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SOKOINE UNIVERSITY OF AGRICULTURE

COLLEGE OF AGRICULTURE

DEPARTMENT OF FOOD TECHNOLOGY, NUTRITION, AND CONSUMER SCIENCES

DEGREE PROGRAM: BSc. FOOD SCIENCE AND TECHNOLOGY

SPECIAL PROJECT

TITLE: ASSESSMENT OF GENERAL AWARENESS ON MAIZE FLOUR FORTIFICATION BY SMALL-SCALE MILLERS AND CONSUMERS IN KIBAIGWA, DODOMA.

AUTHORS

Dennis David Jaka
Jamila Mohamed Kimaro
&
MOURICE GHOSSE

ABSTRACT

Fortification of staple foods is a globally accepted strategy to address micronutrient malnutrition in nutritionally vulnerable populations. Fortification can be done with one or multiple vitamins and minerals fortification is crucial to prevent severe micronutrient deficiencies in populations already at risk (low diversity before any crisis) .Food fortification is simply the addition of specific micronutrients (vitamins and minerals) to specific foods. The general objectives of this study was to assess awareness of small scale millers and consumers on fortified maize flour in Kibaigwa district, Dodoma region. The study used a questionnaire involving 10 small scale millers and 30 consumers. Awareness information regarding maize flour fortification was collected through face-to-face interviews with the consent of the interviewee using semi-structured questionnaires. The data were analyzed by using descriptive statistics. The results obtained revealed that many consumers of maize flour are unaware of the type of fortified maize flour as indicated by 76.66% of respondents were not aware of the fortified maize flour. While only 23.33% were aware fortified maize flour and for small scale, millers show that 80% were unaware of the type of fortified maize flour and 20% were aware of type fortified maize flour. The study recommends government should manage food fortification process .For food fortification improvement policy makers and government should ensure that fortification inputs were available and affordable. Education about maize flour fortification should be provided at Kibaigwa district, Dodoma region.

DECLARATION

I, Jaka, Dennis David, hereby declare that to the best of my knowledge, this report is my work under the supervision of Ms.Mkojera B.T and has not been submitted for a degree award at any higher learning institution.

…… ……

Signature of student Date

Name of the student

Jaka,Dennis David

The above declaration is confirmed by

…… ……

Name of the supervisor

Ms.Mkojera B. T Date

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DEDICATION

This work is dedicated to my beloved parents Mr. David Jaka and Mrs. Fikiria Kunzugala who laid the foundation of my education, my family members, friends, and relatives for their prayers, love, patience, and support during my studies. Thank you all and may God bless you abundantly.

TABLE OF CONTENT

CHAPTER ONE

1.0 INTRODUCTION

Food fortification was also known as food enrichment is when nutrients are added to food at higher levels than what the original food provides. This is done to address micronutrient deficiencies across populations, countries, and regions. Adding micronutrients to common staple foods can significantly improve the nutritional quality of the food supply and improve public health with minimal risk. The foods most commonly fortified are wheat, corn, rice, soya sauce, and other condiments. For a fortification program to be effective, the chosen food vehicles have to be available nationwide or, at least, in the specific geographical areas targeted by the program. In practice, this means that the product must be available to purchase from local retail stores or outlets that are accessible to the targeted segments of the population. Furthermore, the fortified products have to be purchased by the target families and consumed with sufficient frequency and inappropriate amounts by the targeted individuals(Gwirtz*etal*.,2014).

An alliance of actors from the private and public sectors is pursuing an ambitious food fortification program to address Tanzania's high rates of micronutrient undernutrition. This program is overseen by the National Food Fortification Alliance, a stakeholder body that includes food-processing companies, government agencies, donors, and non-governmental organizations (NGOs). Every year deficiencies in iron, vitamin A and folic acid cost the country

over US$ 518 million, around 2.65 % of the country's GDP (World, 2012). Food fortification is increasingly recognized as effective means of delivering micronutrients, with the objective being to deliver micronutrients to remote and impoverished populations affordably and sustainably (World, 2012).

Twelve countries have mandatory maize flour or meal fortification. The World Health Organization (WHO) is updating evidence-informed guidelines for the fortification of staple foods in public health, including the fortification of maize flour and cornmeal with iron and other micronutrients (WHO, 2O13). Although there is limited experience with the fortification of maize, mass fortification of maize flour with at least iron has been practiced for many years in several countries in the Americas and Africa: Brazil, Costa Rica, El Salvador, Kenya, Mexico, Nigeria, Rwanda, South Africa, Tanzania, Uganda, the United States, and Venezuela WHO, 2O13).

1.1Problem statement and justification

Micronutrient deficiency is among the major development challenge in Tanzania (Nalubola, 2002). About 32 % of fewer than 5 years old children in Tanzania are stunted due to malnutrition(Gwirtz,2014).. To fight against this challenge Tanzania has developed various policies and regulations. A food fortification policy of 2011 requires all businesses producing three types of food (wheat flour, maize flour, and vegetable oil) to add to these products several micronutrients key to people's health (Iron, Vitamin A, Folic acid, and/or Zinc) (Dunn,2014). As these micronutrients are currently absent from the diet of many Tanzanians, the fortification program aims to provide them to more than ten million people who live in rural areas, as these groups suffer a vastly disproportionate burden of under-nutrition(Gwirtz,2014). In addition, various stakeholders including local and international NGO's conduct several food fortification programs. The government encouraged Tanzanians to consume fortified food products as stipulated for their health benefits. A series of fortification-related initiatives are undertaken by the government in Tanzania, including the formation of the National Fortification Alliance

(NFFA) responsible for developing a national action plan to carry out mandatory fortification of staple foods, including wheat flour, maize flour, and edible oil. Tanzania joined the SUN Movement in June 2011 and has steadily taken necessary critical steps for curbing malnutrition by ensuring food security in the country and scaling up nutrition through various decisive measures (Smarter, 2016).

Regardless of the government and other stakeholders' efforts, awareness of food fortification is very low to consumers as well as to small-scale processors(Gwirtz,2014).. This implies the poor level of implementation of fortification program, for instance, according to the Economic Research Service using data from the Government of Tanzania (2010-11) the majority of the Tanzanian population, particularly those at the 'bottom of the pyramid', consume mostly starchy cereals. Foods rich in micronutrients are largely absent from diets of low-income households (GAIN, 2016).The Nielsen survey on food fortification programs in Tanzania (2010) focus on consumer behavior, knowledge and attitude of consumer whereby commission of SUN Business Network in Tanzania, found that only 53 % of 1087 consumers had heard of food fortification (Kavishe, 2017). When the concept of food fortification was explained, a further 63% of consumers' fortified food is mainly for the and 59% felt it is not available everywhere. (Kavishe, 2017). The purpose of this study is to assess the awareness of consumers and small-scale maize millers in Kibaigwa, Dodoma. The information collected was enabled to the structure of interventions such as seminars, training, and provision of technical assistance to both small-scale millers and consumers.

1.2Research objectives

1.2.1 General objective

Assessment of the general awareness of maize flour fortification by small-scale millers and consumers in Kibaigwa, Dodoma.

1.2.2Specific objectives

Specific objectives were to;

- Assess the general awareness on knowledge of macronutrients deficiency related to unfortified maize flour from both consumers and small-scale millers.
- Determine the factors that influence the purchase decision of consumers on fortified maize flour.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Maize flour processing

The process of maize flour production starts by cleaning the maize grain using sieving process to remove unwanted materials remain from the farm like sand, dirt's and grits that when left unremoved can result to health complication of consumer and cause some damage on the processing machine. The cleaned maize is then conditioned, this is nothing but adding moisture through soaking under specified controlled time to allow the easy peeling off of the bran. Before the milling process, the maize grain is de-germinated and polished then germ meal, bran, and endosperm are separated which results in the maize meal of high quality. The poor-quality maize meal is obtained when bran, endosperm, and germ are ground together and it is characterized by the shorter shelf life with the yellowish porridge give the bloating effect to the consumer. Sieving is the last step carried out in maize flour production after the milling process, now the maize flour of desired characteristics is obtained while the residues in the sieve are returned to the milling machines for further process or they can be used as they are for animal feed and any other use depending on the interest of the handler (Gwirtz*et*, 2014).

2.2 Micronutrient losses

There is a certain percentage of micronutrients expected to be lost in the fortification process during the preparation, blending, storage, or distribution of the product. It is therefore important that the vitamin and mineral levels be sufficiently high to account for foreseeable losses instability along the course to retail. These potential losses were taken into account when the fortification addition levels were formulated. Having batches that are less stable in some micronutrients also means no benefits will be to the consumer who digests them(Allen,2006). Overdosing the fortification mix is also not an option as doing so could jeopardize public safety and also monitoring, effectively monitoring fortification mix manufacturers/suppliers/ importers as well as millers, and having laboratory test results, are all critical to the food fortification regulatory process. Monitoring is essential to ensure the quality of fortified food that is released into the market(Smarter Futures,2016).

2.3 Status of Maize Fortification in Africa

Currently, 89,745,000MT of maize grain is produced locally and imported into Africa of which 52,627,000MT (60.5%) is for human consumption (Bymolt, and d'Anjou, 2017). The maize scoping study commissioned by Smarter Futures reveals that less than 30% of the human consumed maize is fortified, mostly that milled in large scale roller mills, in South Africa, Uganda, Kenya, Namibia, Nigeria, Zambia, and Zimbabwe (Bymolt, and d'Anjou 2017). Technology for fortification in commercial hammer mills is being developed and tested in Tanzania under cooperative models (Bymolt and d'Anjou, 2017). However, the success of this (voluntary) program was/is attached to donations (of equipment and premix), and since this support is temporary, industries may stop to fortify, if projects end, thus, undermining all the

efforts and resources put in place (Bymolt and d'Anjou, 2017). Unfortunately, the consumption of fortified maize products in Tanzania is very low, in 2015 only 2% of households consumed fortified maize flour in Tanzania (Klaas, 2012).

2.4 Why food fortification

Food fortification is one of the important initiatives to address the problem of micronutrients malnutrition which currently is more prevalent in most African countries include Tanzania as an example. It helps to eliminate the nutrition gap if consumed as recommended since fortified foods help to maintain nutrients in the body more effectively than supplements do. The problem of multiple deficiencies occurring due to poor quality diet and seasonal inadequate food supply can also be prevented by fortified foods. This contributes to the proper growth and development of children who are highly in need of a constant supply of micronutrients (Ngoma,2018).

Fortified foods increase the vitamins content in breast milk thus reducing the need for supplementation in postpartum women and infants. This is more important to women who are about to enter in pregnancy period and lactation with sufficient storage of nutrients. Unlike other foods, when the fortification process is carried in a controlled manner it results in the food with a very small risk of chronic toxicity.

Fortification is cost-effective varies according to the specific type of food, minerals, and vitamins (fortificants) to be added, it only costs $0.05 to $0. 25 per person per year (Ngoma,2018). This is the cost is small comparing to the gain in productivity and savings to the national healthcare program. The World Bank took Tanzania as an example where the calculated cost for iron deficiency, vitamin A and folic acid is more than $518 million (2.65% of DGP). The

food fortification program to be introduced is anticipated to yield $8.22 in profit for each dollar spent. Global report (2009)

Table 1: Minimum requirement for fortified food (TFDA 2011)

Food vehicle	Nutrient	Fortificant compound	Specifications	
			Minimum	Maximum
Wheat flour	Iron	EDTA, Zinc Oxide	30 mg/kg	50 mg/kg
	Zinc	Vitamin B12	30 mg/kg	50 mg/kg
	Vitamin B12	Folic acid	0.0005 mg/kg	0.025 mg/kg
	Folate		1 mg/kg	5 mg/kg
Maize flour	Iron	Sodium Iron EDTA	5 mg/kg	25 mg/kg
	Zinc	Zinc oxide	20 mg/kg	25 mg/kg
	Vitamin B12	Vitamin B12	0.0002 mg/kg	0.01 mg/kg
	Folate	Folic acid	0.05 mg/kg	2.5 mg/kg
Edible fats and oils	Vitamin A	Retinyl palmitate	6 mg/L	28 mg/L
	Vitamin E	Alpha-tocopherol	65 mg/L	190 mg/L

2.5 Maize flour fortification

Food fortification is the deliberate practice of adding essential micronutrients in food to improve its nutrition quality as well as providing public health benefits with minimal risk to the health of the consumer. The added nutrients technically are known as fortificant, these include those compounds containing specific micronutrients added to food vehicles intentionally. Fortified milled maize products are those products like maize meal or maize flour and others like to which the fortificants have been added in accordingly (Allen,2006). Fortified milled maize products shall conform to the requirements given in the table.

Table 2: Specific quality requirement for fortified milled maize products (TBS 2014)

Characteristic	Type of product				
	Sifted maizemeal	Granulated maize meal	Whole maize meal	Maize flour	Test method

Crude fiber content % by mass, max.	0.7	1.0	3.0	0.7	ISO 5498
Crude fat on a moisture-free basis, % by mass, max	2.25	2.25	3.1	2.25	ISO 11085
Moisture content, % by mass, max	13	13	13	13	ISO 6540
Total mass, % by mass, max	1.0	1.0	3.0	1.0	ISO 2171
Acid insoluble ash, % by mass, max	0.15	0.35	0.40	0.15	Annex A
Crude protein (N × 6.25) % by mass, min	*7.0*	*7.0*	*8.0*	*7.0*	*ISO 20483*
Fat acidity, mg KOH per 100g of product, on dry matter basis, max.	50	50	50	50	ISO 7305

The maize to be fortified first must be produced from shelled maize complying with the requirements recommended by East African Standards, then the fortified milled maize product at the end of the process must be with the following features: natural color conforming to the color of maize from which it was prepared, practically free from foreign matter such as insects, fungi and dirt, free from fermented musty or other objectionable colors, free from rancidity, foreign odors, safe and suitable for human consumption. The fortified milled maize product shall conform to the requirements and the levels of micronutrients provided in the following table of samples include the original number of micronutrients present before the fortification process (Darnton, 2002)

Table 3: Requirements for micronutrients in fortified milled maize products (TBS 2014)

Nutrient	Fortification compound	Recommended factory level	Regulatory levels, mg/kg	
			Minimum	Maximum
Vitamin A[1]	Vitamin A (Retinyl) palmitate	1 (+ or - 0.4)	0.5	1.4

Folate	Folic acid	1.2 (+ or -0.5)	0.6	1.7
Total iron	Total iron	31 (+or -10)	21	41
Added Iron	NaFeEDTA	20 (+ or -10)	10	30

2.6 Challenge facing fortification in Tanzania

2.6.1 Low Demand and market for fortified maize flour and products

There is currently low market demand for packed/labeled fortified maize flour across Africa. Most of the people in rural areas consume their home-grown maize, milled at small hammer mills which have limited capacity to fortify maize flour (FACT Survey, 2015). In most African countries except South Africa and major cities, fortified maize flour is not readily available. It is difficult to get fortified maize flour to rural communities-where 80% of the population relies on hammer mills (FACT Survey, 2015). However, in the long run with the increasing rate of urbanization, more consumers will be purchasing maize flour from the shelves. The urban and peri-urban population largely depends on commercially available maize flour, either directly bought at a mill or in a shop. These products need to all be fortified! In addition to urbanization, the homegrown maize grain supply is seasonal. At harvest time maize is plentiful and cheap but as the year proceeds, consumers' stocks become depleted and households begin to buy maize grain and/or maize flour from the market ((Ngoma,2018)).

2.6.2 Inadequate Facilities and Equipment

At the milling level, importing the feeders is problematic for small commercially packaging mills. With the limited capital base, they find it uneconomical to import appropriate technologies. Even when medium millers have the resources, there is a lack of knowledge to select the correct feeders for the mills. Lack of appropriate technology for maize flour fortification at small to medium commercial mills that package flours are proving to be a disincentive for industries to fortify and for partners to support programs geared towards enhancing the capacity of small mills to fortify (Van Liere,2018). Most countries reported having very few quality control labs at the milling facilities. The industries consider it as an additional overhead expense to undertake laboratory analysis of the flour in small mills. The limited

number of labs take time to release analytical results of micronutrients/tracers hence complicating certification and maize flour production. In addition, lack of knowledge about fortification and quality assurance and quality control hamper many smaller scale millers (Van Liere, 2018).

2.6.3 Poor premix distribution systems

Timely and regular access to affordable and quality-assured premix remains a barrier even for large-scale roller mills and yet stable access to premix is an essential component towards sustainable fortification program (Guamuch et al, 2014). Small millers struggle with financing an upfront purchase of premix that balances the risk of stock-out with that of premix expiration. For most countries, premix must be imported, and there can be high costs associated with this, such as customs taxes, VAT, and currency exchange fluctuations. This makes it cost-prohibitive and risky to purchase premix in small volumes that such millers require. Some countries like Tanzania and many more others exclude premixes from taxes. VAT is paid for by the consumers and remitted to by backers. This is a strength. Delays in international procurement of premix which can have lead times of three months or more are impractical for the highly fluctuating demand requirements as dictated by changing consumer acceptance and emergency assistance programs.

2.6.4 Limitation of food fortification and health implication

The fortified food product is rich in a particular micronutrient but in low-income societies, people are often suffering from multiple micronutrient deficiencies and hence they may not benefit by consuming a fortified product rich in a certain micronutrient only. Fortified foods have some added micronutrients. Many researchers believe that dietary diversity is a better approach to attain nutrient requirements naturally. There are technical issues relating to food

fortification, especially concerning appropriate levels of nutrients, stability of fortificants, nutrient interactions, physical properties, as well as acceptability by consumers(Allen,2006).

More knowledge is required about the impact of interactions among nutrients. For example, the presence of large amounts of calcium can inhibit the absorption of iron from a fortified food; the presence of vitamin C has the opposite effect and increases iron absorption. While it is often more cost-effective than other strategies, there are nevertheless considerable costs associated with the food fortification process. These may range from start-up costs and the costs of conducting trials for micronutrient levels, physical qualities, and taste, to a realistic analysis of the purchasing power of the probable beneficiaries (Kavishe, 2017).

Interest in fortification has shifted from prevention of deficiencies to improving health. However, it is not known whether discretionary fortification improves health, and its long-term effects remain unknown. In some countries, even basic information on existing dietary intakes is lacking. This is confounded by the nutrients for which nutrient requirements have not been elucidated for given age group and sex. Accurately assessing intakes of fortification vehicles is needed to assess the dietary impact of any fortification program.

Because the need for and the effectiveness of fortification varies by age, sex, life stage, and genetic profile, groups that are at high risk of inadequacy and/or excess deserve special attention in all countries. It is evident that a greater understanding of how food intake influences biomarker concentrations are critical so that more appropriate vehicles for food fortification can be identified and better advice given to those who wish to pursue this strategy (Smarter Futures, 2016).

CHAPTER THREE

3.0 MATERIAL AND METHODS

3.1 Location of the study

The study was conducted in Dodoma at Kibaigwa district . Kibaigwa is an admistrative ward in the Kongwa district of Dodoma region of Tanzania. According to the census of 2002 the ward has a total population of 15,426 were men are 6513 , women are 7018 and chidren are 1895 .The latitude for Kibaigwa is -6 .080167”S and longitude 36º39”0.14”E.

3.2 DATA COLLECTION

The questionnaires were used to collect the qualitative data(Appendix 1). The questionnaire was included both open and close-ended questions. The questionnaire was provided to the respondents to answer the questions and after answering the question, the questionnaire was provided data when was analyzed providing the information on the challenges which they face.

3.3 SAMPLING

3.3.1 SAMPLING PLAN AND SAMPLING SIZE

Simple random sampling techniques were used to select the sample (consumer); this technique is good since it gives the true representative that produced reliable and correct information (Bartlett,2005**).** There was one sampling site at Kibaigwa district which is located in Tanzania. Snowball sampling was used to gather information and data through questionnaires . The sample was collected from 30 consumers and 10 small-scale millers.

3.3.2 STATICAL DATA ANALYSIS

Data were analyzed using SPSS (Statistical Package for Social Science) software and the results were presented in statistical formats like tables, charts, histograms, and frequencies to see the variety of samples.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION.

4.1 Demographic information for Kibaigwa small scale millers and Consumers

Data of consumers and Kibaigwa small scale millers of fortified maize flour, a large number of respondents were male compared to female whereby male was (60%) and female were (40%), as indicated by Table 1. Also, the age group of respondents ranged between (21-30), (45%) had large percent compared to other age groups as (31-40), (41-60) and (above 60) there percentages were as follows (35%), (20%) and (0%) respectively. Education level of respondents with Secondary education (47.5%) followed with respondents with primary education (30%) and respondents with certificate/diploma and informal education, the university had (15%), (7.5%)and (0%) respectively.

Table 1: Demographic data for Kibaigwa millers and consumers.

Characteristics	Frequency(N)	Percentage(%)
Gender		
Male	24	60
Female	16	40
Age		
21-30	18	45
31-40	14	35
41-60	8	20
Education		
Primary education	12	30
Secondary education	19	47.5
Certificate/Diploma	6	15
University	3	7.5

4.2 Awareness of maize flour fortification for Kibaigwa Small Scale Millers and Consumers

From the results, it showed that the extent of awareness of maize flour fortification to both consumers and small scale millers in Kibaigwa district was very low as indicated by Table 2 and 3 below. This showed that many respondents were not aware of the fortification of maize flour. Therefore, this signifies that the population is at high risk of micronutrient deficiency and needs corrective actions to combat the risk.

Similar study by Nalubola (2002) found that mostly of the community which is not aware with fortification programs is at high risk of macronutrient deficiency.

According to (Klaas and Mildon, 2012) fortifying commonly eaten foods with tiny quantities of essential vitamins and minerals is an effective strategy for decreasing micronutrient deficiencies at a population level.

Table 2: Awareness of maize flour fortification for Kibaigwa Consumers

Characteristics	Frequency(N)	Percentage(%)
Yes	7	23.33
No	23	76.66

Table 3: Awareness of maize flour fortification for Kibaigwa Small Scale millers

Characteristics	Frequency(N)	Percentage(%)
Yes	2	20
No	8	80

4.3 Awareness of maize flour fortification for both male and female

Gender was included in demographic data males and females differ in terms of knowledge on the fortified maize flour, this reveals a difference among males and females respondents on awareness concerning the fortification of maize flour. Male were (60%) respondents seemed to be aware of the fortification of maize flour than female (40%) respondents as indicated in table 4 below .

Similar study by Bymolt (2017) found that mostly of men were aware with programs concern about fortification programs which help to reduce risk of macro nutrient deficiency in the community.

Table 4: Awareness of maize flour fortification for both male and female

Gender	Frequency(N)	Percentage(%)
Male	24	60
Female	16	40

4.4 Linkage between education level and awareness on maize flour fortification

Participants in this study (7.5%) had a university education as indicated by table 1. This could explain why they were knowledgeable about maize flour fortification. Education provides knowledge and skills to encourage new behavior and increase individual collective empowerment: it is the center for social and economic development empowerment.

According to Shweta (2003) lack of knowledge of the dietary requirements and the nutritive value of different foods is an important contributory cause of the widespread occurrence of malnutrition among vulnerable sections of the population in developing countries.

4.3 Acceptability to maize flour fortification for Kibaigwa Small Scale Millers and Consumers.

Acceptability of maize flour was one of the social demographic data collected where most people preferred whole grain maize flour(dona) followed by non-fortified degummed maize flour due to lack of knowledge about fortified maize flour. This showed that if a large number of respondents do not consume fortified maize flour meaning that there was a high level of micronutrient deficiency in the population(Nalubola,2002). Fortification of maize flour contributes towards the achievement of the sustainable development goals (SDGs), in particular, such as end hunger, achieve food security and improved nutrition and promote sustainable agriculture, ensure healthy lives and promote well-being for all at all ages (Bymolt and Anjou, 2017).

According to Bietlot (2012) the majority of the participants indicated that food fortification addresses malnutrition, Poverty, food insecurity, and chronic malnutrition continue to pose significant threats to the health and well-being of Tanzanians, due to failure of affording the cost of fortified maize flour as fortified maize flour appeared to be of high cost than unfortified maize flour due to such price difference makes fortified maize flour inaccessible to the community as observed in table 5.

By adding low-cost vitamins and minerals to everyday staple products, food fortification will benefit the entire national (Maestre,2014). Food fortification offers an affordable, convenient, and effective mechanism to improve the nutrition status of large segments of a population (Kiremire, 2010).

Table 5; Acceptability to maize flour fortification for Kibaigwa Small Scale Millers and Consumers.

Characteristics	Frequency	Percentage %

Acceptable	37	92.5
Not acceptable	3	7.5

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

Drawing from the summary of major findings, the studied case have shown that consumers and small scale millers were not aware on the fortified maize flour .The results from the use of fortified maize flour to a conclusion that the studied case to the both small scale millers and consumers did not make use of fortified maize flour (Jaka , 2021).

5.2 RECOMMENDATIONS

i. Policy makers should promote fortification programs in their policy frameworks so that it can contribute to development of fortification programs in Tanzania. For sustainable fortification programs it is proposed that the government should support the implementation policy in terms of resources so that vision ,mission and objectives are achieved.

ii. Production managers should ensure that fortification plans as major input to the food industrial management are in place .The government should make it mandatory so that every food factory possess fortification plan which guide the implementation phase

.

iii. Government should be able to demonstrate their ability to set long term direction for competitiveness as well as develop and communicate mission and vision as well as motivating followers of fortification programs so that their effort are channelled towards that direction. Government has role to play in managing food fortification process.

iv. On the issue of food fortification improvement, policy makers in collaboration with government should ensure that there is availability of fortification at affordable price .

v. Schools, health facilities, health professionals, and the lay press be afforded a greater opportunity in imparting knowledge on the benefits of food fortification and fortified foods because enough information was provided by educated respondents in areas with the least knowledge about maize flour fortification like in Kibaigwa district.

vi. Efforts on the education of the public on aspects of food fortification in some regions in Tanzania like Dar- es -Salaam and Morogoro appear to have been largely successful and should be continued and intensified. A continued and consistent message on the benefit of food fortification should be addressed to the public at large to improve on an already excellent coverage as part of the monitoring and evaluation program on food fortification.

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APPENDIX 1

QUESTIONNAIRE

Dear respondent,

This questionnaire will be used to assess the general awareness of maize flour fortification by small-scale millers and consumers in the Kibaigwa district, Dodoma. It is for research and training purposes only. The responses and results of this questionnaire will be treated confidentially and reported anonymously. You are, therefore, kindly requested to fill in this questionnaire

A. GENERAL INFORMATION

1. Date of interview

DD MM YYY

2. Name of the small scale miller ……..

B; **PERSONAL INFORMATION**

Gender: Male × Female×

Age:

×10-20Years

×21-30years

×31-40 years

×41-60 Years

× Above 60 years

Education Level

× Informal education

×Primary school education

×Certificate/Diploma

×Secondary school education

×Higher Education

C; GENERAL AWARENESS

1. Do you know maize flour fortification?

× YES × NO

If yes, explain how it is done……

……..

2. Do you think maize flour fortification is mandatory?

× YES × NO

3. Do you fortify maize flour?

× YES × NO

4. If yes, how do you fortify the flour?

a. Use of automatic densifier

b. Manual addition (by manual weighing)

c. By approximation of the amount of maize (no measurements and control)

d. Others (specify)…….....

5. Which fortificants do you use to fortify maize flour ……

……

6. Where do you get your fortificants/premix?.....

7. Do you have any support, please mention……..

8. How do you store the fortificants/premix? …… ……..……

9. How often do you repair your equipment and dosifier? ……..

…….

10. Do you conduct any calibration of your weighing equipment? …….....

…….....

11. Have you attended any training on maize flour fortification?

× YES (specify)……

× NO

12. Which maize flour is preferred by consumers

a. fortified maize

b. non-fortified maize

c. whole maize flour (*dona*)

13. Do you think the sale of unfortified maize flour is illegal?

× YES × NO

14. Do you use the fortification logo on your packages?

× YES × NO

15. Do you fortify maize flour of individual customers bringing their maize for milling?

× YES × NO

16. Do you receive any inspection on fortification?

□YES (mention) …….

□NO

17. If yes, how often?.....

D: CONSUMERS' GENERAL AWARENESS OF MAIZE FLOUR FORTIFICATION

1. Do you know maize flour fortification?

   × YES × NO

2. Do you think maize four fortification is mandatory?

   × YES × NO

3. Does selling non-fortified maize flour illegal?

   × YES × NO

4. Is it possible to find fortified maize flour on the market

   × YES × NO

5. How often do you purchase and consume fortified maize flour?

   × YES × NO

6. Is fortified maize flour expensive than non-fortified maize

   × YES × NO

7. Do you prefer fortified maize flour to non-fortified maize flour?

   × YES × NO(explain)……..……...

8. Do you know any benefits of consuming fortified maize flour?

   YES □ (mention)……..

   NO □

9. Do you know the fortification logo that should appear on the maize flour package?

   YES □ (mention)……..

   NO□

10. Apart from maize, which other fortified products do you eat? ……..……..…

….....……