will change when the other changes. Most bivariate correlations with the ‘Behaviour Intention’ were statistically significant, except for the ‘Attitudes towards behaviour’ together with all the 3 constructs of the ‘External Factors’ (i.e. Subjective norms, Control beliefs and Cues to action) as illustrated in Figure 5. Statistically significant correlations were found in the group of ‘Background and Perception’ (all the 4 constructs i.e. Knowledge, Perceived susceptibility, Perceived severity and Health value) with ‘Health Behaviour Identity’.

Within the ‘‘Belief and Attitude’’ group of constructs, Health Behaviour Identity showed significant correlation with Attitude towards behaviour (rs = 0.513, P < 0.000) and perceived barriers (rs = -0.33, P <0.000). Perceived barriers correlated (rs = 0.646, P <0.039) significantly with the Behaviour Intention. Caregivers’ intention to give pigeon pea to their school-aged children correlated significantly (*rs* = 0.263, P < 0.002) with the Behaviour (actual giving pigeon pea to their school children) as depicted in Figure 5.

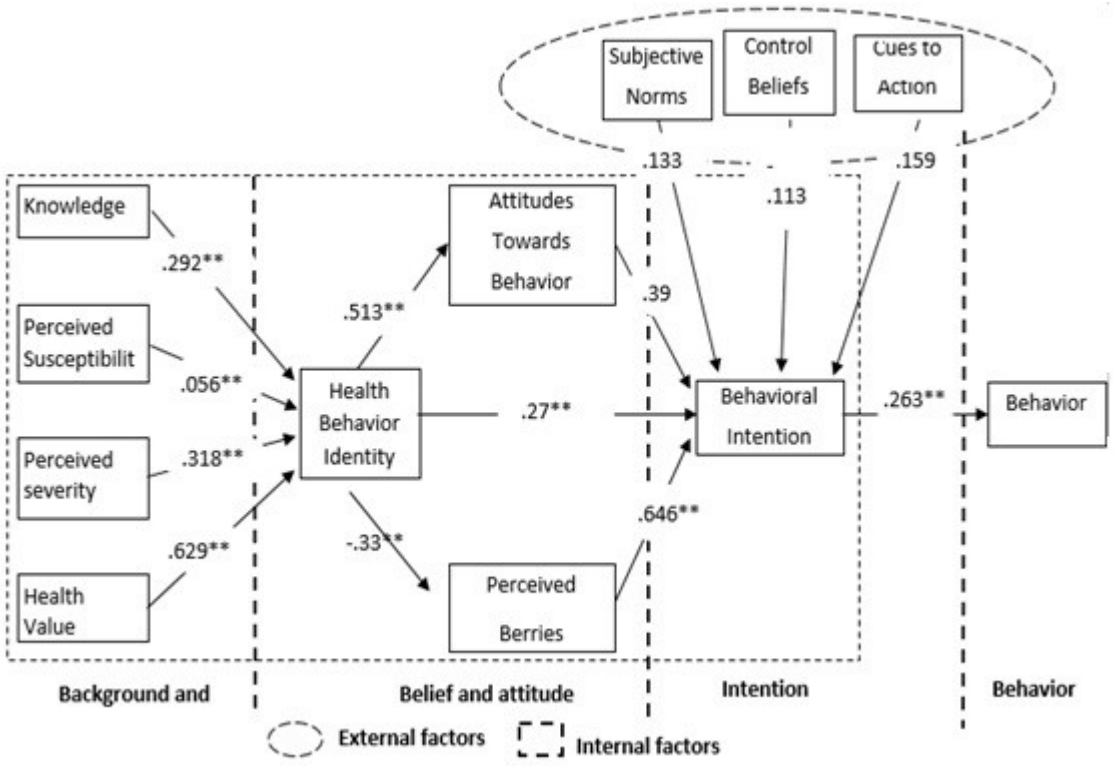


Figure 5: A combined model of the Theory of Planned Behaviour and Health Belief Model with Spearman correlation coefficients among related constructs.

Source: Adapted from Sun et al., 2006.

*Key: **P < 0.01 (2-tailed)*

4.5.2 Multiple regression analysis

Multiple regression is used to explore the predictive ability of a set of independent variables on one continuous dependent measure. The analysis can also be used to compare the predictive ability of particular independent variables and to find the best set of variables to predict a dependent variable. Predictor variables contributed to the outcome variables for models 1– 4 as shown in Table 10. Multiple regression analysis was used to predict the variables in each of the 4 models. Health value (β=0.485, P<0.000) in **Model 1** was a significant predictor of the Health Behaviour Identity. Attitude towards behaviour (β= 0.206, P< 0.035) was a significant predictor of the Behaviour Intention (care givers intention to feed pigeon peas to their school-aged children) in **Model 2**, while none of the

variables in the External Factors (**Model 3**) were significant. **Model 4** shows that the intention to consume pigeon peas was a significant predictor of pigeon peas consumption (β= 0.254, P< 0.003). The interaction term between Intention and Perceived barriers was also significant (*β*= 0.268, *P*< 0.001) indicating that Perceived barriers did modulate the association between intention and consumption.

Table 10: Multiple regression analysis with Health Behaviour Identity (Model 1) and Behavioural Intention (Models 2 and 3) and Behaviour or actual consumption (Model 4) as dependent variables (n=138)

Models [a]	**Standardized β**	**p**	**R^2**	**Adjusted R^2**
Model 1				
Dependent variable: Health Behaviour Identity			0.28	0.229
Knowledge	0.103	0.274		
Perceived susceptibility	-0.290	0.702		
Perceived severity	0.000	0.995		
Health values	0.485	0.000		
Model 2				
Dependent variable: Intention to consume p.pea			0.067	0.054
Health behaviour identity	0.068	0.48 0		
Perceived barriers	0.063	0.453		
Attitudes toward behaviour	0.206	0.035		
Model 3				
Dependent variable: Intention to consume p. pea			0.049	0.06
External control beliefs	-0.120	0.158		
Cues to action	0.154	0.125		
Subjective norms	0.070	0.486		
Model 4				
Dependent variable: Behaviour (Actual consumption of pigeon peas)			0.069	0.056
Perceived barriers	-0.092	0.270		
Intention to consume pigeon peas	0.254	0.003		
Perceived barriers + Intention to consume pigeon peas	0.268	0.001	0.138	0.109

[a] All models are adjusted for age, caregivers education and interviewer effect

CHAPTER FIVE

5.0 DISCUSSION

5.1 Overview

The aim of this study was to identify and investigate factors that predict the intention of care givers living in Kongwa District in Tanzania to feed pigeon peas to their school-aged children (5-12 years). Multiple regression analysis revealed that higher intention to consume pigeon peas was directly associated with a positive attitude. Intention was impacted indirectly by health behaviour identity through attitudes towards behaviour. Health behaviour identity on its turn was especially associated with women's health value. Finally, the association between intention and behaviour was lower when perceived barriers were higher.

The combined model of the TPB and HBM (Sun *et al*., 2006) was used for identification of the factors. The TPB is based on an important underlying assumption that the best predictor of behaviour is a person's *intention* to perform (or not to perform) that behaviour. Indeed, *intention* was significantly correlated with *behaviour* in the present study.

5.2 Intention to Consume and Actual Consumption of Pigeon Peas

The present study confirmed the results of previous studies stating that behaviour is mainly determined by a related intention. However, *behaviour* was measured by self-reporting and not by measuring actual pigeon peas consumption. Self-reporting of dietary intake can be biased by social approval, especially when correct answers are known (Hebert *et al.,* 1995). As in the present study bias was observed when the respondents knew the goal of the

research in advance, as it was the second phase of the project and it was very clear to them in the first phase what the project is about, hence majority gave the satisfactory responses. If the respondents thought that pigeon peas is good, it will be likely that they have overestimated rather than underestimated their pigeon peas consumption due to their expectations from the project.

Self-reporting during the interview, the number of caregivers who intended to consume pigeon peas two or more times a week was slightly lower than those consuming pigeon peas two or more times a week in the past month, indicating that more than half of the caregivers consume pigeon peas weekly compared to those who intended to consume in the coming month.

Frequency of pigeon peas consumption in the area was attributed by a number of factors such as economic status and food taboos. Occupation affects the economic status of a person directly and studies have shown that low income is associated with food insecurity (Ivers and Cullen, 2011). Majority of the caregivers depended on farming as their major source of food and income. From the study it was observed that pigeon peas was one among the traditional foods in the area during the early ages where one respondent said that:

> *"…before the Indian market was introduced, pigeon peas was highly consumed by our grandparents as a traditional food, and believed to cure dry throat, but now it is consumed in very low amount compared to the past as it is seen more of a cash crop than food crop, because of the India market which has now collapsed. The situation is even worse currently as the crop is considered to be food for the poor…"* (Respondent in Laikala village).

In the study, it is observed that pigeon peas can be consumed in three different forms as a relish, a mixture of pigeon peas and maize (so called *kande ya mbaazi*) and pigeon peas and rice (*mseto*). Majority of the caregiver's households consumed pigeon peas as a relish accompaniment to stiff porridge/*ugali* or rice for about four to five times a week. Unlike in other countries where pigeon peas is processed and prepared into different products such as cookies and biscuits (Okpala and Okoli, 2011, Adeola and Ohizua, 2018), there is hardly or no processing at all of pigeon peas in Tanzania.

Based on protein and iron rich foods, consumption of cereals, legumes, fruits and green vegetables was consumed in low amount together with animal proteins. Similarly, a study conducted in Dodoma by Makori *et al.* (2018) revealed that animal source foods were the least consumed by children. This indicates that majority of the households do not consume foods of animal origin probably due to their low economic status, i.e. poor purchasing power. The staple food in the community is maize in the form of Ugali and is mainly consumed with beans and vegetables. The findings of this study also agree with another study done in Burkina Faso in 2010 which found that the common diet included cereals (98.6%) and leafy vegetables (87.1%) (Becquey and Martin-Prevel, 2010).

5.2 Internal Factors with Intention to Consume Pigeon Peas

Concerning the internal factors, the study showed that attitude measures were the best predictor of intention to consume, confirming the findings of Nejad *et al.* (2015). The most important items reported within positive attitude were: pigeon peas has a good taste, it is important and nutritious food for children, it can be soaked, it is a traditional staple food, helps children attain adequate weight for age, and stimulates bowels movement. Taste was not one of the factor hindering pigeon peas consumption where the results are contrary

with the findings reported by Zavinon and Sagbadja (2019). Undesirable characteristics cited by the farmers included bad taste and very long cooking time. Studies by Onwuka (2006) and Fasoyiro (2005) reported that soaking and cooking method reduced cooking time, therefore encouraging individuals to intend to consume pigeon peas.

Health behaviour identity was significantly correlated with attitude towards behaviour, for the attitude, this indicates that caregivers will evaluate the consequence of pigeon peas consumption more positively, when they agree that pigeon peas is good for them and their household member. Sun *et al.* (2006) also found a significant positive correlation between health behaviour identity and the attitude towards pigeon peas. Items considered to be significant were:

> "*Food that contain iron is one of the best thing that I can do give to my child to improve his/her cognitive development*" and "*Giving pigeon peas is one of the best thing I can do for my child to improve her/his intelligence*".

In the present study, *health value* turned out to be a significant predictor for *health behaviour identity.* Hence whether caregivers think that pigeon peas is good for their children it is influenced by the health value perceptions, as they were very sensitive with their children's health and well-being rather than the knowledge about the nutritive content of pigeon peas or the *susceptibility* and *severity* to protein and iron deficiency. Sun *et al.* (2006) also reported similar findings in his study that *health value* was highly correlated with *health behaviour identity* for the rural subjects. The study done by Fanou-Fogny *et al. (*2011) noted that heath value was highly correlated with health behaviour identity. However, knowledge, perceived severity and perceived susceptibility were not significantly correlated with health behaviour identity. It should be noted that Fanou-Fogny *et al*. (2011) had performed simple correlation analyses and multiple regression analyses,

which is similar to the current study, but Sun *et al.* (2006) only performed simple correlation analyses.

5.3 External Factors with Intention to Consume Pigeon Peas

Concerning the external factors, subjective norms significantly predicted the intention to consume pigeon peas. Individual's behaviour is highly influenced by the community members. Within the construct, especially the Opinions of the doctor and the nurse were the most important items included in this study. This applies to both urban and rural setting that the doctors and nurse's advice is mostly valued and respected and also significantly influence the behavior of the individual. The present results confirmed the findings of Rah *et al.*, 2004 who showed that the subjective norms were correlated with the behavioral intention but predicted it more weakly than the attitudes.

Sun *et al.* (2006) in their original model, omitted the construct *subjective norms* from the model because they considered the questions to be too complicated for rural women to understand. In the context of Africa, extended family can very much influence the behaviour of an individual, and may not allow someone to exercise his/her opinion but doing what other are actually doing (McClenahan *at el.,* 2007), However, the construct *subjective norms* were included in the model in the present study, which appeared to be operative as they valued the doctors and nurse's opinion.Thus, nutrition education regarding pigeon peas should first address positive attitudes, but also influencing the beliefs of doctors and nurses about pigeon peas consumption would be an important step for the promotion of pigeon peas consumption.

Cues to action (from external factors), three items were significantly associated with intention to consume pigeon peas, namely: *Illness/sickness of my child makes me want to*

use pigeon peas, my child suffering from anaemia makes me want to use pigeon peas and shortage of food makes me want to feed my child pigeon peas. Caregivers are very concerned with the health of their children as majority are not educated and they are not aware of the nutritional benefits of pigeon peas but they can still feed them in order to prevent diseases.

It is interesting to note that more than half of caregivers did not attend any formal education. As level of education can affects food choices and also affects the economic status as it is a determinant of the occupation of a person. The same finding was reported by NBS (2014) that a significant proportion of rural women in Tanzania still had no formal education. The low levels of education observed may be due to the early marriages for the caregivers in the study area. Nyange (2016) reported that cultural practices such as initiation ceremonies, commonly known as "*Kumnema mwali*" (meaning mentoring a girl on how to become a good wife) and female genital mutilation (FGM) were the most important factors contributing to school drop out in the study area. Similar findings have been reported in different studies done in Tanzania (Hakielimu, 2010; Mtewele, 2012; Magesa *et al*., 2014). Therefore if women could have a better understanding of nutrition content of pigeon peas and how it associates with child's health it would have help to reduce nutritional related problems like PEM and ID.

A 5-points Likert scale was used as response scale in the questionnaire. An important issue is whether cultural groups differ in the way they respond to Likert scales, and especially whether such differences affect the conclusions reached. In some cultures, the idea of measuring something on a scale is unfamiliar (Harzing, 2009; Lee, 2002). In the present study, it was a bit challenging to clarify the scale to the caregivers as a large proportion were illiterate and it took time to clarify the scale before attempting to ask the questions,

and sometimes they still could not respond to the extreme responses, and rather opted to say agree or disagree.

It was noted that before pigeon peas was promoted in Kongwa as a nutritious and healthy food, there existed a popular belief in the area that the roots of a pigeon peas plant were good as traditional medicine for people with dry throat. Such beliefs were not surprising because also in Oman people believe that pigeon peas seeds are good medicine for treatment of different chronic diseases (Al-Saeedi and Hossain, 2015), probably due to their high contents of total phenols, flavonoids and antioxidant activity.

CHAPTER SIX

6.0 CONCLUSION, AND RECOMMENDATIONS

6.1 Conclusion

There are different factors influencing one's consumption. This study was able to identify factors that were considered to be important in predicting pigeon peas consumption among school-aged children in Kongwa. The factors include health values, subjective norms and attitude towards behaviour. Furthermore health consequences of pigeon peas consumption should be emphasized in order to stimulate a positive attitude. Finally the reduction of the barriers to consume pigeon peas will encourage those intending to actual consumption.

Lastly, income was a leading challenge as the majority of the caregivers were farmers and do not have high savings hence they could not consume pigeon peas and wanted to sell it to obtain money to support other activities as buying uniforms for the children and other foods that can complement pigeon peas.

6.2 Recommendations

Based on the results obtained, the study recommends the following:

i. The government through the Ministry responsible for health should strengthen provision of nutrition education through the use of health workers (doctors and nurses) at the grass root level as their advices are highly valued in the community. Nutrition education should include health benefits of consuming various food items such as pigeon peas and other locally available foods. It may be necessary to have a training of trainers (ToTs) initiatives whereby healthy

workers, and especially community-health-workers (CHWs), can be well trained on how to give nutrition education.

ii. Caregivers and other community members should be encouraged to form social groups which will help them to solve various economic and social issues that deal with nutrition related problems. Such problems include wrong perception or misconceptions about eating certain foods and lacking awareness about potential nutritious foods.

iii. Formulation of new products that are acceptable by the people, which can be as main dishes or snacks. Given the great nutritive potential of pigeon peas, the formulated foods should target all the age groups in the population such as complementary foods for the infants and young children, snacks for school-aged children and adults, as well as family general meals.

iv. As part of long-term plan, efforts should be made by researchers and development partners to design and promote consumption of pigeon peas in urban areas, to help improve economy and household food security of rural farmers who cultivate pigeon peas.

REFERENCES

Abizari, A. R., Moretti, D., Zimmermann, M. B., Armar-Klemesu, M. and Brouwer, I. D. (2012). Whole cowpea meal fortified with NaFeEDTA reduces iron deficiency among Ghanaian school children in a malaria endemic area. *The Journal of Nutrition* 142(10): 1836 – 1842.

Abizari, A. R., Pilime, N., Armar-Klemesu, M. and Brouwer, I. D. (2013). Cowpeas in Northern Ghana and the factors that predict caregivers' intention to give them to schoolchildren. *PloS One* 8(8): e72087.

Achouri, I., Aboussaleh, Y., Sbaibi, R., Ahami, A. and El Hioui, M. (2015). Prevalence of iron deficiency anaemia among school children in Kenitra, Northwest of Morocco. *Pakistan Journal of Biological Sciences* 18(4): 191.

Adeola, A. A. and Ohizua, E. R. (2018). Physical, chemical, and sensory properties of biscuits prepared from flour blends of unripe cooking banana, pigeon peas, and sweet potato. *Food Science and Nutrition* 6(3): 532-540.

Al-Saeedi, A. H., and Hossain, M. A. (2015). Total phenols, total flavonoids contents and free radical scavenging activity of seeds crude extracts of pigeon peas traditionally used in Oman for the treatment of several chronic diseases. *Asian Pacific Journal of Tropical Disease* 5(4): 316-321.

Amare, M., Asfaw, S. and Shiferaw, B. (2012). Welfare impacts of maize–pigeon peas intensification in Tanzania. *Agricultural Economics* 43(1): 27-43.

Baker, R. D. and Greer, F. R. (2010). Diagnosis and prevention of iron deficiency and iron-deficiency anemia in infants and young children (0–3 years of age). *Paediatrics* 126(5): 1040 – 1050.

Bennett, B., Mugisha, J., Mausch, K. and Weber, J. (2014). *Identification of Upgrading Options for Legume Value Chains Using a Comparison across Countries and Crops–Tanzania Pigeon Peas and Uganda Groundnut*. Socioeconomics Discussion Paper Series No. 24.

Bhutia, D. T. (2014). Protein energy malnutrition in India: the plight of our under five children. *Journal of Family Medicine and Primary Care* 3(1): 1 – 63.

Bundara, N., Mwanri, L. and Masika, J. (2013). Addressing childhood under nutrition in Tanzania: challenges and opportunities. *African Journal of Food, Agriculture, Nutrition and Development* 13(1): 7288 – 7306.

Choumert-Nkolo, J., Motel, P. C., and Le Roux, L. (2019). Stacking up the ladder: A panel data analysis of Tanzanian household energy choices. *World Development* 115: 222-235.

Elango, R., Humayun, M. A., Ball, R. O. and Pencharz, P. B. (2011). Protein requirement of healthy school-age children determined by the indicator amino acid oxidation method. *The American Journal of Clinical Nutrition* 94(6): 1545-1552.

Eze, E. D., Barasa, A., Adams, M. D., Rabiu, K. M., Ayikobua, E. T., Ezekiel, I. and Okpanachi, A. O. (2018). Assessing factors contributing to the prevalence of protein–energy malnutrition among children under five years of age attending

Kigoma District Hospital, Tanzania. *Journal of Food and Nutrition Sciences* 6(5): 123 – 128.

Fanou-Fogny, N., Saronga, N. J., Koreissi, Y., Dossa, R. A., Melse-Boonstra, A. and Brouwer, I. D. (2011). Weight status and iron deficiency among urban Malian women of reproductive age. *British Journal of Nutrition* 105(4): 574 – 579.

Fanou-Fogny, N., van Dam, B., Koreissi, Y., Dossa, R. A., and Brouwer, I. D. (2011). Factors predicting consumption of fonio grain (Digitaria exilis) among urban Malian women of reproductive age. *Journal of Nutrition Education and Behavior* 43(4): 219-228.

Fasoyiro, S. B., Ajibade, S. R., Saka, J. O., Ashaye, O. A., Obatolu, V. A., Farinde, E. O. and Afolabi, O. O. (2005). Physical characteristics and effects of processing methods on pigeon peas varieties. *Journal of Food Agriculture and Environment* 3(4): 59-65.

Field, A. (2005). *Discovering Statistics Using SPSS*. 2nd ed. London, United Kingdom: SAGE. 342pp.

Francis, J., Eccles, M. P., Johnston, M., Walker, A. E., Grimshaw, J. M., Foy, R. and Bonetti, D. (2004). Constructing questionnaires based on the theory of planned behaviour: A manual for Health. 45pp.

Ghadge, P. N., Shewalkar, S. V. and Wankhede, D. B. (2008). Effect of processing methods on qualities of instant whole legume: Pigeon peas (*Cajanus cajan* L.). *Agricultural Engineering* 10: 12-33.

Hakielimu, (2010). How to ensure educational success for girls: They have the right to complete their studies. Dar es Salaam, Tanzania. 87pp.

Harzing, A. W., Baldueza, J., Barner-Rasmussen, W., Barzantny, C., Canabal, A., Davila, A. and Liang, Y. K. (2009). Rating versus ranking: What is the best way to reduce response and language bias in cross-national research. *International Business Review* 18(4): 417-432.

Hebert, J., Clemow, L., Pbert, L., Ockene, I., Ockene, J. (1995). Social desirability bias in dietary self-report may compromise the validity of dietary intake measures. *International Journal Epidemiology* 24: 389-398.

Hillbur, P. (2013). The Africa RISING research sites in Tanzania: Opportunities and challenges to sustainable intensification and institutional innovation.

Hillenbrand, E. P. and Waid, J. L. (2014). 14 Adapting Food-based Strategies to Improve the Nutrition of the Landless: A Review of HKI's Homestead Food Production Program in Bangladesh. *Improving Diets and Nutrition.* 173pp.

Høgh-Jensen, H., Myaka, F. A., Sakala, W. D., Kamalongo, D., Ngwira, A., Vesterager, J. M. and Adu-Gyamfi, J. J. (2007). Yields and qualities of pigeon peas varieties grown under smallholder farmers' conditions in Eastern and Southern Africa. *African Journal of Agricultural Research* 2(6): 269-278.

Huang, M., Sudfeld, C., Ismail, A., Vuai, S., Ntwenya, J., Mwanyika-Sando, M. and Fawzi, W. (2018). Maternal dietary diversity and growth of children under 24 months of age in rural Dodoma, Tanzania. *Food and Nutrition Bulletin* 39(2): 219 – 230.

Ivers, L. C. and Cullen, K. A. (2011). Food insecurity: special considerations for women. *American Journal of Clinical Nutrition* 94(6): 1740S-1744S.

James, D. (2004). Factors influencing food choices, dietary intake, and nutrition-related attitudes among African Americans: application of a culturally sensitive model. *Ethnicity and Health* 9(4): 349-367.

Jeevarathinam, G. and Chelladurai, V. (2020). Pigeon Peas. In: *Pulses* . Springer, Cham. pp. 275-296

Karri, V. R. and Nalluri, N. (2017). Pigeon Peas (*Cajanus Cajan* L.) By-Products as Potent Natural Resource to Produce Protein Rich Edible Food Products.

Lee, J. W., Jones, P. S., Mineyama, Y. and Zhang, X. E. (2002). Cultural differences in responses to a Likert scale. *Research in Nursing and Health* 25(4): 295-306.

Magesa, R., Bakari, V., Mtoro, E. and Magombola, D. (2014). Effects of initiation rituals to primary and secondary school girls in Morogoro rural district. *International Journal of Innovative and Scientific Research* 6(1): 9-17.

Mainasara, A. S., Ibrahim, K. K., Uko, E. U., Jiya, N. M., Erhabor, O., Umar, A. and Ladipo, S. K. (2017). Prevalence of anaemia among children attending paediatrics department of UDUTH, Sokoto, North-Western Nigeria. *International Blood Research and Reviews* 2: 1-9.

Makori, N., Kassim, N., Kinabo, J. and Matemu, A. (2018). Factors associated with stunting in Dodoma region, Tanzania. *African Journal of Food, Agriculture, Nutrition and Development* 18(3): 13842-13861.

Makori, N., Kassim, N., Kinabo, J. and Matemu, A. (2018). Factors associated with stunting in Dodoma region, Tanzania. *African Journal of Food, Agriculture, Nutrition and Development* 18(3): 13842-13861.

Marathe, S. A., Rajalakshmi, V., Jamdar, S. N. and Sharma, A. (2011). Comparative study on antioxidant activity of different varieties of commonly consumed legumes in India. *Food and Chemical Toxicology* 49(9): 2005 – 2012.

McClenahan, C., Shevlin, M., Adamson, G., Bennett, C. and O'Neill, B. (2007). Testicular self-examination: a test of the health belief model and the theory of planned behaviour. *Health Education Research* 22(2): 272-284.

Meena, P. H., Lyirno-Macha, J. G. and Nyaruhucha, C. N. (2015). Nutritional status of tinder—five year children in selected Villages of Mvomero and Kongwa Districts, Tanzania. 78pp.

Miller, D. D. and Welch, R. M. (2013). Food system strategies for preventing micronutrient malnutrition. *Food Policy* 42: 115 – 128.

Millward, D. J. (2017). Nutrition, infection and stunting: the roles of deficiencies of individual nutrients and foods, and of inflammation, as determinants of reduced linear growth of children. *Nutrition Research Reviews* 30(1): 50-72.

Ministry of Health, Community Development, Gender, Elderly and Children, Tanzania Mainland], Ministry of Health, Zanzibar, National Bureau of Statistics Office of the Chief Government Statistician and (2016). Tanzania Demographic and Health Survey and Malaria Indicator Survey 2015-16.

Mondal, N., Basumatary, B., Kropi, J. and Bose, K. (2015). Prevalence of double burden of malnutrition among urban school going Bodo children aged 5-11 years of Assam, Northeast India. *Epidemiology, Biostatistics and Public Health* 12(4): 5-13.

More, S., Shivkumar, V. B., Gangane, N. and Shende, S. (2013). Effects of iron deficiency on cognitive function in school going adolescent females in rural area of central India. Anemia, 2013.

Mponda, O., Kidunda, B., Bennett, B., Orr, A. and Mausch, K. (2014). *A Value Chain Analysis for Pigeon Peas in the Southern Regions of Tanzania, Socioeconomics.* Discussion Paper Series No. 17.

Mtewele, G. (2012). The influence of traditional customs and practices on girls secondary education in Morogoro region in Tanzania. A case study. A Thesis for Award Degree of Masters of Philosophy in Comparative and International Education Institute of Educational Research at University of Oslo. 145pp.

Mtumwa, A. H., Paul, E. and Vuai, S. A. (2016). Determinants of under nutrition among women of reproductive age in Tanzania mainland. *South African Journal of Clinical Nutrition* 29(2): 75-81.

National Bureau of Statistics (NBS) (2016). *Tanzania Demographic and Health Survey and Malaria Indicator Survey*. United Republic of Tanzania, ICF International Rockville, Maryland, USA. 174pp.

NBS, (2014). Household budget survey, 2011/12. Tanzania: NBS, Dar es Salaam. 94pp.

NBS/ICF Macro (2011). *Tanzania Demographic and Health Survey 2010*. National Bureau of Statistics and ICF Macro. Dar es Salaam.

Nejad, L. M., Wertheim, E. H. and Greenwood, K. M. (2015). Comparison of the Health Belief Model and the Theory of Planned Behavior in the prediction of dieting and fasting behavior. *Journal of Applied Psychology Social Section* 1: 63-74.

Nithiyanantham, S., Kalaiselvi, P., Mahomoodally, M. F., Zengin, G., Abirami, A. and Srinivasan, G. (2019). Nutritional and functional roles of millets—A review. *Journal of Food Biochemistry* 3(1): 1-12.

Nyange, T. M., Sikira, A. N. and Lyimo-Macha, J. G. (2016). Gender based violence and legal aid services interventions among rural women in Morogoro rural and Kongwa Districts, Tanzania. 61pp.

Ochieng, J., Afari-Sefa, V., Lukumay, P. J. and Dubois, T. (2017). Determinants of dietary diversity and the potential role of men in improving household nutrition in Tanzania. *PloS One* 12(12): e0189022.

Okpala, L. C. and Okoli, E. C. (2011). Nutritional evaluation of cookies produced from pigeon peas, cocoyam and sorghum flour blends. *African Journal of Biotechnology* 10(3): 433-438.

Oliveira, D., Ferreira, F. S., Atouguia, J., Fortes, F., Guerra, A. and Centeno-Lima, S. (2015). Infection by intestinal parasites, stunting and anemia in school-aged children from southern Angola. *PLoS One* 10(9), e0137327.

Onwuka, G. I. (2006). Soaking, boiling and antinutritional factors in pigeon peas (*Cajanus cajan*) and cowpeas (Vigna unguiculata). *Journal of Food Processing and Preservation* 30(5): 616 – 630.

Otieno, Z. A. (2010). The Role of Varietal Traits on the Adoption of Improved Pigeon Peas Varieties in Kenya: The Case of Taita District. Dissertation for Award of MSc Degree at University of Nairobi, Kenya. 155pp.

Otieno, Z., Okello, J. J., Nyikal, R., Mwang'ombe, A. and Clavel, D. (2011). The role of varietal traits in the adoption of improved dryland crop varieties: The case of pigeon peas in Kenya. *African Journal of Agricultural and Resource Economics* 6(311): 2016-5587.

Perignon, M., Fiorentino, M., Kuong, K., Burja, K., Parker, M., Sisokhom, S. and Wieringa, F. T. (2014). Stunting, poor iron status and parasite infection are significant risk factors for lower cognitive performance in Cambodian school-aged children. *PloS One* 9(11): e112605.

Poelman, M. P., de Vet, E., Velema, E., Seidell, J. C. and Steenhuis, I. H. (2014). Behavioural strategies to control the amount of food selected and consumed. *Appetite* 72: 156 – 165.

Powers, J. M. and Buchanan, G. R. (2014). Diagnosis and management of iron deficiency anemia. *Hematology/Oncology Clinics* 28(4): 729 – 745.

Pretty, J., Toulmin, C. and Williams, S. (2011). Sustainable intensification in African agriculture. *International Journal of Agricultural Sustainability* 9(1): 5-24.

Pujiati, P. and Primiani, C. N. (2016). Analisis Kadar Gula Reduksi pada Fermentasi Kacang Gude (*Cajanus cajan*) oleh Aspergillus niger. *Biology, Science, Environmental, and Learning* 13(1): 832-835.

Rah, J. H., Hasler, C. M., Painter, J. E. and Chapman-Novakofski, K. M. (2004). Applying the Theory of Planned Behavior to women's behavioral attitudes on and consumption of soy products. *Journal of Nutrition Education Behaviour* 36: 238-244.

Rajendran, S., Afari-Sefa, V., Shee, A., Bocher, T., Bekunda, M. and Lukumay, P. J. (2017). Does crop diversity contribute to dietary diversity? Evidence from integration of vegetables into maize-based farming systems. *Agriculture and Food Security* 4: 1-9.

Rao, A. and Parikh, A. (2015). Prevalence of anemia in school age children. *Journal of Advanced Medical and Dental Sciences Research* 2(1): 12-23.

Reinhardt, K. and Fanzo, J. (2014). Addressing chronic malnutrition through multi-sectoral, sustainable approaches: a review of the causes and consequences. *Frontiers in Nutrition* 4: 1-15.

Ruel, M. T., Alderman, H. and Maternal and Child Nutrition Study Group. (2013). Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition? *The lancet*, 382(9891): 536-551.

Saxena, K. B. (2006). *Seed Production Systems in Pigeon peas ICRISAT*. International Crops Research Institute for the Semi-Arid Tropics. 87pp.

Saxena, K. B. (2008). Genetic improvement of pigeon peas—a review. *Tropical Plant Biology* 1(2): 159-178.

Saxena, K. B., Chauhan, Y. S., Sameer Kumar, C. V., Hingane, A. J., Kumar, R. V., Saxena, R. K. and Rao, G. V. R. (2018). Developing improved varieties of pigeonpea. 38pp,

Seetha, A., Tsusaka, T. W., Munthali, T. W., Musukwa, M., Mwangwela, A., Kalumikiza, Z. and Okori, P. (2018). How immediate and significant is the outcome of training on diversified diets, hygiene and food safety? An effort to mitigate child undernutrition in rural Malawi. *Public Health Nutrition* 21(6): 1156 – 1166.

Sengupta, R., Ghorai, N., Basu, S. K., Zandi, P. and Cetzal-Ix, W. (2019). A Review on the Nutritional Challenges of School Children from the Perspective Developing Countries. In: *The Role of Functional Food Security in Global Health*. Academic Press, pp. 109 – 143.

Sharghi, A., Kamran, A. and Faridan, M. (2011). Evaluating risk factors for protein-energy malnutrition in children under the age of six years: a case-control study from Iran. *International Journal of General Medicine* 2(2): 16-38.

Sharma, S., Agarwal, N. and Verma, P. (2011). Pigeon peas (*Cajanus cajan* L.): A hidden treasure of regime nutrition. *Journal of Functional and Environmental Botany* 1(2): 91 – 101.

Shiferaw, B. A., Kebede, T. A. and You, L. (2008). Technology adoption under seed access constraints and the economic impacts of improved pigeon peas varieties in Tanzania. *Agricultural Economics* 39(3): 309-323.

Simbauranga, R. H., Kamugisha, E., Hokororo, A., Kidenya, B. R. and Makani, J. (2015). Prevalence and factors associated with severe anaemia amongst under-five children hospitalized at Bugando Medical Centre, Mwanza, Tanzania. *BioMed Central Haematology* 15(1): 1 – 13.

Singh, U., Jain, K. C., Jambunathan, R. and Faris, D. G. (1984). Nutritional quality of vegetable pigeon peas [*Cajanus cajan* (L.) Millsp.]: Dry matter accumulation, carbohydrates and proteins. *Journal of Food Science* 49(3): 799 – 802.

Sujithra, M. and Subhash, C. (2014). Seasonal incidence and damage of major insect pests of pigeon peas, *Cajanus cajan* (L.). *Indian Journal of Entomology* 76(3): 202 – 206.

Sun, X., Guo, Y., Wang, S. and Sun, J (2006). Predicting iron-fortified soy sauce consumption intention: application of the theory of planned behavior and health belief model. *Journal Nutrition Education Behavior* 38: 276–285.

Talnikar, A. S., Kadam, G. L., Karande, D. R. and Jogdand, P. B. (2008). Integrated weed management in pigeon peas [*Cajanus cajan* (L.) Millsp.]. *International Journal of Agricultural Sciences* 4(1): 363-370.

Teblick, A., De Deken, S., Vanderbruggen, W., Vermeersch, M., Teblick, S., Ruymaekers, M. and Mmbando, B. P. (2017). Anthropometry and nutritional status of primary school children in a sub-urban region in Tanzania. *International Journal of School Health* 4(3): 1-12.

Thompson, B. (2011). *15 Combating Iron Deficiency: Food-based Approaches*. Combating micronutrient deficiencies. Food-based approaches. 268pp.

Tikle, A. N., Saxena, K. B. and Yadava, H. S. (2015). *Pigeon Peas Hybrids and Their Production*. New India Publishing Agency. 224pp.

UNICEF (2018). Levels and trends in child malnutrition. Social Sciences. 16pp.

United Republic of Tanzania. (2013). *Population and Housing Census 2012: Population Distribution by Administrative Areas* National Bureau Stasticts, Dare es Salaam and Office of Chief Government Statistician President's Office, Zanzibar.

Waldman, K. B., Ortega, D. L., Richardson, R. B., & Snapp, S. S. (2017). Estimating demand for perennial pigeon peas in Malawi using choice experiments. *Ecological Economics* 131: 222-230.

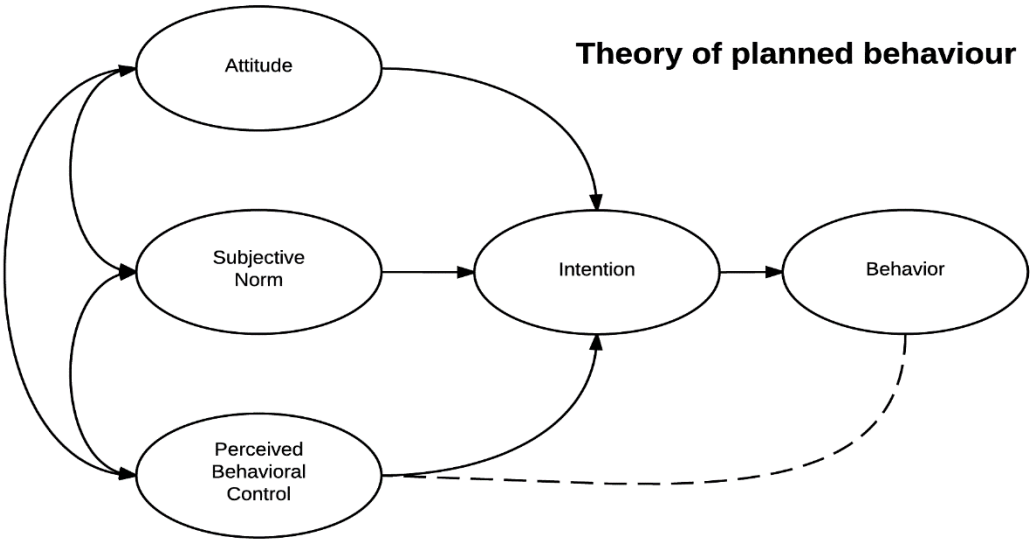
World Health Organization (WHO) (2013). *Essential Nutrition Actions: Improving Maternal, New-Born, Infant and Young Child Health and Nutrition*. World Health Organization Geneva, Switzerland.

World Health Organization. (2015). *WHO Global Disability Action Plan 2014-2021: Better Health for All People with Disability*. World Health Organization, Geneva. [www.who.int › disabilities › actionplan] site visited on 12/08/2019.

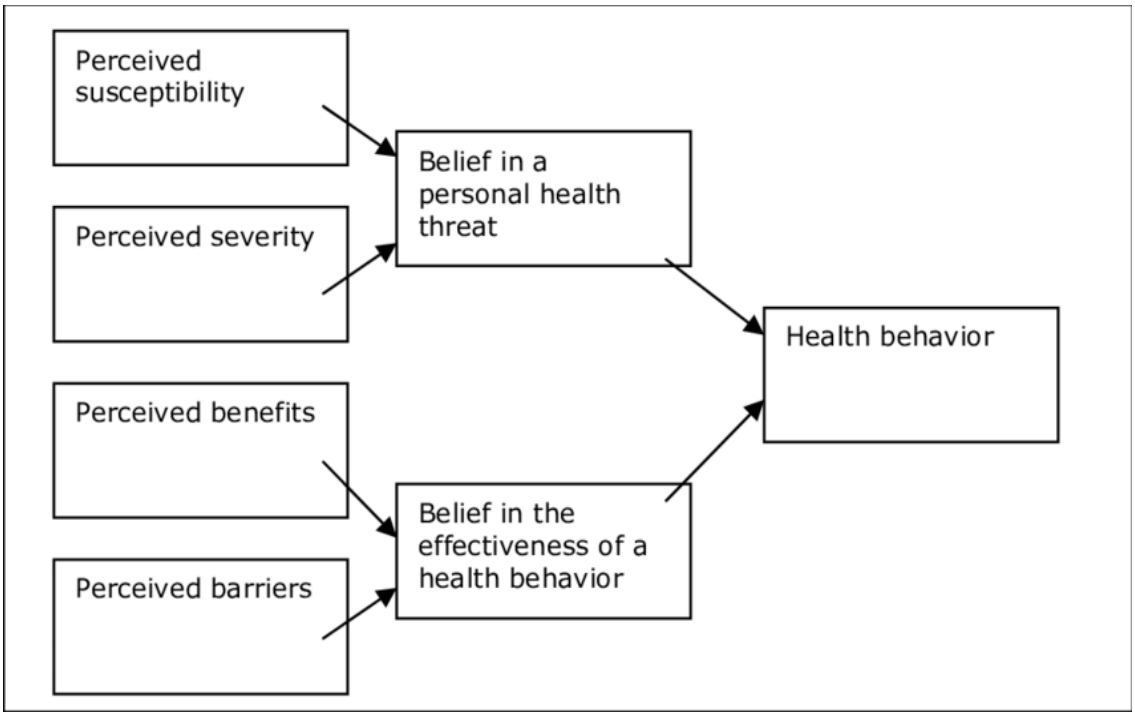
Yasmin, G., Kustiyah, L. and Dwiriani, C. (2014). Risk factors of stunting among school-aged children from eight provinces in Indonesia. *Pakistan Journal of Nutrition* 13(10): 557 – 566.

APPENDICES

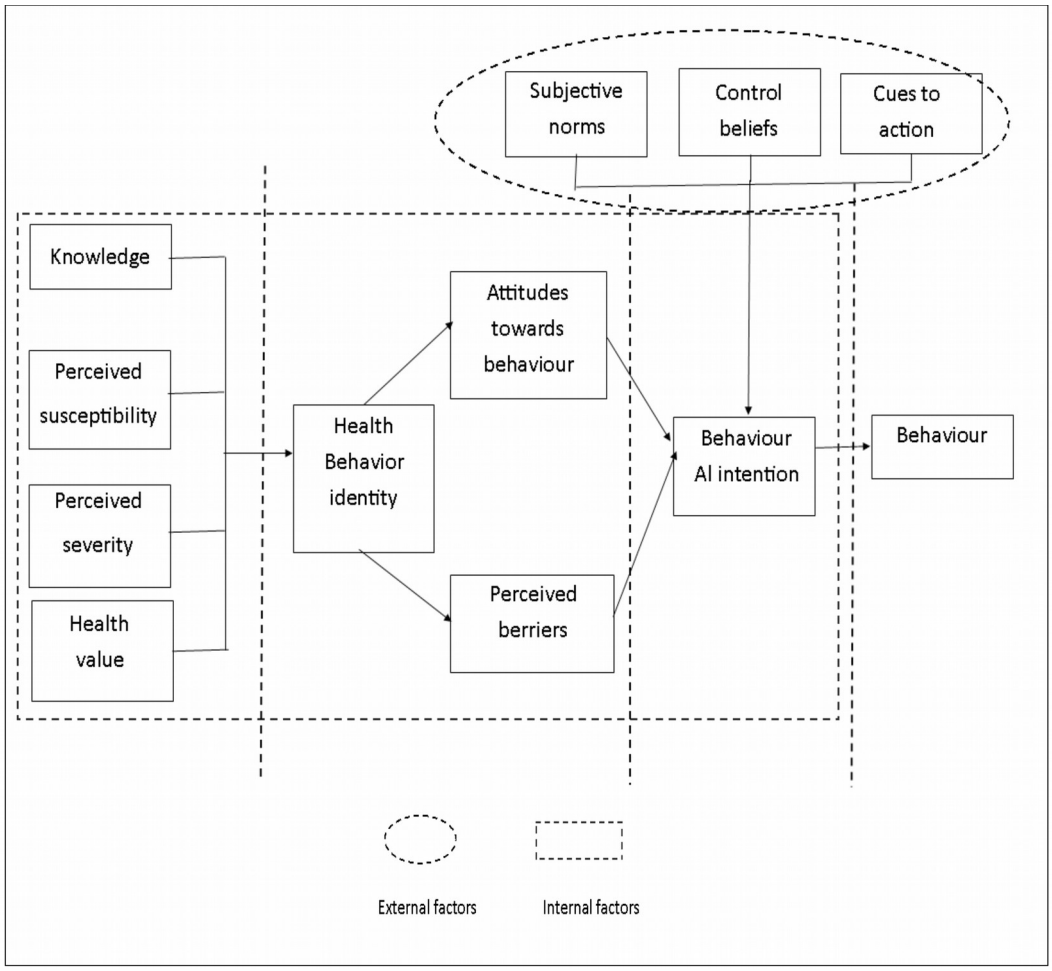
Appendix 1: Theory of Planned Behavior (TPB)



Appendix 2: Healthy Belief Model (HBM)



Appendix 3: A Combined model of the Theory of Planned Behaviour and Health Belief Model



Appendix 4: Results of Mann-Whitney tests for comparing various items included for the External Factors construct between low and high intention respondents

Variable	Mean Scores		P- value
	Low intention	High intention	
External control belief			
I am the one who decides my child should consume pigeon peas	51.00	87.00	0.255
Cues to action			
Ramadan, harvest time or women meetings make my child want to eat pigeon peas	65.25	71.99	0.270
My child likes to eat pigeon peas when we go out to a restaurant	68.29	70.21	0.735
I comply with the doctors, clinicians or health workers advice to give pigeon peas to my child	64.06	72.69	0.099
Illness/sickness of my child makes me want to use pigeon peas	60.07	75.03	0.010
My child suffering from anaemia makes me want to use pigeon peas	61.22	74.36	0.019
A shortage of food makes me want to feed my child with pigeon peas	61.97	73.91	0.053
People around me using pigeon pea makes me want to feed pigeon peas to my child	71.01	68.61	0.671
Pigeon peas sellers and marketers make me want to buy pigeon peas	66.94	71.00	0.467
The media makes me want to buy pigeon peas	69.05	69.76	0.900
The training in the community makes me want to feed my child pigeon peas	66.56	71.22	0.447
Subjective norms			
My husband gives me the advice to feed pigeon peas to my child	66.26	71.40	0.400
The advice of my husband is important to me	70.25	69.06	0.823
My mother-in-law advices me to feed pigeon peas to my child	64.65	72.34	0.195
The advice of my mother in law is important to me	66.28	71.39	0.372
My mother advises me to feed pigeon peas to my child	69.17	69.70	0.931
Advice from my mother is important to me	67.27	70.80	0.380
My friend(s) advise me to feed pigeon peas to my child	67.97	70.40	0.694
The advice of my friend(s) is important to me	64.24	72.59	0.155
My child's teacher(s) give me the advice to feed my child with pigeon peas	67.08	70.92	0.498
The advice of my child's teacher(s) is important to me	66.19	71.44	0.273
My nurse advices me to feed pigeon peas to my child	60.32	74.88	0.020

The advice of my nurse is important to me	65.72	71.72	0.104
Doctors give me the advice to feed my child with pigeon peas	62.38	73.67	0.067
The advice of the doctors is important to me	64.57	72.39	0.010
My village leaders give me advice to feed my child with pigeon peas	65.98	71.56	0.350
The advice of my village leaders is important to me	70.20	69.09	0.784
My religious leaders gives me advice to feed my child with pigeon peas	65.91	71.60	0.331
The advice of my religious leaders is important to me	68.99	69.80	0.851

Appendix 5: Results of Mann-Whitney tests for comparing various items included for the Belief and Attitude construct between low and high intention respondents

Variable	Mean Scores		
	Low intention	High intention	P-value
Health Behaviour Identity			
Giving pigeon peas is one of the best things that l can do for my child	71.32	68.43	0.338
Giving pigeon peas is one of the best things that I can do for my family members	70.91	68.67	0.433
Food that contain iron is one of the best thing that I can do give to my child to improve his/her cognitive development	60.85	74.57	0.023
Giving pigeon peas is one of the best thing I can do for my child to improve her/his intelligence	61.73	74.06	0.026
Giving pigeon peas is one of the best thing I can do for my child to improve her/his health	67.13	70.89	0.349
Giving pigeon peas is one of the best thing I can do for my child for her/his survival	67.08	70.92	0.373
Perceived Barriers			
I worry about the availability of pigeon peas on the market	70.14	69.13	0.865
I worry about the price of pigeon peas on the market	64.54	72.41	0.202
Pigeon peas requires a long soaking period of time before cooking.	64.9	72.2	0.194
I worry about the time required for processing pigeon peas	69.99	69.21	0.898
I worry about peas being contaminated with stones, gravels	67.14	70.89	0.546
Pigeon peas are easily prone to insect attack such as weevils	70.40	68.97	0.780
My child complains about the feeling of uneasiness after eating pigeon peas	69.28	69.63	0.939
My child complains about having a problem with flatulence after eating pigeon peas	64.70	72.32	0.122
I worry about chemicals used by farmers to control field and storage pests of pigeon peas	68.38	70.16	0.766
These chemicals have implications on one's health especially children	71.58	68.28	0.599
Pigeon peas are expensive in the rainy season than the dry season	71.65	68.24	0.559
I worry about the availability of fuel required to cook pigeon peas	67.77	70.51	0.656
I worry about the quantity of fuel required to cook pigeon peas	62.66	73.51	0.082
I worry about the availability of ingredients used to prepare pigeon peas relish	67.06	70.93	0.534
I am worried because the variety I prefer is not readily available	64.49	72.44	0.201
It is not easy to store/preserve pigeon peas	73.01	67.44	0.361
Attitudes Towards Behaviour			
Pigeon peas has a good taste	66.94	71.00	0.023
Pigeon peas has a bad smell	64.50	72.43	0.116
My child prefers foods that taste good	70.87	68.70	0.446
Pigeon peas has a bad colour	65.51	71.84	0.158
Pigeon peas cause ulcers	73.12	67.38	0.154
Pigeon peas are not easily digestible in my child digestive system after consumption	71.72	68.20	0.464
It is necessary for my child to eat something that is easily digestible	71.02	68.61	0.609
Pigeon peas do not require a long boiling time after soaking	73.71	67.03	0.281

The shorter boiling time makes me want to feed pigeon peas to my child	61.38	74.26	0.027
Pigeon peas is a nutritious legume	65.91	71.60	0.247
It is important to me to feed my child with foods that are nutritious	63.99	72.73	0.026
Pigeon peas creates variety in my child's meal	63.41	73.07	0.120
It is important for me to feed my child something that creates variety in his/her meal	64.70	72.32	0.122
Pigeon peas is an example of a traditional staple food	63.25	73.16	0.030
It is important for me to feed my child with traditional staple foods	64.49	72.44	0.065
Feeding my child with pigeon peas helps to have adequate weight for age	60.09	75.02	0.003
It is important for me that my child has adequate weight for her age	65.57	71.80	0.059
Giving pigeon pea to my child helps to prevent blood shortage (becoming anemic)	66.75	71.11	0.479
It is important to feed my child with foods that prevent blood shortage	67.46	70.70	0.526
Feeding my child with pigeon peas helps stimulate free bowels(prevents constipation)	61.85	73.98	0.049
It is important that I give foods that stimulate free bowels to my child	72.25	67.89	0.332
My child does not enjoy eating pigeon peas	63.34	73.11	0.095
It is important for me to feed my child with food that he/she enjoys eating	67.98	70.39	0.291
My child enjoys eating pigeon peas with maize such as kande	65.74	71.71	0.237
It is important for me to feed my child pigeon peas with maize such as kande	65.78	71.68	0.211
My child enjoys eating pigeon pea with rice such as (mseto)	69.87	69.28	0.904
It is important for me to feed my child pigeon peas with rice such as mseto	66.97	70.98	0.435

Appendix 6: Results of Mann-Whitney tests for comparing various items included for the Background construct between low and high intention respondents

Variable	Mean Scores		P-value
	Low intention	High intention	
Knowledge			
Food is important for the health of my school age child	71.14	68.54	0.297
Food can prevent low weight in my school child	65.94	71.59	0.351
Food can prevent shortage of blood in my school child	73.21	67.33	0.986
Pigeon peas contains high levels protein	69.57	69.46	0.163
Pigeon peas contains high levels of iron	64.48	72.44	0.854
Protein is important for the growth of my school child	68.83	69.89	0.362
Iron is important for the health of my school child	65.98	71.56	0.753
Protein can prevent my school child from becoming underweight	70.70	68.80	0.715
Iron can prevent shortage of blood in my school child	68.19	70.27	0.229
Pigeon peas can prevent my school child from becoming underweight	64.85	72.22	0.854
Pigeon peas can prevent shortage of blood in my school child	70.20	69.09	0.528
Intestinal worms can cause shortage of blood in my school child	67.15	70.88	0.341
Perceived susceptibility			
My school child suffers easily from weight loss	68.30	70.20	0.753
My school child becomes disinterested in his environment easily	70.48	68.93	0.795
My school child suffers easily from shortage of blood	65.05	72.11	0.134
My school child becomes weak and tired easily	67.85	70.47	0.651
Perceived severity			
Protein deficiency plays a role in the weight of my school child	70.75	68.76	0.747
Iron deficiency plays a role in my child suffering from shortage of blood	67.15	70.88	0.523
Iron deficiency plays a role in my child disinterested with the environment	65.80	71.67	0.282
Shortage of blood plays a role in the growth of my school child	66.32	71.36	0.396
Shortage of blood plays a role in the intelligence of my school child	66.60	71.20	0.432
Shortage of blood can make my school child perform poorly in school	66.74	71.12	0.451
Shortage of blood can make my school child weak and tired all the time	68.76	69.93	0.819
Poor growth can increase the chances of death of my school child	67.80	70.49	0.626
Shortage of blood can increase the chances of death of my school child	66.91	71.02	0.445

Health value			
The health of my school child is very important to me	70.64	68.83	0.429
The weight of my school child is important to me	68.91	69.84	0.728
The growth of my school child is important to me	69.27	69.63	0.875
The intelligence of my school child is important to me	68.29	70.21	0.283
The school performance of my school child is important to me	68.77	69.93	0.574
It is important that my school child is strong all the time	66.76	71.10	0.129
The survival of my children is important to me	68.81	69.90	0.595
Iron is important for the cognitive development of my child	62.70	73.49	0.080
Iron is important for the activeness of my school child	62.01	73.89	0.050

Appendix 7: Food frequency questionnaire

(Put (√) where appropriate).

During the last 7 days, how many times did your school aged child consume the following foods:	
Dairy foods	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Fish & sardines	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Eggs	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Maize	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Rice	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Wheat or food products made from wheat such as chapatti, maandazi, bread	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Pigeon peas	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Peas	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Beans stew	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Cowpeas stew	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Soybeans	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Groundnuts	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Sunflower seeds	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Meat (poultry, beef, goat)	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Organs (liver, kidney)	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Mixed peas and maize (Kande ya njegere)	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember

Mixed beans and maize (Kande ya maharage)	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Mixed cow peas and maize (Kande ya mbaazi)	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Mixed maize and soya (Kande ya soya)	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Porridge that has soya	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Porridge that has beans	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Porridge that has groundnut	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Mixed rice and pigeon peas (Mseto)	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Green vegetables such as mchicha, mlenda, mnafu, matembele, sukumawiki, spinach	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember
Fruits rich in vitamin C (oranges, lemon, lime, baobab)	☐ 0 ☐ 1 ☐ 2 - 3 ☐ 4 - 5 ☐ > 6 ☐ Can't remember

Remark Section

……

Appendix 8: This questionnaire is designed to identify factors predicting pigeon peas consumption among school aged children (5-12 years) in Kongwa district, Dodoma region. It will be administered to the caregivers with school aged children (5-12 years)

All information will be treated as confidential and anonymity is assured. Please provide frank/correct answers to the following questions.

Questionnaire Code Number: ……...
Interviewer's name: ……..
Date and time of first visit: ….……..
Respondent number: …….
Page: ……

The interview is:

- Completed hand in the questionnaire to supervisor
- Not completed report to supervisor
- If not completed: Reason: ……
- Date and time new visit: ……
- Not performed report to supervisor
- Not performed, because: Respondent not at home

Respondent refused: Respondent not capable
Respondent moved
Different, namely: ……

- New visit: Date and time, second visit: ……..
  Data and time, third visit: ……..

Instructions for the Interviewer:

Please fill in your name, the date and time, and the respondent number on top of each page. During the interview, please follow the following instructions:

- Ask the questions **exactly as they are written**; do not give examples or clarification.
- Ask the questions **in the same order** as given.
- Ask **all questions**; do not skip questions. If an answer is not clear, repeat the question kindly or ask for clarification.

- Give the respondent the **time to think**; insert a short moment of silence if necessary.
- Stay neutral to the responses of the respondent.
- **Record answers immediately.**
- Write any **remarks** down at the **remark section** on the last page**.**
- **Answer questions** of the respondent frankly.

Introduction

Interviewer: *Begin by introducing yourself and explain why you want to do an interview*

"I am …… from …. and I would like to ask you some questions about pigeon peas. ***Ask if she knows pigeon peas, If not, then you do not perform the interview.*** The questions will take … minutes. The research will help us to understand more about the consumption of pigeon peas, and is important to improve the health of school aged children. The answers you give, will be processed anonymously, so without mentioning your name.

Ask the respondent if you can speak alone with her. Then, explain to her more about the interview. First of all, thank you for your time and your willingness to do the interview. Please, answer the questions according to your real situation. There is no right or wrong answers. For each question you can choose between 5 answers. In the example question below, I will explain exactly how you can answer each question. Your opinion is important for us, and therefore your participation in this survey is of great meaning.

Section A1: Socio-demographic questions (Tick at the right answer)

1. Name of the index child ……..
2. What is your relationship with the child?

   a) Mother [ ] b) Stepmother [ ] c) Grandmother [ ]

d) Aunt [ ] e) other, specify…..……..

3. Date of birth of the index child (School aged child selected for the study)

   ……..
4. Sex of index child (school aged child selected for the study).

   a) Male [ ] b) Female [ ]
5. Is the index child in school?

6. Marital status of caregiver

   a)Married – monogamous b) Married – polygamous c)Widow d)Divorced e)Separated f)Partnered g)Never married

7. Religion

   a) Christian b) Muslim c) Others……

8. Highest educational level attained

   a) No school [ ] b) Primary school [ ] c) Secondary school [ ] d) Tertiary

9. What is your highest income generating activity (Source of livelihood?)

a) Farming [ ] b) Trading [ ] c) Civil servant (Government employee) [ ] d) Artisans (Hairdressers, Seamstress) [ ] e) Unemployed/House wife [ ] f) Others, please specify…….

10. How many household members have been eating the same meals prepared in the past four (4) weeks? .....

11. Number of children who have to share meals prepared at home……

12. Ethnic origin

a) Rangi b) Gogo c) Kaguru

13. Who do you live with in the house?

a) Husband alone b) husband with children c) Husband, children and other relatives d) Parent and children

14. Who are the main consumers of pigeon peas in the house hold? [You can choose more than one aspect]

a) Spouse/partner b) Self c) Infants (children less than one year) d) Young children (2-5 years) e) School going children (4-11 years) f) Adolescent (12-19 years) g) Youth (21-49 years) h) Older people (above 50).

A2: Socioeconomic status information

15. Present household assets/durable goods or property

   a) Television b) radio c) lands d) Refrigerator e) Own house f) Rent house

16. Housing quality (walls, floor, roofing material)

i) Type of floor material

a) Tiled [ ] b) Terrazzo [ ] c) Cemented [ ] d) Bare floor (soil, sand) [ ]

e) Other, specify…….....

ii) Type of roofing material

a) Corrugated iron sheets [ ] b) Mud (Tembe) [ ] c) thatched/leaves [ ]

d) Wood [ ] e) other, specify…….....

iii) Type of wall material. a) Cement [ ] b) Mud [ ] c) Wood [ ]

d) Thatch [ ] e) other, specify…….....

17. Toilet facilities.

a) Toilet in house [ ] b) Don't use any constructed facility [ ] c) Use of pit latrine [ ]

d) Use of public toilet/shared toilet [ ]

18. Main source of drinking water.

a) Pipe born water [ ] b) Protected dug out well [ ] c) River/Stream/Pond [ ]

d) Rain – tank storage [ ] e) Bore – hole water [ ]

19. Main source of lighting for the house

a) Electricity [ ] b) Solar power [ ] c) Kerosene [ ] d) Firewood [ ] e) Others (Specify)

20. How many household member have mobile phones?

a) None [ ] b) One [ ] c) Two d) More than two

21. Does the caregiver own a mobile phone? a) Yes b) No

B. Knowledge on pigeon peas

	I strongly disagree	**I disagree**	**Neutral**	**I agree**	**I strongly agree**
B1. Food is important for the health of my school aged child.					
B2. Food can prevent low weight in my school child					
B3. Food can prevent shortage of blood in my school child					
B4. Pigeon peas contains high levels of protein.					
B5. Pigeon peas contains high Levels of iron.					
B6. Protein is important for the growth of my school child.					
B7. Iron is important for the health of my school child.					
B8. Protein can prevent my school child from					

becoming underweight					
B9. Iron can prevent shortage of blood in my school child					
B10. Pigeon peas can prevent my school child from becoming underweight					
B11. Pigeon peas can prevent shortage of blood in my school child					
B12. Intestinal worms can cause shortage of blood in my school child.					

C. Perceived susceptibility of protein and iron deficiency

	I strongly disagree	**I disagree**	**Neutral**	**I agree**	**I strongly agree**
C1. My school child suffers easily from weight loss					
C2. My school child becomes disinterested in his environment easily					
C3. My school child suffers easily from shortage of blood					
C4. My school child becomes weak and tired easily.					

D. Perceived severity of protein and iron deficiency

	I strongly disagree	**I disagree**	**Neutral**	**I agree**	**I strongly agree**
D1. Protein deficiency plays a role in the weight of my school child					
D2. Iron deficiency plays a role in my school child suffering from shortage of blood					
D3. Iron deficiency plays a role in my school child disinterested with the environment					
D4. Shortage of blood plays a role in the growth of my school child.					

D5. Shortage of blood plays a role in the intelligence of my school child.					
D6. Shortage of blood can make my school child perform poorly in school					
D7. Shortage of blood can make my school child weak and tired all the time					
D8. Poor growth can increase the chances of death of my school child					
D9. Shortage of blood can increase the chances of death of my school child					

E. Heath Value

	I strongly disagree	**I disagree**	**Neutral**	**I agree**	**I strongly agree**
E1. The health of my school child is very important to me.					
E2. The weight of my school child is important to me.					
E3. The growth of my school child is important to me.					
E4. The intelligence of my school child is important to me.					
E5. The school performance of my school child is important to me.					
E6. It is important that my school child is strong all the time.					
E7. The survival of my children is important to me.					
E8. Iron is important for the cognitive development of my child					
E9. Iron is important for the activeness of my school child					

F. Health Behaviour Identity

	I strongly disagree	**I disagree**	**Neutral**	**I agree**	**I strongly agree**
F1 Giving pigeon peas is one of the best things that l can do for my child					
F2 Giving pigeon peas is one of the best things that I can do for my family members					
F3. Food that contain iron is one of the best thing that I can do give to my child to improve his/her cognitive development					
F4. Giving pigeon peas is one of the best thing I can do for my child to improve her/his intelligence					
F5. Giving pigeon peas is one of the best thing I can do for my child to improve her/his health					
F6. Giving pigeon peas is one of the best thing I can do for my child for her/his survival					

G. Perceived Barriers to Pigeon Peas Consumption

	I strongly disagree	**I disagree**	**Neutral**	**I agree**	**I strongly agree**
G1. I worry about the availability of pigeon peas on the market					
G2.I worry about the price of pigeon peas on the market					
G4 Pigeon peas requires a long soaking period of time before cooking.					
G5 I worry about the time required for processing pigeon peas.					
G6 I worry about pigeon peas being contaminated with stones, gravels etc					

G7 Pigeon peas are easily prone to insect attack such as weevils					
G8 My child complains about the feeling of uneasiness after eating pigeon peas.					
G9. My child complains about having a problem with flatulence after eating pigeon peas.					
G10.I worry about chemicals used by farmers to boost growth of pigeon peas,					
G11. These chemicals have implications on ones health especially children.					
G12. I worry about the seasonal supply of pigeon peas, not available throughout the year.					
G13. Pigeon peas are expensive in the dry season than the rainy season.					
G14. I worry about the availability of fuel required to cook pigeon peas					
G15. I worry about the quantity of fuel required to cook pigeon peas.					
G16 Am worried because the variety I prefer is not readily available.					
G17. It is not easy to store/preserve pigeon peas					
G18. Pigeon peas have a short shelf life.					

H. Attitudes towards Behaviour

	I strongly disagree	**I disagree**	**Neutral**	**I agree**	**I strongly agree**
H1. Pigeon peas has a good taste.					
H2. Pigeon peas has a bad smell					
H3. My child prefers foods that taste good					
H4. Pigeon peas are not easily digestible in my child digestive system after consumption.					
H5. It is necessary for my child to eat something that is easily digestible					
H6. Pigeon peas do not require a long boiling time after soaking					
H7.The shorter boiling time makes me want to feed pigeon peas to my child					
H8. Pigeon peas is a nutritious legume.					
H9. It is of great importance to me to feed my child with foods that are nutritious					
H10. Pigeon peas creates variety in my child's meal					
H11. It is important for me to feed my child something that creates variety in his/her meal.					
H12. Pigeon peas is an example of a traditional staple food.					
H13. It is important for me to feed my child with traditional staple foods.					

H14. Feeding my child with pigeon peas helps to have adequate weight for age					
H15. It is important for me that my child has adequate weight for her/his age					
H16. Giving pigeon peas to my child helps to prevent blood shortage (becoming anemic)					
H17. It is important to feed my child with foods that prevent blood shortage					
H18. Feeding my child with pigeon peas helps stimulate free bowels(prevents constipation)					
H19. It is important that I give foods that stimulate free bowels to my child.					
H20. My child does not enjoy eating pigeon peas					
H21. It is important for me to feed my child with food that he/she enjoys eating					
H22. My child enjoys eating pigeon peas – based added foods such as kande					
H23. It is important for me to feed my child with pigeon peas based added foods such as kande					
H24. My child enjoys eating pigeon peas – based added foods such as rice mixed with pigeon peas (Mseto).					
H25. It is important for me to feed my child					

with pigeon peas based added foods such as rice mixed with pigeon pea (Mseto).					

I. External Control Belief

	I strongly disagree	**I disagree**	**Neutral**	**I agree**	**I strongly agree**
I am the one who decides my child should consume pigeon peas.					

J. Cues to Action

	I strongly disagree	**I disagree**	**Neutral**	**I agree**	**I strongly agree**
J1. Important ceremonies like weddings or funerals make my child want to eat pigeon peas					
J2. Special guest(s) at home make my child want to eat pigeon peas					
J3. Celebrations, festivals, Ramadan, harvest time or women meetings make my child want to eat pigeon peas					
J4. My child likes to eat pigeon peas when we go out to a restaurant					
J5. I comply with the doctors, clinicians or health workers advice to give pigeon peas to my child.					
J6. Illness/sickness of my child makes me want to buy pigeon peas.					
J7. My child suffering from anaemia makes me want to buy pigeon peas					
J8.A shortage of food makes me want to feed my child with pigeon peas					
J9. People around me buying pigeon pea makes me want to feed pigeon					

peas to my child.					
J10.Pigeon pea sellers and marketers make me want to buy pigeon peas.					
J11. The media makes me want to buy pigeon peas.					
J12. The training in the community makes me want to feed my child pigeon peas					

K. Subjective Norms

	I strongly disagree	**I disagree**	**Neutral**	**I agree**	**I strongly agree**
K1. My husband gives me the advice to feed pigeon peas to my child.					
K2. The opinion of my husband is important to me.					
K3. My mother-in-law advices me to feed pigeon peas to my child					
K4 The opinion of my mother in law is important to me.					
K5. My mother advise me to feed pigeon peas to my child					
K6.The opinion of my mother in law is important to me.					
K7. My friend(s) advise me to feed pigeon peas to my child.					
K8. The opinion of my friend(s) is important to me.					
K9. My child's teacher(s) gives me the advice to feed my child with pigeon peas.					
K10. The opinion of my child's teacher(s) is important to me.					
K11. My nurse advices me to feed pigeon peas to my child.					

K12. The advice of my nurse is important to me.					
K13. Doctor give me the advice to feed my child with pigeon peas.					
K14. The opinion of the doctor is important to me.					
K15. My village leaders gives me advice to feed my child with pigeon peas.					
K16. The advice of my village leaders is important to me.					
K17. My religious leaders gives me advice to feed my child with pigeon peas					
K18. The advice of my religious leaders is important to me.					

L. Behavioural Intention

	Not	**Once or less per month**	**2-3 times per month**	**Once a week**	**Two or more times a week**
L1. How often do you think you will feed pigeon peas to your child in the coming month?					

M. BEHAVIOUR

	Not	**Once or less per month**	**2-3 times per month**	**Once a week**	**Two or more times a week**
M1. How often did you feed pigeon peas to your child in the last month?					