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Assessment of Dietary and Life-Style Behaviors of Diabetic and Non-Diabetic Jordanian Atorvastatin Users

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Abstract

Objective: To assess and compare the dietary and life-style behaviors among the diabetic and non-diabetic atorvastatin users.

Materials and Methods: A cross-sectional study was conducted on 359 Jordanian patients aged more than 18 years old, using atorvastatin 20 mg/day for at least 6 months and attending the diabetic and endocrine clinics at King Abdullah University Hospital. Dietary and life-style behaviors were assessed and compared among diabetic and non-diabetic patients.Descriptive statistics, Chi-square, student t-test and correlations were performed along with binary logistic regression analysis to examine collectively the association between diabetes and the significant risk factors identified from the univariate analysis.

Results: Non-diabetic patients were significantly ($P< 0.05$) younger, follow low calorie weight reducing diet, loss more weight after diet, eating snacks consist of (artificial juice, ice creams, sweets, chocolates and biscuits, taking supplements and drink amount of alcohol more than the diabetic patients. Female patients ($p<0.001$; OR=3.15) eating (sweets, chocolates and biscuits) ($p<0.05$; OR=0.53) and having chronic diseases ($p<0.001$; OR=10.27) were more likely to develop diabetes.

Conclusions and Implications: Dietary and life-style behaviors did not differ significantly among diabetic and non-diabetic atorvastatin users. Diet and physical activity life-styles remain essentially unchanged for many patients after using atorvastatin. Involving patients in preventive programs promotes the successful adoption of healthy lifestyles.

Keywords: Diabetes; Atorvastatin; Diet; Life-Style; Behavior

Introduction

Atorvastatin is a member of lipid lowering drugs called statins. It is prescribed for most of type 2 diabetic patients and non-diabetic patients with hyperlipidemia. In general, patients have hyperlipidemia or hypercholosteremia either diabetic or non-diabetic should modify their dietary and life-style behaviors to improve their lipid profile. However, little is known, of the impact of life-style advices or of patients' behavior around the time of starting statin therapy in primary care.

All over the world, diabetes is one of the rapidly increasing metabolic disorder and an important public health issue. Recently, the International Diabetes Federation (IDF) in 2013, estimated that the number of diabetic adults in the world will increase from 382 million in 2013 to 592 million in less than 25 years[1]. Jordan, like the rest of the world, is experiencing a remarkable increase over the past 10 years in the prevalence of diabetes, and has been reported to be 14.9 % and 12.5 % in men and women, respectively [2].

Several studies have reported that type 2 diabetes can efficiently prevented through a healthy life-style [3,4] such as maintaining a normal body weight [3], being physically active [5], cessation from smoking [6], and eating a healthy diet [7]. Moreover, the moderation in alcohol consumption has been associated with lowering the risk of type 2 diabetes compared with non-alcoholic or with excessive consumption [8,9]. Thus, moderate alcohol consumption could be considered as a favorable behavioral life-style factor that decreases the risk of type 2 diabetes [10].

The professional diabetes management is based on the balance between healthy eating, physical exercise and medication [11]. However, the problem is most of diabetic patients have little knowledge in determining the recommended quality and quantity of food they should eat to control their blood glucose level. Patient choices in food consumption were based on diabetes nutrition education which concentrates on food intake with low fat, low sodium and high dietary fibers [12].

Evidence suggests that changing of the lifestyle can enhance the effect of statins in lowering cholesterol levels [13]. Although, the lifestyle behaviors of statin users do not differ from non-users [14]. Therefore, emphasis on the importance of healthy lifestyles and on the role of health professionals in providing their patients with health education, promotion of healthy lifestyle and supporting for changing their behavior is an increasing need [15].

Despite of these evidences, previous studies concentrate on healthy life-style behaviors among diabetic patients regardless of the medications prescribed. Therefore, this study objective was to assess and compare the dietary and life-style behaviors among the diabetic and non-diabetic atorvastatin users.

Methods

Study Design and Humman Participants

The study design was a cross-sectional conducted at King Abdullah University Hospital (KAUH). The participants were Jordanian patients attending the Diabetes and Endocrine Clinics. The study participants were selected by simple random sampling method from March 2016 to July 2016 and from each individual participant in the study an informed consent was obtained.

Sampling

The current population sample size allocated according to the prevalence of Jordanian patients using atorvastatin and attending the diabetes and endocrine clinics at KAUH. Therefore, a convenient sample of at least 359 patients was used in this research project.

Inclusion and Exclusion Criteria

The inclusion criteria were as follows: (1) patients aged more than 18 years (2) attending the diabetic and endocrine clinics at KAUH (3) diagnosed with hyperlipidemia (4) using atorvastatin 20 mg per day for at least six months.

The exclusion criteria included: (1) patients aged less than 18 years (2) attending other clinics at KAUH (3) have normal lipid profile (4) using other statins (4) and using atorvastatin for less than 6 months.

Study Protocol

A sample of 359 patients visiting the diabetes and endocrine outpatient clinics at KAUH were selected and assessed for eligibility according to the inclusion criteria after the hospital administration and the Institutional Research Board (IRB) committee approval. Patients names, telephone and medical record numbers whose using atorvastatin were adapted from the hospital database. Patients' diagnosis, medical history, the initial body weight, and the concurrent body weight measurements were collected from the patient's medical record. In addition, the dietary and life-style behavior were collected for each selected patient using a structured, reliable and valid questionnaire completed by the research assistant who was trained by the principal researcher. The selected patients using atorvastatin were divided into 2 groups; diabetic and non-diabetic. The dietary and life-style differences between the two groups were analyzed accordingly.

Statistical Analysis

Collected data were entered in a data sheet and analyzed using SPSS statistical package (IBM, SPSS version 22, 2013) and initially examined by performing descriptive statistics for all categorical and continuous variables. Student t-test, Chi-square and correlation were also applied using the partial correlation function controlling for age and other confounding variables. A multivariable binary logistic regression analysis was performed to examine collectively the association between diabetes and the significant risk factors identified from the univariate analysis. Level of $P \leq 0.05$ was considered as significant.

Results

Socio-Demographic and Medical Characteristics

The Mean age of the study participants was 62.88±0.6 year. The distribution of the study sample according to gender showed that 53.3% vs. 46.5% were male and female respectively, 90% were married, 29.2% of the samples were highly educated and 51.8% their monthly income was between 201-500 JD. On the other hand, 87.5% of the study sample were having chronic diseases (cardiovascular, hypertension, diabetes, thyroid malfunctioning) and 68.8% of them having diabetes, 65.2% having a family history of hypocholesteremia, and 72.7% using atorvastatin for more than 2 years.

Dietary and Life-Style Characteristics

The arithmetic means and standard errors of the means for dietary and life-style behavior were shown in (Table 1). It was noticed that the mean body weight after using atorvastatin (84.51±2.47) was higher than the mean body weight before using atorvastatin (80.30±0.70) among the total study sample. This could be related to atorvastatin or dietary and life-style behavior.

The frequencies of the study participants categorical variables according to dietary and life- style behavior among the 359 patients were also shown in (Table 1); around 33% of the study sample were playing sports on regular basis, 23.4% were smokers, 1.1% were alcoholic, 90.8% were coffee drinkers, 11.7% were follow a weight reducing diet, 71.9% were always eating breakfast, 84.4% were eating snacks, 32.9% were fast food eaters, 22.6% eating more than one type of fast food, 50.4% were eating food rich in cholesterol, 98.6% were using margarine and/or vegetable oils in preparing their food, 93.8% of them were using olive oil in their diet and 44.3% were taking supplements.

Descriptive Statistics and Mean Comparisons between Diabetic and Non-Diabetic Patients

The descriptive statistics and mean comparisons of age, weight, dietary and life-style behavior after stratifying of the study sample into two groups the diabetic and non-diabetic patients using independent sample T-test were shown in (Table 2). Results showed that there was a statically significant difference ($P \leq 0.05$) between both groups regarding age (P=0.04), weight loss after diet (P=0.002) and the mean difference in alcohol drinking quantity (P=0.001).

Comparing frequencies (cross tabulation) between diabetic and non-diabetic patients

The frequencies of the personal information between diabetic and non-diabetic patients in the study sample showed that there was only a statistically significant difference ($P \leq 0.05$) between

the study groups gender, where the frequency of diabetic females is significantly (P=0.001) higher than males. Also, frequencies of medical history showed that there was only a statistically significant difference (P≤0.05) regarding history of chronic diseases (P=0.001) were 94.7% of the diabetic patients having chronic diseases compared with 70.5% of non-diabetic patients.

Comparing the frequencies of dietary and life-style behavioral variables among the diabetic and non-diabetic patients, results showed that non-diabetic patients were statistically and significantly (p<0.05) have higher frequency of smoking (p=0.003), following low calorie weight reducing diet (p=0.01), eating snacks consist of artificial juice and ice creams (p=0.04), eating snacks consist of sweets, chocolates and biscuits (p=0.003) as well as taking supplements (p=0.05) more than the diabetic patients (Table 2).

Table 1: Descriptive Statistics of Age, Weight, Dietary and Life-Style Behavior for all study participants (N=359)

Variable	Mean ± S.E.M	Minimum	Maximum
Age (year)	62.88±0.60	31.0	89.0
Weight before using atorvastatin (kg)	80.30±0.70	7.0	129.0
Weight after using atorvastatin (kg)	84.51±2.47	47.0	122.0
Sport time (min/day)	43.54±2.65	0.0	180.0
Number of cigarettes smoked/day	23.49±1.50	0.0	60.0
Alcohol quantity (cup/day)	2.25±0.25	2.0	3.0
Soft drinks (cup/day)	1.33±0.06	0.25	6.0
Coffee quantity (cup/day)	2.62±0.10	0.5	14.0
Milk quantity (cup/day)	1.45±0.04	0.0	8.0
Weight loss due to diet (kg)	3.64±0.67	0.0	20.0
		Frequency (n)	**%**
Play sports on a Regular Basis		118	32.9
Daily light sport		112	95.0
Sport type (walking or running)		112	95.0
Smoking		84	23.4
Drinking alcohol		4	1.1
Drinking soft drinks		166	46.2
Drinking soft drinks daily		31	18.7
Drinking coffee		326	90.8
Drinking coffee daily		260	79.8
Follow weight reducing diet		42	11.7
Low calorie weight reducing diet		32	76.2
Eating meals on a regular basis		249	69.4
Eating three meals per day		132	36.8
Always eating breakfast		258	71.9
Eating snacks		303	84.4
Eating two snacks per day		111	36.6
Drinking milk		322	89.7
Drinking milk daily		219	68.0
Eating sea food		278	77.4
Eat fish or sea food monthly		176	49.0
Eating fast food		118	32.9
Eating fast food daily		14	11.9
Eating hamburger, fried chicken and pizza		81	68.6
Eating foods rich in cholesterol		181	50.4
Eating vegetables and whole grains		238	66.3
Food allergy		18	5.0
Using margarine and/or vegetable oils in food preparation		354	98.6
Using olive oil		332	93.8
Using corn oil		264	74.6
Using palm oil		12	3.4
Using other fats and oils		45	12.7
Taking supplements		159	44.3
Taking omega-3		62	39.0
Taking multivitamins		75	47.2
Taking vitamin D		77	48.4
Taking other supplements		54	34.0

Values are presented as means and standard error of the means (mean ± S.E.M), frequencies (n) and percentages (%).

Table 2: Frequencies and Mean Comparisons of Age, Weight, Dietary and Life-Style Behavior for Diabetic and Non-Diabetic Patients. (N=359).

Variable	DM (n=247)	NDM (n=112)	P-Value
	Mean ± S.E.M	Mean ± S.E.M	
Age (year)	63.67±0.68	61.13±1.16	.04*
Weight before using atorvastatin (kg)	80.55±0.79	79.75±1.42	.60
Weight after using atorvastatin (kg)	85.76±3.54	81.75±1.25	.45
Sport time (min/day)	43.99±3.43	42.56±3.94	.80
Number of cigarettes smoked/day	23.20±2.11	23.85±2.15	.83
Alcohol quantity (cup/day)	2.00±0.00	3.00±0.00	<.001*
Soft drinks (cup/day)	1.32±0.07	1.35±0.10	.81
Coffee quantity (cup/day)	2.51±0.13	2.86±0.18	.12
Milk quantity (cup/day)	1.43±0.04	1.51±0.10	.40

Weight loss due to diet (kg)	2.52±0.29	7.00±2.25	.002*
	n (%)	**n (%)**	**(χ^2)**
Play sports on a Regular Basis	80 (32.4)	38 (34.0)	.43
Smoking	47 (19.0)	37 (33.0)	.003*
Drinking alcohol	3 (1.2)	1 (0.9)	.63
Drinking soft drinks	107 (43.3)	59 (52.7)	.07
Drinking coffee	227 (91.9)	99 (88.4)	.20
Follow weight reducing diet	28 (11.3)	13 (11.6)	.54
Low calorie weight reducing diet	19 (7.7)	13 (11.6)	.01*
Eating meals on a regular basis	177 (71.7)	72 (64.3)	.10
Always eating breakfast	177 (71.7)	81 (72.3)	.50
Eating snacks	210 (85.0)	93 (83.0)	.37
Eating snacks (fruits and fresh juice)	221 (89.5)	99 (88.4)	.40
Eating snacks (artificial juice and ice creams)	17 (6.9)	15 (13.4)	.04*
Eating snacks (sweets, chocolates and biscuits)	47 (19.0)	37 (33.0)	.003*
Eating snacks (salty crackers)	26 (10.5)	14 (12.5)	.36
Drinking milk	220 (89.1)	102 (91.1)	.35
Eating sea food	189 (76.5)	90 (80.4)	.25
Eating fast food	76 (30.8)	42 (37.5)	.13
Eating hamburger, fried chicken and pizza	20 (8.1)	39 (34.8)	.50
Eating foods rich in cholesterol	123 (49.8)	59 (52.7)	.35
Eating vegetables and whole grains	159 (64.4)	79 (70.5)	.15
Food allergy	15 (6.1)	3 (2.7)	.13
Using margarine and/ or vegetable oils in food preparation	243 (98.4)	111 (99.1)	.50
Using olive oil	227 (91.9)	105 (93.8)	.35
Using corn oil	176 (71.3)	88 (78.6)	.10
Using palm oil	9 (3.6)	3 (2.7)	.45
Using other fats and oils	32 (12.9)	13 (11.6)	.43
Taking supplements	102 (41.3)	57 (50.9)	.05*
Taking omega-3	41 (16.6)	21 (18.8)	.36
Taking multivitamins	49 (19.8)	26 (23.2)	.28
Taking vitamin D	49 (19.8)	29 (25.9)	.13
Taking other supplements	35 (14.2)	19 (17.0)	.30

Values are presented as means and standard error of the means (mean ± S.E.M), frequencies (n) and percentages (%).

* P- value ≤0.05 is statistically significant.

Binary Logistic Regression Model of Diabetes

The final model of the binary logistic regression of diabetes includes three significant (p≤0.05) contributing and predicting factors . The likelihood of eating (sweets, chocolates and biscuits) as snacks was about half times (p<0.05; OR=0.53) more likely to develop diabetes than the non-eaters. Females were about 3 times (p<0.001; OR=3.15) more likely to develop diabetes than males. In addition, the likelihood of patients having chronic diseases (CVD, hypertension and thyroid problems) was 10 times (p<0.001; OR=10.27) more likely to develop diabetes (Table 3).

Discussion

The study findings showed that the mean body weight of the atorvastatin users was increased after using atorvastatin; most of the study participants were drinking coffee and using olive oil in preparing their food. More than the half eating vegetables and whole grains and always eating their breakfast. Also, around the third of them eating three meals per day and few of them eating fast food daily. Comparing the diabetic and non-diabetic atorvastatin users there was a significant difference in the means of age, alcohol consumption and the weight loss due to diet. Diabetic patients were older, drink less alcohol and lost few kilograms from their body weight due to diet compared with the non-diabetic. In addition, diabetic patients were significantly had low frequencies of smokers, followers of low calorie weight reducing diet, and low eaters of snacks consist of artificial juice, ice cream, sweets, chocolates and biscuits compared with non-diabetic patients. The logistic regression model showed that the presence of chronic diseases (hypertension, cardio-vascular and thyroid problems), being a female and eating snacks consist of sweets, chocolates and biscuits increased the likelihood of developing diabetes.

Recently, similar results were reported in a United Kingdome population study, which found that the initiation of statin prescription was not associated with adoption of healthy diet or physical activity behaviors for most patients. However, approximately one third of the sample improved their diet with the first time of statin prescription, whilst, at 1 month and 4 months later approximately 40 % continued to consume higher levels of fat than advised, 55 % consumed low levels of fiber and over 80 % were insufficiently active for health benefits [16]. It has been reported that moderate alcohol consumption does not have major detrimental effects on long-term blood glucose control in people with diabetes. Risks associated with alcohol consumption include hypoglycemia (particularly for those using insulin therapies), weight gain, and hyperglycemia (for those consuming excessive amounts) [17,18].This could be explained by the significant low alcohol consumption among the diabetic compared with non-diabetic patients in this study.

Vitamins or minerals supplementation for diabetic patients without reporting deficiencies has no clear evidence.[17]Metformin is associated with vitamin B12 deficiency as reported recently, thus, it was suggested that vitamin B12 levels should be tested periodically for metformin treated patients [19]. Routine supplementation with vitamins E and D or other micronutrients

Table 3: Binary Logistic Regression Model[1] for A group of Covariates Dependent on Diabetes.

Variable	b	S.E.	P-Value	OR	95% C.I for OR	
					Lower	Upper
Eating snacks (sweets, chocolates and biscuits)	-0.63	0.32	.04*	0.53	0.29	0.99
Age	0.01	0.01	.44	1.01	0.98	1.04
Gender (female)	1.14	0.28	<.001*	3.15	1.83	5.41
Hypertension	-0.24	0.29	.39	0.78	0.44	1.38
Presence of chronic diseases	2.33	0.42	<.001*	10.27	4.55	23.18
Body weight	0.01	0.01	.11	1.02	0.99	1.04
Play sports on regular basis	0.26	0.30	.37	1.30	0.73	2.33
Drinking soft drinks	-0.12	0.30	.68	0.89	0.50	1.58
Follow weight reducing diet	0.20	0.43	.64	1.22	0.53	2.83
Drinking coffee	0.67	0.43	.11	1.95	0.85	4.50
Eating breakfast	-0.01	0.19	.95	0.99	0.68	1.44
Eating fast food	-0.02	0.33	.95	0.98	0.52	1.88
Constant	-3.96	1.38	.004	0.02		

1- Hosmer and Lemeshow test: $\chi^2 = 9.446$; df = 8; *p*-value = 0.306.

2- b: Regression coefficient.

3- S.E.: Standard error of the regression coefficient.

4- CI: Confidence Interval.

5- *p-value ≤0.05 is statistically significant.

[20] is not advised, because of insufficient evidence to improve glycemic control in diabetic patients [17,18]. Similarly, in this study diabetic patients were less frequent in taking supplements compared with non-diabetic which could be attributed to previous findings and medical advices through routine follow up and diabetic care.

Recent data show tobacco use is higher among adults with chronic conditions [21]. Other studies of individuals with diabetes consistently demonstrate that smokers and passive smokers have a higher risk of CVD, premature death, and micro vascular complications, and smoking may have a role in the development of type 2 diabetes [22]. A study on smokers newly diagnosed with type 2 diabetes found that smoking cessation was associated with amelioration of metabolic parameters and reduced blood pressure and albuminuria at 1 year [23].These results were consistence with this epidemiological study. Physical activity including all exercises is an important part of the diabetes management plan. Exercise has been shown to improve blood glucose control, reduce cardiovascular risk factors, contribute to weight loss, and improve well-being. It has been recommended that all adults, and particularly those with type 2 diabetes, should decrease the time spent in daily sedentary behavior and prolonged sitting should be interrupted every 30 min for blood glucose benefits [24].Unfortunately, around two third of this study participants were physically inactive and the time spend during exercise for physically active ones was relatively low compared with the recommended time.

Body weight management is an important part of diabetes care plan for overweight and obese people with diabetes. Therefore, life-style intervention programs should be intensive and have frequent follow-up to achieve significant weight reductions and improve clinical parameters such as lipid profile [24].Many studies found strong and consistent evidence that modest persistent weight loss can delay the progression from pre diabetes to type 2 diabetes [25,26] and is beneficial to the management of type 2 diabetes. Modest weight loss (reduction of 5% of initial body weight), has been shown to improve glycemic control and to reduce the need for glucose-lowering medications [27,28]. For many obese individuals, with type 2 diabetes, weight Loss >5%is needed to produce beneficial outcomes in glycemic control, lipids, and blood pressure. Whilst sustained weight loss of >7% is the optimal [29].The diets used in intensive lifestyle management for weight loss should emphasis on nutrient dense foods, such as whole grains, vegetables, fruits, legumes, low-fat dairy, lean meats, nuts, and seeds, as well as on achieving the desired energy deficit [30,32]. In this study, small portion of the diabetic patients were using the low-calorie weight reducing diet and the amount of weight loss due to diet was relatively low compared with non-diabetic which disagree with body weight management recommendations. Although, diabetic patients were less eaters of snacks consist of artificial juice, ice cream, sweets, chocolates and biscuits and more than the half of them eat vegetables and whole grains seeds but around 50% of them eat foods rich in cholesterol. These results along with the low rate of physical activity could explain the small reduction in body weight among the diabetic group compared with previous studies.

A meta-analysis in Sub-Saharan Africa demonstrated that, men in Eastern, Middle and Southern Africa had a significantly

higher prevalence of impaired fasting glycaemia and a lower prevalence of impaired glucose tolerance compared with the women. Although, the overall prevalence of diabetes mellitus did not significantly differ by sex but the prevalence of diabetes mellitus was found to be lower or higher in women than in men when examined by African sub-region [33]. Although, diabetes is more prevalent in males than in females [34], in this study, women were more likely to have diabetes. Controversial results could be attributed to the diversity in body composition such as low muscle mass compared to fat mass, endocrine imbalances, psychological stress and genetics [34].

Compared with individuals without diabetes, patients with type 2 diabetes mellitus have higher risk of cardiovascular morbidity and mortality. Most of this higher risk is associated with enhanced prevalence of well-known risk factors such as hypertension, dyslipidemia and obesity in these patients [35]. Hypertension is present in more than 60% of type 2 diabetes patients [36].Hypertension and diabetes mellitus are multilateral risk factors for cardiovascular diseases. Diabetes doubles the cardiovascular risk in men and more than triples the risk in women, hypertension quadruple cardiovascular risk in diabetic patients [37]. Similarly, in this study the risk of diabetes increases with the presence of chronic diseases as well as diabetes increases the risk of other chronic diseases such as hypertension and cardiovascular diseases.

Finally, the study had limitations including the cross-sectional design, the small sample size and lacking dietary, biochemical and clinical assessments. Therefore, prospective longitudinal follow up study with large cohort including healthy population assessed biochemically, clinically and dietary using 24-hour recall or food frequency questionnaire to determine the total calories, macro and micronutrients consumed would help confirm these results.

Conclusions and Implications

Our findings showed that most of dietary and life-style behaviors did not differ significantly among diabetic and non-diabetic atorvastatin users. Nevertheless, diabetic patients showed better dietary behavioral modifications than the non-diabetic except for the weight reducing diet. Diet and physical activity life-styles remain essentially unchanged for many patients after using atorvastatin, with higher consumption of saturated fat, less dietary fiber and lower levels of physical activity than recommended. Also, the risk of diabetes increases among females, eating snacks consist of sweets, chocolates and biscuits and having chronic diseases. Involving patients in preventive programs promotes the successful adoption of healthy lifestyles. Physicians should pay their utmost attention to non-diabetic as well as diabetic patients who are treated with atorvastatin to make a qualitative change in their eating and daily life-style behaviors to control blood glucose levels and prevent medical complications for diabetics and to reduce risk of developing diabetes in future for the non-diabetics.

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Declarations

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