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PERCEPTIONS OF *UJEQE* AND AMARANTHUS, A POTENTIAL SUPPLEMENT FOR IMPROVED FOOD AND NUTRITION SECURITY OF SOUTH AFRICA

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ABSTRACT

Food security remains the bedrock of the sustainable well-being of all nations. However, the dietary lifestyles of many underprivileged persons are compromised by limited access to nutritious food, which contributes negatively to malnutrition in developing countries. Bread, a wheat-based staple food, is consumed globally. It has been made in diverse forms, including Ujeqe, a traditional bread that is appreciated among the Zulus in South Africa. Its complementary foods are beans and those of animal origin, including *Usu* (offal), which not all people access; therefore, its singular consumption can predispose the consumer to deficiency challenges, thereby positioning it as a strategic medium for the delivery of essential nutrients for optimum well-being. Hence, interest in bread supplementation remains vital for improving nutrient intake and well-being. A food-based strategy that encourages diversified diets for essential nutrient intake has been highlighted as a cost-effective and sustainable approach to tackle malnutrition at the household level. Thus, this study assesses the perceptions of *Ujeqe* and *Amaranthus* as a potential supplement for improved food and nutrition security of the rural households in Empangeni KwaZulu-Natal, South Africa. A mixed-design research approach was adopted for the study, and purposive convenience random sampling techniques were used to sample the population. A total of 100 structured questionnaires were generated, and clustered data of 91 respondents were pre-processed and analyzed using descriptive content analysis. The study's findings revealed that 92.59% of the respondents attested that *Ujeqe* is a traditional steamed bread indigenous to the study area. It is preferred because the ingredients are readily available, with an easy preparation mode. Moreover, *Ujeqe* is well appreciated and consumed as a main meal and a snack by all ages, excluding babies. Furthermore, 100% of the respondents in this study were familiar with *Amaranthus* leaves but were not familiar with their utilization as an ingredient in *Ujeqe* bread. *Amaranthus* is an underutilized crop. In this study, the respondents indicated their willingness to consume *Amaranthus* enriched-*Ujeqe* bread for improved food and nutrition security in rural communities. Therefore, awareness and processing of nutrient-dense plants, including (Amaranthus) cannot be overemphasized. Similarly, *Amaranthus* can be explored in *Ujeqe* bread for improved nutrient intake to address nutrition insecurity, especially in malnourished communities, including Empangeni KwaZulu-Natal Republic of South Africa.

Key words: Food and Nutrition Security, Indigenous, Ujeqe, Malnutrition, *Amaranthus* leaves, supplementation, attitude

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INTRODUCTION

Malnutrition is a condition that includes nutrient-related problems such as overnutrition, double or triple burden of malnutrition, and micronutrient deficiencies [1]. Regardless of the form of malnutrition across the world, the long-term negative impact on humans is devastating as it reduces life span since it is linked with high morbidity and mortality rates, which is limiting the livelihoods, national productivity, and economic development of many nations [2]. Food security, especially nutrition security is, therefore, crucial for sustainable well-being, a non-negotiable element for any productive country. This is because food security can only exist when everyone always has the physical and purchasing power to acquire safe, sufficient, and nutritious food for their dietary needs and preferences that support active and healthy life [3, 4]. It can happen when food security is conventionally considered in its entirety; this means it should encapsulate the four traditional pillars of food security, which include food availability, food accessibility, food utilization, stability, or sustainability, all aimed at meeting dietary needs that can optimize active, healthy life [3]. On the other hand, nutrition security refers to all people having equal access and control over the physical, social, and economic means that ensure sufficient, safe, and quality (nutritious) food that meets dietary needs for an active and healthy life.

South Africa is projected as a nationally food-secure country. However, there is a contradiction at the household level as some people cannot access the desired meal, let alone access nutritious meals. Over the years, it is appropriate that interventions like fortification of staple foods that targets larger population has been explored [5]. But, despite these strategies, malnutrition still lingers as one of the top health challenges across the globe, especially in rural communities of many developing countries; it accounts for 820 million people suffering from malnutrition-related illnesses [6,7]. Recently, the National Department for Health reported that 43% of children below the age of five are considered malnourished and overtly with (stunting 27%, wasting 3%, overweight 13%), and 68% of women in South Africa are deemed overweight [8, 9]. The highest prevalence of malnutrition is reported in Asia and sub-Saharan Africa (SSA) [10]. Although South Africa is nationally a food-secured country, the report indicated some inconsistency at the household level [11, 12].

Food insecurity is prevalent, especially among the rural population of many resource-developing countries, including South African rural communities [13]. Besides other underlying factors to this challenge, the prevailing issues of poverty, hunger, and problems with accessing safe, nutritious food resulting from financial incapacitations are major causes of food insecurity and extension of nutrition security [12, 14]. Hence, many households cannot afford safe and nutritious foods

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that include foods of animal origin; also, legumes, nutrient-dense fresh fruits, and vegetables are not easily accessible to the marginalized [13]. Instead, the vulnerable essential nutrients are replaced with foods and drinks containing high sugar, fat, and salt because they are cheaper and more readily available [15, 16]. Additionally, the COVID-19 pandemic has compounded food insecurity issues by furthering the increased vulnerability to food insecurity and nutrition insecurity, which is prevalent more among poorly resourced countries and less privileged persons [6, 17].

Furthermore, the ongoing global recession has disrupted global food supply chains, making it more challenging to cater to large food imports from some countries, especially sub-Saharan Africa (SSA) [6]. Therefore, finding the right balance between food and nutrition security, especially at the household level, is a global challenge and is of increased interest to researchers. Measures to address food insecurity and malnutrition via value-adding practices and utilizing nutrient-dense materials like *Amaranthus* leaves are vital for delivering essential nutrients to nutrient-deficit staple foods, including Ujeqe.

Ujeqe is a cereal-based staple food made from Wheat [18]. Wheat (*Triticum aestivum L.*), from the grass family, is a cereal grain widely cultivated for its seed, which is the second most important top three world food crops, following rice and maize [19]. Wheat has been identified as the most important food security crop globally, producing 750 million tons on 220 million hectares of land [20]. Interestingly, Africa produces over 25 million tons of wheat on 10 million hectares. In comparison, sub-Saharan Africa (SSA) yields 7.5 million tons on a total area of 2.9 million hectares, accounting for 41.4% of the wheat production in Africa and at global levels [21]. In sub-Saharan Africa, South Africa is one of the wheat-producing countries with the highest output in the Western Cape province [20-22]. Across the globe and in South Africa, wheat has been identified to have a wide range of applications in the modern and traditional food industry [23]. It is an essential ingredient in the preparation of many cereal-based foods, including pies, noodles, biscuits, cookies, *Danwake* (a Northern Nigerian food) *Vetkoek (*a traditional South African fried dough bread), *Amagwinya* and all kinds of cakes, and bread of all types including *Ujeqe* [24]. Wheat flour, sugar, and salt are the main raw materials for different types of bread, including *Ujeqe* [25,26]. Bread, especially those from wheat sources like Ujeqe, is among the foods that represent identity and traditions, which also often carries religious or other symbolic meanings [26]. Wheat is considered a good source of energy, protein, minerals, B-group vitamins, and dietary fiber [27]. However, a single consumption of wheat-based food products, including Ujeqe, has been considered inadequate in providing essential nutrients to its consumers[24, 28, 29]. This is because a

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compromised dietary lifestyle of foods like Ujeqe, void of fruits and vegetables, is identified as one of the causes of malnutrition. Thus, curbing malnutrition can be achieved by utilizing available nutrient-dense food materials to optimize the availability of essential nutrients.

Since *Ujeqe* is an indigenous staple food, it is appreciated in Empangeni KwaZulu-Natal, South Africa; it can, thus be considered a strategic potential food product for essential nutrient supplementation that will improve the consumers' intake of essential nutrients that will optimize their well-being. Supplementation of staple foods can be explored by utilizing cheaper yet nutrient-dense food sources such as legumes and vegetables to optimize the staple foods of the malnourished populations who cannot access *Ujeqe's* complementary food from animal sources. The reason is that a compromised diet is a significant cause of malnutrition, a global health challenge that has existed for a long time and is still lingering today [5]. A food-based approach where nutrient-dense plant materials are applied to staple foods as ingredients during food preparation is considered a cost-effective and sustainable measure to tackle malnutrition, especially at the household level. Although thousands of plants are reported as food plants that are nutrient-dense for human nutrition, only a few of these have been explored for food in human nutrition; others, including *Amaranthus spinous* species, are underutilized; literature affirms that their underutilization is linked to their negative association with preferences, attitudes, and consumer perceptions [24]. However, *Amaranthus* is considered a functional foods plant endowed with essential vitamins (A, C, and B); minerals (iron, calcium, potassium), bioactive compounds, and phytochemicals properties that can be investigated to enhance the essential nutrient-in cereal-based staple food products including *Ujeqe* [30]. Indigenous cereal foods, including bread like Ujeqe, are appreciated more than conventional bread in many localities, including Empangeni KwaZulu-Natal, South Africa. Since cereal-based food products are considered inadequate in essential nutrients, essential nutrient fortification/supplementation of such foods, including *Ujeqe* steamed bread with *Amaranthus* leaves, could improve the necessary nutrient intake of people to prevent or curb malnutrition challenges. Therefore, this survey study assessed the perceptions and utilization of *Ujeqe* and *Amaranthus* leaves as a potential food ingredient for improved food and nutrition security in rural communities in South Africa.

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MATERIALS AND METHODS

A mixed-method research design was adopted for the survey study. Mixed-method or integrated design enables the collection and processing of data using both (quantitative and qualitative) research methods in a single study [31,32]. A purposive convenience random sampling technique was employed to sample 100 respondents using structured survey questionnaires, where 91 filled questionnaires were returned and analyzed. The researcher also interviewed six key informants to gain insight into *Ujeqe* preparation and the perceptions of *Amaranthus* as a potential supplement in Ujeqe.

Description of the study area

Empangeni is located 160 km from Durban along the R34 off the N2, KwaZulu-Natal, South Africa. Empangeni is positioned in the hilly countryside of the uThungulu district with hot, sticky, and languid days. The geolocation of Empangeni is -28° 44' 50.3868", 31° 54' 42.7078" [33]. Empangeni's major crops are cotton, timber, and sugarcane plantations. Agriculturally, it is also known for cattle rearing.

It was initially the location of a Norwegian Mission station founded near the stream called Empangeni, which was later moved to Eshowe [33]. The name 'Empangeni' comes from a Zulu word called 'pangaed', which means 'grabbed,' and it refers to the number of crocodile attacks on water bearers in the nearby Empangeni stream [33].

Data Analysis

The data for the study were processed using Origin software (9.0), and the results were presented in percentages and frequencies on pie charts and bar graphs. The key informants' information was analyzed using descriptive narrative content analysis.

Ethical clearance

The ethical clearance for this study was obtained from the Research Ethics Committee at the University of KwaZulu-Natal, South Africa. Reference number HSSREC/00000435/2019. Consent form was employed in both cases of the survey studies to obtain the Respondent and key informant's consent to partake in the study.

RESULTS AND DISCUSSION

Participants' demographic information

Figure 1(a-e) presents this study's participants' demographic information. Figure 1a indicates that 75.3% of the respondents were females and 24.7% were males; this is a common feature of the South African population, especially among the

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smallholder farmers in rural communities [34]. Figure 1b describes the age group, which ranged between 18 and 70, with 30.7% percent of the respondents below the age of 26. Figure 1c reveals the educational level of the respondents, with 47%, 30%, 7%, and 4% of the respondents constituting people with informal education, mainly self-employed businessmen and women, primary education, secondary education, and tertiary education, respectively. Figure 1d further elucidates the employment status of participants in the study area. The employment distribution shows that 49% are unemployed, 42.% are self-employed, 7.4% are employed in the private sector and 1.7% in government). These results reveal the typical characteristics of many sub-Saharan African countries, including South Africa. The unemployment status of sub-Saharan African countries is reported to be high, especially in rural communities, accounting for the high prevalence of malnutrition in rural communities [35, 36]. The study demographic Figure 1e also reveals that 100% of the respondents were predominantly black Africans. This agrees with previous demographic studies in Empangeni [37], which reported that the Empangeni population is mostly black Zulu-speaking Africans.

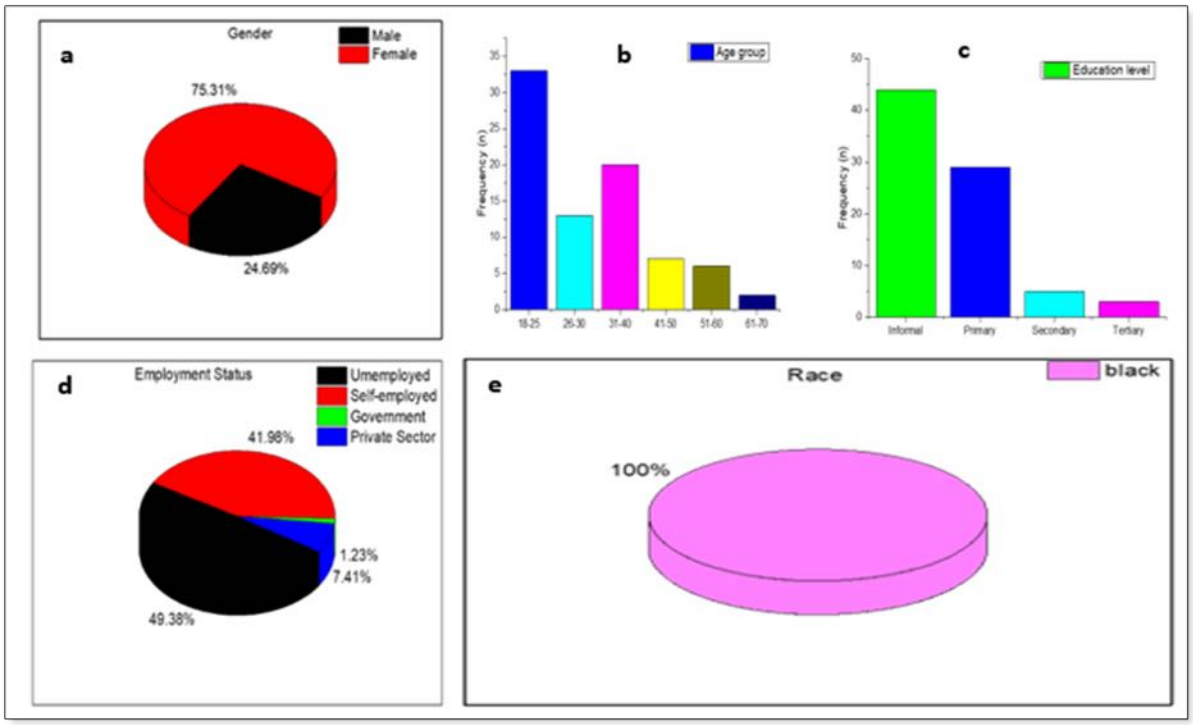

Figure 1: (a-e) Respondent demographics showing: 1a Gender, 1b Age group, 1c Education level, 1d Employment status, and 1e Race

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Preparation and utilization of *Ujeqe* bread in Empangeni

Findings from this study revealed that traditionally, *Ujeqe* bread is made by estimating the different ingredients ("flour, yeast, a little salt, little sugar, little butter or oil, warm water, and milk"). The ingredients are combined appropriately to obtain a soft, elastic dough. The dough is placed under the sun or kept in a warm place to undergo fermentation for an estimated time of 40 minutes. Temperature is a significant factor in the preparation of *Ujeqe* bread. Depending on the weather conditions, the fermentation duration of the *Ujeqe* dough can be extended from 40 minutes to an hour or more, especially on a cold day. A visible rise in the dough's size confirms the desired fermentation period. The risen dough is collapsed by punching it down and kneading it for the second time; then, the dough is placed into a plastic bag or large container that will be used for the steaming process. The dough is allowed to rise for another period of 40 minutes before being placed in a big pot of boiling water with the lid closed, and the dough is steamed for an hour. The steamed *Ujeqe* bread is confirmed to be cooked when a skewer or knife is inserted and comes out neatly immediately. The *Ujeqe* bread described in (Figure. 2) can be served alone as a snack or meal. *Ujeqe* is usually served with some complimentary foods of animal origin or beans for those who can afford it. However, according to informants, it is sometimes consumed alone as a single meal. However, the long-term impact of monotonous meals from starch-based food without nutrient-dense complementary foods can predispose consumers to nutrient deficiency challenges.

Figure 2: Picture of regular Ujeqe

Consumption of *Ujeqe* bread in Empangeni

Figure 3a of this study shows that 100% and 92.59% in Figure 3b of the study, the Respondent is familiar with *Ujeqe* and agreed that *Ujeqe* bread is an indigenous food to the Empangeni community and South Africa. Additionally, the informant indicated that *Ujeqe* bread is consumed by all age groups, excluding babies. The

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reasons why informants consume *Ujeqe* include the following: They consume *Ujeqe* because it is an indigenous food; hence, it is one of the most appreciated foods available on the family's menus. It is also stated that it is a filling food that provides the consumers with desirable energy; hence, it is food that can be served any time of the day, and above all, the mode of preparing *Ujeqe* is easy. This study is consistent with the study reported by Touyarou [38]. Moreover, the informant also asserted that it is appreciated and consumed just for fun. It is a snack that can be consumed at any time of the day, but babies do not consume this food. In addition, *Ujeqe* is a food that is served during special occasions and ceremonies like weddings and religious and traditional rites. For instance, some participants confirmed that *Ujeqe* is a food usually served to observe Sabbath day, buttressing that *Ujeqe* is used for religious ceremonies. An interviewee added that traditionally, it is believed that *Ujeqe* bread should be food that is naturally cooked without modern food additives like spices. Hence, indigenous food is preferred, especially when served with *Usu* (*offal meat*). From this study, it is obvious that the nutritional content of *Ujeqe* bread is not considered one of the reasons for its consumption. Also, this study revealed that *Ujeqe* bread is sometimes the only food option on some household menus for the day. These perceptions and attitudes toward dietary lifestyles may predispose individuals to nutrient deficiency challenges. This implies that nutritional knowledge of cereal-based food, including *Ujeqe* bread, may be lacking among the rural populace. Traditionally, it is identified that *Ujeqe* bread is consumed with protein-rich foods like *Usu* (*offal meat*), chicken, and beans. However, not everyone has access to protein foods like *Ujeqe's* complementary foods; hence, many households sometimes consume *Ujeqe* bread without these complementary foods.

Long-term consumption of foods limited in essential nutrients, including *Ujeqe* bread, could predispose the regular consumer to nutrient deficiency challenges. Also, informants' notion that *Ujeqe* bread is a "healthy food" shows some consistency in lack of nutrition knowledge regarding *Ujeqe* bread. Although *Ujeqe* can provide lots of calories and energy for consumers, studies have shown that cereal-based foods are limited in essential nutrients. Hence, it is considered inadequate to meet the daily dietary needs for optimal well-being, especially when consumed as a sole source of nutrients. Therefore, supplementing *Ujeqe* with nutrient-dense vegetables like *Amaranthus* cannot be overemphasized.

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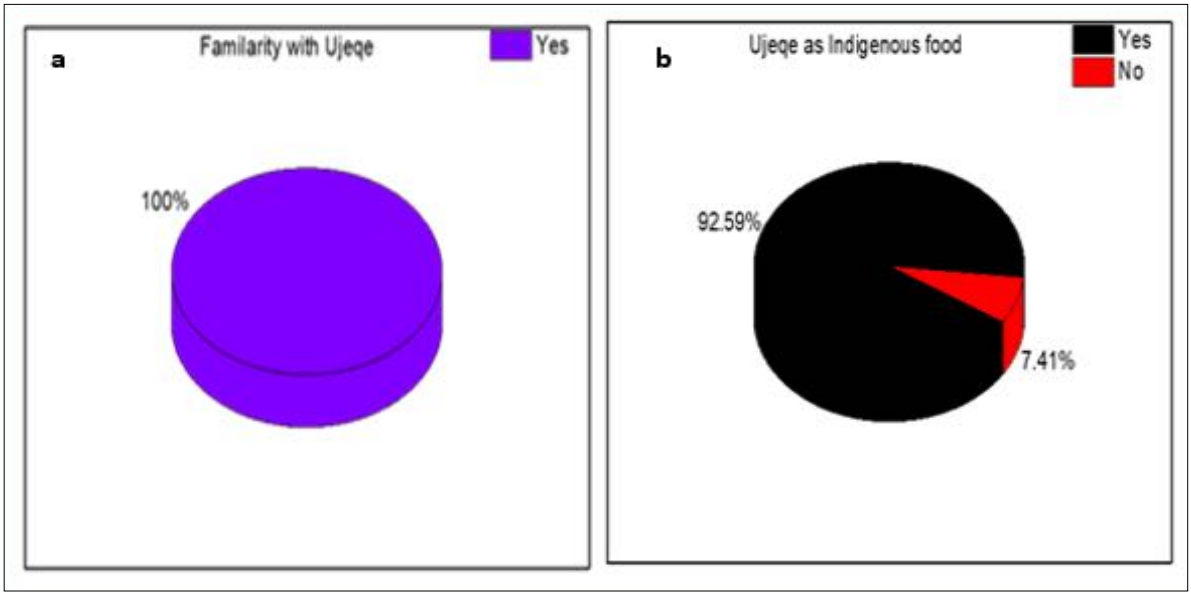

Figure 3 (a and b): Respondents' familiarity and the utilization of *Ujeqe* as indigenous food

Part of *Amaranthus* leaves consumed, and who consumes the Amaranthus?
Figure 4a reveals that 98.77% consume the fresh form of *Amaranthus* leaves, and 1.23% consume the root for medicinal purposes. Figure 4b represents the frequencies of both adults and children regarding *Amaranthus* consumption in households. This shows that both children and adults consume *Amaranthus* in the study area, even though, empirically, children between the ages of one and five years have shown a low consumption of leaf vegetables [39]. This is mostly because many of them within such groups are considered picky eaters.

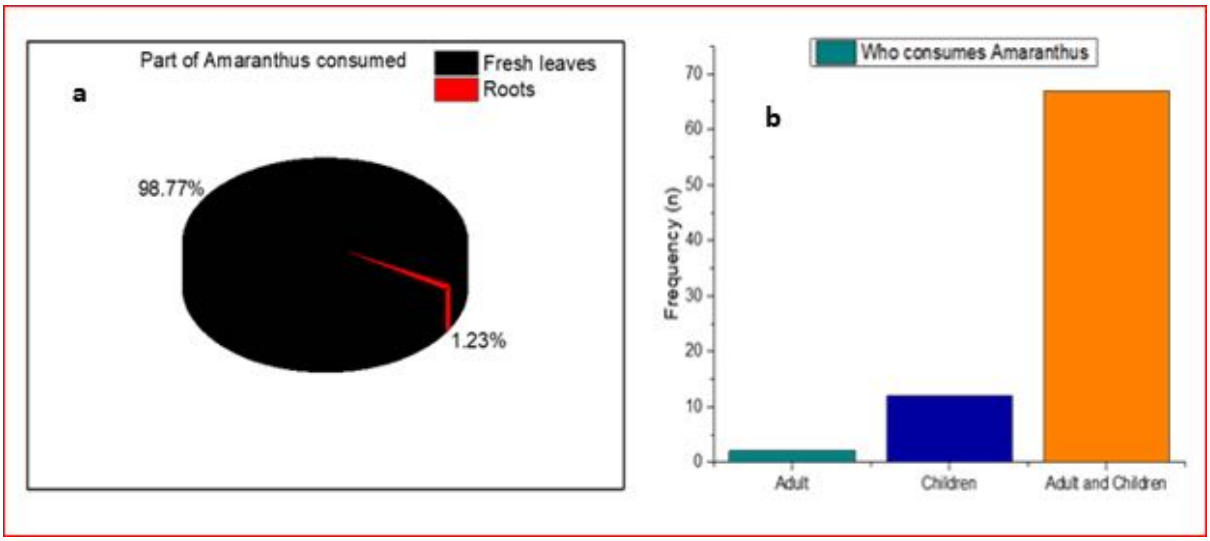

Figure 4 (a and b): (a) part of *Amaranthus* consumed (b) who consumes *Amaranthus* in the household

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Figure 5b reveals that 96. 3% consume the green leafy Amaranthus, whereas 3.7% consume the red Amaranthus, commonly known as purple Amarant. The green leafy Amaranthus, which includes *Amaranthus spinous* and *cruentus* species, is the most grown and sold in the study area. Even though several species of *Amaranthus* have been reported [40], the respondents can identify the species only by their color and mode of propagation. Thus, irrespective of the species grown in the study area, they are considered red or green Amaranthus. However, *Amaranthus spinous* species are the most neglected because it is perceived as food for the less privileged or as feed for animals. Again, children are known to dislike vegetables; however, in this study, a significant percentage (77.8%) of the respondents agreed that children liked Amaranthus, which attests that even though it is an underutilized food plant, the respondents are from households that appreciated *Amaranthus* as an ingredient in food preparation.

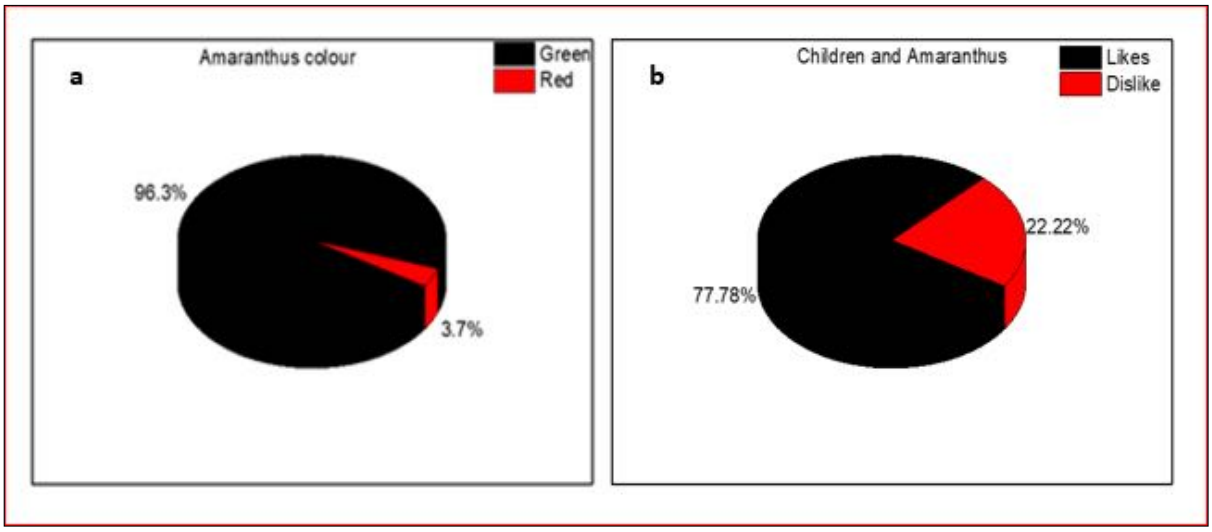

Figure 5 (a and b): Colors of *Amaranthus* consumed (a), Children's disposition towards *Amaranthus* (b)

In Figure 6a, about 47% of the respondents do not consume *Amaranthus* seeds, only 11. 1% do. Literature reports that *Amaranthus* is a pseudo-cereal crop, a multipurpose crop used as an ingredient in various foods in other parts of the world. However, this study shows a considerable knowledge gap regarding *Amaranthus* seed consumption and its nutritional benefits. Hence, Figure 6b reveals that most respondents throw away *Amaranthus* seeds, while others save the *Amaranthus* seed for the next planting season. This study is consistent with other studies reporting that most African countries do not consume *Amaranthus* seeds; the seeds are often discarded or saved for the next season [41, 42].

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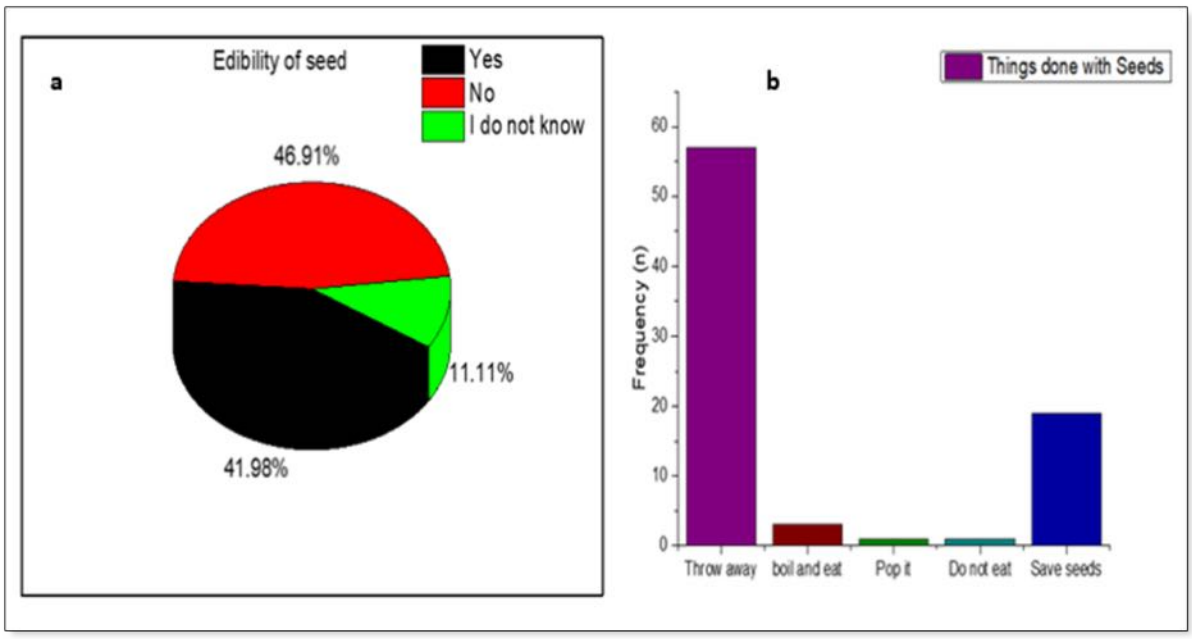

Figure 6a Is *Amaranthus* edible? 6b Uses of *Amaranth* seeds

The parts of Amaranthus, rate of consumption, and willingness to consume *Amaranthus* Ujeqe

In Figure 7a, 100% of the respondents consume only the *Amaranthus* leaves. 7b shows the pattern and frequency of *Amaranthus* consumption. In this study, the lowest rate of *Amaranthus* consumption is in daily consumption. Although *Amaranthus* is nutrient-dense and an indigenous vegetable to the Empangeni community, it is underutilized in the study area in some of the staple foods, including *Ujeqe* [43, 44]. This study is like the studies that report on low consumption of traditional leafy vegetables [24, 44]. The low consumption of green leafy vegetables is unacceptable because the World Health Organization (WHO) recommends the consumption of green leafy vegetables like *Amaranthus* as a potential solution to remedy micronutrient deficiency and health challenges among malnourished populations [45]. Similarly, Figure 7c shows that 71.6% of the respondents are willing to consume ALP-supplemented *Ujeqe* food products. However, 28.4% of the respondents were indifferent about consuming ALP-supplemented *Amaranthus Ujeqe* bread. The respondents were very familiar with Ujeqe, and they eat it mainly because it is their indigenous food. The participants view *Ujeqe* as food that provides energy for daily activities. The monotonous consumption of cereal foods as a single meal has been considered a compromised dietary lifestyle [45], which means that regular consumption of *Ujeqe* as a single meal without a nutrient-dense food source, including fruits and vegetables, like Amaranthus, may expose the individual to nutrient deficiencies and its consequential health hazards [24]. During the interview, some participants were unsure about eating Amaranthus-supplemented *Ujeqe* bread. At the same time,

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other interviewees expressed willingness to consume Amaranthus-supplemented *Ujeqe* for health purposes. This study shows that some are willing to try something different or new, especially for healthier reasons, while others are not.

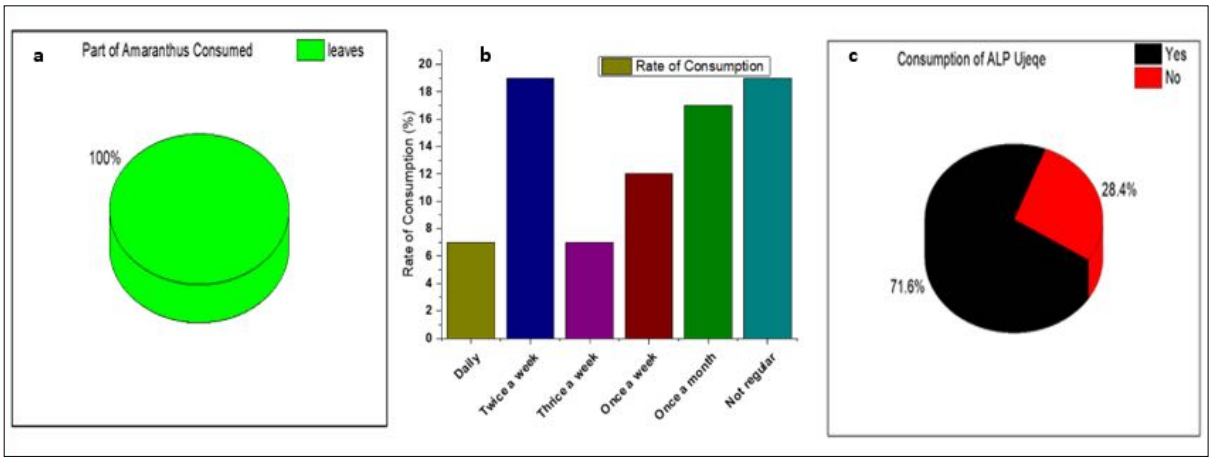

Figure 7a Parts of *Amaranthus* consumed, 7b rate of *Amaranthus* consumption, and 7c willingness to consume *Amaranthus* Ujeqe

CONCLUSION, AND RECOMMENDATIONS FOR DEVELOPMENT

This study reports the perceptions and the utilization of *Ujeqe* and *Amaranthus* as potential food supplements for improved food security in Empangeni KwaZulu-Natal, South Africa. *Ujeqe* is identified as a traditional wheat-based steamed bread. However, it is a food well-appreciated in the Empangeni community in KwaZulu-Natal, South Africa, which is scarce in other studies. *Ujeqe* is a staple food consumed by all age groups except infants. This study enumerates the ingredients and the traditional method of preparing *Ujeqe* in the study area, alongside reasons why *Ujeqe* is appreciated in the study area. These reasons include its ease of preparation and ability to be consumed at any time. It is a food served in traditional ceremonies, including weddings and during religious and ancestral worship. Complementary food for *Ujeqe* identified during the study was mainly protein-rich, including beans, chakalaka, meat, and *Usu offal meat*. However, not everyone is privileged to access these complementary foods. Thus, the marginalized consume *Ujeqe* alone. *Amaranthus* is considered a nutrient-dense indigenous plant; it is cheap and accessible to community members. However, it has not been used as a food ingredient in *Ujeqe* bread. However, the community members are willing to consume Amaranthus-supplemented *Ujeqe* for health purposes. Therefore, there is a need for more awareness of the potential of *Amaranthus* leaves and their inclusion in staple foods, including *Ujeqe* steamed bread. *Amaranthus* leaf-supplemented powder *Ujeqe* can be developed, and its consumer acceptability is assessed for improved food and nutrition security in rural communities. Also, the cultivation, processing, and commercialization of

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Amaranthus should be promoted in rural communities for enhanced food and nutrition security.

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