Food behaviour towards natural functional foods during the COVID-19 pandemic

Innocent Kutyauripo,[1] Jeff Chivheya,[2] Rufaro Siyawamwaya,[3] Jasper Maguma[4]
[1]Ministry of Higher and Tertiary Education, Innovation Science and Technology Development, New Government Complex, Corner S. Machel and S.V Muzenda, Harare, Zimbabwe
[2]Division of Veterinary Services, Department of Veterinary Public Health, New CSC Complex, Corner Birkenhead and J Chinamano, Bulawayo, Zimbabwe
[3]Zimlabs Pvt Ltd, 123 Borgward Road, Msasa, Harare, Zimbabwe
[4]Harare Polytechnic, Applied Science Division, Corner Rotten Row and Hebert Chitepo, Harare, Zimbabwe

Corresponding author: Innocent Kutyauripo; ikutyauripo@gmail.com

Funding
This study was not funded by any organisation.

Competing interests
The authors declare no conflicts of interest

Abstract

Background

COVID-19 is a pandemic that has resulted in sickness and death the world over. Due to the lack of a COVID-19 cure, people have resorted to various forms of treatments or prevention measures. It has been reported that functional foods have some preventative or therapeutic effects on viral diseases including against COVID-19, though this has not been scientifically proven. This paper sought to gather empirical evidence on whether natural functional food consumption has changed during the first year of the COVID-19 pandemic in Zimbabwe.

Methods

A cross sectional study was conducted in Harare. A structured questionnaire was designed using Google forms. Convenience sampling was used to identify participants and 400 respondents completed the questionnaire online. Descriptive statistics were used to analyse the consumption of 5 selected functional foods namely garlic (*Allium sativum*), ginger (*Zingiber officinale*), lemon (*Citrus limon*), fever tree (*Lippia javanica*) and moringa (*Moringa oleifera*) before and during the COVID-19 era. Factors influencing the consumption of natural functional foods were analysed using binary logistic regression.

Results

The majority of the respondents (80.5%) consumed natural functional foods to prevent or relieve COVID-19 symptoms. Lemon was the most consumed functional food and 80% of the respondents consumed more than one functional food. The majority of the respondents (72%) consumed the functional foods in tea or as tea. More than half of the respondents (50.3%) rarely consumed functional foods before COVID-19 period but after the outbreak of COVID-19, only 16.3% were rarely consuming functional foods. Women, the aged, and the educated had a significant ($p \leq 0.05$) association with consumption of natural functional foods for the purpose of COVID 19 prevention or remedy.

Conclusion

Consumers have increased the consumption of each of the functional foods we asked about during the first year of COVID-19 in Harare, Zimbabwe.

Keywords: COVID-19; natural functional foods; food choice motive

Introduction

COVID-19 is a novel coronavirus that was identified in December 2019 and has affected the whole world. Various countries have imposed restrictions to control the spread of the disease. Some of these restrictions have affected the food choices of households (Snuggs and McGregor, 2020). A change in food choices has been witnessed during the period of COVID-19 as physiological needs influence human food choices (Snuggs and McGregor, 2020; Hassen et al. 2020). It has been reported that since the onset of COVID-19, individuals have changed their eating patterns and have become more inclined to healthier foods (Hassen et al., 2020). Determinants of food choices also changed due to the effect of COVID-19 (Głąbska et al., 2020). Information from scientists influences the food choices made by consumers during the COVID-19 period and the perception that certain food protects against COVID-19, acts as a source of motivation towards the consumption of that specific food (Laguna et al., 2020). A change in the dissemination of food information was witnessed since the emergence of COVID-19. Advertising of certain foods either through television or social media has influenced consumer food choice as well (Rodrigues et al., 2021).

Functional foods are often assumed to be capable of fighting viral diseases due to immune-boosting characteristics. Functional foods have been defined as foods (including herbs and

spices) that provide nutrients to the body and also play a role of improving human health and reducing threats associated with diseases (Ozen, 2012). Functional foods refer to foods that possess biologically active compounds and that can be used in the management, treatment and prevention of infectious and chronic diseases if consumed in non-toxic amounts (Martirosyan, 2020; Yang et al., 2020). Functional foods exist as either natural foods or modified foods (Ozen, 2012).

The choice of food is influenced by different motives and health is one of the common factors that influence the choice of food (Shen et al., 2020). The health status of the consumers influences the choice of food (Gebremichael and Asfaw, 2019). Many people tend to choose functional foods in managing diseases due to their low price and high accessibility (Suleria et al., 2015). In African countries, social media advice on the high likelihood of lemon, garlic and ginger being useful against COVID-19 has been spreading since the beginning of the COVID-19 pandemic (Ayipey, 2020). The consumption of ginger, garlic and citrus fruits has been reported to ease symptoms of common colds, though there is no empirical evidence on its effectiveness against COVID-19 (Khadka et al., 2020). There is evidence suggesting that lemon, garlic, and ginger may provide therapeutic effects against acute respiratory distress syndrome, pneumonia and pulmonary fibrosis (Thota et al., 2020).

Garlic (*Allium sativum*) is a vegetable that is mostly used in flavouring and seasoning (Suleria et al., 2015). It is often used to ease pains, sore throats, fever and colds. It may have the potential of mitigating the adverse effects of acute lung injury and respiratory tract infections (Thota et al., 2020). Garlic has been reported to be effective in the treatment of chronic cough and it possesses antimicrobial and antioxidant effects (Bayan et al., 2014). Extracts of garlic have been reported to stimulate the immune system and also to have an immunomodulation effect (Oosthuizen et al., 2018). These apparent effects have been attributed to the presence of sulphur-containing bioactive compounds in garlic (Yang et al., 2020).

Ginger (*Zingiber Officinale*) contains phytochemicals that may provide antioxidant, hepatoprotective, anti-inflammatory and antiviral properties (Thota et al., 2020). Its therapeutic effects have also been ascribed to its shogaols, gingerol, gingerdione, gingerdiol, vitamin C, flavonoids, iron, paradols, calcium and magnesium (Shahrajabian et al., 2019).

Lemon (*Citrus Limon*) contains ascorbic acid which may be immunomodulatory and protect against respiratory diseases (Thota et al., 2020). Citrus flavonoids in lemons have been reported to possess antiviral properties (Mohanapriya et al., 2013)

Fever tree *Lippia javanica* (Family: Verbenaceae), or Zumbani/Umsuzwane in Zimbabwe, is a woody erect shrub that has long been exploited for its wide range of ethnomedicinal properties. Its phytochemical constituents include a wide range of both volatile and non-volatile metabolites like flavonoids, amino acids, alkaloids, triterpenes and iridoids (Maroyi, 2017). The leaves, stems, roots and twigs, prepared and used as herbal teas, medicinal decoctions, and food additives, are said to have mitigatory effects on wide-ranging conditions including bronchitis, asthma, fever and diarrhoea (Shikanga et al., 2010).

Moringa oleifera leaf is consumed as tea, used in cooking soups, or as a vegetable. It was used as a remedy to fever by 78.7% of the respondents in one Nigerian study (Stevens et al. 2013). The majority of these consumers used it for the treatment of sore throat and common colds.

Since the inception of COVID-19, various studies have been conducted on food behaviour due to COVID-19 (Snuggs and McGregor, 2020; Hassen et al., 2020; Głąbska et al., 2020; Rodrigues et al., 2021; Fanelli, 2021; Sidor, 2020) and their findings indicated a change has occurred. These studies concentrated on behaviour towards broad categories of food. However, little research of this kind has been done in Zimbabwe. This study, therefore, assessed consumption of selected natural functional foods (lemon, garlic, ginger, fever tree, and moringa oleifera). The objectives of this study were to assess the consumption pattern of these foods during the COVID-19 period and to determine factors that influenced their consumption.

Methods

This cross-sectional study was conducted in Harare, located in the northeast of Zimbabwe. It is Zimbabwe's largest city with a population estimate of 2.1 million residents (Zimstat, 2012). Harare was chosen as the study area because it had the highest burden of COVID-19 cases in Zimbabwe. As of the 31st of March, 2021, Harare the cumulative of cases was 12 974 out of a national total of 36 882 (35.18%) (Ministry of Health and Child Care, 2021).

The Google forms platform was used in the designing of a structured questionnaire. It included sections on respondents' demographics (age, gender, marital status, level of education and employment status), choice of any of five functional foods, (lemon, garlic, ginger, lippia javanica and moringa oleifera), major reason for consumption, consumption pattern (frequency of consumption, manner of consumption and knowledge of perceived effect on health) and determinants of consumption. Face validity of the questionnaire was tested by evaluating whether all the research objectives were being addressed by the questionnaire. The questionnaire was pretested through a pilot survey using 20 respondents. Convenience sampling was used to collect data online from 400 residents of Harare. Data were collected from individuals who were at least 18 years of age and who consumed at least one of the functional foods before the COVID-19 pandemic. Informed consent was sought from all the participants. On average, three minutes were required to complete the form. The data were collected from 20 March 2021 to 10 April 2021. Descriptive statistics were used to analyse the demographic information and choice of functional foods. SPSS version 20 was used in binary logistic regression analysis of factors influencing the consumption of functional foods (see Table 1).

Results

Demographic Information

Table 2 shows that the majority of the participants were male. The majority of the respondents were in the age range of 18-40 years. A minority of the respondents were widowed or divorced. The majority of the respondents were holders of higher education qualifications and were formally employed.

Table 1. Description of variables for binary logistic regression analysis

Variable	Description
Gender	1 if male, 0 otherwise
Age	1 if young, 0 otherwise
Marital status	1 if married, 0 otherwise
Education	1 if educated, 0 otherwise
Employment status	1 if employed, 0 otherwise

Table 2. Demographic information on respondents

Variable	Frequency (n)	Frequency (%)
Sex		
Female	153	38.3
Male	247	61.8
Age		
18-30	124	31.0
31-40	198	49.5
41-50	50	12.5
51-60	24	6.0
Above 60	4	1.0
Marital status		
Single	162	40.5
Married	218	54.5
Divorced	16	4.0
Widowed	4	1.0
Education level		
No formal education	1	0.25
Secondary education	10	2.5
Tertiary education (Certificate and Diploma levels)	99	24.8
Higher education	290	72.5
Employment status		
Unemployed	23	5.75
College student	25	6.25
Formally employed	332	83.0
Informal trader	18	4.5
Pensioner	2	0.5

Functional food consumption

Four hundred respondents participated in the survey. All the 400 participants who consumed at least one of the selected natural functional foods before the COVID-19 pandemic continued to do so, but 80.5% cited COVID-19 prevention or remedy as their major reason for consuming these foods. The majority (88.3%) did not practice measurement of the functional food when preparing it for consumption. The majority of the respondents (89.3%) perceived no negative effects from the consumption of functional foods.

From Figure 1, lemon was consumed most among these five functional foods followed by ginger. Moringa oleifera was the least consumed of the selected functional foods. Some people consumed more than one type of functional food. The specific combinations of functional foods that were consumed are shown in Table 3, showing that 20% consumed only one type of functional food, 14.8% consumed two types, 31% consumed three types, 27.5% consumed four types, and 6.75% consumed all five functional foods. A combination of garlic, ginger and lemon was consumed with or without other functional foods by 52.8% of the respondents.

Choice of functional foods during the first year of COVID-19

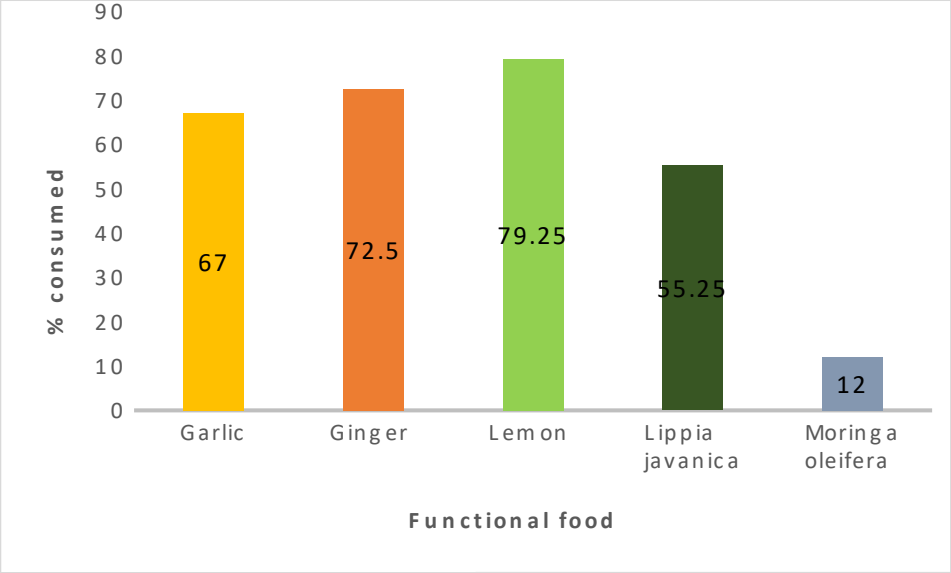

Figure 1. Choice of consumption of functional foods

From Figure 2, some individuals had more than one choice of the consumption method of functional foods. The majority of the respondents (72%) consumed functional foods in tea whilst a few (9.5%) consumed them as soup. Other forms included decoctions, mixture with other foods, and as raw foods.

In Table 4, weekly consumption of functional foods during the COVID-19 era (72.3%) was higher as compared to weekly consumption of functional foods before COVID-19 (31.8%). More than half of the respondents rarely consumed functional foods before COVID-19 period but after the outbreak, only 16.3% were rarely consuming functional foods.

Figure 3 shows the results of the consumption period of functional foods by consumers. Most of the respondents had consumed functional foods for only 1-3 months (January to March 2021) whilst the rest had been consuming for longer periods during the first year of COVID-19.

Determinants of consumption are presented in Table 5. Gender significant association ($p = 0.003$) with the choice of functional foods as a remedy or preventative measure towards COVID-19, with males less likely (odds ratio of 0.404) to use functional foods for preventive or remedy. Age had a negative and significant association ($p = 0.031$) with the choice of functional foods as a remedy or preventative measure towards COVID-19. Young people had lower odds (odds ratio of 0.405) of using functional foods for preventive or remedy purposes. Employment had a positive and significant effect ($p = 0.023$) on the choice of functional foods as a remedy or preventative measure towards COVID-19. Employed people were 2.4 times more likely to use functional foods for COVID-19 prevention or remedy.

Discussion

Several factors might have influenced the high percentage of natural functional food consumption by respondents in this study as a COVID-19 remedy or a preventative measure. Firstly, the consumption of functional foods for prevention of COVID-19 might have been influenced by information disseminated via social media, which has been reported to play a

Table 3. Choices of functional foods during the first year of COVID-19

Functional food choice	Frequency	Percent
Garlic	15	3.75
Ginger	9	2.25
Lemon	29	7.25
Lippia Javanica	25	6.25
Moringa Oleifera	2	0.5
Garlic, ginger	7	1.75
Garlic, lemon	4	1.0
Garlic, ginger, lemon	83	20.8
Garlic, ginger, lemon, lippia javanica	101	25.3
Garlic, ginger, lemon, lippia javanica, Moringa Oleifera	27	6.75
Garlic, lippia javanica	2	0.5
Garlic, lemon, lippia javanica	7	1.75
Garlic, ginger, lippia javanica	10	2.5
Ginger, lemon, lippia javanica	17	4.25
Ginger, lemon	21	5.25
Ginger, lippia javanica	6	1.5
Garlic, ginger, lemon, moringa oleifera	5	1.25
Lemon, lippia javanica	16	4.0
Garlic, ginger, lippia javanica, moringa oleifera	3	0.75
Garlic, lemon, moringa oleifera	2	0.5
Garlic, lemon, lippia javanica, moringa oleifera	1	0.25
Lippia javanica, moringa oleifera	3	0.75
Lemon, lippia javanica, moringa oleifera	2	0.5
Ginger, lemon, moringa oleifera	2	0.5
Garlic, lippia javanica, moringa oleifera	1	0.25
Total	400	100

very significant role in influencing the consumption of functional foods (Hassan et al., 2020; Mullie et al., 2009). Secondly, customer preference for functional foods is mainly influenced by health claims that are made about the specific functional foods (Zafar and Ping, 2020). Although no conclusive evidence exists to back up the claims of these particular functional foods in preventing COVID (Lange, 2020), this shift in dietary choice was perceived by respondents as positive health behaviour. Lastly, the acceptance of functional foods was reported to increase if a member of the family is ill (Verbeke, 2006). During the first year of COVID-19, some individuals might have assumed that any illness in close family members or friends might be COVID-19. A rise in consumption of functional foods might be attributed to a perception that any failure to practice protective measures resulted in an individual consumer increasing their risk of being infected by COVID-19 (Górnicka et al., 2020). (At the time of the study, both masks and vaccines were easily available in Harare.)

Garlic, ginger, lemon, lippia javanica and moringa oleifera medicinal properties have been scientifically proven for some ailments though there is no evidence for COVID-19. However, the fact that these foods have some proven medicinal properties that relieve symptoms related

Methods of consumption of functional foods

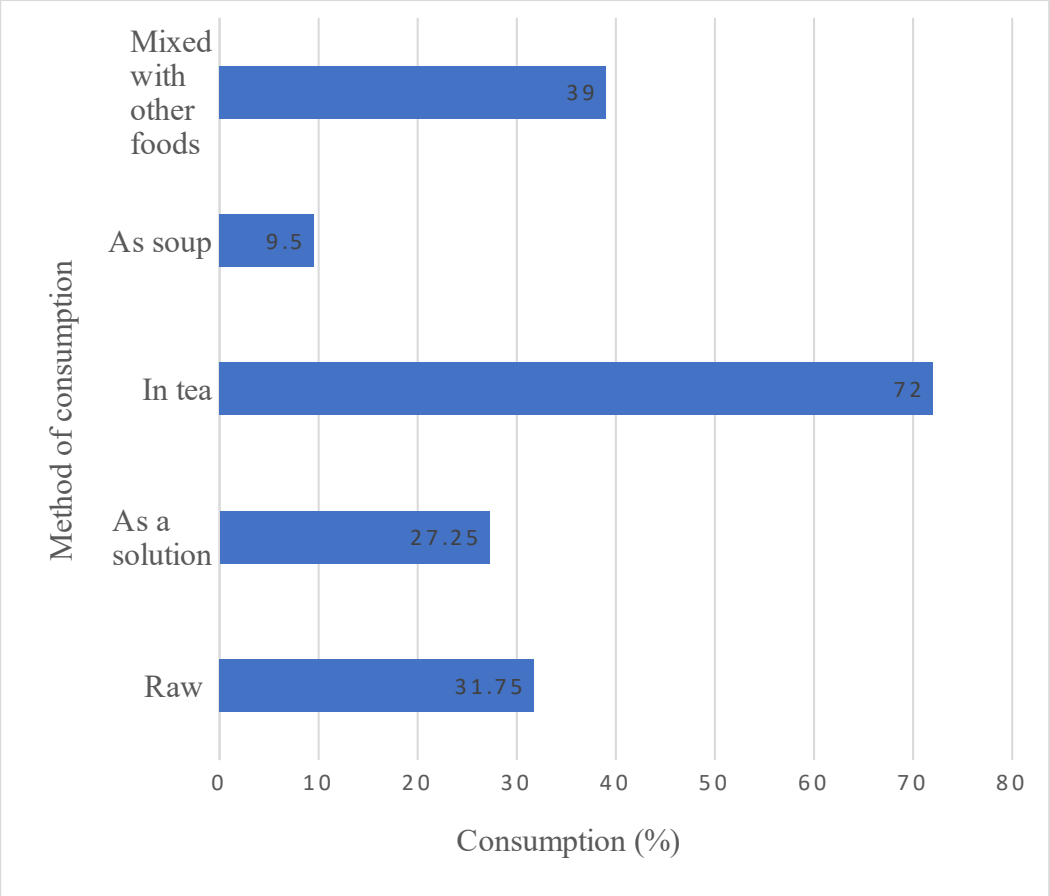

Figure 2. Choice of method of consumption of functional foods during the COVID-19 first year

Table 4. Consumption frequency of functional foods before and during COVID-19 period

Consumption frequency	**Consumption before COVID-19 (n)**	**Consumption before COVID-19 (%)**	**Consumption during COVID-19 (n)**	**Consumption during COVID-19 (%)**
Once a day	33	8.25	98	24.5
More than once a day	14	3.5	42	10.5
Once a week	39	9.75	67	16.8
More than once a week	41	10.3	82	20.5
Once in 2 weeks	20	5.0	16	4.0
More than once in 2 weeks	11	2.75	15	3.75
Once a month	41	10.3	15	3.75
Rarely	201	50.3	65	16.3
Total	400	100	400	100

Consumption patterns of functional foods in times of COVID-19

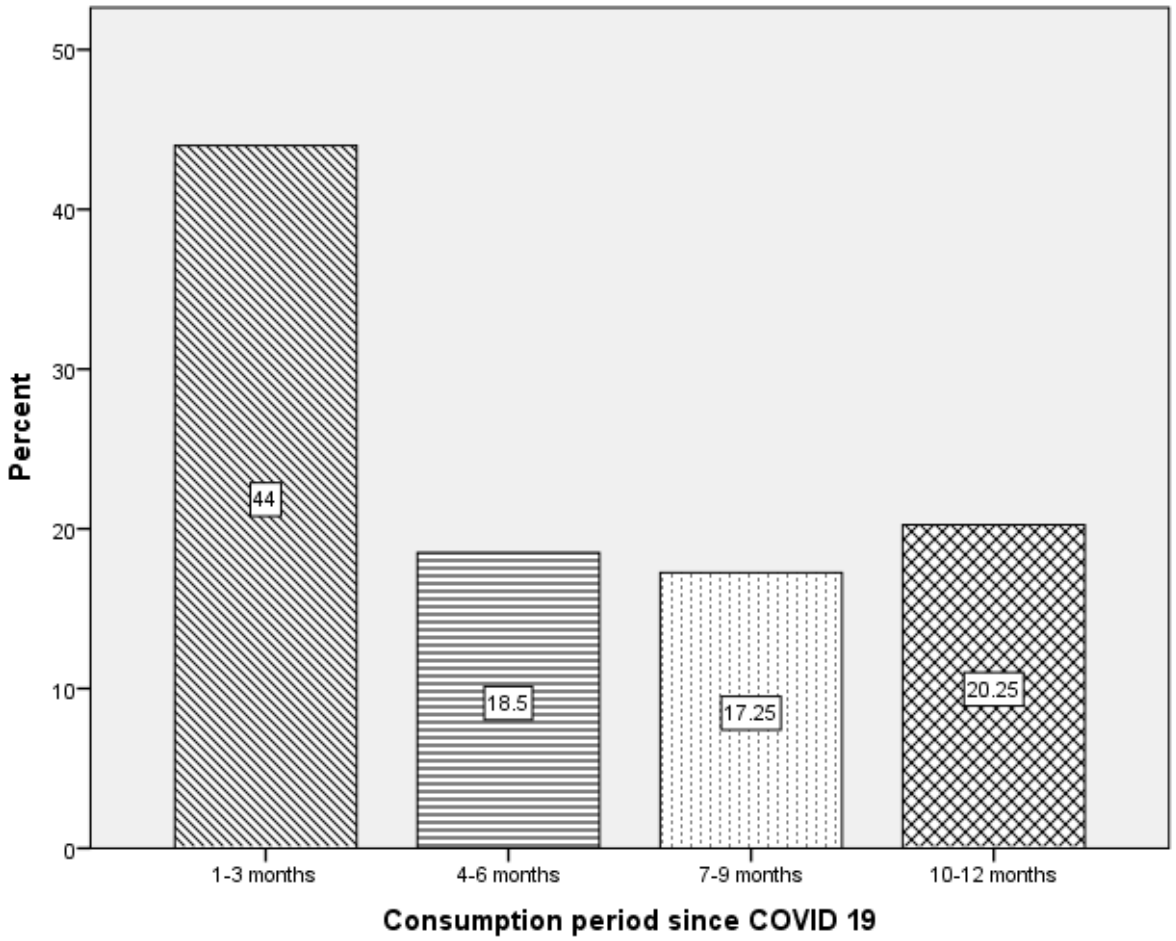

Figure 3. Consumption period of functional foods for COVID-19 prevention/remedy since COVID-19

Table 5. Binary logistic regression analysis of factors influencing consumption of functional foods for medicinal reasons during COVID-19 period

Variables	B	Sig.	Exp (B) (OR)
Gender (male)	-0.905	0.003	0.404
Age (young)	-0.904	0.031	0.405
Marital	0.020	0.941	1.021
Education	-0.818	0.448	0.441
Employment	0.873	0.023	2.4
Constant	2.8	0.013	16.42

-2 Log likelihood 367.08
Cox and Snell R Square 0.046
Nagelkerke R Square 0.073
$P \leq 0.05$

to those typical of COVID-19 might have played a significant role in the decisions of the consumers to use these functional foods during the time of COVID-19.

While on the one hand perceived health benefits motivate consumers to use functional foods (Ali and Rahut, 2019), there is also a perception that there can be no negative effects of natural functional foods. Research however points to the fact that excess consumption of some of these foods could be toxic (Lange, 2020); therefore, necessitating the need for further studies to provide a guide to the consuming public.

The most consumed functional foods in order were lemon, ginger, garlic, lippia javanica and moringa oleifera respectively. The choice of functional foods by people is a result of the influence of a mixture of factors that include but are not limited to; taste, preference, affordability, and nutritional perception (Ali and Rahut, 2019). The COVID-19 pandemic in Zimbabwe has been characterised by periods of intermittent lockdowns which severely disrupted the usual food supply chains. This could also have influenced the accessibility and consequently the choice of the functional foods by the respondents; for example, people have resorted to foods that are readily available in backyard gardens (Matsungo and Chopera, 2020). Ali and Rahut (2019) also found that those who perceive themselves to be of poorer health may tend to consume more or more than one type of functional foods.

The results of this study reflect that during the period of data collection when the country was experiencing a COVID-19 second wave (during the first year of COVID-19), with the country suffering more than 1000 deaths in January 2021 (Madziva et al., 2021) (just before we did our study), there were many consumers eating functional foods. This is in line with the Mayasari et al. (2020) study in which the search for information on functional foods (to include garlic and ginger) concerning COVID-19 remedies and prevention was significantly and positively influenced by the number of the COVID-19 reported cases.

Moussaoui et al. (2020) also found that men are less likely to adhere to these practices. This is in line with (Ares and Gámbaro, 2007) who found that women had a higher perception of the health benefits of functional foods than men. Women (who are the ones doing most of the cooking (Chambers et al., 2008)) have been reported to generally have a more positive attitude to healthier foods as compared to men (Westenhoefer, 2005).

The influence of age where older respondents in the study were more likely to consume functional foods is in line with (Ozen, 2012) studies that identified elderly consumers as a group that is affirmative towards functional foods. This can be explained by several factors. Firstly, young people between the age of 18 and 29 prefer functional foods that are more sugary as compared to consumers of old age (Ares and Gámbaro, 2007). The natural functional foods in this research are not sweet thus the aspect of taste might have discouraged the young people from consuming the functional foods in question. Secondly, the notion that younger, healthy people are less likely to be susceptible to COVID-19 infection (Li et al., 2021) could explain the reason why older respondents were more likely to use functional foods to prevent infection. Thirdly, younger consumers have difficulties in cooking as compared to older consumers who devote most of their time when cooking (Chambers et al., 2008). Lastly, old age food selection is based more on the effect of the food on health than young people (Chambers et al., 2008). This might be because older people might be suffering from other chronic illnesses (which are not common among the young generation) thus they are more careful.

The study finding where employed people were more likely to consume natural functional foods can be explained by the availability of funds and willingness to pay for the functional foods by the employed consumers. Income has a direct influence on the consumption of functional foods (Hassan et al., 2020). The higher the income availability, the higher the chances of consumers buying functional foods (Afina, 2018). Employed people may also have assumed they were more at risk of exposure to COVID at work.

Conclusions

It can be concluded that there was a significant change towards natural functional foods due to COVID-19. The majority of the consumers intensified their consumption of ginger, garlic, lemon, lippia javanica and moringa for their perceived medicinal properties during the first year of COVID-19 in Harare, Zimbabwe. The selection of natural functional foods to prevent or treat COVID-19 is significantly influenced by gender, age and employment status. It is recommended that studies be done to gather empirical evidence on the efficacy of natural functional foods against COVID-19.

References

Afina S and Retnaningsih R. 2018. The Influence of Students' Knowledge and Attitude toward Functional Foods Consumption Behavior. Journal of Consumer Sciences, 3(1):1-14. https://doi.org/10.29244/jcs.3.1.1-14

Ali A and Rahut DR. 2019. Healthy Foods as Proxy for Functional Foods: Consumers' Awareness, Perception, and Demand for Natural Functional Foods in Pakistan. International Journal of Food Science, 2019. https://doi.org/10.1155/2019/6390650

Ares G and Gámbaro A. 2007. Influence of gender, age and motives underlying food choice on perceived healthiness and willingness to try functional foods. Appetite, 49(1):148-158. doi: 10.1016/j.appet.2007.01.006.

Ayipey P. 2020. Impact of Covid-19 on ginger export, a root crop as a traditional remedy for Covid-19. Journal of Basic and Applied Research in Biomedicine, 6(1):25-31. DOI: 10.51152/jbarbiomed.v6i1.5

Bayan L, Koulivand PH, and Gorji A. 2014. Garlic: a review of potential therapeutic effects. Avicenna Journal of Phytomedicine, 4(1):1-14. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4103721/

Ben Hassen T, El Bilali H, and Allahyari MS. 2020. Impact of COVID-19 on Food Behavior and Consumption in Qatar. Sustainability, 12(17):6973. https://doi.org/10.3390/su12176973

Chambers S, Lobb A, Butler LT, et al. 2008. The influence of age and gender on food choice: a focus group exploration. International Journal of Consumer Studies, 32(4):356-365. doi: 10.1111/j.1470-6431.2007.00642.x.

Fanelli RM. 2021. Changes in the Food-Related Behaviour of Italian Consumers during the COVID-19 Pandemic. Foods, 10(1):169. DOI: 10.3390/foods10010169.

Gebremichael B and Asfaw A. 2019. Drivers of Food Choice among Pastoral/Agro-Pastoral Community in Somali Regional State, Eastern Ethiopia. Advances in Public Health, 2019. https://doi.org/10.1155/2019/1472487

Głąbska D, Skolmowska D, and Guzek D, 2020. Population-Based Study of the Changes in the Food Choice Determinants of Secondary School Students: Polish Adolescents' COVID-19 Experience (PLACE-19) Study. Nutrients, 12(9):2640. https://doi.org/10.3390/su12176973

Górnicka M, Drywień ME, Zielinska MA, et al. 2020. Dietary and lifestyle changes during COVID-19 and the subsequent lockdowns among Polish adults: A Cross-sectional online survey PLifeCOVID-19 study. Nutrients, 12(8):2324. DOI: 10.3390/nu12082324.

Hassan H, Sade AB, and Subramaniam LS. 2020. Purchasing functional foods to stay fit. Journal of Humanities and Applied Social Sciences, 2(1):3-18. https://doi.org/10.1111/j.1753-4887.2012.00492.x

Khadka S, Hashmi FK, and Usman M. 2020. Preventing COVID-19 in low-and middle-income countries. Drugs & Therapy Perspectives, 36(6):250-252. https://dx.doi.org/10.1007%2Fs40267-020-00728-8

Laguna L, Fiszman S, Puerta P, et al. 2020. The impact of COVID-19 lockdown on food priorities. Results from a preliminary study using social media and an online survey with Spanish consumers. Food Quality and Preference, 86:104028. https://dx.doi.org/10.1016%2Fj.foodqual.2020.104028

Lange KW. 2020. Food Science and Covid-19. Food Science and Human Wellness, 10(2021):1-5. https://doi.org/10.1016/j.fshw.2020.08.005

Li J, Huang DQ, Zou B, et al. 2021. Epidemiology of COVID-19: a systematic review and meta-analysis of clinical characteristics, risk factors, and outcomes. J Med Virol, 2021(93):1449–58. DOI: 10.1002/jmv.26424.

Madziva R, Thondhlana J, Garwe EC, et al. 2021. Internally displaced persons and COVID-19: a wake-up call for and African solutions to African problems—the case of Zimbabwe. Journal of the British Academy, 9(s1):285-302. https://doi.org/10.5871/jba/009s1.285

Maroyi A. 2017. Lippia javanica (Burm. f.) Spreng.: Traditional and commercial uses and phytochemical and pharmacological significance in the African and Indian subcontinent. Evidence-Based Complementary and Alternative Medicine, 2017. https://doi.org/10.1155/2017/6746071

Martirosyan D. 2020. The emerging potential of functional foods in viral disease prevention. Bioactive Compounds in Health and Disease, 3(6):95-99. DOI: 10.31989/bchd.v3i6.726

Matsungo TM and Chopera P. 2020. The effect of the COVID-19 induced lockdown on nutrition, health and lifestyle patterns among adults in Zimbabwe. medRxiv. https://doi.org/10.1101/2020.06.16.20130278

Mayasari NR, Ho DKN, Lundy DJ, et al. 2020. Impacts of the COVID-19 pandemic on food security and diet-related lifestyle behaviours: an analytical study of Google trends-based query volumes. Nutrients, 12(10):3103. https://doi.org/10.3390/nu12103103

Ministry of Health and Child Care. 2021. Ministry of Health and Child Care - Daily Updates - COVID-19 Daily Updates. http://www.mohcc.gov.zw/index.php?option=com_phocadownload&view=category&id=15&Itemid=742

Mohanapriya M, Ramaswamy L, and Rajendran R. 2013. Health and medicinal properties of lemon (Citrus Limonum). International Journal of Ayurvedic and Herbal Medicine, 3(1):1095-1100.

Moussaoui LS, Ofosu ND, and Desrichard O. 2020. Social Psychological Correlates of Protective Behaviours in the COVID-19 Outbreak: Evidence and Recommendations from a Nationally Representative Sample. Applied Psychology: Health and Well-Being, 12(4):1183-1204. https://doi.org/10.1111/aphw.12235

Mullie P, Guelinckx I, Clarys P, et al. 2009. Cultural, socioeconomic and nutritional determinants of functional food consumption patterns. European Journal of Clinical Nutrition, 63(11):1290-1296. https://doi.org/10.1038/ejcn.2009.89

Oosthuizen CB, Reid AM, and Lall N. 2018. Garlic (Allium sativum) and its associated molecules, as medicine. In: Medicinal Plants for Holistic Health and Well-being, pp. 277-295. Academic Press. https://doi.org/10.1016/B978-0-12-812475-8.00009-3

Ozen AE, Pons A, and Tur JA. 2012. Worldwide consumption of functional foods: a systematic review. Nutrition Reviews, 70(8):472-481.

Rodrigues MB, de Paula Matos J, and Horta PM. 2021. The COVID-19 pandemic and its implications for the food information environment in Brazil. Public Health Nutrition, 24(2):321-326. https://doi.org/10.1017/S1368980020004747

Shahrajabian MH, Sun W and Cheng Q. 2019. Clinical aspects and health benefits of ginger (Zingiber officinale) in both traditional Chinese medicine and modern industry. Acta Agriculturae Scandinavica, Section B—Soil & Plant Science, 69(6):546-556. https://doi.org/10.1080/09064710.2019.1606930

Shen W, Long LM, Shih CH, et al. 2020. A Humanities-Based Explanation for the Effects of Emotional Eating and Perceived Stress on Food Choice Motives during the COVID-19 Pandemic. Nutrients, 12(9):1-18. https://dx.doi.org/10.3390%2Fnu12092712

Shikanga EA, Combrinck S and Regnier T. 2010. South African Lippia herbal infusions: total phenolic content, antioxidant and antibacterial activities. South African Journal of Botany, 76(3):567-571. http://dx.doi.org/10.1016/j.sajb.2010.04.010

Sidor A and Rzymski P. 2020. Dietary choices and habits during COVID-19 lockdown: experience from Poland. Nutrients, 12(6):1657. DOI: 10.3390/nu12061657

Snuggs S and McGregor S. 2020. Food & meal decision making in lockdown: How and who has COVID-19 affected? Food Quality and Preference, 89:104145. https://dx.doi.org/10.1016%2Fj.foodqual.2020.104145

Stevens GC, Baiyeri KP, and Akinnnagbe O. 2013. Ethno-medicinal and culinary uses of Moringa oleifera Lam. in Nigeria. Journal of Medicinal Plants Research, 7(13):799-804. https://doi.org/10.5897/JMPR12.1221

Suleria HAR, Butt MS, Khalid N, et al. 2015. Garlic (Allium sativum): diet-based therapy of 21st century–a review. Asian Pacific Journal of Tropical Disease, 5(4):271-278. https://doi.org/10.1016/S2222-1808(14)60782-9

Thota SM, Balan V and Sivaramakrishnan V. 2020. Natural products as home-based prophylactic and symptom management agents in the setting of COVID-19. Phytotherapy Research, 34(12):3148-3167. DOI: 10.1002/ptr.6794.

Verbeke W. 2006. Functional foods: Consumer willingness to compromise on taste for health? Food Quality and Preference, 17(1-2):126-131. DOI: 10.1016/j.foodqual.2005.03.003.

Westenhoefer J. 2005. Age and gender-dependent profile of food choice. Diet Diversification and Health Promotion, 57:44-51. https://doi.org/10.1159/000083753

Yang F, Zhang Y, Tariq A, et al. 2020. Food as medicine: A possible preventive measure against coronavirus disease (COVID-19). Phytotherapy Research, 34(12):3124-3136. DOI: 10.1002/ptr.6770

Zafar MU and Ping Q. 2020. Consumers'attitude and Preferences of Functional Food: A Qualitative Case Study. Pakistan Journal of Agricultural Sciences, 57(1):9-16. DOI: 10.21162/PAKJAS/20.9219.

Zimstat. 2012. Census 2012: Preliminary Report. Zimbabwe National Statistics Agency. Harare, Zimbabwe