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The use of telehealth technology for lifestyle modification among patients with hypertension in Nigeria and Ghana

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Abstract

Introduction: Sedentary lifestyle and consumption of an unhealthy diet are significantly associated with hypertension in Nigeria and Ghana. Increasing the uptake of physical activity and diet rich in fruits and vegetables has been a challenge in the region. This study aimed at assessing the effect of a mobile health intervention (mhealth) on physical activity, and fruits and vegetables intake in patients with hypertension in Nigeria and Ghana

Methods: The study was a quasi-experimental study conducted in Mamprobi Hospital (MH) in Ghana, and State University Teaching Hospital (EKSUTH) in Nigeria. One hundred and sixteen consenting adult patients with hypertension were consecutively recruited and given regular reminders on physical activity and intake of fruits and vegetables via mobile app (mnotify®) for six months. All participants were followed up for six months and data collected at Baseline, three months and six months. Analysis was done using Stata 14 software (StataCorp. College Station, TX) assuming an alpha level of 0.05. Ethical approval was obtained from both countries and ethical standards were followed.

Results: A total of 116 (53 from Ghana and 63 from Nigeria) patients with hypertension participated in the study. Respondents had a mean age of 61.0 ± 9.1 years, and were mostly females (64.7%). There was an increase in the level of physical activity which was significant by the third month ($p < 0.0001$) but became insignificant by the 6th month ($p = 0.311$). Fruits and vegetables intake also improved at 3 months ($p = 0.054$) and significantly at 6 months ($p = 0.002$).

Conclusion: The study found the use of telehealth as an effective tool for the delivery of adjunct therapy for lifestyle modification in the management of hypertension in Nigeria and Ghana. It is therefore recommended that telehealth be incorporated into the management of hypertension and other chronic diseases for better health outcome.

Keywords

mHealth, lifestyle modification, physical activity, diet, fruits, vegetables

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Introduction

Hypertension is one of the most important, modifiable risk factor for cardiovascular disease and mortality.[1] Modification of this risk factor may be achieved by lifestyle modification to reduce sedentary lifestyles and encourage healthy diets.[2] This is particularly important as physical inactivity has been identified as one of the leading risk factors for hypertension in sub-Saharan Africa.[3,4] Targeted weight-loss interventions in population subgroups might be more effective for the prevention of hypertension than a general-population approach. A diet rich in high-potassium fruit and vegetables is strongly recommended.[5] It has been shown that diet and exercise reduce blood pressure in patients with resistant hypertension. Adoption of a structured 4-month program of diet and exercise as an adjunct to treatment resulted in a significant reduction in blood pressure and improvement in selected cardiovascular disease biomarkers.[6] Healthy lifestyle has also been shown to reduce cardiometabolic multimorbidity in hypertensive patients thus helping in the reduction in the burden of the disease.[7,8]

Sedentary lifestyle and consumption of unhealthy diet are common among adult populations in Nigeria and Ghana and have been significantly associated with hypertension in the region.[9,10] Thus the use of lifestyle modification as an adjunct to pharmacotherapy would improve the prevention and control of hypertension in the region.[10] A major challenge of this adjunctive therapy has remained the method of delivering the diet and exercise program. We tested the use of mobile health technology (mhealth) for the delivery of adjunctive diet and exercise therapy for the management of patients with hypertension.

The use of mobile health technology has shown promise in increasing physician-patient interaction in the management of hypertension.[11] The increase in the use of mobile phones globally has led to an increase in the use of mobile health technology (mhealth) in the management of several medical conditions including chronic diseases like hypertension and diabetes.[11–15] It has been shown to enhance communication between the healthcare providers and the patients thus supporting direct healthcare delivery.[14] The aim of this study was to assess the effect of a mobile health intervention (mhealth) on physical activity, and fruits and vegetables intake in patients with hypertension in Nigeria and Ghana.

Methods

This study is a secondary data analysis of a wider study that assessed the effect of mobile health (mhealth) technology on blood pressure control among patients with hypertension in Ghana and Nigeria. The study was a quasi-experimental study conducted between May and December 2021 in Mamprobi Hospital (MH) in Ghana, and the General Outpatient Department (OPD) clinics of Ekiti State University Teaching Hospital (EKSUTH) in Nigeria.

Adult patients with hypertension who consented to participate and did not have any cognitive impairment or severe illness that will limit their participation were consecutively recruited into the study. Patients 18 years and above with essential hypertension, receiving antihypertensive medications, who owned a smartphone, and ability to read and understand English were included in the study. However, patients with self-reported secondary hypertension; self-reported renal disease; physical or mental disability that impaired use of the mobile application; and severely ill or weak patients whose condition would not allow them to be interviewed at review dates were excluded from the study.

Minimum sample size was calculated to be 43 per study site giving a total of 86. Participants received regular reminders on the need to do physical activities like brisk walking, cycling, jogging, swimming, etc as well as the importance of fruit and vegetable intake and what to take via mobile app (mnotify®) for the 6-month period. This was in addition to standard care for patients with hypertension which included monthly follow up, medications, and counseling.

The mHealth intervention consisted of an interactive phone application (m-notify®) that sent reminders to the participants on healthy lifestyle choices such as regular fruit and vegetable intake and the need for regular physical activity for at least 30 min daily for 5 or more times per week. These messages were sent twice weekly throughout the duration of the study (6 months). An example of message sent was

> *Walk briskly for at least 30 minutes a day for a minimum of 5 days a week for a healthy heart*,

The m-notify App gives feedback that respondents actually got the messages and read them.

All participants were followed up for six months and data were collected at Baseline, 3 months and 6 months. Data collected included sociodemographic characteristics like age, sex, occupation, level of education and marital status. Respondents were categorized based on age into those 45 years and below (young), those 46 to 55, and 56 to 65 years (middle age) and those greater than 65 years (elderly). Sex was categorized as male or female. Occupation was categorized as unemployed (those without any form of employment like students, housewives, etc), self-employed (like farmers, traders, and artisans), and employed (responds in paid jobs). Level of education was categorized into nonformal education, primary (elementary school), secondary (high school), and tertiary (college/university). Respondents were categorized based on marital status as married and unmarried (singles, widows, and divorcees). Data were also collected on physical activity and adequate diet represented by adequate fruit and vegetable intake.

Level of physical activity was assessed based on the engagement in moderate to intense exercise like cycling, swimming, running, jogging, skipping, brisk walking, etc, for at least 30 min a day for a minimum of 5 days a week. Those who met the above World Health Organization (WHO) criteria (150 min of cumulative exercise weekly)[1] were considered by the study to be physically active and those who did not meet the criteria were considered inactive.

Also, respondents who consumed five or more servings of fruits (a medium size of common fruits = 1 serving) or vegetables (half cup of cooked or raw vegetables = 1 serving) in a day were considered as having adequate intake.[16,17]

Analysis was done using Stata 14 software (StataCorp. College Station, TX). Descriptive statistics were used to analyze sociodemographic characteristics of respondents and reported with their proportions. Continuous variables were expressed as Means (SD) while categorical variables were expressed as frequency (percentages). Chi-square test was used to compare other categorical variables with consequent test of association assuming an alpha level of 0.05. Binary logistic regression was used to further compare the level of physical activity and adequacy of fruit and vegetable intake among respondents and the level of significance was set at two-sided p-value of 0.05.

Ethical approval for the study was granted by the Ethics Review Committees of EKSUTH, Ado Ekiti, Nigeria (EKSUTH/A67/2020/06/007) and Ghana Health Service (GHS) Ethical Review Committee (GHS-ERC 007/10/20). Written informed consent was obtained from all the subjects prior to study initiation. All procedures were performed in accordance with the ethical standards of the 1964 Helsinki declaration and its later amendments and comparable ethical standards.

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Table 1. Socio-demographic characteristics of the study population ($N = 116$).

Parameters	Frequency ($N = 116$) (%)
Country	
Ghana	53 (45.7)
Nigeria	63 (54.3)
Age (years)	
≤45	7 (6.0)
46-55	26 (22.4)
56-65	47 (40.5)
>65	36 (31.1)
Mean ± SD (years)	61.0 ± 9.1
Sex	
Males	41 (35.3)
Females	75 (64.7)
Education status	
No formal education	8 (6.9)
Primary	15 (12.9)
Secondary	30 (25.9)
Tertiary	63 (54.3)
Occupation	
Unemployed	40 (34.5)
Self-employed	34 (29.3)
Employed	42 (36.2)
Marital Status	
Married	77 (66.4)
Unmarried	39 (33.6)

Results

A total of 116 patients with hypertension participated in the study, with 53 patients seen in the Ghana study sites and the remaining 63 seen in the Nigerian study sites. Most respondents were between 56 and 65 years old with a mean age of 61.0 ± 9.1 years. There were more females (64.7%) and most respondents had a minimum of secondary education, were mostly self-employed and were married. The sociodemographic characteristics of respondents are summarized in Table 1.

Table 2 shows the level of physical activity of respondents from baseline through three months to six months the study lasted. There was a significant increase in the level of physical activity by the third month ($p < 0.0001$) with participants 6 times more active. However, by the sixth month, though participants were 1.3 times more active compared to baseline, the difference was not statistically significant ($p = 0.311$).

Table 2. Level of physical activity at baseline, 3rd month and 6th month ($N = 116$).

	Physical activity (116) (%)				
Parameters	Inactive	Active	*p*-value	Odd ratio	Confidence interval
Baseline	86 (73.9)	30 (26.1)		Ref	
3rd Month	36 (30.4)	80 (69.6)	<0.0001*	6.370	3.595 to 11.290
6th Month	79 (67.8)	37 (32.2)	0.311	1.343	0.759 to 2.375

*Statistically significant.

Table 3. Adequacy of fruits and vegetable intake at baseline, 3rd month and 6th month ($N = 116$).

	Fruits and vegetables intake (116) (%)				
Parameters	Inadequate	Adequate	*p*-value	Odd ratio	Confidence interval
Baseline	109 (93.9)	7 (6.1)		Ref	
3rd Month	100 (86.2)	16 (13.8)	0.054	2.491	0.984 to 6.307
6th Month	92 (79.3)	24 (20.7)	0.002*	4.062	1.674 to 9.857

*Statistically significant.

The adequacy of fruit and vegetable intake among respondents is illustrated in Table 3. Respondents were 2.5 times more likely to take adequate fruits and vegetables by the third month but the difference was not statistically significant ($p = 0.054$). The odds increased to 4.1 by the sixth month of the study with significant increase in fruit and vegetable consumption ($p = 0.002$).

Discussions

The study was a quasi-experimental study to assess the use of telehealth in the improvement of physical exercise and fruits and vegetables intake among patients with hypertension in Nigeria and Ghana. There was a significant increase in physical activity at the end of the 3 months. However, there was a gradual decline at the end of the 6 months. The initial rise that was seen at 3 months could be a result of the additional telehealth regular reminders of the importance of physical activity by health providers at the point of care. This was similar to other studies using mHealth.[18,19] This underscores the role of health education and counseling using appropriate technology to effect positive lifestyle change.[10] There was however a drop in physical activities at 6 months. This could likely be due to alert fatigue resulting from the use of mHealth.

Our study showed that the use of mhealth improved the intake of fruit and vegetables. Though this was not significant by the 3rd month, but by the 6th month of using mHealth, the increase became statistically significant. This is in keeping with findings from a randomized controlled trial in New Delhi, India which showed a significant reduction in behavioral risk factors such as unhealthy diet and insufficient physical activity in the intervention group compared to control following mhealth intervention package consisting of weekly text messages and monthly phone calls. This further demonstrates the effect of mHealth on modifying behavioral risk factors on non-communicable diseases.[20]

There is a need for measures that will help patients with hypertension and other NCDs initiate and sustain positive lifestyle changes that will help in preventing and control hypertension and thus prevent the complications associated with the disease. This could include the use of mhealth to enhance communication between patients and healthcare providers on various aspects of management including lifestyle modifications.

Limitations

The assessment of physical activity was based on patient-reported assessment of physical activity. This is a subjective assessment that may be subject to the Hawthorne effect.

Getting patients to adhere to their follow up visits was a limitation. However, those who could not come on the exact

dates were seen at the closest convenient date which was within three days of their appointment date.

Financial issues were reported by some respondents. This limited their ability to come for follow-up on exact dates as well as sustain the use of their mobile devices. Those respondents with financial difficulties were assisted with a token for transportation. mHealth intervention was through sms thus respondents did not require data.

Conclusions

Delivery of adjunct therapy for lifestyle modification using mobile health (mhealth) intervention led to an improvement in the level of physical activity and adequacy of fruit and vegetable consumption among patients with hypertension in Nigeria and Ghana over a six-month period. Physicians should try and inculcate the use of mhealth in the management of hypertension and other chronic diseases to help patients adopt healthy lifestyle that will result in better health outcome. Policy makers should also include mhealth in the management guidelines for the prevention and control of chronic diseases.

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