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Original article

Adherence to oral glucose lowering drugs, quality of life, treatment satisfaction and illness perception: A cross-sectional study in patients with type 2 diabetes

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ABSTRACT

Objective: To evaluate treatment adherence to oral glucose lowering drugs (OGLD) and health related quality of life in Lebanese diabetics. Secondary objectives were to examine associations between treatment adherence, quality of life (QOL), treatment satisfaction and illness perception.
Methods: This cross-sectional study, conducted in all districts of Lebanon between August 2016 and April 2017, enrolled 207 adult patients, taking any OGLD.
Results: The effectiveness score (Beta = 0.55), female gender (Beta = 7.04), and the quality of life score (Beta = 0.28) would significantly increase the adherence score respectively. On another hand, the body mass index (Beta = −1.216) would significantly decrease the adherence score. Adherence was negatively and significantly associated to IPQ score (r = −0.181), effectiveness score (r = −0.504), side effects (r = −0.583), convenience (r = −0.317), global satisfaction (r = −0.428), physical health (r = −0.477), psychological health (r = −0.521), social relationships (r = −0.405) and environment (r = −0.429).
Conclusion: Perceived effectiveness and patient's quality of life seem to be important parameters enhancing adherence. Based on this study, planning interventions to enhance treatment adherence and improve the quality of life is crucial for all diabetic patients. Additional efforts are suggested to be made by concerned authorities to set up awareness campaigns to increase alertness on the importance of adherence to medications in diabetics.

1. Introduction

The Word Health Organization (WHO) announced in the World Health Day (2016) , the need to beat diabetes, since the number of people with diabetes has almost quadrupled from 108 million in (1980) to 422 million (i.e.: 1 person in 11 has diabetes) in (2014) (Global report on diabetes, 2016), where type 2 diabetes accounts for 90–95% of all diabetes (Association, 2015), driven by factors including overweight (appears 1 in every 3 people) and obesity (appears 1 in every 10 people) (Global report on diabetes, 2016). Also, 1.5 million deaths are directly attributed by diabetes each year (Global report on diabetes, 2016), leading to be the 7th cause of death worldwide in 2030 (Mathers and Loncar, 2006). As for Lebanon, according to IDF (2011), it was included in the six of

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the top 10 countries with the highest prevalence of diabetes in adults (<80 years) in the Arab region (20.2%) (Boutayeb et al., 2012).

Medication adherence is defined by the World Health Organization as "the degree to which the person's behavior corresponds with the agreed recommendations from a health care provider" (Dobbels et al., 2005).

There is a crucial need nowadays to better understand and manage non-adherence, especially with the increasing numbers of effective self-administered treatments (Haynes et al., 2008). Diabetes complications are primarily due to poor adherence to treatment (Shaimol et al., 2014).

Medication non-adherence is particularly common among patients with type 2 diabetes (T2D) (Cramer, 2004), thus, leading to decreased treatment efficacy and increased direct and indirect costs, mortality and morbidity (Sokol et al., 2005; Lee et al., 2006).

Several factors may influence adherence, including age, gender, income, educational level (Cramer, 2004; Walker et al., 2006), along with the patient's understanding of the regimen and its benefits, potential side effects, costs, and treatment complexity (Rubin, 2005). The complexity of a patient's medication regimen, in turn, is influenced by several attributes, including the number of medications, the dosage frequency and dosage form, as well as special administration instructions (Pollack et al., 2010). Furthermore, adherence to the prescribed medication was positively linked with quality of life (QOL) in diabetic patients (Alfian et al., 2016).

Treatment satisfaction is defined as the patient's evaluation of the treatment received and its associated outcomes (Shikiar and Rentz, 2004). Treatment satisfaction affects the adherence to medication, which in turn, impact the outcomes of treatment (Hudak and Wright, 1976). Patients' lack of belief in medication effectiveness and a bad illness perception are two commonly reported barriers to adherence to medications.

The self-regulation model refers to the observations, opinions and perceptions of people managing a chronic illness such as T2D to make sense of, cope with, adjust to, and manage their condition (Leventhal et al., 1984; Robitaille, 1997). Self-management attitude, including adherence to pharmacological and non-pharmacological treatments and self-monitoring, is closely linked to the illness and treatment perceptions are linked to self-management behaviors (Horne and Weinman, 1999; Leventhal, 1985; French et al., 2008; Cander et al., 2014).

To our knowledge, no previous study has assessed the relationship between adherence to Oral Antidiabetic Drugs (OGLD), treatment satisfaction, illness perception and the quality of life among patient suffering from diabetes. Our objectives were to evaluate treatment adherence to OGLDs and health related quality of life in Lebanese diabetics. The secondary objectives were to examine associations between treatment adherence, quality of life (QOL), treatment satisfaction and illness perception among these patients.

2. Methods

2.1. Study design and population

This cross-sectional study, conducted in all districts of Lebanon, was done between August 2016 and April 2017. An exhaustive list of 3000 pharmacies was provided by the Lebanese Order of Pharmacists. An online software was used to randomly choose the community pharmacies sample. It then targeted the first eligible person entering the community pharmacy and accepting to take part of the study.

Our sample was obtained from 20 community pharmacies, 4 from each of 5 governorates in the country. Lebanese subjects of both genders, aged 18 years and above, taking any oral antidiabetic were included in this study. Exclusion criteria included were the inability of the patient to read and understand the questions and the presence of cognitive impairment. A sample of 182 patients was targeted to allow for adequate power for bivariate and multivariate analyses to be carried out based on a population size of four million inhabitants in Lebanon, a 38.5% expected frequency of adherence to oral antidiabetics (Bruce et al., 2015) and a 5% confidence limits (Dossa et al., 2017). A total of 250 questionnaires was distributed to take refusals into account.

2.2. Data collection

The detailed questionnaire was distributed to patients randomly by the pharmacist on duty in each pharmacy, who were not related to the study. The pharmacist approached every patient who came to the pharmacy with a prescription of at least one OGLD, asking him if he wants to participate in the study. After obtaining the authorization from each patient via a written consent, the study objectives were explained to each patient.

2.3. Questionnaire

The self-administered anonymous questionnaire was in Arabic, the native language in Lebanon; it was composed of different sections: sociodemographic, social habits (smoking, alcohol consumption), duration of diabetes, number of associated diseases, starting date of the OGLD, number of drugs and number of tablets taken by the patient. In addition, the World Health Organization Quality of Life short version (WHOQOL-BREF), Treatment Satisfaction Questionnaire for Medications (TSQM), and the Brief Illness Perception Questionnaire (brief IPQ) questionnaires were used.

2.3.1. Adherence assessment

The adherence to OGLD was assessed by asking the patients about the frequency, percent and rating response of their statin use during the last month. Concerning the frequency, we asked the patient "did you take all your medications all the time?" with the possible responses being divided as follow: 0% for none of the time, 20% for a little of the time, 40% for some of the time, 60% for a good bit of the time, 80% for most of the time and 100% for all the time. The percent item was checked using the question "what percent of the time were you able to take your medications exactly as your doctor prescribed them?". The rating item was assessed using the following question "rate your ability to take all your medications as prescribed" with the possible answers being divided as follows: 0% = very poor, 20% = poor, 40% = fair, 60% = good, 80% = very good and 100% = excellent. The total score was calculated by summing all 3 answers and presented in a percentage (Preston and Colman, 2000; Lu et al., 2008; Garfield et al., 2012).

2.3.2. Quality of life (QOL) measurement

We used the WHOQOL-BREF, a brief version of the WHOQOL-100. The WHOQOL-BREF questionnaire contains an item for Overall QOL and an item for General Health, in addition to 24 items divided into four domains: 7 items for the physical health domain, 6 items for the psychological health domain, 3 items for the social relationships and 8 items for the environmental health. Each item is rated on a 5-point Likert scale. The raw domain scores obtained were transformed according to guidelines (World Health Organization's, 1996) to 4–20 scores, which were later transformed linearly on a 0–100 scale (Skevington and Tucker, 1999). Higher scores indicate a better QOL and a better levels of functioning and well-being.

2.3.3. Brief Illness Perception Questionnaire (Brief IPQ)

Patient perception of their T2D was evaluated using the Brief Illness Perception Questionnaire (Brief IPQ). The Brief IPQ is a 9-item questionnaire assesses illness cognitive and emotional representations of the illness (Broadbent et al., 2006) with a response scale of 0–10. The Brief IBQ is divided into several items as follows:

- 5 items assessing the cognitive representation of illness (consequences, timeline, personal control, treatment control, and identity)
- 2 items assessing the illness emotional representation (concern and emotions)
- The BIPQ global score ranges from 0 to 90 with a higher score indicating a bad disease perception and a lower score indicating a good disease perception. Assessment of the causal representation is by an open-ended response item which asks patients to list the three most important causal factors in their illness (Item 9).

2.3.4. Treatment Satisfaction Questionnaire for Medications (TSQM)

The TSQM version 1 is a 14-item questionnaire designed to assess treatment satisfaction (Atkinson et al., 2005; Atkinson et al., 2004). The TSQM items' answers are obtained using a 5- or 7-point Likert type scale and consists of 4 domains (Effectiveness; Side effects; Convenience and Global satisfaction), corresponding to separate facets of patient's satisfaction with their current treatment. Each item score is on a 0–100 scale and the total score is obtained for each domain by summing of the corresponding items; higher values indicate higher satisfaction, better perceived effectiveness and better convenience, and lower perceived side-effects.

2.4. Statistical analysis

Questionnaire's data were collected and processed by Statistical Package for the Social Sciences SPSS, Version 23. Categorical variables were presented in frequencies and percentages, and continuous variables as means with standard deviations. Statistical analysis was conducted using Chi-square, Fisher exact *t*-test, and analysis of variance. ANOVA and Kruskal-Wallis tests were used to compare between three groups or more, and Pearson correlation coefficient were used to assess correlations between quantitative variables. Bonferroni adjustment was used for ANOVA post hoc tests of between groups comparison. In addition, a multivariate regression was conducted to eliminate confounders. A linear regression was performed taking the adherence to treatment as the dependent variable. Variables which gave a p-value < 0.2 in the bivariate analysis were independent variables. A p-value < 0.05 was considered significant.

3. Results

3.1. Sample description

Out of the 250 questionnaires distributed in the pharmacies, 214 were collected (85.6%), with 36 (15.4%) patients refusing to participate. Table 1 summarizes the sociodemographic and clinical characteristics of the participants. The mean age was 53.19 ± 9.24, the mean duration of treatment with OGLD was 7.74 years. 53.7% were males and 65.9% had a familial history of diabetes. Metformin was the most commonly prescribed OAD among the sample (83.2%) (Table 2).

We calculated the reliability of each scale to assess the quality of our data. We obtained high Cronbach alphas for all scales as follows: TSQM scale (0.898), adherence scale (0.849), WHOQOL-bref scale (0.855), and IPQ scale (0.916). Since we obtained good internal consistency, we considered the results obtained from these scales adequate, solid and reliable. The percentage of adherence among our sample was 82.7%. The means and standard deviations for each scale's score are summarized in Table 3.

Table 1
Sociodemographic characteristics of the participants.

Factor	N (%)	Mean ± SD
Gender		
Male	115 (53.7%)	
Female	99 (46.3%)	
Marital status		
Married	184 (86%)	
Single	21 (9.8%)	
Divorced	5 (2.3%)	
Widowed	4 (1.9%)	
Educational level		
Primary	17 (7.9%)	
Secondary	65 (30.4%)	
University	132 (61.7%)	
Cigarette smoking		
Never smoked	121 (56.5%)	
1–15 cig/day	21 (9.8%)	
>15 cig/day	32 (15%)	
Previous smoker	38 (17.8%)	
Waterpipe smoking		
Non smoker	189 (88.3%)	
1–3 waterpipes/week	15 (7%)	
>3 waterpipes/week	8 (3.7%)	
Previous smoker	2 (0.9%)	
Alcohol drinking		
Never	75 (35%)	
Previous drinker	4 (1.9%)	
≤1 glass/week (occasional drinking)	129 (60.3%)	
>1 glass/week	6 (2.8%)	
Family history of diabetes		
Yes	141 (65.9%)	
No	73 (34.1%)	
Using a pill planner		
Yes	21 (9.8%)	
No	193 (90.2%)	
Age		53.19 ± 9.24
BMI		26.87 ± 3.77
Time since diagnosis of diabetes (years)		7.74 ± 6.63
Number of other pathologies		0.94 ± 0.86
Interval between HbA1C testing		6.01 ± 4.40
Last HbA1C value		7.10 ± 1.60
Last fasting blood glucose level		143.08 ± 45.91
Number of OADs		1.39 ± 0.62
Number of pills of OADs		1.90 ± 0.98
Number of drugs taken for other diseases		2.27 ± 2.22

Table 2
Pharmacological classes of oral antidiabetics prescribed to the patients.

Pharmacological class	N[a] (%)
Sulfonylureas	61 (28.5%)
Dipeptylpeptidase-4 inhibitors	56 (26.2%)
Metformin	178 (83.2%)
Thiazolidinediones	9 (4.2%)
Sodium-glucose co-transporter-2 (*SGLT2*) inhibitors	6 (2.8%)
Glucagon-like peptide-1 (GLP-1) agonists	3 (1.4%)

[a] Some patients were taking more than one OAD.

3.2. Factors affecting adherence

Mean adherence score was of 88.67%. No significant association was found between adherence and marital status (p = 0.125), educational level (p = 0.594), family history of diabetes (p = 0.660), cigarette smoking (p = 0.805), waterpipe smoking (p = 0.378) or

Table 3
Means and standard deviations of all domains of the scales.

	Mean	Standard deviation
TSQM		
Effectiveness score	66.56	10.45
Side effects score	92.17	15.86
Convenience score	68.04	9.85
Global satisfaction score	66.81	13.24
WHOQOL-BREF		
Physical health	73.46	11.28
Psychological health	67.82	11.02
Social relationships	66.90	12.43
Environment	61.43	10.63
Quality of life	71.14	10.55
Global health	70.91	12.73
IPQ	33.77	13.10
Adherence	88.67	21.10

alcohol drinking (p = 0.463). Furthermore, no significant difference was found between genders (p = 0.092). However, a significantly higher mean adherence score was found in patients who use a pill planner (94.19) compared to those who don't (88.06) (p = 0.035).

A negative but significant correlation was found between the adherence score and the BMI (r = −0.2), fasting blood glucose (r = −0.284) and IPQ score (r = −0.181). It is worth noting that the correlation between adherence and the effectiveness and side effects subscales scores (of the IPQ) came out significant (r = 0.281 and r = 0.223) respectively. Finally, a significant correlation was found between adherence and the following subscales of the WHOQOL-BREF: physical health (r = 0.2), psychological (r = 0.202), quality of life (r = 0.167) and global health (r = 0.149) (Table 4).

3.3. Factors affecting treatment satisfaction

Table 5 shows significant associations between TSQM domains and participants' sociodemographic factors. Age was significantly and negatively correlated with the side effects and convenience scores, while a significant difference was found between the educational level and the side effects score (p = 0.001). The post hoc analysis showed that a significantly higher mean difference in the side effects score was found between patients with a university level of education compared to those with a primary level (mean difference = 12.05; p = 0.009).

Table 4
Correlation coefficients of quantitative variables associated with the adherence score.

Variable	Correlation coefficient	p-value
Age	0.088	0.198
BMI	−0.2	0.003
Years since diabetes diagnosis	−0.055	0.428
HbA1C value	−0.093	0.178
Fasting blood glucose	−0.284	0.009
Number of OADs	−0.021	0.755
Number of tablets of OADs	−0.129	0.06
Number of medications other than for diabetes	0.021	0.759
TSQM		
Effectiveness score	0.281	<0.0001
Side effects score	0.223	0.001
Convenience score	0.031	0.647
Global satisfaction score	0.048	0.483
WHOQOL-BREF		
Physical health	0.2	0.003
Psychological	0.202	0.003
Social relationships	0.097	0.158
Environment	0.122	0.075
Quality of life	0.167	0.014
Global health	0.149	0.029
IPQ	−0.181	0.008

Table 5
Factors significantly associated to TSQM domains scores.

	Effectiveness	Side effects	Convenience	Global satisfaction
Marital status				
Married	66.18 ± 10.44	92.90 ± 14.69	67.57 ± 9.05	65.91 ± 13.33
Single	69.05 ± 11.86	85.71 ± 23.23	72.22 ± 14.59	71.76 ± 11.91
Divorced	67.77 ± 2.48	100 ± 0.00	67.77 ± 9.94	72.22 ± 3.80
Widowed	69.44 ± 9.62	82.81 ± 23.59	68.06 ± 14.61	75.35 ± 16.76
p-value	0.618	0.193	0.315	0.098
Educational level				
Primary	67.32 ± 13.16	82.35 ± 20.52	68.63 ± 13.17	70.50 ± 14.90
Secondary	66.41 ± 11.92	90.19 ± 18.38	67.43 ± 12.10	66.30 ± 12.08
University	66.54 ± 9.32	94.41 ± 13.15	68.27 ± 8.05	66.58 ± 13.59
p-value	0.905	**0.001**	0.831	0.484
Age				
Correlation coefficient	0.003	−0.157	−0.135	−0.068
p-value	0.963	**0.022**	**0.048**	0.320

Numbers in bold show a significant correlation between the two variables (p < 0.05.)

3.4. Factors affecting illness perception

Adherence was negatively and significantly associated with the IPQ score (r = −0.181), effectiveness score (r = −0.504), side effects (r = −0.583), convenience (r = −0.317), global satisfaction (r = −0.428), physical health (r = −0.477), psychological health (r = −0.521), social relationships (r = −0.405) and environment (r = −0.429) (Table 6). Furthermore, when looking into factors affecting the IPQ score, the results showed that age (p = 0.198), marital status (p = 0.111), cigarette smoking (p = 0.762) and water-pipe smoking (p = 0.530) did not show any significant correlation with IPQ. It is of note that the educational level (p = 0.001) and alcohol drinking (p = 0.001) did have a significant correlation with the IPQ score. The post hoc analysis showed that a significantly higher mean difference in the educational level was found between patients who drink more than 1 glass per week compared to those don't drink alcohol (mean difference = 18.04; p < 0.0001) and those who occasionally drink (<1 glass/week) (mean difference = 15.73; p = 0.001) (data not shown).

3.5. Multivariable analyses

The results of the linear regression taking the adherence score as the dependent variable, showed that the effectiveness score (Beta = 0.55), female gender (Beta = 7.04), and the quality of life score (Beta = 0.28) would significantly increase the adherence score respectively. On another hand, the body mass index (Beta = −1.216) would significantly decrease the adherence score (Table 7).

4. Discussion

OGLDs are able to control the symptoms of T2D if taken as prescribed. However, unfortunately, many patients requiring these drugs are not adherent to their treatment. Our results showed that the perceived effectiveness score was significantly and positively associated with the adherence score, in agreement with previous findings (Walz et al., 2014). Measures reported by the patient can help health care professionals (HCP) aim new/additional methods that will improve patient outcomes of care (Lohr and Zebrack,

Table 6
Significant associations between IPQ score and TSQM domains or WHOQOL-BREF domains.

		EFF[a]	SE[a]	CON[a]	GS[a]	PH[b]	PSY[b]	SR[b]	ENV[b]	IPQ	Adherence
EFF[a]	r	–	0.428	0.546	0.708	0.264	0.377	0.206	0.280	−0.504	0.281
	p-value		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.002	<0.0001	<0.0001	<0.0001
SE[a]	r	0.428	–	0.208	0.417	0.611	0.470	0.311	0.160	−0.583	0.223
	p-value	<0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.019	<0.0001	0.001
CON[a]	r	0.546	0.208	–	0.563	0.131	0.234	0.081	0.237	−0.317	0.031
	p-value	<0.0001	0.002		<0.0001	0.055	0.001	0.239	<0.0001	<0.0001	0.647
GS[a]	r	0.708	0.417	0.563	–	0.126	0.270	0.142	0.525	−0.428	0.048
	p-value	<0.0001	<0.0001	<0.0001		0.066	<0.0001	0.038	<0.0001	<0.0001	0.483
PHY[b]	r	0.264	0.611	0.131	0.126	–	0.617	0.443	0.717	−0.477	0.2
	p-value	<0.0001	<0.0001	0.055	0.066		<0.0001	<0.0001	<0.0001	<0.0001	0.003
PSY[b]	r	0.377	0.470	0.234	0.270	0.617	–	0.599	0.674	−0.521	0.202
	p-value	<0.0001	<0.0001	0.001	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001	0.003
SR[b]	r	0.206	0.311	0.081	0.142	0.443	0.599	–	0.674	−0.405	0.097
	p-value	<0.0001	<0.0001	0.239	0.038	<0.0001	<0.0001		<0.0001	<0.0001	0.158
ENV[b]	r	0.280	0.354	0.160	0.237	0.525	0.717	0.674	–	−0.429	0.122
	p-value	<0.0001	<0.0001	0.019	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001	0.075
IPQ	r	−0.504	−0.583	−0.317	−0.428	−0.477	−0.521	−0.405	−0.429	–	−0.181
	p-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		0.008
Adherence	r	0.281	0.223	0.031	0.048	0.2	0.202	0.097	0.122	−0.181	–
	p-value	<0.0001	0.001	0.647	0.483	0.003	0.003	0.158	0.075	0.008	

[a] TSQM: EFF = effectiveness score; CON = convenience score; SE = Side effects score; GS = Global satisfaction score.
[b] WHOQOL-BREF: PHY = Physical health domain; PSY = Psychological health domain; SR = social relationships; ENV = Environmental health.

Table 7
Multivariable analysis.

Linear regression taking the adherence score as the dependent variable					
Factor	Unstandardized beta	Standardized beta	p-value	Confidence interval	
Effectiveness score	0.550	0.273	<0.0001	0.296	0.805
Body mass index	−1.216	−0.218	0.001	−1.919	−0.513
Gender (males[a] vs females)	7.040	0.167	0.010	1.708	12.372
Quality of life score	0.280	0.140	0.030	0.027	0.532

[a] Reference group.

2009). Based on the results of Al-Aujan et al. (2012), providing support for non-satisfied patients is crucial for adherence improvement, which will lead to a positive clinical outcome. Structuring an individualized patient education program after recognizing and addressing the issues that each patient is facing, could result in a decrease in the patient's fear of these issues, and therefore may increase patient treatment's adherence and satisfaction. This requires the combined efforts of all persons (physicians, nurses, pharmacists, dieticians, and physiotherapists) collaborating in providing care for diabetic patients (Al-Aujan et al., 2012). A solid patient-health professional relationship can help assess the effectiveness of treatment, understand the patient's problems, and recognize disease progression (Revicki et al., 2008). The patient-reported outcomes are essential in detecting whether the uncontrolled diabetes is due to a poor treatment adherence from the patient's side or to an inadequate treatment. The patient's reporting and perspective is vital in all chronic diseases to ensure a delay of complications and ensure a good QOL (Revicki et al., 2008). Decreased treatment satisfaction should be taken seriously because it is associated with poorer adherence and an increased risk of discontinuation and non-persistence (Barrett-Connor et al., 2012).

Our results showed that an increased body weight was significantly and inversely associated with adherence, similar to previous studies (Nagrebetsky et al., 2012; Grandy et al., 2013). An indirect effect of weight gain and a decrease in treatment adherence has previously been described in the literature (Bae et al., 2016). Patients should be counseled about the benefits of weight loss among overweight patients with T2D since the latter was associated with more than 25% reduction in mortality and cardiovascular disease (McAdam-Marx et al., 2014).

Females were found to be more adherent to OGLDs than their men counterparts. Results from previous studies are controversial; one study suggested that the quality of diabetes control was worse in women than men at all ages (Pound et al., 1996), while another study reported a higher adherence in men (Raum et al., 2012). Further larger studies are needed to assess this issue.

Patients included in this study generally had a good level of adherence, similar to previous studies (McAdam-Marx et al., 2014; Jimmy et al., 2014). Many factors could be responsible, namely a good patient-physician communication and an increased patients' knowledge about monitoring their disease and its complications (Jimmy et al., 2014). Health professionals have an obligation to provide adequate education regarding their therapeutic treatment in order to avoid this intentional non-adherence (McQuaid et al., 2014).

A better patient counseling by health care professionals is needed to educate the patient about the possible side effects that might occur with OGLDs and most importantly about the efficacy of these drugs.

A significant correlation between QOL and adherence to treatment was found in this study, similar to previous findings (Saleh et al., 2014) that indicated that higher non-adherence is associated with a low quality of life, which is consistent with the results of other studies (Chaveepojnkamjorn et al., 2008; Honish et al., 2006; Shim et al., 2012). Effective and cultural-oriented education interventions successfully enhance adherence and simultaneously increases the QOL. These new findings emphasize the need for future research to better understand the dynamics between adherence and QOL in patients with T2D. Such data would be critically important for the optimal management of the patient.

Illness perception was significantly associated with adherence to treatment in the bivariate analysis. Previous studies demonstrated that the accurate beliefs about the effectiveness of treatment, the necessity for medication, and the perceived disease course are predictive of adherence. Our findings highlight the need for health professionals to address diabetic illness perceptions with their patients (Hampson et al., 1995; Horne et al., 1999). It is also important to discuss and reframe fixed beliefs rather than just checking the patients' knowledge or understanding of their disease (Barnes et al., 2004).

4.1. Limitations

Our study has several limitations. The total sample size is small and might not be representative of the whole population. This is a cross sectional survey with retrospective reports, and consequently a low level of evidence. The effect of the recall bias could be differential and could lead to the overestimation of effects for some known risk factors. The use of a questionnaire may not always be accurate (problems in question understanding, recall deficiency and over/under evaluating symptoms), causing a risk of information bias. The questionnaires used in this study were not previously validated in Lebanon. Hypoglycemia is another factor that would affect quality of life and adherence to therapy, but it was not taken into account in this study.

5. Conclusion

This study showed that adherence to OGLDs was correlated to the patient's perceived effectiveness of treatment and to the patient's quality of life. In addition, patient's evaluation of their health care is now an established component of quality assessment. Perceived effectiveness and patient's quality of life seem to be important parameters enhancing adherence. Based on this study, planning interventions to enhance treatment adherence and improve quality of life is crucial for all patients with T2D. For this purpose, appropriate patient education and good patient-health professional relationships are definitely warranted.

Compliance with ethical standards

The study protocol was approved by the ethics committee of Saint-Joseph University of Beirut (reference number: USJ-2016-56). All authors declare that they have no conflict of interest. Informed consent was obtained from all individual participants included in the study. No funding was received for this study.

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