



A Pilot-study of the use of Nutrition-related Apps and Software in Africa during the COVID-19 Pandemic

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Abstract

The ongoing COVID-19 pandemic and the associated lockdown measures have risen the malnutrition problem in the world, especially in Africa. The use of nutrition apps/software at individual level therefore appears as suitable solution given the context. This study aimed at assessing the actual usage level of nutrition apps/software and the determining factors. A cross-sectional study consisting of an online-survey conducted from April to May 2020 with as target Africans aged of 18 and above was carried out. A total of 460 respondents from different African countries was registered. Globally they appeared to have started using computer and smartphones since at least 5 years and this mostly at a daily frequency together with internet. A total of 52.2 % of the respondents recognized not to apply or not to know if they apply the principles of a balanced diet in their day-to-day life, but just 18% reported to be using a nutrition apps/software; COVID-19 pandemic having pushed 7% to refer more to these tools and 0.7% to start using one. South Africa nationals, people living in a household of 3-5 people and those having a monthly income above 500 USD tended to use them more. Almost half of the users report that these tools do not take into consideration foods available in their context. On the other hand, almost half of the non-users (41.5% of respondents) said they would prefer to be advised by a dietician. However up to 50.9% clearly stated they are interested in learning more about these tools, which is of quite of big interest in preventing Non-communicable diseases resurgence in relation to COVID-19 pandemic.

Keywords: Africa; COVID-19; Eating Habits; Non-communicable Diseases; Nutri-apps.

1. Introduction

The COVID-19 pandemic which started since December 2019 from China has spread at an astonishing rate worldwide. Many countries affected by this disease have adopted lockdown strategies in order to control the disease. These restrictive measures that are partial or total from one country to another suggests populations remaining indoors and working from home. It is estimated that half of the world population, have been asked or ordered to stay at home for a certain period of time by their governments. Physical inactivity, smoking and alcohol consumption are often reported as population habits during that period [1-3]. Furthermore, malnutrition either in terms of quantity or quality cannot be excluded [4]. In fact, overeating and the consumption of unhealthy foods when staying at home for a long-period is common, leading to overweight and obesity [5, 6]. On the other hand, many persons might change their eating habits taking into consideration factors like foods availability or prices (food insecurity). Situations of undernutrition or unbalanced diet arising from the ongoing coronavirus pandemic are certain. Unfortunately, smoking, malnutrition,

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physical inactivity and alcohol misuse are recognised as behavioural risk factors causing non-communicable diseases (NCDs). These diseases, also known as chronic diseases, were reported to account for 71% of the 57 million deaths that occurred globally in 2016 [7, 8] in comparison to the 6% world mortality rate of the COVID-19 [9]. Cardiovascular diseases, cancers, chronic respiratory diseases and diabetes represent those with the highest prevalence, unhealthy diet being the main cause among the 4 previously cited [10]. As reported by the World Health Organization, 85% of deaths associated to these NCDs occur in low- and middle-income countries and in vulnerable communities where access to preventative healthcare is lacking. Besides, a greater COVID-19 mortality is known for persons already suffering from these NCDs [11, 12]. This therefore increase the public health concern as COVID-19 pandemic has been declared by WHO in August 2020 to be probably of long duration as no vaccine has been completely tested. Many nutrition apps and software have been developed during the last decades in order to promote healthy nutrition within populations [13, 14]. They have gained popularity in the past decade as effective self-help alternatives that are complimentary to a dietician's intervention. They act as effective catalyst for promoting healthy lifestyles, shaping behaviour and improve consumer knowledge on the nutritional value of foods [13]. In clinical settings, researchers and doctors have found such applications useful in monitoring patient's recovery performance, dietary intake, eating pattern and relative effectiveness of dietary prescription [15]. They have become increasingly prevalent [16] but their use is not yet systematic. Africa is one of the continents mostly concerned by the double burden of malnutrition (undernutrition and overweight/obesity) [17] and is also facing the COVID-19. As the continent is gradually turning more towards the 4th Industrial Revolution, the use of Nutri apps or software may therefore be of interest in order to avoid the above described lethal snowball effect between COVID-19 and NCDs. These tools are perhaps the most potent medium for delivering healthcare assistance with less cost burden and mobility in these present times. In this perspective, this study aims at assessing the actual usage level of Nutri apps or software in African countries and the determining factors.

2. Research Methodology

2.1. Study Design and Participants

The cross-sectional study was conducted between April and May 2020. The data was collected using an online survey form that only Africans aged of 18 and above were invited to complete. This approach appeared as the best considering the COVID-19 lockdown measures. The African Nutrition Leadership Programme (ANLP) Alumni Network assisted with the data collection and was helpful in ensuring data could be collected across different African countries.

2.2. Data Collection

Data was collected using a well-structured questionnaire which consisted of four main sections namely Sociodemographic; Health; Computer and Smartphone use experience; Nutrition Apps/Software and personal experience. The questionnaire was simultaneously prepared in French and English languages as these are the main official languages in African countries. The questionnaire was piloted on 25 people and suggestions inserted in the final questionnaire.

2.3. Ethical Statement

The research proposal was reviewed and approved by the Ethics Committee of Research of the University of Johannesburg. All participating respondents voluntarily and anonymously filled the online survey form.

2.4. Data Analysis

The collected data was exported and coded in an excel folder. The statistical software SPSS (Statistical Package for Social Sciences), version 25.0 was then used to perform descriptive statistics. This software was also use for the ANOVA analysis of the Computer, Smartphone and Internet (CSI) use experience score of respondents per studied socio-demographic. parameter. Indeed, for each of the 5 questions asked to assess this experience, a score from 1 (low experience) to 4 (high experience) was given, and the total score out of 20 calculated.

3. Results and Discussion

3.1. Sociodemographic Characteristics of the Surveyed Population

A total of 460 people participated to this study with 30.4% from Central Africa [Cameroon (133), Chad (2), Gabon (4), Republic Democratic of Congo (1)]; 26.7% from West Africa [Nigeria (117), Mali (2), Ivory coast (1), Senegal (1), Liberia (1), Niger (1)]; 25.7% from Southern Africa [South Africa (116), Malawi (1), Mozambique (1)]; 9.3% from North Africa [Algeria (4), Egypt (3), Morocco (35), Tunisia (1)]; and 7.8% from Eastern Africa [Uganda (17), Ethiopia (13), South Sudan (2), Kenya (1), Sudan (1), Rwanda (1), Tanzania (1)]. The population was largely comprised of females (61.1%) and grouped into 4 different races (77.8% Black, 7.6% Coloured, 4.8% Indian and 9.8% White). Among them, 41.1% were aged between 30 and 49 years old, while 47.6 % and 11.3% were younger and older, respectively.

About 91.3% had tertiary education meanwhile 8% had secondary education and 0.6% less. Only 29.1% lived in a household of 1-2 persons, the others living in either a 3-5 persons households (52.6%) or above (18.3%). Some reported to have a monthly income lower than 100USD (21.1%), and others fell in the range of 100-300USD (31.5%), 301-500USD (21.7%), and above 500USD (25.7%).

3.2. Computer, Smartphone and Internet (CSI) use Experience

Among the respondents, 57.8% have been using computer for more than 10 years, 22.8% between 6-10 years and 13.5% between 1-5 years. Just 5.9% reported to have used one for less than 1 year. Concerning Smartphone, 42.8% declared a usage experience ranging from 6-10 years meanwhile 35% were above 10 years, 19.6% between 1-5 years and 2.6% below one year. In contrast to smartphone where the use is almost daily (96.5%), computer used was either daily (65.2%) or weekly (13.2%). This is also the case for internet connection that tended to be daily (92.4%) or at least weekly (4.6%). This may suggest an increase in the CSI use in Africa. In fact, in 2017, smartphones ownership as well as internet use had already been described as more common around the globe, Africa being behind with countries like South Africa, Ghana, Senegal, Nigeria, Tunisia, Kenya and Tanzania leading the chart [18]. Today, smartphones are no longer a luxury [19] and are used by millions of people not only for fun, but for regular communication with friends, family and colleagues, email access, internet access, efficiency, and connectivity. The continuous improvement of smartphones over the years is one of the main drivers that contributed to the rapidly growing numbers of mobile applications, as well as different mobile categories [18].

The calculation of the CSI score (Table 1) clearly shows that overall population has a high usage experience, the lowest minimal mean value being 16 over 20. This CSI score appeared to be significantly determined by all the above described socio-demographics parameters of the surveyed population. In fact, people from Eastern and Southern Africa, males, coloured people, people aged between 30-49 years old, those with tertiary education level, those living in a house of maximum 2 persons, and those having a monthly income above 500USD presented the highest score.

3.3. Nutrition Apps and Software usage Level

The rapid developments in mobile technology have encouraged the use of smartphones in health promotion research and practice. Although many applications (apps) related to diet and nutrition are available from major smartphone platforms, relatively few empirical studies have been conducted on their effectiveness in promoting healthy eating behaviour [20]. Electronic health (eHealth) and mobile health (mHealth) technologies including mobile devices, and smartphone applications (apps), provide opportunities for population wide promotion of physical activity and healthy eating [21]. As shown in Table 2, 93.9% of studied population declared they know what a balanced diet is, and to have heard about from nutrition courses they took (50.4%), their doctor/nutritionist or dietician (32.4%) and personal reading (32.2%), Social media (28.3%) and Radio/TV (27%). However, 41.5% admitted not applying its principles in their day-to-day life. A high percentage of this population (82%) was not using any nutrition app/software. The most used one appeared to be Samsung Health app (7.4%), MyFitnessPal (3.7%), Fitbit (2.8%), CarbsControl (1.1%), Fitocracy (1.1%) and Fooducate (1.1%). This preference to Samsung Health app may come from the fact that Samsung Smartphones already integrate that app compared to the other apps that the owner have to download and installed. For those using one, reasons like calories intake monitoring; Keep fit/Healthy diet or lifestyle; weight loss or program already installed on my phone were enounced. On the other hand, those not using gave reasons like no interest/reason to use/need; Non-awareness; Financial reason (Access); Unavailability of some food suggested or unaffordability; Medical reason; Lazyness; Personnal Instructor and lack of time. From the 18% of users, 10.7% have been using nutrition apps/software for just 1-5 years. A positive appreciation of their effectiveness in solving the problem they are used for was given by 9.5% of the respondents while 7.6% gave an average opinion and 0.9% a negative one. The COVID-19 pandemic has pushed just 0.7% to start using one, and 7% to refer more to these tools. This emphasizes the risk of a rise of the double burden malnutrition.

A comparison of the number of users and non-users per socio-demographic parameter can be made with Table 3. Region, race, household size and monthly income appeared as the only socio-demographic parameters significantly determining that number. Southern Africa was by far the region with the highest users, followed by West Africa. People living in a household of 3-5 people and those having a monthly income above 500 USD tended to use those tools more. Besides, the number of users tended to decrease with respondents age (8.9% for the 18-29 years old; 7.6% for the 30-49 years old; and 1.5% for the 50 years old and older). Similar observation was made by Kunst [22] when studying the usage of these tools among 962 US adults and who reported 64% of users among 18-29 years old respondents, 60% among 30-45 years old respondents, 27% among 46-60 years old respondents, and just 15% for those older. In fact, Millennials who are a generational cohort born between 1980 and 2000 "grew up with technology" are perceived to have the highest affinity for technology [23]. To Millennials, technology is as essential to life as is the food they eat and the clothes they wear [24].

Table 1. Change of CSI score with the sociodemographic variables (N=460)

Variable	Score				ANOVA between groups					
	Mean	Std. Deviation	Minimum	Maximum	Sum of Squares	df	Mean Square	F	p-value	
Region	Central Africa	16.03	3.726	3	20	470.388	4	117.597	14.687	0.000
	Eastern Africa	18.28	1.892	11	20					
	North Africa	17.98	2.395	9	20					
	Southern Africa	18.58	1.814	11	20					
	West Africa	17.27	2.808	8	20					
Gender	Female	16.93	3.319	3	20	139.393	1	139.393	16.065	0.000
	Male	18.06	2.236	3	20					
Race	Black	17.11	3.169	3	20	119.676	3	39.892	4.555	0.004
	Coloured	18.69	1.132	15	20					
	Indian	18.09	2.114	13	20					
Age	White	18.09	2.485	9	20	232.059	2	116.030	13.662	0.000
	18-29	16.94	2.702	8	20					
	30-49	18.19	2.227	3	20					
Education level	50 and more	16.25	5.160	3	20	608.407	3	202.802	26.384	0.000
	No formal education	20.00		20	20					
	Primary level	6.50	4.950	3	10					
	Secondary school	14.41	4.323	4	20					
Numbers of people in the household	University/Tertiary institution	17.68	2.589	3	20	76.133	2	38.067	4.309	0.014
	1-2	17.96	2.349	9	20					
	3-5	17.24	3.243	3	20					
Monthly income	6 or more	16.81	3.044	8	20	545.740	3	181.913	23.251	0.000
	Above average (301-500 USD)	17.98	2.361	9	20					
	Affluent (> 500 USD)	18.87	1.604	11	20					
	Average (100-300 USD)	16.54	3.672	3	20					
Total	Poor (< 100 USD)	16.15	2.837	4	20	17.37	2.994	3	20	

Table 2. Level of nutrition related apps/software usage and reasons behind (N=460)

Questions	Answers distribution
1. Do you know what a "balanced diet" is?	Yes (93.9%); No (6.1%)
2. Where did you hear about?	I have never heard about (5.7%); Doctor, nutritionist or dietician (32.4%); Friends or relatives (22.2%); Nutrition courses (50.4%); Personal reading (32.2%); Radio or TV (27%); Social media (28.3%)
3. Do you think you apply the principles of "balanced diet" in your day-to-day life?	I do not know (10.7%); No (41.5%); Yes (47.8%)
4. Which Nutrition/Fitness apps or software do you use?	I do not use one (82%); Apple health (0.9%); CarbsControl (1.1%); Fat burning (0.2%); FatSecret (0.4%); Fitbit (2.8%); Fitocracy (1.1%); Fiton (0.2%); Fooducate (1.1%); Google Fit (0.2%); Huawei Health App (0.4%); Mi Fit (0.2%); MyFitnessPal (3.7%); MyPlate (2.2%); MyNetDiary (0.4%); Nutri Survey (0.2%); Samsung Health app (7.4%); Strava health app (0.2%)
5. How would you rate their effectiveness in solving the problem you are using them for (expectations)?	I do not use one (82%); Average (7.6%); Excellent (1.7%); Good (7.8%); Poor (0.9%)
6. Since when have you started using Nutrition apps or software?	I do not use one (82%); 1-5 years (10.7%); 6-10 Years (1.1%); Above 10 years (0.9%); Less than one year (4.8%); Since COVID-19 in the country (0.7%)
7. Do you refer more often to it during this lockdown period associated to the COVID-19 pandemic?	I do not use one (82%); No (11.1); Yes (7%)

Table 3. Variation of the Nutri apps/software usage level with the sociodemographic variables of the population and their healthy status (N=460)

Variable	Use of a Nutri App/Software		Value	df	Asymptotic Significance (2-sided)	
	No	Yes				
Region of the country of residence	Central Africa	28.3%	2.2%	20,055	4	0.000
	Eastern Africa	6.1%	1.7%			
	North Africa	7.8%	1.5%			
	Southern Africa	18.5%	7.2%			
	West Africa	21.3%	5.4%			
Gender	Female	50.9%	10.2%	,848	1	0.357
	Male	31.1%	7.8%			
Race	Black	65.9%	12.0%	11,313	3	0.010
	Coloured	5.9%	1.7%			
	Indian	2.8%	2.0%			
	White	7.4%	2.4%			
Age	18-29	38.7%	8.9%	,835	2	0.659
	30-49	33.5%	7.6%			
	50 and more	9.8%	1.5%			
Educational Level	No formal education	0.2%		3,417	3	0.332
	Primary level	0.4%				
	Secondary level	7.4%	0.7%			
	University/Tertiary institution	73.9%	17.4%			
Number of people living in the household	1-2	24.8%	4.3%	6,917	2	0.031
	3-5	40.9%	11.7%			
	6 or more	16.3%	2.0%			
Economic status (Monthly income)	Above average (301-500 USD)	17.8%	3.9%	20,154	3	0.000
	Affluent (> 500 USD)	18.3%	7.4%			
	Average (100-300 USD)	25.9%	5.7%			
	Poor (< 100 USD)	20.0%	1.1%			
Personal affection by NCDs or obesity	No	69.1%	15.0%	,076	1	0.783
	Yes	12.8%	3.0%			
Affection of family members by NCDs or obesity	No	52.8%	12.8%	1,325	1	0.250
	Yes	29.1%	5.2%			

3.4. Population Opinion Regarding Nutri-apps/software

Table 4 gives an overview of the surveyed population’s opinion about different statements made concerning nutrition app/software. Whatever the statement, the percentage of the population who declared not having any idea about (“I do not know”) was always lower than the non-users percentage (82%). For this non-users sub-population, if not neutral, they tended to think nutrition apps and software are not complex to use, not adapted to foods available in their context, not boring to use, mainly made for weight change, effective for diet monitoring, useful to improve eating habits but will prefer to have advice from a nutritionist or dietician. Similar opinion was reported by the users except that they correctly do not think that app/software are mainly made for weight change. A high interest in learning more about Nutrition app/software was noticed among the population (64.8%) with 25.9% being neutral. Changing individual health behaviours is challenging but convenience, cost, culture, social acceptance, comfort, marketing, product placement, store placement, advertisements, brand trust, ingredients, allergies, kitchen access, serving size, and so much more influence behaviours surrounding food choice [25]. Eating healthy has become a challenge that many simply cannot attain. Health focused smartphone apps have the ability to break through barriers and enable users to make healthier choices [26]. Creating healthy behaviour changes requires making the healthy choice in regard to food consumption.

Table 4. Users and non-users opinion concerning Nutri Apps and software (N=460)

Statement	Users of a Nutri app/software	Opinion					
		I do not know	Agree	Strongly Agree	Neutral	Disagree	Strongly disagree
1. Nutrition apps and software are complex to use	No	58.5%	3.7%	0.9%	8.3%	8.3%	2.4%
	Yes	0.7%	3.0%	0.2%	4.8%	7.4%	2.0%
2. They are not adapted to foods available in my context	No	56.5%	8.0%	4.8%	6.5%	4.6%	1.5%
	Yes	1.1%	6.3%	0.9%	4.3%	4.6%	0.9%
3. They are boring to use	No	56.3%	4.3%	0.7%	8.5%	9.1%	3.0%
	Yes	0.7%	2.6%	0.2%	3.9%	8.3%	2.4%
4. They are mainly made for weight change	No	48.9%	13.0%	1.7%	9.6%	6.5%	2.2%
	Yes	0.7%	5.4%	1.1%	2.6%	6.7%	1.5%
5. Diet monitoring using these tools are effective	No	56.7%	11.7%	2.0%	9.8%	1.3%	0.4%
	Yes	1.1%	7.6%	2.2%	4.8%	1.7%	0.7%
6. They are useful tools to improve behaviour related to nutrition	No	47.0%	20.4%	4.6%	8.5%	1.1%	0.4%
	Yes	0.4%	10.4%	1.7%	4.3%	1.1%	-
7. I will prefer to have advice from a nutritionist or dietician rather than using those tools	No	0.4%	26.5%	15.0%	30.7%	5.0%	4.3%
	Yes	0.2%	7.2%	2.6%	5.9%	1.7%	0.4%
8. I am interested in learning more about Nutrition software or apps	No	-	33.3%	17.6%	22.20%	4.1%	4.8%
	Yes	0.2%	10.0%	3.9%	3.7%	0.2%	-

3.5. Prevalence of Non-Communicable Diseases and Obesity within the Population

Up to 84.13% of the surveyed population declared to be neither concerned by obesity nor by an NCDs, but only 65.65% declared their family members too (Figure 1). Cardiovascular diseases, diabetes, Chronic respiratory diseases and cancer were the most represented diseases among the sick sub-populations and respondents’ families. Obesity was also reported by few respondents (7.39 %) and to be present in 6.74% of families. No significant correlation was noticed between the health status of the respondents or its family members and the use of nutrition apps/software. COVID-19 has yet been described as more lethal for those suffering from NCDs [1; 10]. Adoption of healthy lifestyles through the use of nutrition-related apps/software might therefore be helpful for those subpopulations.

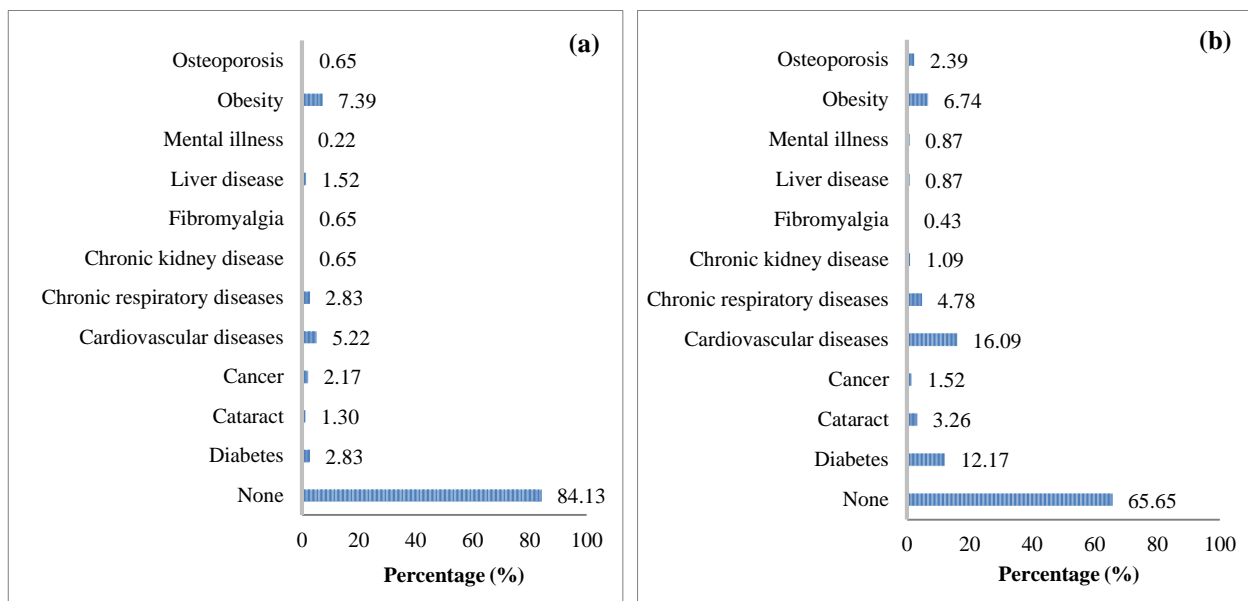


Figure 1. Prevalence of NCDs and Obesity within the surveyed population (a) and their families (b)

4. Conclusion

This study demonstrated that the use of nutrition Apps/software in Africa is still very low, but people are interested in learning more about. Measures promoting their use in this COVID-19 pandemic time may therefore be of interest in order to limit the associated double burden malnutrition and avoid a resurgence of non-communicable diseases across the continent as the Computer, Smartphone and internet use experience is rising continuously. Furthermore, development of apps/software which incorporate healthy African indigenous foods available is imperative as this will go a long way to encourage the use of these tools and increase their effectiveness in Africa.

4.1. Limitations of the Study

This study is limited to an online survey by the COVID-19 lockdowns which did not allow the researchers move to certain rural/semi-urban settings to include participants from those areas. Hence, this study only covers a particular socio-economic class of people who are educated and almost 80% earning 100USD or above per month. This work which takes its strength from its international dimension is also limited by its relatively small sample size but already gave an overview of parameters determining nutrition apps usage in Africa.

5. Declarations

5.1. Author Contributions

Conceptualization, A.T., H.K., G.K., and E.O.O.; formal analysis, A.T., H.K., G.K., and E.O.O.; writing—original draft preparation, A.T., H.K., G.K., and E.O.O.; writing—review and editing, A.T., H.K., G.K., and E.O.O. All authors have read and agreed to the published version of the manuscript.

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5.4. Ethical Approval

The research proposal was reviewed and approved by the Ethics Committee of Research of the University of Johannesburg. All participating respondents voluntarily and anonymously filled the online survey form.

5.5. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

5.6. Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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