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FACTORS INFLUENCING FOOD FORTIFICATION AS A MEANS TO COMBAT MALNUTRITION AMONG CHILDREN ATTENDING IMMUNIZATION AT NAKASONGOLA HEALTH CENTER IV. A CROSS-SECTIONAL STUDY.

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Abstract

Introduction:

Objectives: To determine the factors influencing food fortification as a means to combat malnutrition among children attending immunization whereas the specific objectives were to assess the knowledge of caretakers, ascertain the attitude, and determine the practices affecting food fortification as a means to combat malnutrition among children attending immunization at Nakasongola Health center IV.

Methods:

A cross-sectional study was conducted in the district at Nakasongola Health Center IV. Simple random sampling was used to recruit 100 respondents who had brought children for immunization and data was analyzed using Excel.

Results:

The results from this study revealed that more than 50% of the participants were not aware of the term 'food fortification'. Most of the participants (86%) were not aware of the fact that the Ugandan government made food fortification compulsory on staple foods and the majority of the respondents reported their source of information as health personnel 63(63.0%). Over 60% of the caretakers reported that they cooked fortified foods in the same way as unfortified foods while 33% cooked the fortified food differently. Most participants (90%) of the respondents think food fortification is important, 22% of the respondents read food labels before buying food while only 2% of the respondents feed their children on fortified food.

Conclusion:

Overall, the study suggests that while there is some level of awareness and positive attitude towards food fortification among caretakers of children attending immunization at Nakasongola Health Center IV, there is still a need for further education and promotion of food fortification practices. This can be achieved through increased awareness campaigns and education by health workers and other stakeholders.

Recommendation:

Education and awareness campaigns should be conducted to increase knowledge about food fortification, its benefits, and the use of fortified foods among the population.

Keywords: Knowledge, Food Fortification, Malnutrition, Biofortification, Malnutrition, Micronutrient, Attitude, Submitted: 2023-05-09 Accepted: 2023-07-27

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1. Background of the study.

Food fortification refers to the practice of deliberately increasing the content of one or more micronutrients like vitamins and minerals in food to improve the nutritional quality of the food supply and provide a public health benefit with minimal health risk and this is according to WHO 2022. When there is an increase in the nutritional content of staple foods, the addition of micronutrients can help to restore the micronutrient content lost during processing and this is according to WHO. Fortification is also an evident and informed intervention that contributes to the prevention, reduction and control of micronutrient deficiencies and it can also be used to correct a demonstrated micronutrient deficiency in the general population of mass or large-scale fortification or in specific population groups targeted fortification such as children, pregnant women and the beneficiaries of social protection programs.

WHO and FAO, 2016 states that Vitamin and mineral deficiencies affect around 2 billion people worldwide and have been identified as a global health issue in many low- and middle-income countries whereby micronutrients often referred to as vitamins and minerals are essential for the body to function and the Deficiency of micronutrients can be linked to anemia, adverse birth outcomes, night blindness and increased risk of mortality in children and pregnant women, increased risk of osteoporosis in adults and rickets in children, reduced resistance to infectious diseases, fatigue, and impaired cognitive function and this is according to the World Health Organization . To the word Health Orgnization, these outcomes have far-reaching social and economic consequences, not only placing a massive burden on individuals and families, but also increasing pressure on core public services such as health, social care and education. Studies show that micronutrient deficiencies can contribute to a loss of up to 5% Gross Domestic Product (GDP) (World Bank, 2015). For example, according to the World Food Programme, iron deficiency can contribute to a loss of up to 2% GDP in the worst affected countries (Hunt *et al*, 2012). The World Food Programme therefore, addresses micronutrient deficiencies on a large scale represents a proven opportunity to build healthy societies and sustainably boost local economies just as stated in Linkedin.

According to the World Food Programme, The ideal solution to addressing micronutrient gaps is improving diets through dietary diversification and yet the high level of resources, the availability and the accessibility that is required to ensure diets are varied enough to meet the micronutrient needs, often prevent reaching this goal through this approach alone. In this situation, food fortification, micronutrient supplements and bio fortification are widely recognized as highly effective and affordable complementary strategies (Ritchie and Roser, 2017). According to the World Food Programme,well-implemented food fortification programs significantly impact the health and productivity of target groups for a comparatively low cost. Further more ,food fortification with micronutrients has been ranked among the top three strategies in terms of economic return on investment due to its high cost-benefit ratio, according to analysis carried out by a panel of global economic experts for the Copenhagen Consensus Center and this is according to the World Food Programme. The well-respected think tank noted its "tremendously high benefits compared to costs." By successfully addressing micronutrient deficiencies on a large scale with relatively limited budget, food fortification can help countries reach their nutrition goals, improve the nutritional and health status of populations, enable them to achieve their potential and support economic prosperity on a national level (R Wanyama, 2019). In addition, fortified foods can support households in meeting nutrition needs by improving affordability of a nutritious diet and this is according to the (WFP, 2022).

Various interventions exist to address micronutrient malnutrition These include food supplementation, industrial fortification, bio fortification and dietary education programs, among others (Bouts and Saltzman, 2017; Thompson and

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Amoroso, 2011).According to R Wanyama et al. ,2019, food-based approaches that do not require recurring public support are generally seen as more sustainable.

According to Bouis *et al* 2011, the breeding of staple food crops for higher micro nutrient contents - can be a promising intervention especially in rural areas, where households do not consume a lot of processed foods . Industrial fortification and related approaches to increase the nutritious value of processed foods can be promising avenues in urban areas. In any case, successfully introducing nutritionally enhanced foods requires good understanding of consumer preferences. Poor people's preferences in particular need to be understood, not only because they are the main target group for nutritional improvements but also because their preferences may differ from those of richer households. Oftentimes, the poor have lower nutritional awareness and lower willingness and ability to pay R Wanyama, 2019.

According to R Wanyama , 2019,several studies have been conducted in developing countries to evaluate consumer attitudes toward new types of nutritious foods . A few studies focused on consumer acceptance of bio fortified crops, mostly in rural areas. According to Jackson *et al* (2013), others worked with samples from urban areas and nutritional enhancements of processed foods and carried out sensory evaluation of different porridges in Botswana and found that participants liked the taste of nutritionally enhanced recipes but were not willing to pay more than for traditional and less nutritious porridge flour but analyzed consumer attitudes towards fortified foods in urban Senegal and also found a low willingness to pay (WTP) a premium, which increased somewhat with more nutrition information provided.

According to the World Food Programme, the effects of malnutrition are globally recognized as being devastating and far-reaching. In other words, according to the fill the nutrient gap Uganda summary report malnutrition is widespread across Uganda - 29 percent of children under the age of 5 years are stunted and 53 percent are anemic and unlikely to reach their full mental and physical potential and the burden varies by region and progress has been hampered by several factors including poverty; agriculture policies focused on staple foods; poor supply chain and market infrastructure for nutritious according to the fill the nutrient gap Uganda national summary Fresh foods; low school attainment and high youth unemployment; and unaffordability of nutritious food according to WFP addressing malnutrition in a sustainable manner in Uganda must take a lifecycle approach with a special focus on children under 2 years. Adolescent girls and pregnant and lactating women. It must include a range of context-specific, targeted interventions that engage stakeholders across multiple sectors.

The Government of Uganda is implementing mandatory food fortification regulations for salt, wheat flour, maize flour, and edible oils and fats to improve the nutritional status of the population. The regulation for universal iodization of salt came into effect in 1993. According to the MoH and FFI report, 2021,the regulations for fortified foods came into effect in 2011 and require that all wheat flour mills, maize flour mills producing 20 MT of maize flour daily, and oil industries producing 10 metric tons (MT) of oil/fats every day for the fortify products according to the, the Rapid Assessment of the Impact of COVID-19 on Food Fortification Regulation Compliance report in Uganda the regulations require that all wheat flour, maize flour, and imported oil/fats be fortified according to the national standards. Furthermore, the rapid assessment of the impact of COVID-19 on Food fortification regulation complainace report ,2021, the compliance to food fortification regulations is monitored and enforced by food producers through internal quality assurance and quality control (QA/QC) mechanisms; routine market surveillance and inspection of premises by local government authorities that is to say the District and Municipality and the Uganda National Bureau of Standards (UNBS), the annual "Q" mark certification audits by UNBS; and assessments of the health impact of fortified foods through surveys such as the Fortification Assessment and compliance Tool (FACT), Uganda Demographic Health Sur-

vey (UDHS), and Uganda National Panel Survey (UNPS) A Rapid Assessment of the Impact of COVID-19 on Food Fortification Regulation Compliance in Uganda ,2021. since the country began to impose lock down measures in March.

1.1. General Objective.

To assess factors influencing food fortification as a means to combat malnutrition among Children attending immunization at Nakasongola Health Center IV.

1.2. Specific objectives.

- To assess the knowledge of the care takers of children attending immunization at Nakasongola health center IV about food fortification as a means to combat malnutrition.
- To ascertain the attitude of the care takers of children attending immunization at Nakasongola health center IV towards food fortification as a means to combat malnutrition.
- To determine the practices affecting food fortification as a means to combat malnutrition among children attending immunization at Nakasongola health center iv.

2. METHODOLOGY.

2.1. Study area.

The study was conducted in Nakasongola Health Centre IV, Nakasongola District which is located in Central Uganda. The facility is found in Buruli quarter, Nakasongola town council in Nakasongola district. The health center offers many health care services including immunization, child health services, HIV/AIDS management services, general patient management, laboratory services, nutrition services, antenatal, maternity, and postnatal services, EMTCT program as well as VCT services among many others. The study area was selected because the problem under study had been noted on the ground by the researcher and it was easily accessible by both the researcher and the general public. The study was carried out between 5th and 24th January, 2023. It considered a period of the last 1 year in which a significant rise in malnutrition was reported at the facility.

2.2. Study Design.

The study design will be a cross-sectional study, employing quantitative data collection methods. It is a cross-sectional type of design because it will involve the collection of data at a single point in time and from a group of respondents whose characteristics such as age, parity, marital status, level of education, and occupation will be stipulated.

2.3. Study Population.

The study included only post-natal mothers and caretakers having malnourished children attending immunization at Young Child Clinic in Nakasongola Health Centre IV, Nakasongola District.

2.4. Sample size determination.

The sample size was determined using Solven's method as below

$n = \frac{N}{1+Ne2}$

Where;

n is the required sample size

N is the estimated population of mothers with malnourished children in Nakasongola Health center IV catchment area of the study (143) according to INR reports of the health center

n = 134/ (1+134 (0.052))

= 100, Therefore, the researcher targeted a total of 100 care takers.

2.5. Sampling Technique.

The researcher used a simple random sampling procedure to select the required number of caretakers in Nakasongola Health Centre IV. In this procedure, the researcher wrote the words YES and NO on pieces of paper, placed them in an enclosed box, shake it then offered potential respondents an opportunity to participate by picking papers from the box. Any respondent who picked a paper with the word YES written on it would be requested to participate in the study. This would continue until the total number of respondents to be interviewed per day was achieved.

2.6. Data collection tools.

Data was collected using an approved semi-structured interview guide which will consist of both open and closed-ended questions. This tool was selected because the study involved mixed respondents who are both literate and illiterate and cannot understand English used to develop the questionnaire. The interview guide was pre-tested at Bukerere Health Center III which assisted the researcher to assess the accuracy and reliability of the tool before using it for data collection. The tool was also translated into a language that the respondents understood best.

2.7. Data collection procedures.

Before approaching and collecting data from respondents at the MCH Clinic, the researcher was accompanied and introduced to the respondents by the In-Charge of the clinic and explained the purpose of the study. The researcher made a self- introduction and then administered questionnaires to respondents at the MCH Clinic. This improved efficiency and confidentiality during data collection. The researcher intended to interview 5 respondents per day for a total of 100 respondents in 20 days.

2.8. Piloting the study.

The interview guide was pre-tested at Bukerere Health Center III which assisted the researcher to assess the accuracy and reliability of the tool before using it for data collection. The tool was also translated into a language that the respondents understood best.

2.9. Inclusion criteria.

The study included only post-natal mothers and caretakers having malnourished children attending immunization at Young Child Clinic in Nakasongola Health Centre IV who would be available during the data collection period and were willing to voluntarily consent to participate in the study.

2.10. Exclusion criteria.

The study excluded all post-natal mothers and Caretakers who were ill and could not participate as well as those who refused to voluntarily consent to participate in the study.

2.11. Data Presentation analysis.

The views and responses were filled and the researcher collected the questionnaires from the respondents and check to ensure that all questions were answered. For questionnaires which were not fully filled in, the researcher probed for more information from those particular respondents. The data was later recorded, stored and entered into Microsoft Excel which tallied and converted frequencies and generated percentages. The information was presented in charts graphs and tables. The data was analyzed using Microsoft Excel and interpreted.

2.12. Ethical consideration.

The researcher obtained an introductory letter from the research ethics committee of Medicare health professionals College- Mengo addressed to The District Health officer of Nakasongola district for permission to carry out research about the proposed topic of study. The DHO then gave him an introductory letter to the medical superintendent of Nakasongola Health Center IV who then allowed the researcher to collect data from the respondents. The researcher ensured that he gets signed written informed consent from the respondents and ensured confidentiality of the information given by the respondents.

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The study included only post-natal mothers and caretakers having malnourished children attending immunization at Young Child Clinic in Nakasongola Health Centre IV who would be available during the data collection period and were willing to voluntarily consent to participate in the study.

2.17. Exclusion criteria.

The study excluded all post-natal mothers and Caretakers who were ill and could not participate as well as those who refused to voluntarily consent to participate in the study.

2.18. Data Presentation analysis.

The views and responses were filled and the researcher collected the questionnaires from the respondents and check to ensure that all questions were answered. For questionnaires which were not fully filled in, the researcher probed for more information from those particular respondents. The data was later recorded, stored and entered into Microsoft Excel which tallied and converted frequencies and generated percentages. The information was presented in charts graphs and tables. The data was analyzed using Microsoft Excel and interpreted.

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3. PRESENTATION OF FINDINGS.

3.1. Demographic data of respondents.

In Table 1, most of the respondents 39(39%) were between 26 and 30 years while the minority 3(3%) were 40 years and above. By tribe, 42(42%) were Baruli, and a small number were others 7(7%). By religion, 42(42%) were protestants and muslims 4(4%), 69(69%) were housewives and 10(10%) were students. Furthermore 50(50%) were married while 2(2%) were widowed.

3.2. Knowledge of caretakers of children about food fortification as a means to combat malnutrition.

There were several significant differences in the knowledge reported by care takers (Table 2). More than 50% of the participants were not aware of the term 'food fortification' while 43% were aware of the term.

As stated in table 3, Majority of the caretakers (81%) responded that they knew about malnutrition and 19% of the caretakers didn't know about malnutrition.70% of the caretakers knew that fortified food helps in reducing malnutrition while 30% were not aware.

In regards to knowledge about the food fortification logo, 75% of the participants responded

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Table 1: **Shows demographic characteristics of the respondents (n = 100)**

Respondents' demographic characteristics	Variables	Frequency	Percentages (%)
Age	15-20	6	6
	21-25	17	17
	26-30	39	39
	31-35	31	31
	36-39	4	4
	40+	3	3
Tribe	Muganda	20	20
	Munyankole	31	31
	Muruli	42	42
	Others	7	7
Religion	Catholics	31	31
	Anglican	42	42
	Moslem	4	4
	Adventist	10	10
	others	13	13
Occupation	Student	10	10
	House wife	69	69
	Civil servant	11	11
	Business woman	10	10
Marital status	Married	50	50
	Never married	35	35
	Separated	13	13
	Widowed	2	2

Table 2: **Do you know about food fortiftcation? (n = 100)**

Response	Frequency	Percentage (%)
Yes	43	43
No	57	57
Total	100	100

that they didn't know about the food fortification logo while Only 25% of the participants knew about the food fortification identification logo used on food labels in Uganda as shown in table 4.

Table 5 shows that the majority of the participants (86%) were not aware of the fact that the Ugandan government made food fortification compulsory on staple foods.

Figure 1 shows that majority of the respondents reported their source of information as health personnel 63(63.0%) followed by friends 26(26%), media 6(6%) and family/relation 5(5%) were the least used sources of information.

Table 6 shows that all caretakers 100(100%) reported that they would pay more for fortified food. Majority of the caretakers didn't think that food fortification should be made compulsory in Uganda 76(76%) while 24(24%) thought it should be made compulsory in Uganda. All caretakers

Table 3: **Do you know about malnutrition? (n = 100)**

Response	Fre-quency	Percentage (%)
Yes	81	81
No	19	19
Total	100	100
Do you know that fortified foods help in reducing malnutrition? (n = 100)		
Yes	70	70
No	30	30
Total	100	100

Table 4: **Do you know about the food fortiftcation logo used on food labels in Uganda? (n = 100)**

Response	Frequency	Percentage (%)
Yes	25	25
No	75	75
Total	100	100

Table 5: **Do you know that food fortiftcation is being implemented in Uganda? (n = 100)**

Response	Frequency	Percentage (%)
Yes	14	14
No	86	86
Total	100	100

Table 6: Attitudes of the caretakers of the children towards food fortification (N = 100)

	Frequency	Percentage (%)
Think to pay more for fortified food		
Yes	100	100
No	0	0
Think food fortification should be compulsory in Uganda		
Yes	24	24
No	76	76
Feed your child with micronutrient powder		
Yes	100	100
No	0	0
Recommend fortified foods to a friend		
Yes	100	100
No	0	0

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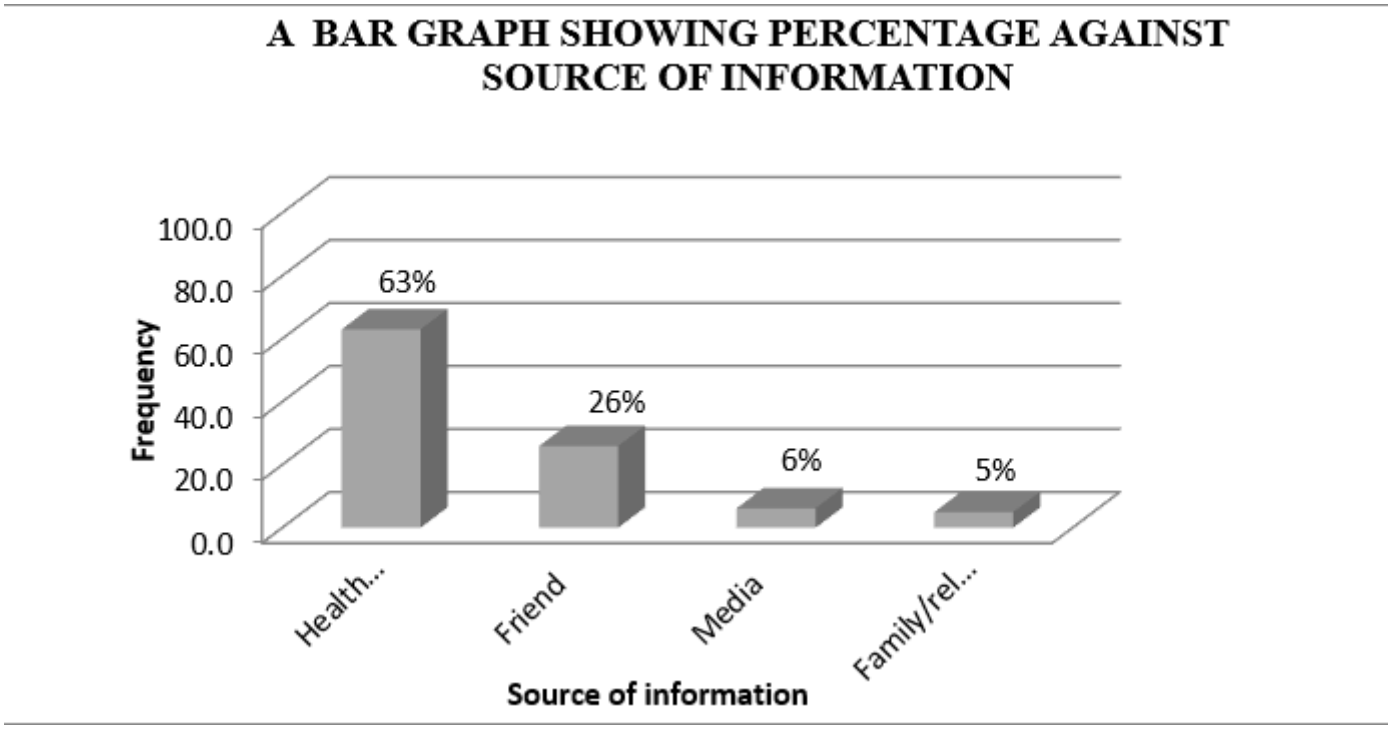

Figure 1: **Shows the source of information about food fortiftcation (n= 100)**

reported that they would feed their children with micronutrient powder and also recommend fortified foods to a friend 100(100%).Shows whether the caretakersperceived food fortification as important or not.

Figure 2 shows that most of the caretakers thought food fortification was important 90(90%) while 10(10%) didn't think it was important.

3.3. Practices influencing food fortification as a means to combat malnutrition among children.

Table 7 shows that more than 70 % of the participants said they didn't read food labels before buying fortified food. Over 60% of the caretakers reported that they cooked fortified foods in the same way as unfortified foods while 33% cooked the fortified food differently. Most participants didn't use micronutrient powder to supplement their food 66(66%) whereas 34% reported use of micronutrient powder to fortify their children's food.

Figure 3 shows that majority of the caretakers 98% reported that they feed their children on nonfortified foods most while only 2% of the caretakers feed their children mostly on fortified foods.

4. Discussions.

4.1. Knowledge of the caretakers of children about food fortification as a means to combat malnutrition.

The results from this study showed that 57% of the respondents answered that they didn't know food fortification, indicating that a significant portion of caretakers attending immunization in Nakasongola Health Center IV may not be aware of the concept of food fortification. This finding is in contradiction with the results from the study by (Motadi *et al*, 2016), which found that 39.5% of women of child-bearing age in Nkowankowa township in South Africa had no knowledge of food fortification.

However, 81% of the respondents answered "yes" to whether they knew about malnutrition, indicating that the majority of caretakers attending immunization in Nakasongola Health Center IV are aware of the concept of malnutrition because of attending heath education sessions con-

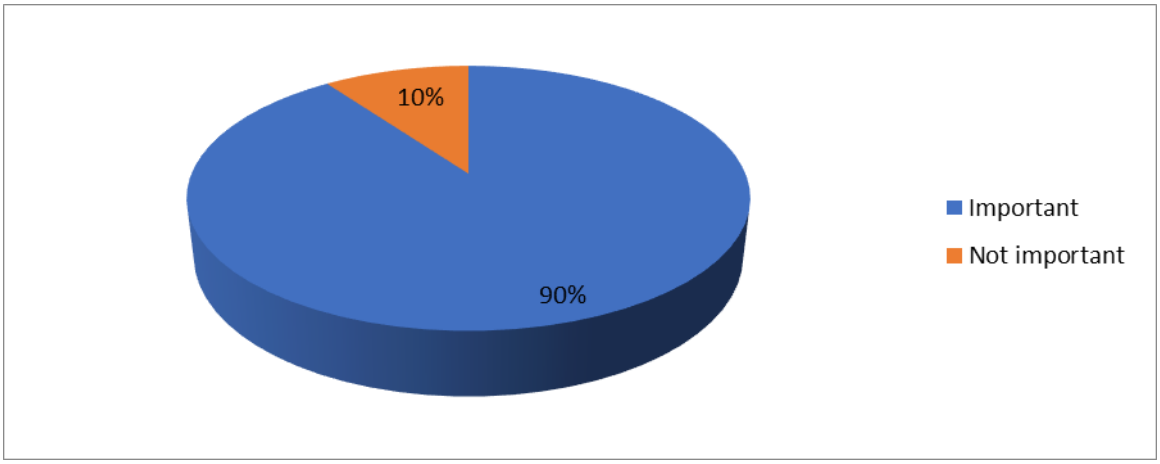

Figure 2: **Shows whether the caretakers perceived food fortiftcation as important or not.**

Table 7: Practice evaluation of caretakers. (n = 100)

	Frequency	Percentage (%)
Do you Read food labels before buying food?		
Yes	22	22
No	78	78
Do you Feed your child on biofortified crop food?		
Yes	61	61
No	39	39
Do you cook fortified food in the same way as unfortified food?		
Yes	67	67
No	33	33
Do you use any micronutrient powder to fortify your child's food?		
Yes	34	34
No	66	66

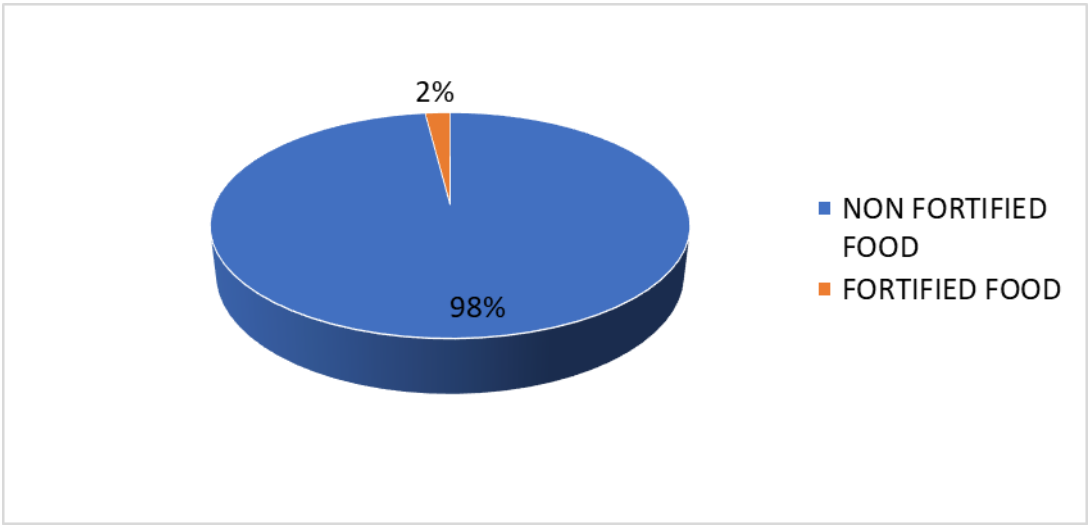

Figure 3: **Shows the distribution of respondents by the type of food they feed their children the most.**

ducted at MCH clinic. This finding is consistent with the results from the study by (Modi *et al*, 2010), which found that 82% of secondary school students in tribal areas in Gujarat, India, knew about malnutrition.

Similarly, the results from our study showed that 70% of the respondents answered that they knew that food fortification helps to reduce malnutrition, indicating that the majority of caretakers attending immunization in Nakasongola Health Center IV are aware of the potential benefits of fortified food possibly obtained from nutrition education by the health persons at the health center. This finding is similar to the results from the study by (Kasankala *et al*, 2018), which found that 68.2% of mother/child caretakers in Kinondoni Municipality, Tanzania knew that food fortification is used to prevent malnutrition.

This study showed that as many as 75% of the respondents didn't know about the food fortification logo, indicating that a large portion of caretakers attending immunization in Nakasongola Health Center IV may not be familiar with the food fortification logo used in Uganda which could be because of the complacency of the health workers to talk about the food fortification logos. There is no similar study to relate too however his finding highlights the need for better awareness-raising campaigns and education efforts about food fortification in Uganda.

The results from this study showed that 86% of the respondents reported that they didn't know that food fortification is being implemented in Uganda, indicating that many caretakers attending immunization in Nakasongola Health Center IV may not be aware of the ongoing food fortification efforts in Uganda possibly due to food fortification as a topic being neglected by health persons during nutrition and health talks. This finding is similar to the results from the study by Gain (2016), which found that there was low awareness among Tanzanian consumers about the food fortification program and the importance of choosing fortified products.

Furthermore, a majority (63%) of respondents reported that their source of information about food fortification was health workers which is consistent with the findings of a study conducted in rural Uganda which found that health workers were the most common source of nutrition information for caregivers, and that they played an important role in promoting the adoption of fortified foods (Allen *et al*, 2019). Similarly, a study conducted in Ghana found that health workers were highly respected and trusted sources of nutrition information, and that they could effectively promote the adoption of fortified foods through counseling and education (Abdu Afarwuah *et al*, 2017).

4.2. Attitude of the caretakers of children towards food fortification as a means to combat malnutrition.

The results show that 100% of the respondents in this study reported that they would pay more for fortified food because of the benefits of fortified food in preventing malnutrition, which is consistent with the findings of the study by (Premkumar and Garg, 2020) conducted among women in urban Delhi, India 92%. However, this result is in contrast to the findings in a study by (Tadesse *et al*, 2021) who reported mixed results from previous studies regarding consumers' willingness to pay for fortified foods.

However, 76% of the respondents reported that they don't think food fortification should be compulsory in Uganda. This may have been due to a feeling of violating their freedom of choice , less nutrition education and awareness about the benefits of food fortification among the population in Nakasongola. This result is lower than the findings by (Bromage *et al*, 2019) who reported that 82% of respondents in Harbin disagreed that industrial food fortification should be mandatory by government of China.

All respondents (100%) reported that they would feed their child with micronutrient powder and would recommend fortified foods to a friend because of the benefits of micronutrients taught to them by the health persons at the health center. These findings are similar to the results reported by (Premkumar and Garg, 2020) and (Mehmood *et al*, 2019), respectively, who found that 95% of

the consumers had positive attitudes towards the use of fortified foods.

Henceforth, majority (90%) of the respondents perceived food fortification as important because of the benefits associated with fortified foods such as preventing malnutrition, which is consistent with the findings by (Wanyama *et al*, 2019) who reported that 94% of the consumers in Uganda perceived nutritionally enhanced foods as important. This suggests that consumers in Uganda are aware of the benefits of food fortification and acknowledge its importance in addressing micronutrient deficiencies.

4.3. Practices influencing food fortification as a means to combat malnutrition among children.

The results of the study show that 88% of the respondents do not read food labels before buying food possibly because they did not know how to read and neither how the fortification logo looks like, which is in contradiction with a study by (Premkumar and Garg, 2020) which reported that only 34% of the caretakers didn't read food labels before buying food. However, these results are consistent with the findings from (Luthringer *et al*, 2015) that regulatory monitoring of fortified foods is a challenge in many countries. This suggests a lack of awareness about the importance of reading food labels and the benefits of consuming fortified foods.

In addition, 61% of the respondents reported feeding their child on biofortified crop food because of the sensitization they got from health workers in regards to benefits of fortified foods to children, which is in line with the study by (Bhagwat *et al*, 2014) that showed that 63% of respondents favored large-scale food fortification programs since they can be effective in eliminating micronutrient deficiencies. This indicates that the use of biofortified crops is gaining popularity among the population and may be a viable strategy for combating malnutrition in children attending immunization at Nakasongola Health Center IV.

Regarding cooking practices, 67% of the respondents reported cooking fortified food in the same way as unfortified food, which suggests that they may not be aware of the specific cooking requirements for fortified foods to retain their nutritional value. This finding is consistent with the review by (Lockyer *et al*, 2018), which highlights that 69% of the respondents in Uganda steamed fortified Orange sweet potato in the same way as native sweet potato which indicates the need for education and training programs to increase awareness and adoption of appropriate cooking practices for fortified foods.

Majority, 66% of the respondents reported not using micronutrient powder to fortify their child's food, which is lower than the findings from (De Moura *et al*, 2016) that 93% of the respondents in the Bangladesh didn't feed their children on vitamin A biofortified β-carotene rice. This suggests that there may be a lack of accessibility and availability of micronutrient powders in the study area, or a lack of awareness of their benefits.

Finally, 98% of the respondents reported feeding their children non-fortified foods most of the time which suggests that there may be a need for more education and awareness-raising campaigns to increase the adoption of fortified foods among the population. These results are in contrast to the potential benefits of consuming fortified foods outlined in (Saltzman *et al*, 2013) but are in agreement with De Moura and others who in 2016 conducted a study that revealed that 93% of the children in Bangladesh, India were fed on non-fortified rice resulting into low vitamin A intake.

5. Conclusions.

Based on the findings of the study, it can be concluded that while there is some level of knowledge about food fortification among caretakers of children attending immunization at Nakasongola Health Center IV, there is still a significant knowledge gap in areas such as the food fortification logo used on food packages in Uganda and the implementation of food fortification in Uganda.

The attitude towards food fortification was generally positive, with all respondents indicating they would be willing to pay more for fortified

food, and most recognizing its importance. However, there is still a low level of support for compulsory food fortification in Uganda.

In terms of practices, there is a low level of reading food labels and using micronutrient powder to fortify children's food. Most respondents reported feeding their children non-fortified foods, with a relatively low percentage using biofortified crops.

Overall, the study suggests that while there is some level of awareness and positive attitude towards food fortification among caretakers of children attending immunization at Nakasongola Health Center IV, there is still a need for further education and promotion of food fortification practices. This can be achieved through increased awareness campaigns and education by health workers and other stakeholders.

6. Study limitations.

The researcher also encountered difficulty in getting the required information from the respondents as some mothers feared to open up to give the needed information.

7. Recommendations.

- Education and awareness campaigns should be conducted to increase knowledge about food fortification, its benefits, and the use of fortified foods among the population. This can be achieved through various channels such as health workers, mass media, and social networks.
- The government of Uganda should make food fortification mandatory to ensure that all foods, especially staple foods, are fortified with essential micronutrients to address the high prevalence of malnutrition in the population.
- Further research should be conducted to investigate the factors influencing the low consumption of fortified foods in Uganda and develop strategies to increase their consumption.
- Food manufacturers and processors should include clear labeling and information about the nutrient content of fortified foods to encourage consumers to choose them.
- Health workers should be trained to provide information and support to caregivers on the use of micronutrient powders, including how to use them properly in food preparation to improve the nutritional status of children.
- Biofortification of staple crops should be promoted to increase the nutrient content of these foods and make them more accessible to the population.

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9. Abbreviations and acronyms.

WHO – World Health Organization
FAO – Food and Agriculture Organization
GDP – Gross Domestic Product
WFP – World Food Programme
WTP – Willingness To Pay
QA - Quality assurance
QC - Quality control
MT – Metric table
UNBS - Uganda National Bureau of Standards
FACT - Fortification Assessment and compliance Tool

UDHS - Uganda Demographic Health Survey
UNPS - Uganda National Panel Survey
MoH – Ministry Of Health
FFI – Food Fortification Initiative
MAAIF – Ministry of Agriculture, Animal Industry and Fisheries
GoU – Government Of Uganda
FCS - Food consumption Score
HIV – Human Immunodeficiency Virus
AIDS – Acquired Immunodeficiency Syndrome
GAIN – Global Alliance Of Improved Nutrition
OFSP – Orange Fleshed Sweet Potato
UNICEF – United Nations International Children's Emergency Fund
EMTCT – Elimination of Mother To Child Transmission
INR – International Normalized Ratio.

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