

Self-Reported Adherence among Individuals at High Risk of Metabolic Syndrome: Effect of Knowledge and Attitude

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Key Words

Adherence · Knowledge · Attitude · Metabolic syndrome · Risk

Abstract

Objective: This study aimed to evaluate factors that affect adherence in individuals at high risk of metabolic syndrome, with a focus on knowledge and attitude effect. **Subjects and Methods:** A sample of 900 high-risk individuals with metabolic syndrome was recruited in this cross-sectional study. During the study period, all participants filled in validated structured questionnaires to evaluate the adherence to different management options of metabolic syndrome, knowledge about the syndrome, and health-related attitude. Simple linear regression followed by multiple linear regression analysis were used to evaluate the effect of knowledge, attitude, and other factors on participants' adherence to both medications and lifestyle changes. **Results:** Of the 900 participants, 436 (48.4%) were nonadherent to medications and 813 (90.3%) were nonadherent to lifestyle changes. Increasing age ($r = 0.140$, $p = 0.000$), the presence of hypertension ($r = 0.075$, $p = 0.036$), and a more positive attitude toward health ($r = 0.230$, $p = 0.000$) were significantly associated with increasing adherence to medications. Higher educa-

tional level ($r = 0.085$, $p = 0.023$), higher knowledge score ($r = 0.135$, $p = 0.001$), and more positive attitude toward health ($r = 0.183$, $p = 0.000$) were found to significantly increase the adherence to lifestyle changes, while central obesity ($r = -0.106$, $p = 0.003$) was found to significantly decrease the adherence to lifestyle changes. **Conclusion:** Patients' knowledge about metabolic syndrome and attitude to health affected adherence rates in patients at high risk of metabolic syndrome. Hence, we suggest the need to incorporate patients' educational programs into current management of metabolic syndrome.

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Introduction

Metabolic syndrome refers to a cluster of metabolic abnormalities associated with increased insulin resistance and, consequently, increased risk of cardiovascular diseases (CVDs) [1]. There are various definitions of metabolic syndrome [1–4]. One of the most commonly used is that of the American Heart Association/National Heart, Lung, and Blood Institute, which defines metabolic syndrome as the presence of at least 3 of the following 5 conditions: fasting blood glucose ≥ 100 mg/dL, blood pres-

sure $\geq 130/85$ mm Hg, triglycerides ≥ 150 mg/dL, high-density lipoprotein-cholesterol (HDL-C) < 40 mg/dL in men or < 50 mg/dL in women, or waist circumference ≥ 102 cm in men or ≥ 88 cm in women [4].

The prevalence rate of metabolic syndrome varies among different populations based on many factors that are associated with the disease, such as age, genetic variations, gender, cigarette smoking, physical inactivity, obesity, atherogenic diet, and family history of premature CVDs [1, 5, 6]. General prevalence rates of 22.9–25.5% had been reported in the adult USA population, but these rates are reportedly increasing for both metabolic syndrome and all of its components [7].

Early diagnosis of patients with metabolic syndrome and the selection of an appropriate treatment protocol is essential in both controlling and reducing its associated risk of CVDs [8]. Lifestyle changes that combine specific recommendations of diet and exercise are considered the initial intervention of choice for patients with metabolic syndrome [9]. Pharmacological treatment should be considered for those patients who do not show adequate response with lifestyle changes [10].

Adherence, as a term, is traditionally defined as the extent to which patients adhere to the recommendations of the treatment by the health care professionals [11]. Adherence rates are reportedly low among patients with chronic conditions [12–14]. Various factors have been reported to be associated with low adherence rates and are related to the patients, physicians, and/or health care systems [15, 16]. Most of these factors are amenable because they provide a great opportunity for health care providers to interfere and modify these factors, which consequently can enhance adherence to both medication and lifestyle changes that can have a great positive influence on the patients' health status [16].

Adopting adequate adherence to different management approaches (medications and lifestyle changes) is highly important in patients with metabolic syndrome or those at high risk (i.e., have at least 1 metabolic syndrome component) in reducing subsequent risk of CVDs [17]. A low rate of adherence to health care recommendations has been reported among this population, and several factors have been identified to affect their adherence rate [18–20]. In a few studies [20, 21], knowledge and attitude to adherence to different management approaches have been evaluated in patients with metabolic syndrome or those at risk. Hence, in this study we aimed to identify the effect of different sociodemographic, disease-based variables and the effect of knowledge and attitude on adherence in individuals at high risk of metabolic syndrome.

Subjects and Method

Study Design, Settings, and Study Subjects

A cross-sectional study design was carried out across 30 internal medicine clinics in Amman, Jordan, from October 2014 to December 2014. The inclusion criteria were adult individuals ≥ 18 years of age, with any confirmed component of metabolic syndrome based on the American Heart Association/National Heart, Lung and Blood Institute (AHA/NHLBI) which includes (1) confirmed diagnosis of diabetes, (2) confirmed diagnosis of hypertension, (3) waist circumference ≥ 102 cm in males or ≥ 88 cm in females, (4) triglyceride value ≥ 150 mg/dL (recent values), and (5) HDL-C < 40 mg/dL in males or < 50 mg/dL in females (recent values) [4], convenient accessibility, proximity to the researcher and willingness to participate in the study. Of 990 subjects recruited, 900 (females: 470, males: 430) fulfilled the inclusion criteria, and were included in the study.

All the participants were interviewed and validated structured questionnaires were filled in by well-trained pharmacists. Hypertension and diabetes as well as low HDL-C and high TG values were obtained from the patients' medical history and records, and waist circumference was measured for all participants. Then the prevalence of metabolic syndrome components was assessed.

Written informed consent was obtained from each participant. The participants' confidentiality was preserved. The study protocol was conducted in accordance with the World Medical Association Declaration of Helsinki guideline [22]. The Ethics Committee of the University of Jordan approved the study.

Questionnaire

A data collection form was developed based on a pretested and validated questionnaire [20]. The content validity was checked by the authors during the preparation for the study; the questionnaire was circulated between authors and the trained pharmacists, and was read thoroughly and filled in by each member of the team. It was discussed afterwards resulting in adding/deleting/modifying some of the questions where problems were detected.

The questionnaire was organized into 4 main sections: (1) sociodemographics assessment, (2) participants' adherence to medications and lifestyle changes, (3) knowledge about metabolic syndrome, and (4) attitude toward health.

Adherence to medications was assessed using 4 items and the patients were asked how often they refilled prescription medication on time, skipped doses to make the prescription last longer, whether or not they stopped taking medications against doctors' instructions, and took prescription medications depending on how they feel. Adherence to lifestyle changes was assessed using 5 questions related to diet and 3 questions relating to exercise. Participants were asked to recall their lifestyle behavior during the last 12 months with the following questions:

- "Have you made some change in the diet in the last 12 months?"
- "How often during the last 12 months did you try to lose weight?"
- "Have you maintained your desired weight for more than 6 months?"
- "How often did you follow the eating plan prescribed by a physician, nutritionist, or dietician?"
- "How often did you eat breakfast?"
- "Have you increased the amount of exercise in past 12 months?"

- “During the last 12 months did you try to lose weight through performing exercises?”
- “Do you perform exercises on regular bases?”

For direct questions, the response was scored using a scale of 5 ratings; never: 0%; rarely: 25%; sometimes: 50%; often: 75%, and always: 100%. For reverse questions the scale was: never: 100%; rarely: 75%; sometimes: 50%; often: 25%, and always: 0%. For each participant the mean medication adherence and lifestyle adherence scores were calculated out of 100%. A cutoff point of 75% or higher was used to identify participants who were adherent to medications or to lifestyle changes.

Participants’ knowledge about metabolic syndrome included 9 closed-ended questions to assess knowledge regarding the definition of metabolic syndrome and its 5 main diagnostic components. Participants’ response was either “Yes,” “No,” or “I don’t know.” For each correct answer, the patient was awarded 1 point and a total knowledge score out of 9 was calculated. Overall participants were classified into 2 groups based on their knowledge score: “adequate knowledge” ≥ 5 , and “inadequate knowledge” < 5 .

Attitude toward health was assessed using 3 items to evaluate the participant’s (1) expectations that their health will get worse over time, (2) whether they feel they get sick a little more easily than other people, and (3) whether they are concerned that their health problems will get worse over time. A Likert scale of 5 domains was used to evaluate participant attitudes toward different health-related aspects: never: 100%; rarely: 75%; sometimes: 50%; often: 25%; and always: 0%. Also, participants were asked to evaluate their general health status: excellent: 100%; very good: 75%; good: 50%; fair: 25%; and poor: 0%. For each participant, a mean attitude score was calculated (out of 100) and the participants were classified into 2 groups: “positive attitude” $\geq 75\%$ and “negative attitude” $< 75\%$.

Statistical Analysis

Data were analyzed using Statistical Package for Social Science version 17 (SPSS Inc., Chicago, IL, USA). The descriptive analysis was done using means and standard deviations for continuous variables and percentages for qualitative variables. Checking for normality was carried out using the Shapiro-Wilk test. The χ^2 test was used to evaluate differences between groups for categorical variables. Initial screening of the data was carried out using simple linear regression. A p value < 0.05 was considered statistically significant and all tests were two-tailed. Any independent variable that had a p value of < 0.05 was considered a candidate for multiple linear regressions after checking for the absence of multicollinearity ($r < 0.9$ between tested independent variables).

Results

The mean age of participants was 55 ± 11.6 years (range: 18–89), and 564 (62.7%) had at least a bachelor’s degree. The demographic details of the study sample are summarized in Table 1. Of the 900 participants, 669 (74.3%) had comorbidities. The most prevalent metabolic syndrome component was central obesity ($n = 553$; 61.4%), followed by hypertension ($n = 408$; 56.4%), dia-

Table 1. Demographic characteristics of study participants ($n = 900$)

Parameter	Total sample
Age, years	55.1 ± 11.6
Gender	
Male	430 (47.8)
Female	470 (52.2)
Educational levels	
Not educated/school	336 (37.3)
Bachelor/graduate study	564 (62.7)
Monthly income	
\leq JOD 500 (USD 715)	406 (46.1)
$>$ JOD 500 (USD 715)	475 (53.9)
Active smoking	
Yes	234 (26.0)
No	666 (74.0)
Alcohol drinking	
Yes	22 (2.4)
No	877 (97.6)
Performs exercises	
Yes	248 (27.6)
No	652 (72.4)
Family history of premature CVD	
Yes	306 (34.0)
No	594 (66.0)

Values are given as means \pm SD or n (%). CVD, cardiovascular diseases.

betes ($n = 403$; 44.8%), high triglyceride level ($n = 397$; 44.1%), and low HDL-C ($n = 245$; 27.2%).

Participants’ Knowledge and Attitude Related to Metabolic Syndrome

The evaluation of the participants’ knowledge and attitudes regarding the concept of metabolic syndrome are given in Table 2: 125 (13.9%) had heard about metabolic syndrome and 177 (13%) reported that they understood what metabolic syndrome meant; approximately 70% of participants ($> 70\%$, $n > 630$) did not demonstrate adequate knowledge about metabolic syndrome and its components. All questions had a response rate of less than 30%, with the exception of 1 question regarding the awareness of the impact of sedentary lifestyle on the development of metabolic syndrome, where the response rate was 60.3% ($n = 543$). The median knowledge score was 1.0 (range: 0–9) and 217 (24%) had “adequate knowledge.”

Of the 900 participants, 289 (32.1%) thought that their health status was very good to excellent, and 731 (81.2%) had a “negative attitude.”

Table 2. Participants' knowledge and attitude related to metabolic syndrome ($n = 900$)

Statement	Total, n (%)
Knowledge	
I have heard about metabolic syndrome or syndrome X (yes)	125 (13.9)
I understand what metabolic syndrome or syndrome X is (yes)	117 (13.0)
Metabolic syndrome is a risk for cardiovascular diseases (yes)	237 (26.3)
Sedentary lifestyle is a risk for metabolic syndrome (yes)	543 (60.3)
Central obesity is a component of metabolic syndrome (yes)	265 (29.4)
Diabetes is a component of metabolic syndrome (yes)	227 (25.2)
Hypertension is a component of metabolic syndrome (yes)	223 (24.8)
High triglyceride level is a component of metabolic syndrome (yes)	238 (26.4)
Low HDL-C level is a component of metabolic syndrome (yes)	182 (20.2)
Attitude	
I expect my health to get worse over time (never-rarely)	287 (31.9)
I seem to get sick a little more easily than other people (never-rarely)	466 (51.8)
I am concerned that my health problems will get worse over time (never-rarely)	280 (31.1)
My health status is (Excellent-very good)	289 (32.1)

Table 3. Factors affecting patients' adherence to medications

Parameter	Medication adherence score			
	Pearson correlation coefficient	p value ^a	Pearson correlation coefficient	p value ^b
Age (years)	0.172	<0.001*	0.140	<0.001*
Gender (0: male, 1: female)	0.056	0.093	–	–
Education (0: not educated/school, 1: bachelor/graduate)	–0.059	0.075	–	–
Monthly income (JOD) (0: ≤500, 1: >500)	–0.068	0.043*	–0.067	0.041*
Family history of CVDs (0: no, 1: yes)	0.017	0.619	–	–
Actual MetS (0: no, 1: yes)	0.075	0.024*	–0.044	0.477
Number of MetS components	0.103	0.002*	0.123	0.052
Advised by physician (0: no, 1: yes)	0.002	0.960	–	–
Hypertension (0: no, 1: yes)	0.132	<0.001*	0.075	0.036*
Diabetes (0: no, 1: yes)	0.046	0.166	–	–
Central obesity (0: no, 1: yes)	0.042	0.210	–	–
Low HDL-C (0: no, 1: yes)	0.017	0.609	–	–
High triglyceride (0: no, 1: yes)	–0.006	0.862	–	–
Knowledge score	0.047	0.160	–	–
Attitude score	0.186	<0.001*	0.230	<0.001*

MetS, metabolic syndrome. ^a Simple linear regression. ^b Multiple linear regression. * Significant at 0.05 significance level.

Adherence to Medications and Lifestyle Changes

Of the 900 participants, 436 (48.4%) were classified as “nonadherent” to medications, while 813 (90.3%) were “nonadherent” to diet and exercises. The association between the sociodemographic as well as disease-based variables and adherence to medications and lifestyle changes are shown in Tables 3 and 4, respectively. Participant age, the presence of hypertension, and attitude toward health

were positively associated with the adherence to medications score ($r = 0.140$, $p < 0.001$; $r = 0.075$, $p = 0.036$; $r = 0.230$, $p \leq 0.001$, respectively) while income level had a negative association ($r = -0.067$, $p = 0.041$) (Table 3).

The participants' educational levels, knowledge scores, and attitudes toward health were positively associated with better adherence to lifestyle changes score ($r = 0.085$, $p = 0.023$; $r = 0.135$, $p = 0.001$; $r = 0.183$, $p \leq 0.001$, respec-

Table 4. Factors affecting patients' adherence to lifestyle changes

Parameter	Lifestyle changes' adherence score			
	Pearson correlation coefficient	<i>p</i> value ^a	Pearson correlation coefficient	<i>p</i> value ^b
Age (years)	-0.107	0.001*	-0.051	0.146
Gender (0: male, 1: female)	0.053	0.110	-	-
Education (0: not educated/school; 1: bachelor/graduate)	0.167	<0.001	0.085	0.023
Monthly income (JOD) (0: ≤500, 1: >500)	0.092	0.006	-0.013	0.708
Family history of CVDs (0: no, 1: yes)	0.019	0.567	-	-
Actual MetS (0: no, 1: yes)	-0.086	0.010	-0.007	0.906
Number of MetS components	-0.097	0.004	0.009	0.881
Advised by physician (0: no, 1: yes)	0.160	<0.001	0.071	0.062
Hypertension (0: no, 1: yes)	-0.059	0.075	-	-
Diabetes (0: no, 1: yes)	-0.016	0.632	-	-
Central obesity (0: no, 1: yes)	-0.124	<0.001	-0.106	0.003
Low HDL-C (0: no, 1: yes)	-0.028	0.394	-	-
High triglyceride (0: no, 1: yes)	0.006	0.846	-	-
Knowledge score	0.214	<0.001	0.135	0.001
Attitude score	0.205	<0.001	0.183	<0.001

MetS, metabolic syndrome. ^a Simple linear regression. ^b Multiple linear regression. * Significant at 0.05 significance level.

tively), while central obesity was negatively associated with the adherence to lifestyle changes score ($r = -0.106$, $p = 0.003$) (Table 4).

The effect of knowledge and attitude on participants' nonadherence rates are given in Table 5. Attitude had a greater influence on patient adherence to both medications and lifestyle changes compared to knowledge. Patients with inadequate knowledge had a higher nonadherence rate to lifestyle changes (from 734 [81.6%] to 837 [93.1%], $p \leq 0.001$) and medications (from 398 [44.2%] to 448 [49.8%], $p = 0.155$). Patients with negative attitudes had higher nonadherence rates to lifestyle changes (from 703 [78.1%] to 841 [93.4%], $p \leq 0.001$) and medications (from 288 [32.0%] to 473 [52.5%], $p \leq 0.001$).

Discussion

In this study, rates of adherence to lifestyle activities and medications were 9.7% and 50.4%, respectively. The 50.4% adherence to medications was lower than 68% reported previously in an Indian study of patients at high risk of metabolic syndrome [21], and that of the SHIELD study where >20% of its participants failed to adhere to medication [20].

Table 5. Patients with higher knowledge had lower nonadherence rates to lifestyle changes and medications, and patients with a positive attitude had lower nonadherence rates to lifestyle changes and medications

	Inadequate knowledge	Negative attitude	Adequate knowledge	Positive attitude
Lifestyle	93.1%	93.4%	81.6%	78.1%
Medication	49.8%	52.5%	44.2%	32%

In this study, older age was associated with better adherence to medications, but not to lifestyle changes. These findings were consistent with a previous report, where older age had been shown to be associated with better medication adherence rates among adults with different chronic diseases [23]. This association could be due to the high prevalence of multimorbidity, poorer health status, and more limitations on adopting lifestyle changes among older patients.

Monthly income was shown to be associated with lower adherence to medications in this study, which is at variance with previous studies in which higher monthly income did not have an association [24], and positive association with adherence rate [23].

The higher level of education that helped to improve patients' adherence to lifestyle changes is in agreement with a previous study [23] that showed an increased mean adherence level with higher levels of education. The findings that the presence of hypertension was associated with better adherence to medications, central obesity was associated with a lower adherence to lifestyle changes, while adherence was not associated with the presence of metabolic syndrome confirmed the previous findings [25, 26]. Guerra et al. [25] reported that metabolic syndrome was not an independent risk factor since its effects were mainly mediated by increased BMI in hypertensive patients. In a systematic review [26], it was reported that metabolic syndrome was not an independent predictor of atherosclerosis after adjustment for its individual components [26]. Hence, it has been suggested that the metabolic syndrome requires more study as too much essential information is missing to assign the term "syndrome," and further studies to examine the clarity of the existing definition of the metabolic syndrome for diagnostic purposes should be conducted to assess the usefulness of the syndromes definition for CVD risk [27]. On the other hand, some other reports strongly highlighted the importance of recognizing metabolic syndrome as a "syndrome"; these reports were investigated in a systematic review which confirmed a strong association of the definition of the metabolic syndrome with cardiovascular risk and recommended that health care providers use the metabolic syndrome as a diagnostic tool to identify patients at risk for cardiovascular events [28].

Participants in our study showed an overall negative attitude toward their health status. The negative attitude toward health in this study had a significant influence on adherence to both management approaches; patients who reported a more negative attitude toward their health status were less likely to adhere to lifestyle changes and medication. This finding is consistent with the suggestion that negative attitude can negatively influence the level of adherence to medications in different chronic medical conditions [29, 30]. The importance of improving attitude was shown in several previous studies to be associated with better behavior, which results in better control rates of diseases [15, 16, 20]. It has been shown that the most difficult patients to treat are those who are nonadherent with negative attitudes toward their health, and the greatest opportunity for health care providers to make a difference lies in a group of nonadherent patients who have a positive attitude [20]. In this study, 32 and 78% of participants with positive attitude were nonadherent to medications and lifestyle changes, respectively. This

group of patients with positive attitudes have been reported to be the most likely to embrace lifestyle changes and improve their adherence to medication, and consequently improve their health status [20].

Participants in our study showed inadequate knowledge about the concept and components of metabolic syndrome and its association with CVDs. Inadequate knowledge about metabolic syndrome was also found to negatively affect adherence to lifestyle changes but not to medications. This is consistent with previous reports of the negative effect of inadequate knowledge on adherence to medication, these reports also suggested that inadequate knowledge can affect the patients' perceived threat of complications, which in turn negatively affects their motivation for behavioral changes [13, 20].

The methodological limitations of this study included reliance on participants self-reporting about their knowledge, attitude, and adherence to different management approaches; this could have underestimated and perhaps overestimated the actual knowledge score and adherence level since the patients might be unwilling to reveal their knowledge or adherence deficiencies.

Conclusion

In this study, low adherence rates to medications and lifestyle changes were common among the participants with metabolic syndrome high-risk. Patients' knowledge about metabolic syndrome and attitudes toward health were among the most important factors affecting adherence rates. The high lack of knowledge and negative health attitude highlighted the need to incorporate patients' educational programs into current management protocols for patients at high risk of metabolic syndrome. Such programs could potentially improve adherence to both medication and lifestyle changes and consequently lead to modifying their cardiovascular risk.

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Disclosure Statement

The authors report no conflicts of interest.

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