

Pharmacist's Intervention in the Control of Blood Sugar Levels in Randomised Diabetes Patients at a Primary Health Care Setting in Benin City

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ABSTRACT

Background: The extended roles of pharmacists in Nigeria in the improvement of quality of health care at the primary health care (PHC) level is currently poorly executed even though pharmacists have been proven to be involved in interventional activities in health care delivery.

Objective: To evaluate pharmacists' intervention in the control of blood sugar levels of diabetes patients in a PHC setting in Benin City, Nigeria.

Methods: At baseline, the fasting blood sugar (FBS), glycosylated hemoglobin (HbA1c), body mass index (BMI) and blood pressure (BP) of randomly selected 170 diabetic patients in a primary health care centre were evaluated. This was followed-up with intervention by the pharmacists through counselling on lifestyle modification, self-medication and drug adherence on monthly basis for three consecutive months after which the FBS, HbA1c, BMI and BP were re-evaluated.

Results: indicated significant reduction in BMI, HbA1c and FBS from $27.1 \pm 4.2 \text{ kg/m}^2$, $8.1 \pm 3.0\%$ and $10.0 \pm 4.2 \text{ mmol/l}$ to $23.5 \pm 3.5 \text{ kg/m}^2$, $7.1 \pm 1.8\%$ and $8.5 \pm 2.1 \text{ mmol/l}$, respectively ($p < 0.001$) was observed following the intervention by the pharmacists.

Conclusion: Direct involvement of pharmacists in the care of diabetic patients in PHC settings can significantly improve the quality of life provided to these patients and hence reduce mortality resulting from the disease. Recruitment of reasonable number of pharmacists should always be considered in health policies for PHC settings in developing countries.

Keywords: Diabetes mellitus, blood sugar levels, pharmacist intervention, primary health care.

INTRODUCTION

Diabetes mellitus (DM) is a non-communicable metabolic disorder affecting more than 195 million people worldwide. By 2030, this figure is expected to have risen to more than 330 million^{1,2}. Of the number of cases worldwide, 80% is found in the developing world which is expected to have the largest increase in diabetic cases^{1,4}. In Nigeria, the incidence and crude prevalence rates for those aged 45 years and above, who live in urban areas, have been reported to be 2.2% and 7.4%, respectively⁵. Since 2003, this rate has been increasing over the years mainly due to

lifestyle changes, overweight and obesity, physical inactivity, alcohol consumption, dietary changes and cigarette smoking. Persistent elevations in blood sugar and glycosylated hemoglobin (HbA1c) levels in diabetic patients increase the risk for the long-term vascular complications including coronary disease, heart attack, stroke, heart failure, kidney failure, blindness, erectile dysfunction, neuropathy, gangrene, and gastroparesis associated with the disease^{6,7}. In the United States, 30% of diabetes patients older than 40 years of age have been reported to have impaired sensation in their feet while 60% of all non-traumatic amputations are attributable to the disease⁸.

In Nigeria, the health care system is made up of primary, secondary and tertiary health care. The primary health care (PHC) includes health centres, dispensaries and health posts at the local government levels as well as health centres and clinics in various institutions like universities and polytechnics providing general preventive, curative, promotive, and pre-referral care. Notable problems affecting the health sector include the lopsided distribution of health professionals in favour of urban centres, the short supply of some categories of health manpower, and the unacceptable mix of under-utilization and over-utilization of the skills of health professionals depending on the geographic location and professional category involved⁹. As the prevalence of diabetes continue to rise, the tackling of the disease burden at the PHC levels has become vital as the majority of Nigerians receive their health care at that level. Of major concern is the role of prescribing assumed by community health officers, nurses, and health assistants in many PHC settings often seen in Nigeria that frequently results in increased level of irrational use of medicines⁹. Furthermore, doctors and pharmacists are hardly engaged at the PHC levels in sufficient numbers for them to be very effective in health care delivery as they are also highly involved in administrative duties. Pharmacists often determine medicine needs, set priorities, procure and manage drugs¹⁰. In PHC settings, the pharmacists are mainly needed to ensure the management of essential drugs and hence the actual dispensing of drugs is most often assigned to pharmacy technicians and pharmacy assistants in the PHCs. These technicians and assistants simply provide the medications to patients with basic information on how to use the medicines. Activities that will eventually improve patients' medication adherence and quality of life are not carried out by them.

As pharmaceutical care activities carried out by pharmacists have been proven to improve patients' quality of life, the ability of pharmacists to contribute to improved well-being of diabetic patients through effective intervention is vital in the care of DM patients. Such interventions often focus on correct medication use, medication adherence and healthy lifestyle promotion. In a systematic review involving 14 trials and 2073 patients, the interventions by pharmacists significantly improved glycaemic control in the patients¹¹. Another study in which the primary outcome was glycaemic control, as measured by fasting plasma glucose and HbA_{1c}, has also observed that pharmacists' intervention in community practice significantly reduced HbA_{1c} (between-group difference: 0.5 %, $P = 0.009$) with the largest impact on HbA_{1c} observed when pharmacotherapy changes on the type and/or dose of hypoglycaemic agents initiated by the physician were sustained with pharmaceutical care¹².

The objective of the present study is to evaluate the impact of a pharmacist intervention to optimize blood sugar control by the use of fasting blood sugar and HbA_{1c} in a PHC facility in Benin City, Edo State. We expected to use the outcome of this study to develop a programme aimed at improving diabetic control in rural communities in Edo State.

SUBJECTS AND METHODS

Setting

This study was conducted at Nigerian National Petroleum Corporation Clinic (NNPCC) Benin City, Edo State in the South-South Nigeria. The medical centre is a PHC facility with patients' turn over rate of about 100 per week.

Study Design

Following ethical approval, 170 patients (sex: male=97, female=83; mean age: 56.7±12, 29-75 years; mean height: 1.63±0.08 m; mean weight: 85.31±15.60 kg) diagnosed with type 2 diabetes mellitus (as previously described¹³) who attended ambulatory care at NNPCC between June and November 2011 were randomly recruited for this study. The patients were diagnosed to have diabetes mellitus using both clinical presentation and laboratory assessment of fasting blood sugar (FBS) and HbA_{1c} levels. They were non-regular smokers and drinkers who were 19 years of age or older and had not previously participated in a lifestyle intervention programme. Excluded from the study were HIV+ subjects, pregnant women, and patients with history of hypoglycaemic coma, seizure, dementia or substance abuse within the last 12 months. Patients who were on renal dialysis or expected to have renal dialysis within the next 6 months and those who had plan to move out of the study region within the next 8 months or participate in another clinical study were also excluded.

At baseline, the patients' information on gender, age, and educational status, as well as their past medical history relevant to the onset of the diabetes mellitus, comorbidities, and diabetes medication regimens were obtained using structured format. In this respect, each patient was interviewed in English language except for less than 10% of them who could not understand the language properly and had to be interviewed in Pidgin English. Following written consent from each of the study participants, the blood pressure (BP) was measured using mercury sphygmomanometer. The weight and height of

each patient were then measured using weighing balance and stadiometer, respectively, and the body mass index (BMI) calculated. Fasting blood (5 ml) for each participant was then taken from the vein in the arm following an overnight (12 hr) fast and fasting blood sugar (FBS) level plus serum HbA_{1c} levels were determined as previously described by Timmer *et al*¹⁴.

The pharmacists then counselled each patient and/or caregiver using standard procedures. Counselling covered weight reduction as well as BP and blood sugar level control. To control blood sugar and BP levels, each patient was encouraged to (i) avoid consuming high-fat foods, (ii) eat balanced diets (containing the right proportions of proteins, carbohydrates, fats, minerals and vitamins), (iii) avoid self-medication particularly with medicines that affect metabolism and increase blood sugar levels such as steroids, contraceptive pills, and some diuretics, (iv) exercise regularly (avoid sedentary lifestyle), (v) cigarette smoking and drinking of alcohol, and (vi) keep the BP under control through proper monitoring and restriction on intake of foods with high sodium content. Emphasis was laid on adherence to treatment, particularly on medications prescribed by the attending physicians.

Each patient was then followed-up each month for three consecutive months by three pharmacists. This follow-up pharmacists' intervention was carried out as the patients visited the clinic to refill their prescriptions. After three months of intervention, the patients' HbA_{1c}, FBS, BP, BMI were re-evaluated using same research instruments.

The outcomes measured were changes in the fasting blood sugar and HbA_{1c} levels, BMI, and blood pressure of baseline when compared to the values at the end of the consecutive three months follow-up by the pharmacist.

Data analysis

The Statistical Package for Social Sciences software (SPSS version 15) was used to compute the results. The variables were analysed using descriptive statistics such as mean, frequency distributions, cross tabulations and standard deviations. Student paired-t-test was used to analyse difference in the measurements between individual pairs of observations while regression analysis was applied to investigate the relationship between two variables.

RESULTS

At baseline, majority of the patients (62.6%) had BMI values higher than normal levels. Those who were under weight were less than 2% (Table 1). There was a significant reduction in BMI among patients that had normal to obese weight after intervention by the pharmacist when compared to baseline values ($\chi^2=13.104$, $df=2$, $p=0.001$). The overall BMI for the patients significantly decreased from 27.1±4.2 kg/m² to 23.5±3.5 kg/m² ($p<0.001$). Of the three underweight patients at baseline, the BMI of two of them became normal following the intervention.

There were significant reductions in the measured values of HbA_{1c} and FBS following the intervention by the pharmacists ($p<0.001$). However, no significant changes occurred in either the systolic or diastolic BP resulted from the intervention (Table 2) but there was positive correlation between the FBS and HbA_{1c} ($r=0.939$). There was no gender differences associated with the results obtained.

Table 1: Age and body mass index (BMI) of diabetic patients before and after pharmacists' intervention

BMI (kg/m ²)	Number of patients (%)	
	Pre-intervention	Post-intervention
<18	3 (1.76)	1 (0.56)
18-24	64 (37.65)	72 (42.35)
25-29	78 (47.88)	91 (53.53)
≥30	25 (14.71)	6 (3.53)

Under weight; normal weight; overweight; obese

Table 2: Glycosylated haemoglobin, fasting blood sugar and blood pressure of diabetic patients before and after pharmacist's intervention

Variables	Pre-intervention (mean±sd)	Post-intervention (mean±sd)	P-value
HbA1c (%)	8.08 (3.03)	7.08 (1.81)	<0.001
FBS (mmol/l)	9.96 (4.22)	8.47 (2.13)	<0.001
Systolic BP (mmHg)	133 (22)	131 (19)	>0.05
Diastolic BP (mmHg)	77 (10)	77 (9)	>0.05

HbA_{1c} - Glycosylated haemoglobin; FBS - fasting blood sugar; BP - blood pressure

DISCUSSION

Consistent with earlier studies in large hospitals and community pharmacy practice^{11,15}, the intervention carried out in the PHC setting studied led to a significant improvement in diabetes control. The positive correlation between the FBS and HbA_{1c} observed in this study has been reported previously¹⁶. Although non-correlation of FBS and HbA_{1c} was also reported in subjects with haemoglobin disorder¹⁷, none of the patients in our study sample had any evidence of haemoglobin disorder as confirmed by both clinical and laboratory data.

As medication therapy experts, pharmacists working in PHC settings are expected to integrate knowledge, skills and professional attitudes to effectively contribute to improved quality of drug therapy through the provision of patient-centred care in collaboration with other health care providers¹⁸. Outside determining medicine needs, setting priorities, and procuring and managing drugs¹⁹, the professional pharmacists in Nigeria are still to be involved in PHC to the extent that a substantial impact can be recorded. Since the pharmacist has the leadership role in Nigeria to ensure that the individuals, families, communities and the nation benefit maximally from his/her expertise in health care delivery, the results of this study indicate that the extended role of the pharmacist in ensuring that the patient benefit maximally from drug therapy will significantly contribute to effective health care at the PHC level.

However, it should be considered that the outcome of this study and conclusion thereof may be limited to the relatively

small number of patients involved in the sample studied. Nevertheless, our findings have very important implications for health policy makers in Nigeria in that they indicate that reasonable number of pharmacists should be recruited in PHC settings and good working conditions that will encourage pharmacists to seek for jobs in PHC settings in the country should always be considered in policy making.

CONCLUSION

Although most pharmacists currently working in PHC settings mainly determine medicine needs, set priorities, procure and manage drugs, our results indicate that pharmacists' interventions in PHC settings can significantly improve the quality of life provided for diabetic patients and hence reduce mortality due to the disease, particularly in developing countries. Therefore, recruitment of reasonable number of pharmacists should always be considered in health policies for PHC settings in developing countries. Such policies should include good working conditions that will encourage pharmacists seeking for jobs to favour those in PHC settings.

CONFLICT OF INTEREST

No conflict of interest associated with this article.

AUTHORS CONTRIBUTION

POE and YOD conceived and designed this study while all authors were involved in data collection. POE and SIB prepared the draft of the manuscript which was approved by all authors

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