

2015_IJTDH_16069.pdf

Original Research Article

A cross-sectional study of adherence to lifestyle modifications among ambulatory type 2 diabetic Nigerians in a resource-poor setting of a primary care clinic in Eastern Nigeria.

Abstract

Background: Despite the evidence that lifestyle modifications(LSMs) play important role in glycaemic control, adherence to healthy lifestyles has been variable in Nigeria and this has great impact on the success or failure of pharmacological care.

Aim: The study was designed to determine adherence to LSMs among ambulatory type 2 diabetic Nigerians in a resource-poor setting of a primary care clinic in Eastern Nigeria.

Study Design: This was a primary care clinic-based cross-sectional study carried out on 120 consecutively sampled adult type 2 diabetic patients who were on treatment for at least 3 months at the primary care clinic of a tertiary hospital in Nigeria.

Place and Duration of study: The study was carried out at the department of Family Medicine of Federal Medical Centre, Umuahia, Nigeria from April 2011 to December 2011.

Methodology: Instrument of data collection was pretested, structured and interviewer-administered questionnaire. Each item of lifestyle was scored on a five points Likert scale ordinal responses of always, most times, sometimes, rarely and none. Adherence to lifestyle modifications was assessed in the previous 12 months for alcohol and tobacco use and 7 days for physical activity, dietary fruits, vegetables, fats and oil consumptions. Each of the domains of lifestyle was given a score of one point for healthy lifestyle and zero point for unhealthy lifestyle. Operationally, patients who scored 6 points in all the assessed domains were considered adherent. Awareness of LSMs and Specific adherence to lifestyle factors were also determined.

Results: The awareness and overall adherence rates to LSMs were 88.3% and 22.5% respectively. Specifically, adherence was highest with the non-tobacco use(100.0%) followed by adequate dietary vegetables consumptions(96.7%) and non-use of alcohol(90.8%). Other adherence rates were consumptions of adequate dietary fruits(51.7%), dietary fat and oils(23.3%) and physical activity(22.5%). Adherence was significantly associated with young age <40 years($p=0.039$).

Conclusion: The awareness of LSMs was high but was not translated to comparative adherence. The adherence to non-tobacco use was rated highest and physical activity the lowest. Young age <40 years was significantly associated with adherence. Targeting the domains of inadequate adherence for improvement is a primary care imperative especially in resource-poor settings where there are limited options for healthy living.

Key words: Adherence, adult type 2 diabetics, LSMs, Nigeria, primary care.

37 INTRODUCTION

38 ¹ Diabetes mellitus is the most common endocrine-metabolic disorder in Nigeria[1-4]
 39 ⁵⁵ and other parts of the world.[5,6] The prevalence has been rising at an alarming rate in
 40 the last two decades particularly in nations in socio-economic and demographic
 41 transition.[6,7] This carries with it a concomitant rise in diabetic complications resulting
 42 in decrease quality of life.[2,4,8] These complications include cardiovascular diseases,
 43 blindness, renal failure, lower limb amputations and erectile dysfunction in men among
 44 others.[9,10] These complications significantly contribute to morbidity and death among
 45 ⁵⁴ the type 2 diabetic patients.

46 The management of type 2 diabetics can be burdensome and can distort
 47 personal, family and social dynamics and lifestyles.[1,11] The changing lifestyles ⁵³ as a
 48 result of urbanization and westernization might influence outcome of type 2 diabetic
 49 care.[1,12] Evidence from research has shown that goal glycaemic control involves
 50 factors other than medication adherence. [1,12-14] Among these factors are adherence
 51 to recommended lifestyles. Lifestyle modification is therefore a non-pharmacological
 52 care plan towards diabetes self management efforts generally and glycaemic control to
 53 target specifically.[15,16]

54 Lifestyle refers to the pattern of an individual behavioral choices and practices
 55 with respect to daily activities that are related to elevated or ⁵⁸ reduced risk of type 2
 56 diabetes mellitus or serve as adjunct to its treatment.[17] Major lifestyles shown to
 57 lower blood glucose include weight reduction in overweight or obese diabetics, regular
 58 physical activities, social habits such as moderation or cessation of alcohol consumption

59 and cessation of smoking, adequate dietary fruits and vegetable consumption and
60 reduction of saturated fat intake.[16-18] Adherence with lifestyle modifications is
61 defined conceptually as the degree to which the type 2 diabetic patient actively
62 participate with prescribed lifestyles and involves partnership between the diabetic
63 patient and the clinician.[1,13]

64 In Nigeria, changes in lifestyle due to modernization influence management of type
65 2 diabetes and diabetes mellitus is associated with increased risks of cardiovascular
66 disease and other chronic diseases in the presence of unhealthy lifestyles.[1,4,12] For
67 effective management of type 2 diabetes, it is imperative that holistic approach be
68 adopted taking into consideration prescribed lifestyles amidst other diabetic
69 management constraints in the study area.[19-21] However, little is known about
70 adherence to LSMs among adult type 2 diabetic Nigerians in primary care settings. Of
71 great concern is that primary care clinicians in the study area, though aware of LSMs
72 and its clinical benefits in the management of type 2 diabetes haven't made it a routine
73 to assess for their adherence. This has led to missed opportunities for health education,
74 health promotion and health maintenance among the type 2 diabetic Nigerians. It is
75 hoped that the findings of this study would help to bridge this gap and also generate
76 data for a better understanding of the concept of adherence to LSMs among type 2
77 diabetic patients in primary care. This study invariably underscores the relevance of
78 inquiring for adherence to LSMs amidst other reinforcement mechanism in management
79 of type 2 diabetic patients. It is against this background that the authors were motivated
80 to determine adherence to LSMs among ambulatory type 2 diabetic Nigerians in a
81 resource-poor setting of a primary care clinic in Eastern Nigeria.

82 MATERIALS AND METHODS

83 Ethical consideration and patients consent

84 ¹ Ethical certificate was obtained from the Ethics Committee of the hospital.
 85 Informed consent was also obtained from respondents included in the study. The
 86 hospital has a research unit and ³⁸ Health Research and Ethics Committee which is
 87 registered with the Health Research and Ethics Council of the Federal Ministry of Health
 88 of Nigeria

89 ¹ Study design

90 This was a primary care clinic-based cross sectional study carried out on 120
 91 diabetic patients between April 2011 and December 2011 at the department of Family
 92 ¹ Medicine of a tertiary hospital in Umuahia, Abia state, Eastern, Nigeria.

93 Study setting

94 ¹ The department of Family Medicine serves as a primary care clinic within the
 95 tertiary hospital setting of the Medical Centre. The hospital is 436 bedded. ¹ All adult
 96 patients excluding those who need emergency health care services, paediatric patients
 97 and antenatal women are first seen at the department of Family Medicine where
 98 diagnoses are made. Patients who need primary care are managed and followed up in
 99 the clinic while those who need other specialists care are referred to the respective core
 100 specialist clinics for further management. The clinic is run by consultant family
 101 physicians and postgraduate resident doctors in Family Medicine.

102 Selection criteria

103 The inclusion criteria were adult diabetic patients aged ≥ 18 years who gave
104 informed consent, had been on outpatient treatment for diabetes mellitus for at least 3
105 months in the clinic. This was to ensure that the study population were on prescribed
106 management. The exclusion criteria included critically ill patients, diabetic
107 hypertensives, diabetic patients who were on insulin medication. The eligible patients
108 were consecutively recruited for the study.

109 Sample size determination

110 Sample size was determined using the formula [1,22] for calculating minimum
111 sample size for studying population $< 10,000$. Thus $n_1 = \frac{n}{1 + (n/N)}$ where n_1 = desired
112 sample size when population $< 10,000$; n = desired sample size when the population is
113 more than 10,000, N = estimate of the population size = 200 adult diabetic patients based
114 on annual primary care ambulatory type 2 diabetic patients' attendance records who
115 were managed and provided with continuity of care at the department of Family
116 Medicine in 2010. [1] These 200 adult diabetic patients excluded other ambulatory
117 diabetic patients referred to and being followed up in other medical outpatients' clinics in
118 the Medical Centre in 2010. The diabetic hypertensives were also excluded from this
119 recorded number.

120 To calculate for n = desired sample size when the population $> 10,000$ using the
121 formula $n = \frac{Z^2 pq}{d^2}$ where Z = Standard normal deviation usually set at 1.96 which
122 corresponds to 95% confidence interval, p = Proportion of the population estimated to
123 have a particular characteristic. In view of the absence of similar study on lifestyle
124 modifications among ambulatory type 2 diabetic Nigerians in primary care setting the

125 authors therefore ¹ assumed that 50% of the adult ambulatory type 2 diabetic patients
 126 would adhere to lifestyle modifications ¹ at 95% confidence level and 5% margin of
 127 error.[22] The assumption was likely to maximize the estimated variance and indicated
 128 a representative sample size for the study. [1,22] ⁴ This gave a sample size estimate of
 129 384; thus $q=1.0 - p=1.0 - 0.5=0.5$, ⁴⁰ $d=\text{degree of accuracy set at } 0.05$. Hence $N= (1.96)^2 \times$
 130 $0.5 \times 0.5 / (0.05)^2$. Therefore, $n=384$.

131 For the population $< 10,000$ and substituting in the formula $n_f= n/1+(n/N)$ where
 132 $n=384$; $N=200$. Thus $n_f=132$. ¹ This gave a sample estimate of 132 patients. However,
 133 selected sample size of 120 adult diabetic patients was used based on the duration of
 134 the study.

135 Sampling method

136 The selection of the study population was done consecutively using every adult
 137 ambulatory type 2 diabetic patient who ¹ registered to see the primary care clinicians on
 138 each consulting day during the study period and who met the inclusion ¹ criteria. This
 139 sampling method was judgementally chosen by the authors based on the fact that the
 140 researchers believed that those selected were likely to be representative of the study
 141 population.

142 Methods

143 Data collection tool was designed by the authors to suit Nigerian setting through
 144 robust review of appropriate literature on lifestyle modifications[17,23-35] The specific
 145 domains of lifestyle factors examined were dietary fruits and vegetables consumption

146 and use of dietary saturated fats and oils, physical activity profile, alcohol and tobacco
147 use .

148 Adherence to each of the specific domain of lifestyle factor was given an ordinal
149 score thus: adherence to physical activity=1 point, adherence to alcohol consumption=1
150 point, adherence to tobacco use=1 point, adherence to dietary fruits consumption=1
151 point, adherence to dietary vegetables consumption=1 point and adherence to the use
152 of dietary fats and oils=1 point. Adherence to each domain of lifestyle ¹item was scored
153 in a five points Likert scale ordinal response as follows: All times=5 points, most
154 times=4 points, sometimes=3 points, rarely=2 points and none=1 point. The lifestyle
155 factor of physical activity was assessed by inquiring how often the respondents
156 engaged in physical activities in the previous 7 days. Those who engaged in physical
157 activities all times and most times were considered adherent while those who engaged
158 in physical activities sometimes, rarely and none were considered non-adherent.
159 Subject's occupational; transport, leisure-related and other activities of daily living were
160 taken into account in assessing for the physical activity. Alcohol consumption was
161 assessed in the previous 12 months preceding the study. Patients who consumed
162 alcohol sometimes, rarely and none were adherent while those who use alcohol all
163 times and most times were non-adherent. Tobacco use was evaluated with respect to
164 the use of smoked and smokeless tobacco in the previous 12 months. Patients who
165 responded none were considered adherent while those who responded all times, most
166 times, sometimes and rarely were considered non-adherent. The dietary fruits
167 consumption was evaluated by asking how many days in the previous 7 days did the
168 respondents eat fruits. Those who responded all times and most times were adherent

169 while those who responded sometimes, rarely or none were non-adherent. The dietary
170 vegetables consumption was evaluated by asking how many days in the previous 7
171 days did the respondents eat vegetables. Those who responded all times and most
172 times were adherent while those who responded sometimes, rarely or none were non-
173 adherent. The question on dietary saturated fats and oils consumption was inquired in
174 the previous 7 days and those who responded all times and most times are considered
175 non-adherent while those who responded sometimes, rarely and none were adherent.
176 The dietary fats and oils were classified into saturated and unsaturated oils and fats
177 based on the type of oils and fats available in Nigeria.

178 The information on physical activity and dietary measurements was based on
179 previous 7 days physical activity and dietary recall methods. This method was expected
180 to give required information on physical activity and dietary assessment based on the
181 feasibility and the Nigerian practice population setting. The researchers explained briefly
182 the concept of the study and made vigorous effort to maximize honest response in order
183 to minimize the potential for information bias especially response acquiescence, social
184 desirability response, floor and ceiling responsorial effects.

185 The pre-testing ¹ of the questionnaire was done internally at the primary care clinic
186 using five non diabetic patients. The ¹¹ pre-testing of the questionnaire lasted for two days.
187 ² The respondents for the pre-testing of the questionnaire were selected haphazardly
188 from the clinic. The pretesting was done to find out how the questionnaire would interact
189 with the respondents and ensured that there were no ambiguities. However, no change
190 was necessary after the pre-test as the questions were interpreted with the same
191 meaning as intended. The questionnaire instrument was interviewer-administered.

192 Language used was English Language. However, local languages were ¹used to explain
193 verbally to the patients who could not understand the medical language in the
194 questionnaire. The ¹questionnaire was administered once to each eligible respondent.

195 Operational definitions of terms

196 The researchers defined young adult patients as those aged 18 years to 40
197 years and old adults as those ≥ 40 years. Lifestyle modification refers to the diabetic
198 patients' behavioural daily choices and practices as regards physical activity, alcohol
199 and tobacco use, dietary fruits, vegetables, fats and oils consumptions. Adherence to
200 LSM by diabetic patients means the ³⁵extent to which the type 2 diabetic patient's
201 ³⁵behaviour with respect to following dietary regimen and ³⁵executing other lifestyle
202 ¹changes coincides with clinical prescriptions. Overall adherence to LSM was defined by
203 the authors as score of 6 points in all the six specific domains of LSMs evaluated while
204 non-adherence refers to the score less than 6 points. Specific adherence to LSM refers
205 to adherence to specific lifestyle factor as defined by the 5 points Likert ordinal score
206 described for each specific domain of lifestyle factor in the methods section and scored
207 as: all times=5 points, most times=³⁹4 points, sometimes=3 points, rarely=2 points and
208 none=¹1 point. Awareness of LSM refers to positive responses to the questions on
209 lifestyle factors such as advice by a health professional to stop smoking, start or do
210 more physical activity, little or no alcohol, eat fruits and vegetables always and eat less
211 saturated fats and oils. Primary care refers to the ⁴⁹care provided by physicians
212 specifically trained for comprehensive first contact and continuing care for
213 undifferentiated patients including early detection, management of the patient, health
214 promotion and maintenance.

215 **Statistics**

216 The results generated were analyzed using software Statistical Package for Social
 217 Sciences (SPSS) version 13.0, Microsoft Corporation, Inc. Chicago, IL, USA for
 218 calculation of percentages for categorical variables. Bivariate analysis involved the use
 219 of Chi-Square for testing the significance of associations between categorical variables.
 220 The level of significance was set at $p < 0.05$.

222 **RESULTS:**

223 Out of the one hundred and twenty type 2 diabetic patients studied, twenty
 224 seven (22.5%)(27/120) were adherent to all the domains of LSMs while ninety three
 225 (77.5%)(93/120) were non-adherent. (Table1).

226 One hundred and six (88.3%)(106/120) out of 120 respondents were aware of
 227 LSMs for type 2 diabetes while fourteen (11.7%)(14/120) were unaware of LSMs for
 228 type 2 diabetes mellitus.(Table 2)

229 On the frequency of adherence to specific domain of lifestyle modifications, one
 230 hundred and twenty were adherent to non-use of tobacco (100.0%)(120/120), one
 231 hundred and sixteen(96.7%)(116/120) were adherent to consumption of dietary
 232 vegetables and one hundred and nine(90.8%)(109/120) were adherent to non-use of
 233 alcohol. Other adherence to specific domains of lifestyle modifications are shown in
 234 table 3.

235 Bivariate analysis of the basic demographic variables as related to adherence to
 236 lifestyle factors showed that young age < 40 years ($\chi^2=4.01$, $p\text{-value}=0.039$) was

237 statistically significant while other demographic variables were not statistically
238 significant.(Table 4)

239

240 **DISCUSSION**

241 This study has shown that the overall adherence rate to lifestyle modifications
242 among the type 2 diabetic Nigerians in the study was 22.5%. The finding of this study
243 has corroborated previous reports on inadequate adherence to LSMs among type 2
244 diabetic patients in Nigeria.[1,21] and in other parts of the world such as Egypt. [36]
245 The inadequate adherence to LSMs among the study population is probably due to
246 health beliefs about diabetes in a milieu of poor knowledge and attitude to the diabetic
247 medical condition [19-21] amidst complementary and alternative medicine use.[37]
248 Thus, it is not enough to prescribe LSMs during clinical encounter with diabetic patients
249 in the study area but regular assessment of the level of adherence should be the focus
250 of quality of care rendered to diabetic patients in primary care settings. Clinicians
251 attending to adult type 2 diabetic Nigerians should therefore ask specific questions
252 during clinical consultation in order to discern overt or covert LS limitations requiring
253 modifications. The primary care strategies to improve quality of life and reduce the risk
254 of cardiovascular events should focus not only on blood glucose control with anti-
255 diabetic medications but also on the benefits of lifestyle interventions.[21,38] This will
256 enable adult Nigerians with type 2 diabetes mellitus benefit from the health promotion
257 and risk reduction advantages of lifestyle modifications.

258 The awareness of LSM was 88.3% but adherence to its practice was 22.5%.
259 This gap in practice of LSMs is a cause for concern considering the enormous negative

260 impact of unhealthy lifestyles on diabetic management. Information based on
261 knowledge is power and this knowledge needs to be delivered as part of primary care
262 package for these diabetic patients. If type 2 diabetic patients are aware of the
263 metabolic and diverse benefits of lifestyle modifications, then it becomes easier to
264 educate and counsel them on LSMs. This posits that interventional programs geared
265 towards translating awareness of LSMs to adherence is ⁴⁴ a quality of care imperative
266 among type 2 diabetic patients in primary care practice in the study area. There is
267 therefore the need to make the type 2 diabetic patients committed to adjusting their
268 lifestyles to the recommended lifestyles that have been proven to be safe, effective and
269 patient centred.

270 This study has demonstrated that adherence to no smoking had the highest
271 adherence of 100.0%. Although the practice of smoking generally varies socio-
272 environmentally, adherence to no smoking among the type2 ²¹ diabetic patients in this
273 study could be adduced that some of the respondents who were previous smokers quit
274 smoking not necessarily due to their diabetic condition or fear of diabetes-related risks
275 but for other reasons such as religious reasons.[1,21] In addition no smoking among
276 the female diabetic patients who constituted larger proportion of the study population
277 could be ascribed to socio-cultural reasons as the Nigerian society detests smoking ¹
278 especially among the females. Cessation or abstinence from smoking is beneficial not
279 only for the patients but also for the clinicians, healthcare delivery system and the
280 Nigerian nation. ¹ The detrimental effects of smoking on diabetes have been reported in
281 previous studies.[39,40] According to these reports, smoking decreases insulin
282 absorption and worsens atherogenic progression by increasing peroxidation of

lipoprotein cholesterol and decreasing the antioxidant levels. ¹ Clinicians should therefore be aware of these subtleties because they can influence the management of patient with covert smoking habits or who are exposed to second hand cigarette smoke. Interventional strategies should be adopted in primary care to ensure that type 2 diabetic patients who didn't smoke avoid smoking while those who cease from smoking didn't recourse to it.

Dietary vegetables consumption had second highest adherence among the ²¹ type 2 diabetic patients. This finding could be a reflection of the Nigerian family diet in which vegetables are predominantly served as part of the daily meals while fruits are eaten by choice as snacks. In addition, there is high cost of fruits in the study area.[41] However, there is need to encourage type 2 diabetic patients to adjusting their lifestyle to the recommended dietary vegetable consumption that have been proven to be beneficial among the diabetics. In this regard, translating adherence practice to the desired health action that could promote healthy consumption of dietary vegetables among the type diabetic patients should be improved.

Alcohol had the third highest adherence. This finding could be due to the awareness of the effect of alcohol on anti-diabetic medications especially the pressor effect which discourages these patients from indulging in alcohol ingestion.[42,43] In ⁴ addition, type 2 diabetic patients in the study area had limited social interactions amidst widespread notions that alcohol makes anti-diabetic medications ineffective. More so, some type 2 diabetic patients avoided alcohol due to financial constraints involved in procuring alcohol in addition to anti-diabetic medications. Furthermore, the interactions of type 2 diabetic patients in search of healing with conventional religious organizations

306 were likely to lead to abstinence from alcohol consumption. Adherence to alcohol use
 307 should therefore be part of the primary care concerns in resource-poor settings
 308 especially among ⁴non-adhering type 2 diabetic patients.

309 Physical activity had the lowest ⁴adherence rate in this study. This finding is in
 310 consonance with the reports that physical activity is inadequate among type 2
 311 diabetics.[36,44] Adherence to recommended physical activity among the type diabetic
 312 patients is therefore critical and indispensable part of the management because of its
 313 beneficial effects.[44,45] According to these recommendations, physical activity
 314 improves blood glucose and enhances cardiovascular health. Appreciating the role of
 315 physical activity among type 2 diabetic patients would sensitize primary care clinicians
 316 to see every encounter with type 2 diabetic patients as an opportunity to render
 317 therapeutic and prophylactic physical activity. The relevance of physical activity in type
 318 2 diabetics is an important management challenge that should be modified during
 319 consultation in primary care. Screening for physical activity profile and initiation and
 320 implementation of necessary measures would help these patients improve their quality
 321 of care and cardiovascular health.

322 The adherence to lifestyle modifications was significantly higher in young
 323 adults patients compared to old adult patients. Although the factors responsible for this
 324 higher adherence among young adults' patients are variable but this could be ascribed
 325 to the fact that young adult ²¹diabetic patients were likely to be physically active and have
 326 social interactions that enhance their attitude and practice of lifestyle modifications for
 327 their diabetic conditions. More so, the young adult patients in the study area were likely
 328 to enjoy wider patient companion to the hospital and dependent on their family

329 members for diabetic care. This companionship to the hospital invariably leads to
330 supervision and monitoring of prescribed lifestyles by their family members who were
331 more proximal to them. However, due to their dependent living the young adult diabetic
332 patients ¹ may not be able to afford the cost of alcohol or tobacco in addition to the cost of
333 diabetic treatment. The young adult diabetic patients, by virtue of understanding that
334 their diabetic condition requires lifelong management were likely to adhere to prescribed
335 lifestyle modifications. The presence of a healthy lifestyle among young adult diabetic
336 patients should mandate the clinician to encourage and motivate improvement in
337 prescribed lifestyle which will impact on the success of other diabetic therapeutic
338 interventions. The primary care physicians should be aware of this disposition in order
339 to tailor lifestyle interventions to accommodate the needs of young adult diabetic
340 patients amidst other diverse diabetic care resources.

341 **Study implications**

342 Nigeria is currently experiencing rapid industrialization, westernization and
343 urbanization which have the tendency of leading to changes in lifestyles with
344 implications for type 2 diabetic cares. ³ Despite the publications of relevant clinical trials
345 on the benefits of lifestyle modifications among type 2 diabetic patients, adherence to
346 these lifestyle factors still remain suboptimal in primary care settings particularly in
347 resource poor settings where there are limited options for healthy living. The magnitude
348 of poor adherence to lifestyle modifications in resource poor Nigerian primary care
349 environment is better imagined than seen amidst societal belief ⁵⁶ on the causes of type 2
350 diabetes mellitus ¹ and will not favour the attainment of clinically therapeutic outcome
351 among type 2 diabetic patients. Appreciating the gap in adherence to lifestyle

352 modifications and narrowing them will enable type 2 diabetic Nigerians benefit timely
353 from recommended lifestyle interventions. This study will therefore sensitize primary
354 care physicians in the study area to routinely evaluate for lifestyle factors during clinical
355 consultations with type 2 diabetic patients and will help to prevent missed opportunities
356 for counselling, health education, health promotion, risk reduction and health
357 maintenance on healthy lifestyles.

358 **Study limitations**

359 The authors recognized the following limitations: First and foremost, the reliability
360 of the qualitative responses on adherence to specific dimensions of lifestyles was
361 subject to systematic error ³ since some patients couldn't clinically provide true responses
362 to adherence to lifestyle factors. However, effort was made to minimize this threat by
363 pre-testing the questionnaire. In addition, research assistants received training and
364 instruction on standard interview procedure and respondents were assured of
365 anonymity. Furthermore, socio-cultural background could explain the rarity of some of
366 the behavioural lifestyle factors among the respondents. In order to minimize recall
367 biases the questions were structured in a manner that will enable the researcher obtain
368 ⁴⁷ information relevant to the objectives of the study. This objectivity was also maintained
369 by not fielding misleading questions. The researchers ensured that questions were not
370 ambiguous or presented to the respondents in such a way as to communicate different
371 meanings that could generate inaccurate and inconsistent responses.

372 More so, this study was not an all inclusive study on lifestyle factors for diabetic
373 management but on some selected common lifestyles ⁴³ such as physical activity, alcohol
374 and tobacco use, dietary consumption of fruits, vegetables, fats and oils. The

375 assessment for the lifestyle factors was not quantitative as regards the cardiovascular
376 relevance of Likert ordinal scores for specific domains of lifestyle factors.

377 Finally the limitation imposed by the relative small sample size for the study is
378 recognized. However, this was the number of patients seen within the duration of the
379 study. Moreover, the sample for the study was drawn from family medicine clinic of the
380 hospital. Hence, the findings of this study may not be general conclusions regarding
381 diabetic patients attending medical outpatient clinics of the department of internal
382 medicine of the hospital.

383 **Strength of the study**

384 This research is the first study in primary care to highlight lifestyle modifications
385 among ambulatory adult type 2 diabetic Nigerians attending primary care clinics.

386

387 **CONCLUSION**

388 The awareness of lifestyle modifications was 88.3% but was not translated to
389 comparative adherence(22.5%). The adherence to non-tobacco use was rated highest
390 and physical activity the lowest. Young age <40 years was significantly associated with
391 adherence. Targeting the domains of inadequate adherence for improvement is a
392 primary care imperative especially in resource-poor settings where there are limited
393 options for healthy living.

394 **FUTURE RESEARCH STUDIES**

395 Future research directions are recommended on quantitative assessment of
396 lifestyle factors among ambulatory type 2 diabetic patients in the study setting in order
397 to further explore the effects of adherence to lifestyle modifications on glycaemic

398 control. This will provide valuable robust clinic-epidemiological data for comparative
399 purposes.

400

401 CONSENT

402 All authors declare that 'written ¹informed consent was also obtained from
403 respondents included in the study.

404 ETHICAL APPROVAL

405 ¹Ethical certificate was obtained from the Ethics Committee of the hospital.

406 REFERENCES

- 407 ²1. Iloh GUP, Ofoedu JN, Njoku PU, Amadi AN, Godswill-Uko EU. ⁴Blood Glucose
408 Control and Medication Adherence Among Adult Type 2 Diabetic Nigerians
409 Attending A Primary Care Clinic in Under-resourced Environment of Eastern Nigeria.
410 North Am J Med Sci 2012; 4:310-315.
- 411 ³³2. Ogbera AO, Chinenye S, Onyekwere A, Fasanmade O. Prognostic indices of
412 diabetes mellitus mortality. Ethnicity and Disease 2007; 17: 721-725.
- 413 ⁵3. Eregie A, Unadike BC. Common causes of morbidity and mortality amongst diabetic
414 admissions at the University of Benin Teaching Hospital, Benin City, Nigeria. Pak J
415 Med Res 2010; 49: 89-93.
- 416 ⁵4. Ogbera AO, Awobusuyi J, Unachukwu C, Fasanmade O. Clinical features, predictive
417 factors and outcome of hyperglycaemic emergencies in a developing country. BMC
418 Endocr Disord 2009;9:9.

- 419 5. Zouvanis M, Pieterse AC, Seffel HC, Joffee BI. Characteristics and outcome of
420 hyperglycaemic emergencies in Johannesburg Africans. Diabetic Medicine 2004; 14:
421 603-606.
- 422 6. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes:
423 Estimates for the year 2000 and projections for 2030. Diabetes Care 2004; 27: 1047-
424 1053.
- 425 7. Malan L, Malan NT, Wissing MP, Seedat YK . Coping with urbanization. A
426 cardiometabolic risk? The THUSA study. Biol Psychol 2008; 79: 323-328.
- 427
- 428 8. Iloh GUP, Uchenna NR, Obiegbu NP. Risk factors of pre-diabetes among adult
429 Nigerians with essential hypertension in resourced-constrained setting of a primary
430 care clinic in Eastern Nigeria. American Journal of Health Research 2013; 1: 56-64.
- 431 9. Lawal M. Management of diabetes mellitus in clinical practice. Br J Nurs 2008; 17:
432 1106-1113.
- 433 10. Siminialayi IM, Emem-Chioma PC. Type 2 Diabetes Mellitus: A review of
434 pharmacological treatment. Niger J Med 2006; 15: 207-214.
- 435 11. Oyegbade OO, Abioye-Kuteyi EA, Kolawole BA, Ezeoma IT, Bello IS. Screening for
436 diabetes mellitus in a Nigerian Family Practice Population. S A Fam Pract 2007;
437 49(8):15.
- 438 12. Uloko AE, Ofoegbu EN, Chinenye S, Fasanmade OA, , Fasanmade AA, Ogbera
439 AO, et al. Profile of Nigerians with diabetes mellitus-Diabcare Nigeria study
440 group(2008): Results of a multicenter study. Indian J Endocrinol Metab 2012; 16:
441 558-564.

- 442 13. Adisa R, Alutundu MB, Fakeye TO. Factors contributing to non-adherence to oral
443 hypoglycaemic medications among ambulatory type 2 diabetes patients in
444 Southwestern Nigeria. Pharm Pract(Internet) 2009; 7: 163-169.
- 445 14. Chinenye S, Unachukwu CN, Hart A. Diet and Diabetes Mellitus-Guidelines for
446 Health Care Providers in the Tropics. Niger Med Pract 2005; 6:113-116
- 447 15. Fox C, Kuvert A. Intensive education for lifestyle change in diabetes. BMJ 2003;
448 327: 1120-1121.
- 449 16. Trento M, Passera P, Barjadi M, Tomalino M, Grass G, Borgo E, et al. Lifestyle
450 interventions by group care prevents deterioration of type 2 diabetes: a 4-year
451 randomized controlled clinical trial. Diabetologia 2002; 45: 1231-1239
- 452 17. Madaki AJK. Lifestyle medicine in primary health care. Nigerian Journal of Family
453 Practice 2012 ; 2: 39-41.
- 454 18. Norris SL, Lau J, Smith SJ, Schmid CH, Engelgau MM. Self-management education
455 for adults with type 2 diabetes: a meta-analysis of the effect on glycaemic control.
456 Diabetes Care 2002; 25: 1159-1171.
- 457 19. Marian AO, Joy IO. Knowledge, Attitudes and Practices of People with Type 2
458 Diabetes Mellitus in a Tertiary Health Care Centre, Umuahia, Nigeria. J Diabetes
459 Metab 3; 187.

- 460 20. Okolie VU, Ehiemere OI, Iheanacho NP, Kalu-Igwe IN. ²³ Knowledge of diabetes
461 management and control by diabetic patients at Federal Medical Centre Umuahia
462 Abia State, Nigeria. *Int J Med Med Sci* 2009; 1: 353-358.
- 463 21. ¹ Nwankwo CH, Nandy B, Nwankwo BO. Factors influencing diabetes management
464 outcome among patients attending government health facilities in south-east Nigeria.
465 *Intern J Trop Med* 2010; 5: 28-36.
- 466 22. ³ Araoye MO. Sample size determination. *Research Methodology with Statistics for*
467 *Health and Social Sciences*, Ilorin: Nathadex Publishers, 2004; p.115–121.
- 468
- 469 23. ⁶ Lakshminarayanan S, Bala SM, Ramanujam M, Kannan G. Effectiveness of
470 physical activity promotion in blood pressure and blood sugar reduction: A
471 community-based intervention study in rural south India. *J Fam Community Med*
472 2012; 19: 81-87.
- 473 24. ¹¹ WHO. Global strategy on diet, physical activity and health. *Bulletins of the WHO*
474 2006; 5: 16-18.
- 475 25. ²⁷ US Preventive Services Task Force. Behavioural counseling in primary care to
476 promote a healthy diet. Recommendations and rationale. *Am Fam Physicians*
477 2003; 67: 2573-2576.
- 478 26. ³⁶ Willet WC. Diet and health: What should we eat? *Science* 1994; 264: 532-537.
- 479 27. ¹ McCullough ML, Willett WC. Evaluating adherence to recommended diets in adults:
480 the Alternate Healthy Eating Index. *Public Health Nutr.* 2006; 9(1A):152-157.

- 481 28. ¹⁰ Chatterjee JS. From compliance to concordance in diabetes. *J Med Ethics* 2006;
482 32: 507-510.
- 483 29. ¹⁸ WHO. Survey of the STEPwise approach for the surveillance of risk factors for non-
484 communicable diseases, Brazzaville, WHO, Region office for Africa, 2007.
- 485 30. ¹² Knowler W, Barrett-connor E, Fowler S, Hamman R, Lachin J, Walker E, Nathan D.
486 Reduction in the incidence of type 2 diabetes with lifestyle intervention or
487 metformin. *N. Engl J Med* 2002; 346: 393-403.
- 488 31. ¹⁷ Carter P, Gray LJ, Troughton J, Khunti K, Davies MJ. Fruit and vegetable intake and
489 incidence of type 2 diabetes mellitus: systematic review and meta-analysis. *BMJ*
490 2010; 341: c4229.
- 491 32. ⁹ Ikem RT, Kolawole BA, Ojofeitimi EO, Salawu A, Ajose OA, Abiose S et al. A
492 Controlled Comparison of the Effect of a High Fiber Diet on the Glycaemic and Lipid
493 Profile of Nigerian Clinic Patients with Type 2 Diabetes. *Pakistan Journal of Nutrition*
494 2007; 6: 111-116.
- 495 33. ³¹ Crandall JP, Polsky S, Howard A, Perreault L, Bray GA, Edelstein SL, et al. Alcohol
496 consumption and diabetes risk in the Diabetes Prevention. *American Journal of*
497 *Clinical Nutrition* 2009; 90: 595-601.
- 498 34. ³⁰ Howard AA, Arnsten JH, Gourevitch MN: Effect of alcohol consumption on diabetes
499 mellitus. *Ann Intern Med* 2004; 140:211-219.
- 500 35. ²⁶ Nobuko S, Mitsuhiro N, Takashi K. Alcohol consumption and risk of type 2 diabetes
501 in Japanese: a systematic review. *Asia Pac J Clin Nutr* 2008; 17: 545-551.

- 502 36. Ibrahim NR, Attia SG, Sallam SA, Fetohy EM, El-Sewi. Physicians' therapeutic
503 practice and compliance of diabetic patients attending rural primary health care
504 units in Alexandria. J Fam Community Med 2010; 17: 121-128.
- 505 37. Ogbera AO, Dada O, Adeleye F, Jewo PI. Complementary and Alternative Medicine
506 Use in Diabetes Mellitus. West Afr J Med 2010; 29: 158-162.
- 507 38. Levitt NS. Diabetes in Africa: Epidemiology, management and healthcare
508 challenges. Heart 2008; 94: 1376-1382.
- 509 39. Muhauser I. Smoking and diabetes mellitus. Practical Diabetes Digest 1990; 7: 10-
510 15.
- 511 40. Wannamethee SG, Shaper AG, Perry IJ, British Regional Heart Study. Smoking as
512 a modifiable risk factor for type 2 diabetes in middle-aged men. Diabetes Care 2001;
513 24: 1590-1595.
- 514 41. Iloh GUP, Amadi AN, Ikwudinma AO, Njoku PU. Prevalence and family biosocial
515 predictors of abdominal obesity among adult Nigerian Africans in a resource
516 constrained setting of a rural hospital in Eastern Nigeria. European Journal of
517 Preventive Medicine 2013; 1: 70-78.
- 518 42. Howard AA, Arnsten JH, Gourevitch MN. Effect of alcohol consumption on diabetes
519 mellitus. Ann Intern Med 2004; 140: 211-219.
- 520 43. Baliunas DD, Taylor BJ, Irving H, Roereke M, Patra J, Mohapatra S, et al. Alcohol
521 as a risk factor for type 2 diabetes: A systematic review and meta-analysis.
522 Diabetes Care 2009; 32: 2123-2132.

- 523 44. Lindstrom J, Ilanne-Parikka P, Peltonen M, Uusitupa M, Tuomilehto J. The finnish
524 diabetes prevention study (DPS). Lifestyle intervention and 3-year results on diet
525 and physical activity. Diabetes Care 2003; 26:3230-3236.
- 526 45. American Diabetes Association and National Institute of Diabetes, Digestive and
527 Kidney Diseases. The prevention or delay of type 2 diabetes. Diabetes Care 2002;
528 23:742-749.

529

530 **Table 1: Frequency of adherence to all domains of LSMs among type 2 diabetic**
531 **patients.(N=120)**

Variable	Number	Percentage
Adherence to LSMs		
Yes	27	22.5
No	93	77.5

532

533 **Table 2: Awareness of LSMs for type 2 diabetic among the study**
534 **participants.(N=120)**

Variable	Number	Percentage
Awareness of LSMs		
Yes	106	88.3

No	14	11.7
----	----	------

535

536 **Table 3: Frequency of adherence to specific domains of LSMs among the type 2**
537 **diabetic patients (N=120)**

538

Variable	Number	Percentage
Adherence to		
Non-use of tobacco	120	100.0
Consumption of dietary vegetables	116	96.7
Consumption of alcohol	109	90.8
Consumption of dietary fruits	62	51.7
Consumption of dietary fats and oils	28	23.3
Physical activity	27	22.5

539

540

541 **Table 4: Association between adherence to LSMs and basic demographic**
 542 **variables of the study participants (N=120)**

Variable	Adherence		χ^2	p-value
	Yes	No		
	Number(%)	Number(%)		
Age(years)				
18-39	18(66.7)	5(5.4)		
≥40	9(33.3)	88(94.6)	4.01	.039*
42 Sex				
Male	12(44.4)	33(35.5)		
Female	15(55.6)	60(64.5)	7.15	.196
Marital status				
Single	4(14.8)	2(2.2)		
Married	15(55.6)	60(64.5)		
Separated or divorced	2(7.4)	2(2.2)		
Widowed	6(22.2)	29(31.1)	5.12	.793

UNDER PEER REVIEW

Education

Primary and less	8(29.6)	20(21.5)		
Secondary and more	19(70.4)	73(78.5)	8.05	.061

Occupation

Trading	3(11.1)	44(47.3)		
Public/Civil Servants	10(37.1)	20(21.5)		
Farming	6(22.2)	4(4.3)		
Clergy	5(18.5)	3(3.2)		
Drivers	0(0.0)	4(4.3)		
Artisans	0(0.0)	2(2.2)		
Retired	3(11.1)	16(17.2)	5.77	.207

543 *=Significant

544

34%

SIMILARITY INDEX

PRIMARY SOURCES

- | | | |
|----------|---|------------------------|
| 1 | www.ncbi.nlm.nih.gov
Internet | 841 words — 12% |
| <hr/> | | |
| 2 | article.sciencepublishinggroup.com
Internet | 112 words — 2% |
| <hr/> | | |
| 3 | phcfm.org
Internet | 102 words — 1% |
| <hr/> | | |
| 4 | Pascal, Iloh G. U.; Ofoedu, John N.; Uchenna, Njoku P.; Nkwa, Amadi A. and Uchamma, Godswill-Uko E..
"Blood Glucose Control and Medication Adherence Among Adult Type 2 Diabetic Nigerians Attending A Primary Care Clinic in Under-resourced Environment of Eastern Nigeria", North American Journal of Medical Sciences, 2012.
Publications | 88 words — 1% |
| <hr/> | | |
| 5 | www.iosrjournals.org
Internet | 73 words — 1% |
| <hr/> | | |
| 6 | www.jfcmonline.com
Internet | 68 words — 1% |
| <hr/> | | |
| 7 | www.thefreedictionary.com
Internet | 52 words — 1% |
| <hr/> | | |
| 8 | Oostdam, Nicolette, Judith Bosmans, Maurice GAJ Wouters, Elisabeth MW Eekhoff, Willem van Mechelen, and Mireille NM van Poppel. "Cost-effectiveness of an exercise program during pregnancy to prevent gestational diabetes: Results of an economic evaluation alongside a | 52 words — 1% |

9	www.nice.org.uk Internet	51 words — 1%
10	www.biomedcentral.com Internet	41 words — 1%
11	www.njcponline.com Internet	39 words — 1%
12	liu.diva-portal.org Internet	36 words — 1%
13	10002063hud.ac.uk Internet	34 words — < 1%
14	www.gidm.it Internet	34 words — < 1%
15	garj.org Internet	34 words — < 1%
16	www.slideshare.net Internet	32 words — < 1%
17	www.diabetes.nhs.uk Internet	31 words — < 1%
18	www.phcfm.org Internet	31 words — < 1%
19	stroke.ahajournals.org Internet	30 words — < 1%
20	A. Esteghamati. "Trends of diabetes according to body mass index levels in Iran: results of the national Surveys of Risk Factors of Non-Communicable Diseases (1999-2007) : Recent trends of diabetes in Iran", Diabetic	30 words — < 1%

21 "Posters", Diabetic Medicine, 12/2006 29 words — < 1%
CrossCheck

22 www.ispub.com 27 words — < 1%
Internet

23 www.jdmdonline.com 26 words — < 1%
Internet

24 Sabitu, K.. "AWARENESS OF OCCUPATIONALHAZARDS AND UTILIZATION OF SAFETYMEASURES AMONG WELDERS IN KADUNAMETROPOLIS, NORTHERN NIGERIA", Annals of African Medicine/15963519, 20090301 25 words — < 1%
Publications

25 Selim, Assmaa O., Sally A. Selim, and Rania A. Wahadan. "Renal corpuscle alterations induced by gentamicin in adult male albino rats and a possible protective role of ginger : histological and biochemical study", The Egyptian Journal of Histology, 2012. 24 words — < 1%
CrossCheck

26 www.integration.samhsa.gov 22 words — < 1%
Internet

27 Whyte, John. "The Metabolic Syndrome: Early Clues, Effective Management.", Consultant, Sept 15 2005 Issue 22 words — < 1%
Publications

28 Schwellnus, MP, DN Patel, CJ Nossel, M Dreyer, S Whitesman, and EW Derman. "Healthy lifestyle interventions in general practice Part 6: Lifestyle and metabolic syndrome", South African Family Practice, 2009. 22 words — < 1%
CrossCheck

29 E. O. Okoro. "Effects of dietary sucrose intake on glycaemic control in Nigerians with type 2 21 words — < 1%

-
- 30 diabeteswatch.org 20 words — < 1%
Internet
-
- 31 Chen Liu. "Associations of alcohol consumption with diabetes mellitus and impaired fasting glycemia among middle-aged and elderly Chinese", BMC Public Health, 2010 20 words — < 1%
CrossCheck
-
- 32 www.bioline.org.br 20 words — < 1%
Internet
-
- 33 www.ajol.info 18 words — < 1%
Internet
-
- 34 health-innovations.us 17 words — < 1%
Internet
-
- 35 Bernard Vrijens. "A new taxonomy for describing and defining adherence to medications : New taxonomy for adherence to medications", British Journal of Clinical Pharmacology, 05/2012 15 words — < 1%
CrossCheck
-
- 36 www.circ.ahajournals.org 14 words — < 1%
Internet
-
- 37 www.bmj.com 14 words — < 1%
Internet
-
- 38 Christa van Wyk. "Country Report South Africa", Veröffentlichungen des Instituts für Deutsches Europäisches und Internationales Medizinrecht Gesundheitsrecht und Bioethik der Universitäten Heidelberg und Mannheim, 2010 12 words — < 1%
CrossCheck
-
- 39 www.3kbioxml.com 11 words — < 1%
Internet

40 Ogunmola, Jeffrey Olarinde, Olatunji Oladosu, and Adeyemi Michael Olamoyegun. "Relationship between socioeconomic status and HIV infection in a rural tertiary health center", HIV/AIDS - Research and Palliative Care, 2014.

CrossCheck

11 words — < 1%

41 www.academicjournals.org

Internet

11 words — < 1%

42 T. M. Trippett. "Phase I and Pharmacokinetic Study of Cetuximab and Irinotecan in Children With Refractory Solid Tumors: A Study of the Pediatric Oncology Experimental Therapeutic Investigators' Consortium", Journal of Clinical Oncology, 10/20/2009

CrossCheck

9 words — < 1%

43 Spijkerman, A. M. W., D. L. van der A, P. M. Nilsson, E. Ardanaz, D. Gavrilu, A. Agudo, L. Arriola, B. Balkau, J. W. Beulens, H. Boeing, B. de Lauzon-Guillain, G. Fagherazzi, E. J. M. Feskens, P. W. Franks, S. Grioni, J. M. Huerta, R. Kaaks, T. J. Key, K. Overvad, D. Palli, S. Panico, M. L. Redondo, O. Rolandsson, N. Roswall, C. Sacerdote, M.-J. Sanchez, M. B. Schulze, N. Slimani, B. Teucher, A. Tjonneland, R. Tumino, Y. T. van der Schouw, C. Langenberg, S. J. Sharp, N. G. Forouhi, E. Riboli, and N. J. Wareham. "Smoking and Long-Term Risk of Type 2 Diabetes: The EPIC-InterAct Study in European Populations", Diabetes Care, 2014.

CrossCheck

9 words — < 1%

44 Yvonne, Omiepirisa. "Diabetes Mellitus in Developing Countries and Case Series", Diabetes Mellitus - Insights and Perspectives, 2013.

CrossCheck

9 words — < 1%

45 rvti.ac.ke

Internet

9 words — < 1%

46 www.cadre-diabetes.org

Internet

9 words — < 1%

47	Internet	8 words — < 1%
48	eprints.soton.ac.uk Internet	8 words — < 1%
49	Bulik, R. J. "Human factors in primary care telemedicine encounters", <i>Journal of Telemedicine and Telecare</i> , 2008. CrossCheck	8 words — < 1%
50	Raniah M. Jamous. "Adherence and satisfaction with oral hypoglycemic medications: a pilot study in Palestine", <i>International Journal of Clinical Pharmacy</i> , 09/15/2011 CrossCheck	8 words — < 1%
51	abcproject.eu Internet	8 words — < 1%
52	ADISA, Rasdaq and FAKEYE, Titilayo O.. "Effect of number and type of antidiabetes medications on adherence and glycemia of ambulatory type 2 diabetes patients in southwestern Nigeria", <i>Pharmacy Practice</i> (18863655), 2013. Publications	8 words — < 1%
53	Adisa, Rasdaq. "Medication adherence among ambulatory patients with type 2 diabetes in a tertiary healthcare setting in Southwestern Nigeria", <i>Pharmacy Practice</i> (18863655)/18863655, 20110401 Publications	8 words — < 1%
54	Z. H. Wang. "Ketoacidosis occurs in both Type1 and Type2 diabetes a population-based study from Northern Sweden", <i>Diabetic Medicine</i> , 07/2008 CrossCheck	8 words — < 1%
55	Sabir, A. A.; Isezuo, S. A. and Ohwovoriole, A. E.. "Dysglycaemia and its Risk Factors in an Urban Fulani Population of Northern Nigeria", <i>West African Journal of Medicine</i> , 2011. Publications	8 words — < 1%

56 Lucie Nield. "Dietary advice for treatment of type 2 diabetes mellitus in adults", Cochrane Database of Systematic Reviews Reviews, 07/18/2007 7 words — < 1%
CrossCheck

57 Vivian C. Tuei. "Type 2 diabetes mellitus and obesity in sub-Saharan Africa", Diabetes/Metabolism Research and Reviews, 07/19/2010 7 words — < 1%
CrossCheck

58 Joosten, Michel M. Chiuve, Stephanie E. . "Changes in alcohol consumption and subsequent risk of type 2 diabetes in men.(ORIGINAL ARTICLE)(Clin", Diabetes, Jan 2011 Issue 7 words — < 1%
Publications

59 "Standards of Medical Care in Diabetes--2013", Diabetes Care, 2013. 6 words — < 1%
CrossCheck

EXCLUDE QUOTES OFF
EXCLUDE BIBLIOGRAPHY OFF

EXCLUDE MATCHES OFF