

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 Diabetes mellitus is the most common endocrine-metabolic disorder in Nigeria[1-4]
 39 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 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 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 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

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

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

82 MATERIALS AND METHODS

83 Ethical consideration and patients consent

84 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 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 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 Medicine of a tertiary hospital in Umuahia, Abia state, Eastern, Nigeria.

93 Study setting

94 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. 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

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

Sample size determination

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

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

125 authors therefore assumed that 50% of the adult ambulatory type 2 diabetic patients
 126 would adhere to lifestyle modifications 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] This gave a sample size estimate of
 129 384; thus $q=1.0 - p=1.0 - 0.5=0.5$, $d=\text{degree of accuracy set at } 0.05$. 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 $n_f=132$. 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 registered to see the primary care clinicians on
 138 each consulting day during the study period and who met the inclusion 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 item 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 of the questionnaire was done internally at the primary care clinic
186 using five non diabetic patients. The pre-testing of the questionnaire lasted for two days.
187 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.

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

Operational definitions of terms

The researchers defined young adult patients as those aged 18 years to 40 years and old adults as those ≥ 40 years. Lifestyle modification refers to the diabetic patients' behavioural daily choices and practices as regards physical activity, alcohol and tobacco use, dietary fruits, vegetables, fats and oils consumptions. Adherence to LSM by diabetic patients means the extent to which the type 2 diabetic patient's behaviour with respect to following dietary regimen and executing other lifestyle changes coincides with clinical prescriptions. Overall adherence to LSM was defined by the authors as score of 6 points in all the six specific domains of LSMs evaluated while non-adherence refers to the score less than 6 points. Specific adherence to LSM refers to adherence to specific lifestyle factor as defined by the 5 points Likert ordinal score described for each specific domain of lifestyle factor in the methods section and scored as: all times=5 points, most times=4 points, sometimes=3 points, rarely=2 points and none=1 point. Awareness of LSM refers to positive responses to the questions on lifestyle factors such as advice by a health professional to stop smoking, start or do more physical activity, little or no alcohol, eat fruits and vegetables always and eat less saturated fats and oils. Primary care refers to the care provided by physicians specifically trained for comprehensive first contact and continuing care for undifferentiated patients including early detection, management of the patient, health promotion and maintenance.

Statistics

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

RESULTS:

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

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

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

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

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

DISCUSSION

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

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

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

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

lipoprotein cholesterol and decreasing the antioxidant levels. 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 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 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 non-adhering type 2 diabetic patients.

309 Physical activity had the lowest adherence 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 diabetic 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

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

Study implications

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

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

Study limitations

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

More so, this study was not an all inclusive study on lifestyle factors for diabetic management but on some selected common lifestyles such as physical activity, alcohol 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 informed consent was also obtained from
403 respondents included in the study.

404 **ETHICAL APPROVAL**

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

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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
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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
Age(years)	Yes	No		
	Number(%)	Number(%)		
18-39	18(66.7)	5(5.4)		
≥40	9(33.3)	88(94.6)	4.01	.039*
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

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