Original Article

Metabolic Syndrome and Health-related Quality of Life in Reproductive Age and Post-menopausal Women: Tehran Lipid and Glucose Study

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Abstract

Background: Given the lack of data clarifying the manner in which women with metabolic syndrome (MetS) in different eras of their life perceive their health-related quality of life (HRQoL), this study aimed at investigating the association between MetS and HRQoL in reproductive age and post menopausal women.

Methods: This was a cross-sectional study conducted within the framework of Tehran Lipid and Glucose Study (TLGS). Metabolic syndrome was defined according to the Joint Interim Statement (JIS) and HRQoL was assessed using the Short Form Health Survey (SF-36). Logistic regression analysis was used to estimate the odds ratio (OR) of poor HRQoL with 95% confidence intervals (CIs) for reproductive age and post-menopausal women separately and adjusted for confounding variables.

Results: All 603 participants with (n = 340) and without (n = 263) MetS were studied. Overall, in both physical and mental domains, those without MetS had higher scores in all subscales of SF-36 except for vitality, role emotional and mental component summary. Unadjusted odds ratios (95% CI) for poor physical HRQoL were 2.8 (1.7–4.6); ($P < 0.001$) and 1.5 (0.7–3.4) for the reproductive age and post-menopausal groups, respectively. Compared to the post-menopausal group, the odds ratio of reporting poor HRQoL for reproductive age women was significantly higher, even after adjusting for age (OR: 1.7, 95% CI: 1.0–3.0, $P < 0.05$).

Conclusion: The results indicate that MetS is associated with poor HRQoL in reproductive age, but not in post-menopausal women, and the association is observed mainly in relation to physical rather than mental health.

Keywords: Menopause, metabolic syndrome, quality of life, women

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Introduction

Metabolic syndrome (MetS), a chronic and progressive condition which includes a cluster of cardiovascular risk factors including obesity, dyslipidemia, hypertension, and insulin resistance, increases the risk of cardiovascular diseases and diabetes type 2.[1] Depending on the different definitions available, the prevalence of MetS among Iranian populations has been reported to range between 17.5%–33.7%, being considerably higher in women than men.[2,3]

Health-related quality of life (HRQoL) refers to the self-reported effects of a medical condition on the physical and mental functioning and the well-being of patients.[4] Based on the majority of previous studies, women with MetS are more likely to report poor HRQoL than men under the same conditions. Park et al., showed the negative relationship of MetS with HRQoL which differs by gender.[5] We have previously reported that MetS predicts poor physical HRQoL only in women but not in men, even using of different definitions.[4,6] Consistent with our findings, Ford et al., reported more physically unhealthy days for women with MetS but found it not significant in men.[7]

The mechanisms underlying the paradoxical gender differences in the association between HRQoL and MetS are not clear. However, these mechanisms might be both biological and psychosocial. Higher prevalence rates of general and central obesity[8,9] stronger marginal correlations among cardiovascular risk factors[10] and weaker psychosocial adjustment in relation to cardiovascular disease[11] among women have been hypothesized as the most important factors in creating these gender differences. On the other hand, several studies showed that menopause, permanent cessation of ovarian function, causes a decrease in women's HRQoL independent of their age,[12–14] an impact which has been attributed to psychological aspects, besides vasomotor and physical symptoms such as hot flashes, headache and bone complaints which strongly impair perceived health by women. Considering the major effects of menopause on HRQoL, it is reasonable to hypothesize that gender differences observed in the relationship between MetS and HRQoL are due to menopausal changes. Given the lack of data clarifying the manner in which women with MetS in different eras of their life perceive their HRQoL, this study aimed to investigate the association between MetS and HRQoL in non-diabetic reproductive age and post-menopausal women participating in the TLGS.

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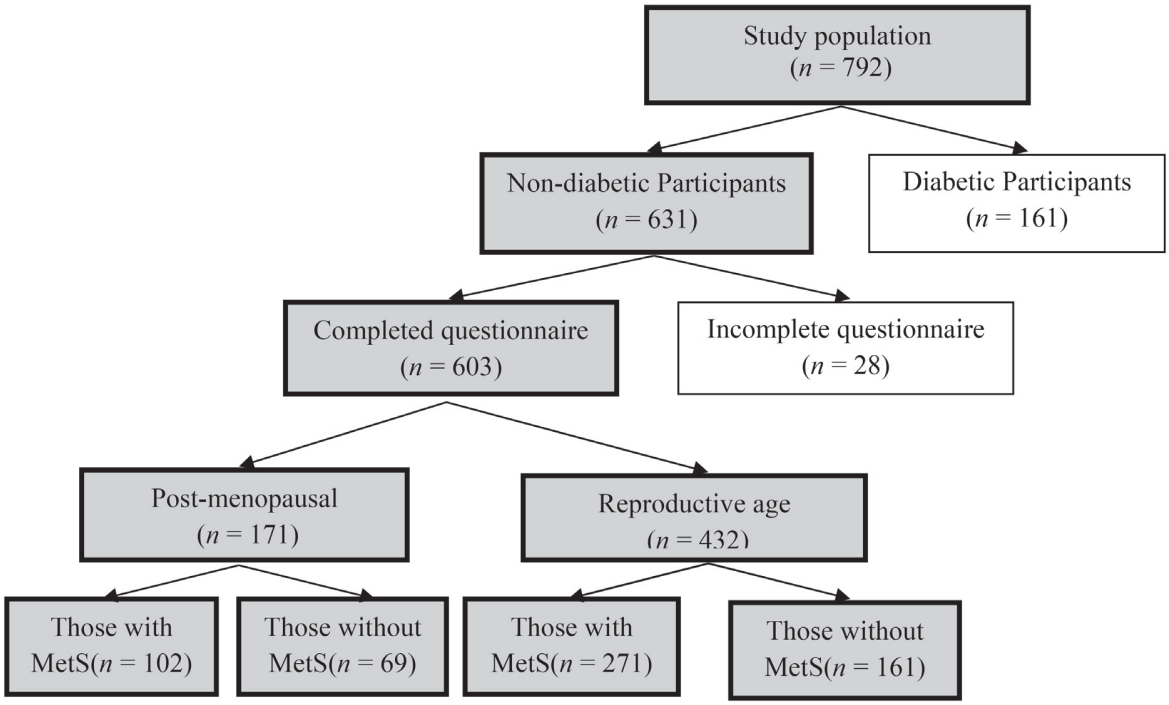

Figure 1. The sampling frame of study.

Materials and methods

Subjects and Design

The current study was conducted within the framework of the TLGS; a large scale community based prospective study performed on a representative sample of residents of District-13 of Tehran, the capital of Iran. Details of the rationale and design of the TLGS have been published elsewhere.[15] The TLGS has two major components: phase 1 (1999 to 2001) was a cross-sectional prevalence study of non-communicable diseases (NCDs) and their associated risk factors; phase 2 is an ongoing prospective follow-up study in which NCD risk factors are measured, approximately every 3 years. Following baseline collection of data, the intervention phase of the study was designed to improve lifestyle and prevent NCD risk factors.[16]

In this study, a representative sample of 792 women aged ≥20 years, who participated in the TLGS between September 2005 and September 2007, were recruited for this study. All participants were interviewed by a trained interviewer to collect data on HRQoL, socio-demographic information, physical activity, smoking habits, and medications used. Of the initial sample, 161 (20.3%) participants diagnosed as diabetic were excluded from the study and finally, after further elimination of 28 (4.4%) participants for missing data, the information of 603 women was analyzed (Figure 1). All participants gave written informed consent. The study was approved by the ethics committee, Research Institute for Endocrine Sciences, Shahid Beheshti University of Medical Sciences.

HRQoL measurement

Health-related quality of life was measured using the Iranian version of the Short Form Health Survey (SF-36), a widely used questionnaire that measures eight health-related concepts, including physical functioning, and role limitations due to physical health problems, bodily pain, general health, vitality, social functioning, role limitations due to emotional problems, and mental health as well as a summary of physical and mental measures.[17] The psychometric properties of the Iranian version of the SF-36 are well documented.[18] For each scale, a score was assigned from 0 to 100, with higher scores denoting better health conditions. However, to calculate the physical component summary (PCS) and the mental component summary (MCS) scores, we used the Quality Metric Health Outcomes Scoring Software 2.

Definitions

Metabolic syndrome was defined according to the JIS criteria,[19] namely: elevated waist circumference ≥91 cm[20]; 2) reduced HDL-C <50 mg/dL or medical treatment for reduced HDL-C; 3) elevated triglycerides level ≥150 mg/dL or medical treatment for elevated triglycerides; 4) elevated blood pressure (≥130 mmHg systolic blood pressure or ≥85 mmHg diastolic blood pressure) or antihypertensive medical treatment in a patient with a history of hypertension; and 5) elevated fasting glucose ≥100 mg/dL or medical treatment for elevated glucose. Menopause was defined as the time of cessation of menstrual periods for 12 consecutive months, not due to surgery or any other biological or physiological causes.[21] Smoking status was considered in two groups: 1) non- and ex-smokers, and 2) current smokers.[22] Leisure time physical activity was measured based on the hours of physical activity throughout the week.[23,24] Diabetes was defined according to the criteria of the American Diabetes Association (ADA) as fasting plasma glucose ≥126 mg/dL or 2-hr post 75(g) glucose load ≥200 mg/dL or current therapy for a definite diagnosis of diabetes.[25]

Other measures

Waist circumference was measured at the umbilical level, over light clothing, using an unstretched tape meter, without any pressure to body surface and measurements were recorded to the nearest 0.1 cm. Blood pressure was measured twice, after participants were seated for 15 min, using a standard mercury sphygmomanometer. There was at least a 30s interval between these two separate measurements and the mean of the two measurements was recorded as the blood pressure. Twelve-hour fasting blood samples were collected in tubes containing 0.1% EDTA and were centrifuged at 4°C and 500×g for 10 min to separate the plasma. Blood glucose was measured on the day of blood collection by an enzymatic colorimetric method using glucose oxidase. Total serum cholesterol and triglyceride concentrations were measured with commercially available enzymatic reagents (Pars Azmoon, Tehran, Iran) adapted to a selectra autoanalyzer. HDL cholesterol was measured after precipitation of the apolipoprotein B-containing lipoproteins with phosphotungistic acid. Low density lipoprotein-cholesterol was calculated from serum total cholesterol, triglyceride, and HDL-C, except when triglyceride concentration was > 400 mg/dL.[16]

All information including age, physical activity,[24] and current use of oral hypoglycemic agents, lipid lowering and anti-hypertensive medication were obtained from TLGS data.

Statistical analysis

Continuous variables were checked for normality using graphical methods and are expressed as means ± SE. Distribution of variables between two groups was compared using independent sample *t*-test, and categorical variables were compared using χ^2 test and are reported as percentages.

Multiple analysis of covariance (MANCOVA) was used to compare the means (SE) of the mental and physical component summary (MCS & PCS) scores, physical subscales (physical functioning, role physical, bodily pain and general health), and mental subscales (vitality, social functioning, role emotional and mental health) scores between women with and without MetS in both reproductive age and postmenopausal groups. Data were adjusted for age, education and physical activity.

Logistic regression analysis was used to estimate the OR of poor HRQOL, defined as scores below the mean scores of the physical or mental component summaries. For this purpose, the study sample was divided into two groups; those who scored equal to or greater than the mean and those who scored below the mean. Odds ratios with 95% CIs were computed for reproductive aged and post-menopausal women separately; model 2 adjusted for age (years), and model 3, adjusted for age, physical activity, smoking (Ref: never or ex-smoking), education (Ref: above high school), and marital status (Ref: married). Statistical analysis were performed using SPSS for Windows (version 16; SPSS Inc., Chicago, IL, USA), and significance was set at $P < 0.05$.

Results

General metabolic and clinical characteristics of participants in the study are listed in Table 1. In both the reproductive age and post-menopausal groups, women with MetS had higher mean levels of triglyceride ($P < 0.001$), systolic blood pressure ($P < 0.001$), diastolic blood pressure ($P < 0.001$), body mass index ($P < 0.001$), waist circumference ($P < 0.001$), and fasting blood sugar ($P < 0.001$) compared to those without this syndrome. Moreover, those with MetS had significantly lower HDL-C levels than those without MetS ($P < 0.001$). In addition, compared to women without MetS, rates of primary education were significantly higher in those with the syndrome in both groups ($P < 0.05$). A significant difference for leisure time physical activity between those with

Table 1. General characteristics of study participants.

	Total		Reproductive age		Post-menopausal status	
	With MetS (*n* = 263)	**Without MetS (*n* = 340)**	**With MetS (*n* = 161)**	**Without MetS (*n* = 271)**	**With MetS (*n* = 102)**	**Without MetS (*n* = 69)**
Age (y)	52.2 (0.8) †	41.3(0.7)	46.4 (0.9)*	36.8 (0.7)	61.5 (0.8)*	59.0 (0.9)
Education (%)						
Primary	165(62.7)	129(37.9)	77 (47.8)*	80 (29.5)	88 (86.3)*	49 (71.0)
Secondary	82(31.2)	147(43.2)	70 (43.5)	131 (48.3)	12 (11.8)	16 (23.2)
Higher	16(6.1)	64(18.8)	14 (8.7)	60 (22.1)	2 (2.0)	4 (5.8)
Marital status (%)						
Married	207(78.7)	272(80)	137 (85.1)	218 (80.4)	70 (68.6)	54 (78.3)
Single/widow/Divorced	56(21.3)	68(20)	24 (14.9)	53 (19.6)	32 (31.4)	15 (21.7)
MET-h/ wk	10.1(1.0)	9.3((0.8)	9.5 (1.4)	9.4(0.9)	11.1 (1.4)*	9.0(1.2)
BMI (kg/m²)	31.9(0.3) †	27.3(0.3)	32.6 (0.4) †	26.8(0.3)	30.8(0.4) †	28.8(0.6)
WC (cm)	100(0.6) †	85.7 (0.7)	100(0.8) †	83.8 (0.7)	99.2 (0.8) †	93.0(1.4)
TG (mg/dL)	217(5.4) †	121.3(3.7)	214 (6.0) †	117 (4.1)	221 (10.1) †	135(8.9)
Total cholesterol	211 (2.4) †	193 (2.0)	205(3.0) †	185 (2.0)	220 (3.7)	223(4.0)
HDL-C (mg/dL)	39.6(0.5) †	48.1(0.6)	38.3(0.6) †	47.0 (0.6)	41.5 (0.9) †	52.5(1.3)
LDL-C (mg/dL)	128(2.3) †	120.4(1.7)	123(2.8) *	114 (1.8)	137(3.8)	143(3.8)
FBS (mg/dL)	94.2(0.6) †	86.6(0.4)	93.2(0.8) †	85.5 (0.4)	95.8 (1.0) †	90.9(1.0)
SBP (mmHg)	125(1.2) †	107.9(0.8)	121(1.5) †	106 (0.8)	132(2.0) †	115(1.9)
DBP (mmHg)	77.1(0.6) †	70.1(0.5)	76.8(0.8) †	69.4 (0.5)	77.5 (1.0) †	72.9(1.0)

Data are presented as Mean (SE) unless stated otherwise. WC = waist circumference; TG = triglycerides; HDL-C = high density lipoprotein-cholesterol; FBS = fasting blood sugar; IFG = impaired fasting glucose; SBP = systolic blood pressure; DBP = diastolic blood pressure; BMI = body mass index; LDL-C = low density lipoprotein-cholesterol. Metabolic syndrome is defined based on joint interim statement (JIS).[19] *$P < 0.05$, †$P < 0.001$according to independent sample *t*-test and Chi-square between those with and without metabolic syndrome.

Table 2. Quality of life scores according to metabolic syndrome status in reproductive age and post-menopausal women.

	Total		Reproductive age		Post- menopausal status	
	With MetS (n = 263)	Without MetS (n = 340)	With MetS (n = 161)	Without MetS (n = 271)	With MetS (n = 102)	Without MetS (n = 69)
Physical functioning	70.3(1.4)	76.2(1.2)*	71.9(1.8)	78.0(1.4)*	66.7(2.9)	71.8(3.0)
Role physical	59.4(2.3)	64.9(2.0)‡	59.9(3.0)	68.7(2.3)*	54.9(4.8)	52.9(5.1)
Bodily pain	65.5(1.3)	70.4(1.1)*	67.3(1.6)	69.1(1.2)	61.8(2.7)	72.9(2.8)*
General health	59.1(1.2)	62.4(1.0)*	58.0(1.6)	62.4(1.2)*	62.8(2.1)	62.0(2.2)
Vitality	57.4(1.3)	57.9(1.2)	56.6(1.7)	57.1(1.3)	57.2(2.6)	57.0(2.8)
Social functioning	70.4(1.5)	73.8(1.3)	70.5(1.9)	73.5(1.5)	69.0(3.0)	72.9(3.2)
Role emotional	59.6(2.6)	59.0(2.2)	63.0(3.3)	62.1(2.5)	52.1 (5.1)	51.3(5.5)
Mental health	63.4(1.3)	65.4(1.1)	63.5(1.7)	65.0(1.3)	63.2 (2.5)	65.8(2.6)
PCS	47.2(0.5)	49.7(0.5) †	47.5(0.7)	50.1(0.5)*	46.5(1.1)	48.5(1.2)
MCS	44.1(0.7)	44.0(0.6)	44.3(1.0)	43.9(0.7)	43.5(1.3)	43.6(1.4)

Data are represented as mean (SE), and adjusted for age, education and physical activity. Metabolic syndrome is defined based on joint interim statement (JIS). [19]
PCS = physical component summary; MCS = mental component summary. *P < 0.05, †P < 0.001, ‡P < 0.08 between those with and without metabolic syndrome

Table 3. Unadjusted and adjusted odds ratios for poor HRQoL in women with MetS compared to those without this syndrome in total and by reproductive age and post-menopausal groups.

		Physical Component Summary (PCS)	Mental Component Summary (MCS)
All (n = 603)			
	Model 1	2.70(1.8–4.0) †	1.1 (0.7–1.6)
Model 2		1.6(1.0–2.6) *	0.9 (0.6–1.4)
	Model 3	1.6 (1.0–2.6)*	0.9 (0.6–1.4)
Reproductive age (n = 432)			
	Model 1	2.8(1.7–4.6) †	1.1 (0.7–1.7)
	Model 2	1.7 (1.0–3.0)*	0.9 (0.5–1.5)
	Model 3	1.7 (1.0–3.0)	0.8 (0.5–1.4)
Post-Menopausal (n = 171)			
	Model 1	1.5(0.7–3.4)	0.8 (0.4–1.8)
	Model 2	1.4 (0.6– 3.0)	0.9 (0.4–2.0)
	Model 3	1.4 (0.6–3.1)	1.0 (0.4–2.2)

Model 1: Unadjusted; Model 2: Adjusted for age; Model 3: Adjusted for age, physical activity, education (Ref: above high school education), and marital status (Ref: married). PCS = physical component summary; MCS = mental component summary. *P < 0.05, †P < 0.001.

and without MetS was seen only in post menopausal women (P < 0.05).

Overall, in both physical and mental domains, those without MetS had higher scores in all subscales of SF-36 except for vitality, role emotional and MCS scores which were approximately the same. Among the subscales, physical functioning and social functioning received the highest scores in total (Table 2). In the reproductive age group, women with MetS had significantly lower scores in the PCS, physical functioning, role physical and general health than those without this syndrome. However, these findings were not significant for the mental subscales and MCS. In the post-menopausal group, except for bodily pain, none of the physical and mental scales and subscales differed significantly between those with and without MetS (Table 2).

In total, women with MetS were more likely to report poorer physical HRQoL than those without this syndrome, even after adjusting for potential confounders. However, there were no significant differences for poor mental HRQoL between those with and without MetS in either the reproductive age and post-menopausal groups.

In a separate analysis, unadjusted ORs (95% CI) for poor physical HRQoL were 2.8 (1.7–4.6) (P < 0.001) and 1.5 (0.7–3.4) for reproductive age and post-menopausal groups, respectively. In reproductive age women, the ORs for physical HRQoL were significantly higher in those with MetS than those without this syndrome even after adjusting for age (1.7 (1.0–3.0), P < 0.05). After adjusting for age, physical activity, education and marital status, women with MetS showed no significant differences in either group (Table 3).

Discussion

This study aimed to compare HRQoL in women with and without MetS in two separate groups of reproductive age and post-menopausal status. The results show that even after adjusting for potential confounders, women with MetS in the reproductive age group, had significantly lower scores in physical functioning, role physical, general health and PCS scale than those without this syndrome. In the post-menopausal group, a significant difference was observed only in bodily pain between those with and without MetS. Moreover, only in the reproductive age group, women with MetS were more likely to report poor physical HRQoL even after adjusting for age, compared to those without this syndrome. However, poor mental HRQoL was not significantly associated with MetS in either the reproductive age or the postmenopausal group.

In this study, findings of poor physical HRQoL among women with MetS support the results obtained in most previous studies; in the US, women with MetS have more activity limited days than those without this syndrome.[7] These results are partially consistent with another study conducted in Korea that found MetS to be associated with a mobility problem in both genders.[5] There is more evidence showing that the number of diagnostic components of the metabolic syndrome were inversely associated with general health among the Japanese, but not in the mental health domain.[26] These results agree with our previous study which revealed a significant decreasing trend in the scores of women's PCS with an increase in the number of metabolic syndrome components.[4] However, some studies found MetS difficult to discern as a risk factor for poor HRQoL among Iranians and some other

populations.[27,28]

Although the association between MetS and poor HRQoL in women has been well established, there is limited evidence addressing this association separately in two of the most important stages of women's life. Based on a previous study, Italian women over 75 years of age, MetS was not associated with poor HRQoL in either the physical and mental domains.[29] More evidence shows that postmenopausal obese women reported better HRQoL than their counterparts in the reproductive age.[30] However, findings from another study revealed that in postmenopausal Ecuadorian women, poor HRQOL in the vasomotor, physical and psychosocial domains were mainly associated with abdominal obesity.[31] In this vein, middle aged Australian women, with higher prevalence metabolic risk factors had significantly lower physical functioning, physical health and higher bodily pain scores.[32]

Based on previous studies, menopausal women experience the worst HRQoL, especially in vasomotor domains, physical health and the psychosocial domains,[12,13] an effect reported to be associated with their socio-demographic status, showing that married women of lower age, higher educational status and lower BMI experience a better quality of life (30). Moreover, the experiences of menopause and menopausal symptoms reported differ among different ethnical groups as Asian women are reported to experience less vasomotor symptoms than Western women.[33,34] In the present study, although postmenopausal women had lower mean scores in all scales and subscales of SF-36, compared to those with and without MetS, we observed a significant association between this syndrome and HRQoL, mostly in the reproductive age group. These findings imply that MetS could not play an important role in the HRQoL of post-menopausal women. Hence, it seems reasonable to hypothesize that the difference of the effect of MetS on HRQoL in the reproductive age and post-menopausal groups could be related to several factors, such as different expectations of health, fitness and physical ability. The metabolic syndrome contributes significantly to the poorly perceived health status, firstly, due to large waist circumference that may influence body image and thus the HRQoL, and secondly, through anxiety, which is the most common psychological disturbance observed in obese patients in clinical settings.[8,35–37]

This study has both strengths and limitations. To the best of our knowledge, this is the first study on a sample of non-diabetic reproductive age and postmenopausal women, enabling us to make direct comparisons between HRQoL of those with and without MetS in different eras of women's lives. However, this study was cross-sectional, so we were unable to draw conclusions regarding the causal association between MetS and HRQoL. Moreover in the current study, subjects were not assessed for depression, which could be a confounder for MCS results.

Conclusion

Despite the fact that postmenopausal women have lower scores on SF-36 than reproductive age women, the significant impact of MetS on HRQoL was mainly observed in the latter group. These findings denote the importance of diagnosis and management of MetS, especially in women of reproductive age.

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