ORIGINAL RESEARCH—WOMEN'S SEXUAL HEALTH

Sexuality and Psychopathological Aspects in Premenopausal Women with Metabolic Syndrome

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ABSTRACT

Introduction. Metabolic syndrome (MetS) is a cluster of cardiovascular risk factors that have been suggested to impact female sexual function.

Aims. This study aims to assess the prevalence of female sexual dysfunction (FSD) in premenopausal women with MetS compared with healthy controls (HC). Psychopathological aspects and the relationship to FSD were also evaluated in both groups.

Methods. Two hundred four premenopausal women, of whom 98 had diagnosis of MetS, were asked to complete the Female Sexual Function Index (FSFI), the Female Sexual Distress Scale (FSDS), and the Middlesex Hospital Questionnaire (MHQ). Routine laboratory tests and anthropometric measurements were routinely performed.

Main Outcome Measures. FSFI and FSDS questionnaires, prevalence of FSD, and MHQ scores.

Results. In the MetS group compared with the HC group, we found: a lower global FSFI score ($P = 0.005$), higher prevalence of pathological scores compared with HC group, and lower scores in the desire, arousal, lubrication, and orgasm domains. An inverse correlation between the FSFI score and the number of risk factors for MetS was detected. MetS women reported significantly higher total scores in the somatization and depression domains when compared with the HC group. The logistic regression showed that high triglycerides (odds ratio [OR] 3.097; 95% confidence interval [CI] 1.272–7.542; $P = 0.026$) and somatization (OR 7.068; CI 95% 2.291–21.812; $P = 0.001$) are independently associated with FSD in premenopausal women.

Conclusions. Our results indicate a higher prevalence of sexual dysfunction in MetS women. A number of risk factors for MetS are positively associated with FSD and higher triglycerides seem to be the strongest predictors of sexual dysfunction. Psychopathological dimensions such as somatization are strongly associated with sexual dysfunction.

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Key Words. Metabolic Syndrome; Female Sexual Dysfunction (FSD); Female Sexual Function Index (FSFI); Female Sexual Distress Scale (FSDS); Middlesex Hospital Questionnaire (MHQ)

Introduction

Female sexual dysfunction (FSD) has become a worldwide public health problem. FSD is considered a disorder of sexual desire, orgasm, arousal, and sexual pain that results in significant personal distress [1], thereby having a big impact on personal relationships and the quality of a woman's life [2].

Many physiological factors can affect female sexual response. Indeed, a recent report by the

Princeton III Consensus suggests that an association between female sexual function and cardiovascular and metabolic disorders does exist and that more research is needed to clarify the impact of metabolic syndrome (MetS) on sexuality [3]. MetS is a multifactorial disease resulting from the co-occurrence of several cardiometabolic disturbances such as hypertension, central obesity, diabetes, and dyslipidemia. The Third National Health and Nutrition Examination survey reported that the age-adjusted MetS prevalence in the U.S. female population is 23% [4]. Similarly, 18% of Italian women are affected by MetS, and the prevalence increases with age reaching 25% in women aged 70 years or older [5]. Besides the indirect evidence provided by experimental studies [6,7], the impact of cardiovascular and metabolic risk factors, such as hypertension, obesity, dyslipidemia and diabetes on a woman's sexual function has been suggested by a few clinical trials [8–11]. Esposito K et al. reported an increased prevalence of FSD in premenopausal women affected by MetS, when compared with healthy counterparts, suggesting a role of increased inflammation associated with cardio-metabolic disorder in determining the impairment of sexual response [12]. Although subsequent studies have confirmed these results in both pre- and postmenopausal women [13,14], in a recent report, Kim et al. failed to demonstrate such an association suggesting little impact of MetS on women's sexuality [15]. This may be related in part to the fact that the researchers did not use validated questionnaires to evaluate sexual function and to the noninclusion of a concomitant evaluation of sexual dysfunction-related distress.

Finally, the exploration of psychopathological correlates of sexual function in healthy and unhealthy women is lacking.

Aims

The aims of the present study were to assess the prevalence of FSD in premenopausal women affected by MetS, compared with healthy counterparts, and to evaluate whether and which psychopathological domains may be associated with FSD.

Methods

Population

Women were screened for study enrollment. Women were selected from patients who attended the unit of gynecology of the university tertiary care center S. Orsola-Malpighi for regular gynecological checkups and from patients attending the unit of Metabolic Disease and Clinical Dietetics of the same centre who came for the first time or for the first control before starting any treatment.

Inclusion criteria were premenopausal status with regular menstrual cycle (length 26–36 days) [16], body mass index (BMI) <36, and no hormone intake at date of inclusion or during the previous 6 months. Exclusion criteria were postmenopausal status, irregular menstrual cycles (<24 or >36 days), contraceptive intake, gynecological pathologies (endometriosis, fibroma, and uterine prolapse), clinically relevant comorbidities (hepatic and renal diseases, cardiac and respiratory diseases, cancers, blood diseases), and diagnosed depressive syndrome with or without psychotropic treatment.

The diagnosis of MetS was based on the new International Diabetes Federation (IDF) criteria [17], which requires central obesity (waist circumference ≥80 cm) plus any two of the following risk factors: systolic blood pressure ≥130 or diastolic blood pressure ≥85 mm Hg; fasting plasma glucose content ≥100 mg/dL; plasma triglycerides ≥150 mg/dL; and plasma high-density lipoproteins (HDL) ≤50 mg/dL. Informed written consent was obtained from all women included in the study, and the study protocol was approved by the local Ethical Committee in accordance to the 1975 Declaration of Helsinki.

Anthropometric Measures and Laboratory Analysis

Clinical, biochemical, and anthropometric parameters were recorded at study inclusion. Height and weight were measured with women wearing lightweight clothing and no shoes. BMI was calculated as weight in kilograms divided by the square of height in meters (kg/m^2). Waist-to-hip ratio was calculated as waist circumference in centimeters divided by hip circumference in centimeters.

Finally blood pressure was measured (mean of three measurements, 5 minutes apart, in a sitting position using a standard sphygmomanometer), whereas fasting plasma glucose, total cholesterol, HDL, and triglycerides concentration were assessed by the centralized clinical laboratory of the S. Orsola-Malpighi University Hospital.

Assessment of Sexual Function

All women included in the study completed anonymously, the Female Sexual Function Index

(FSFI) [18], the Female Sexual Distress Scale (FSDS) [19] questionnaire, and questions on frequency of sexual activity.

The FSFI scale consists of 19 items that evaluate sexual function over 4 weeks and domain scores in six areas: sexual desire, arousal, lubrication, orgasm, satisfaction, and pain. Each domain was considered dysfunctional when the corresponding score was equal to or lower than 4.3, whereas the cutoff value of 26.5 for the global FSFI was used to discriminate women with and without sexual dysfunction [20,21].

The sexual activity-related distress was assessed through the FSDS, a self-assessment questionnaire composed of 12 items [19]. Women were required to quantify the frequency of each mood on a scale from 0 (= never) to 4 (= always). A total score higher or equal to 15 indicates a distress related to sexual life [19,22]. Each domain of sexual function was considered altered if associated with personal distress in accordance with the American Psychiatric Association guidelines [23].

Finally, all women were asked to complete the modified Italian version of the Middlesex Hospital Questionnaire (MHQ) [24,25], a brief self-reporting questionnaire for the screening of mental disorders, which provides scores for free-floating anxiety (MHQ-A), phobic anxiety (MHQ-P), somatization (MHQ-S), obsessive-compulsive (MHQ-O), depressive (MHQ-D), and hysterical (MHQ-H) traits and symptoms.

A list of brief questions on socio-demographic conditions, frequency of intercourse in the last 4 weeks, marital profiles and marital sexual problems as recorded by the woman, personal health, and medical history were also included.

Main Outcome Measurements

Statistical Analysis

All continuous data were described as mean and standard deviation or median and first to third quartiles, whereas grouping variables were expressed as frequencies. The Kolmogorov–Smirnov and Levene tests were applied to verify the normality and homogeneity of variance. Differences between groups were calculated using an independent sample *t*-test or the Mann–Whitney test when appropriate. Fisher's exact test was performed to investigate the relationship between grouping variables. The Kendall Tau correlation was used to investigate the association between grouping variables, whereas the Spearman rho was used for ordinal data. Multivariate logistic regression analysis using the Wald backward selection method was performed to detect covariates independently associated to FSD. Receiver opertaing characteristic (ROC) curve analysis was performed to compare the discriminating performance of covariates against FSD. To correct for multiple comparisons, false discovery rate adjusted *P* value derived from the Hochberg–Benjamini procedure was determined [26]. All tests were two-sided and corrected *P* value less than 0.05 were considered to be statistically significant. All analysis was performed using SPSS 20.0 software (SPSS Inc., Chicago, IL, USA).

Results

Study Population

Two hundred twenty-six women were asked to complete the questionnaires; however, only 215 accepted. Eleven were excluded from the study because they did not meet the inclusion criteria or had at least one exclusion criteria. In the end, 204 Caucasian women fully met the inclusion criteria and were included in the study. Ninety-eight women were diagnosed as having MetS. The other 106 women represented the healthy control (HC) group. Socio-demographic, anthropometric characteristics, clinical and biochemical parameters, and prevalence of risk factors in the HC and MetS women are reported in Table 1. Mean age did not significantly differ between the two groups. Women affected by hypothyroidism were all under replacement therapy in both HC (n = 18) and MetS (n = 20) groups. In the HC group, 50 women had no risk factor for MetS, 40 women had one and 16 women had two, whereas in the MetS group, 67 women had three risk factors, 27 women had four, and four women had five. No significant differences were found between the two groups regarding: smoking status, defined as currently smoking or not smoking, relationship status defined as not stable (no partner or partner < 6 months) or stable (partner > 6 months) relationship, and education level. Frequency of sexual activity in the two groups is reported in Table 2.

Prevalence of FSD in MetS and HC Women

Compared with the HC group, the MetS group had a lower global FSFI score ($P = 0.005$) (Figure 1A). An inverse correlation between FSFI score and the number of risk factors for MetS, as defined by the IDF, was detected (tau = –0.167, $P = 0.004$).

Table 1 Anthropometric, socio-demographic, metabolic, and clinical characteristics of women included in the study

	Whole population (n = 204)	MetS group (n = 98)	HC group (n = 106)	*P* value*
Anthropometric and clinical characteristic				
Age (years)	40.0 ± 8.8	41.3 ± 8.7	38.9 ± 8.8	0.084
Weight (kg)	74.9 ± 15.0	82.4 ± 12.4	68.0 ± 13.8	<0.001
BMI (kg/m^2)	28.3 ± 5.8	30.8 ± 4.1	25.9 ± 6.2	<0.001
Waist (cm)	91.8 ± 14.2	100.9 ± 10.1	83.3 ± 12.2	<0.001
WHR	0.85 ± 0.09	0.90 ± 0.06	0.82 ± 0.10	<0.001
Plasma glucose (mg/dL)	94.6 ± 32.1	102.0 ± 32.5	87.7 ± 30.2	0.005
HDL cholesterol (mg/dL)	57.5 ± 16.3	47.2 ± 12.1	67.2 ± 13.6	<0.001
LDL cholesterol (mg/dL)	103.4 ± 58.4	129.7 ± 61.3	78.8 ± 43.1	<0.001
Total cholesterol (mg/dL)	194.7 ± 36.3	195.7 ± 40.4	193.7 ± 32.2	0.839
Triglycerides (mg/dL)	113.9 ± 61.1	148.2 ± 63.1	81.51 ± 36.8	<0.001
Systolic blood pressure (mm Hg)	123.7 ± 12.2	130.1 ± 10.9	117.9 ± 10.4	<0.001
Diastolic blood pressure (mm Hg)	79.3 ± 7.9	82.4 ± 7.2	76.4 ± 7.5	<0.001
Socio-demographic characteristics				
Current smoker	39 (19.1%)	17 (17.3%)	22 (20.8%)	0.716
Stable relationship†	149 (73.0%)	72 (73.5%)	77 (71.7%)	1.000
Marital sexual problems	20 (9.8%)	12 (12.2%)	8 (7.5%)	0.444
High education‡	172 (84.3%)	82 (84.5%)	90 (84.9%)	1.000
MetS components				
Waist circumference ≥88 cm	134 (65.7%)	98 (100.0%)	36 (34.3%)	<0.001
Fasting glucose ≥100 mg/dL	52 (25.5%)	42 (42.9%)	10 (9.4%)	<0.001
Triglycerides ≥150 mg/dL	54 (26.5%)	50 (51.0%)	4 (3.7%)	<0.001
HDL cholesterol ≤50 mg/dL	84 (41.2%)	77 (78.6%)	7 (6.6%)	<0.001
SBP ≥130 or DBP ≥85 mm Hg	79 (38.7%)	63 (64.3%)	16 (15.1%)	<0.001
Specific medications				
Hypoglycemic drugs	44 (21.6%)	33 (36.7%)	11 (12.4%)	<0.001
Lipid-lowering drugs	17 (8.3%)	14 (15.6%)	3 (3.3%)	0.012
Antihypertensive drugs	25 (12.2%)	19 (21.1%)	6 (6.7%)	0.011

*Student *t*-test or Fischer exact test was used to compare differences between MetS and HC groups
†The relationship status was defined as stable if greater than 6 months
‡The education was defined as high if it includes at least high school or graduation
Data are presented as mean ± SD or frequencies (%)
BMI = body mass index; HDL = high density lipoprotein; LDL = low density lipoprotein; WHR = waist-to-hip ratio

Table 2 Median and (first to third quartile) FSDS and FSFI scores and prevalence n (%) of pathological scores in the two groups

	MetS group (n = 98)	HC group (n = 106)	*P* value
FSDS score	4.0 (1.0–12.0)	7.5 (1.0–13.0)	0.437
FSFI score	27.3 (9.2–31.6)	30.2 (25.8–34.2)	0.005
Prevalence of FSD	19.4% (19/98)	8.5% (9/106)	0.045
Sexual intercourse	1.0 (0.0–3.0)	2.0 (1.0–4.0)	0.004
FSFI domains score			
Desire	3.6 (2.4–4.8)	4.2 (3.6–4.8)	0.002
Arousal	3.9 (0.3–4.8)	4.8 (3.6–5.4)	0.003
Lubrication	4.8 (0.0–5.4)	5.4 (4.2–5.7)	0.010
Orgasm	4.5 (0.0–5.1)	5.1 (4.2–5.7)	0.004
Satisfaction	4.6 (3.2–5.6)	5.0 (4.4–6.0)	0.087
Pain	4.8 (0.0–6.0)	5.2 (4.0–6.0)	0.065
Prevalence of dysfunctional domains			
Desire	17 (17.3%)	12 (11.3%)	0.317
Arousal	12 (12.2%)	9 (8.5%)	0.606
Lubrication	16 (16.3%)	10 (9.4%)	0.214
Orgasm	16 (16.3%)	10 (9.4%)	0.210
Satisfaction	16 (16.3%)	8 (7.5%)	0.121
Pain	15 (15.3%)	8 (7.5%)	0.175

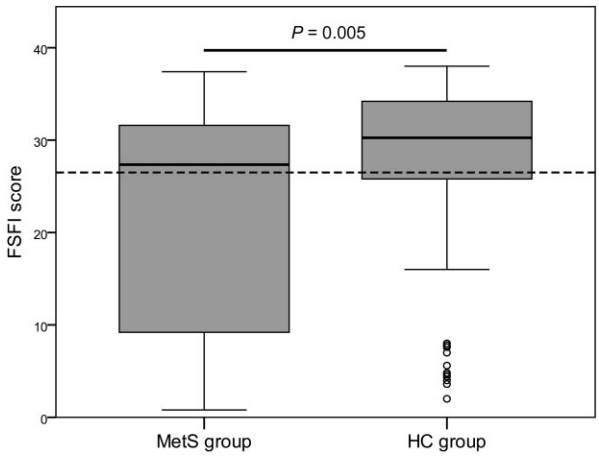

Figure 1 Comparison of FSFI score in women affected by MetS (n = 98) and healthy women (n = 106). The dotted line represents the cutoff FSFI score value of 26.5 used to discriminate women with and without sexual dysfunction.

The prevalence of FSFI pathological score (defined as ≤26.5) was significantly higher in the MetS group when compared with the HC group (44/98, 44.9% vs. 31/106, 29.2%, $P = 0.049$).The analysis of individual domains showed that women with MetS scored significantly lower in the desire, arousal, lubrication and orgasm domains than controls, whereas no statistically significant differences were detected in the satisfaction and pain domains (Table 2 and Figure 2).

Mean FSDS score and prevalence of pathological FSDS score (defined as FSDS ≥15) did not significantly differ between the two groups (Table 2).

Finally, the prevalence of FSD, defined as FSFI ≤26.5 and FSDS ≥15, was significantly higher in the MetS group (19/98, 19.4%) compared with the HC group (9/106, 8.5%) ($P = 0.045$). No significant differences were detected in the prevalence of pathological scores of each of the FSFI questionnaire domains when combined with the FSD (Table 2). ROC curve analysis demonstrated that the number of diagnosis criteria showed good sensitivity and specificity in predicting FSD (Area under the ROC curve [AUROC] 0.644 ± 0.490; 95% CI 0.547–0.741; $P = 0.029$). Frequency of sexual activity was significantly positively correlated with the FSFI total score (rho: 0.596, $P < 0.001$), desire (rho: 0.390, $P < 0.001$), arousal (rho: 0.554, $P < 0.001$), orgasm (rho: 0.554, $P < 0.001$), lubrication (rho: 0.526, $P < 0.001$), satisfaction (rho: 0.518, $P < 0.001$), and pain (rho: 0.532, $P < 0.001$) domain scores, negatively with FSDS scores (rho: –0.270, $P = 0.001$) and somatization (rho: –0.160, $P = 0.042$) domain scores of the MHQ questionnaire.

Prevalence of Psychosomatic Alteration in MetS and HC Women

Individual analysis of the different domains of the MHQ questionnaire showed that women with MetS reported significantly higher total scores only in the somatization and depression domains when compared with the HC group (Table 3). Instead free-floating anxiety, phobic anxiety, obsessive-compulsive traits and symptoms, hysterical traits and symptoms domains score, although slightly higher in the MetS group, did not reach statistical significance (Table 3).

Similarly, the prevalence of pathological scores was significantly higher in the MetS group when compared with the HC group only in the somatization and depression domains (Table 3). Additionally somatization and depression domain scores were directly related to the number of criteria for MetS (MHQ-S tau = 0.234, $P = 0.003$; MHQ-D tau = 0.194, $P = 0.011$).

Association Between Cardiometabolic Risk Factors, Psychosomatic Impairments, and FSD

The univariate analysis showed that in our population, among MetS criteria, only high waist circumference (24/28, 85.7%, $P = 0.034$) and high triglycerides (14/28, 50.0%, $P = 0.011$) were significantly associated to FSD. Women with FSD reported significantly higher prevalence of pathological scores in the anxiety (26/28, 92.9%,

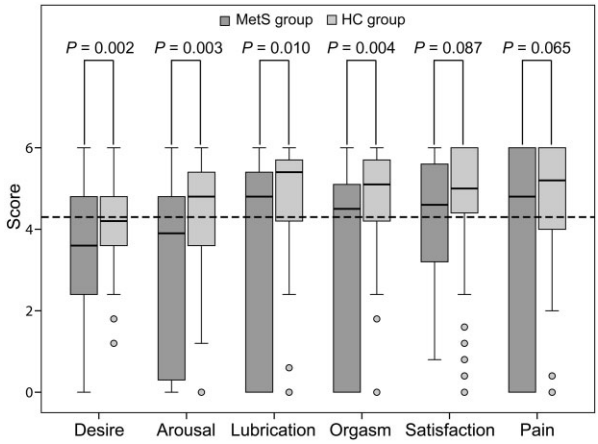

Figure 2 Comparison of the individual FSFI domain scores in women affected by MetS (n = 98) and healthy women (n = 106). The dotted line represents the cutoff value of 4.3 based on which the domains were defined as dysfunctional.

Table 3 Mean ± SD and (95% CI) MHQ domains score and prevalence of pathological scores in the two groups of women

		MetS group (n = 98)	HC group (n = 106)	*P* value
Anxiety	Mean	7.5 ± 3.3 (6.9–8.2)	6.8 ± 3.5 (6.1–7.4)	0.165
	Prevalence	(77/98) 78.6%	(77/106) 72.6%	0.437
Phobia	Mean	6.3 ± 2.9 (5.7–6.8)	5.6 ± 2.6 (5.1–6.1)	0.094
	Prevalence	(72/98) 73.5%	(68/106) 64.1%	0.243
Obsession	Mean	6.6 ± 3.4 (5.9–7.3)	5.9 ± 3.4 (5.3–6.6)	0.240
	Prevalence	(45/98) 45.9%	(44/106) 41.5%	0.699
Somatization	Mean	5.3 ± 3.2 (4.6–5.9)	3.9 ± 2.9 (3.3–4.4)	0.004
	Prevalence	(55/98) 56.1%	(39/106) 36.8%	0.015
Depression	Mean	6.1 ± 3.3 (5.4–6.7)	4.7 ± 3.1 (4.1–5.3)	0.005
	Prevalence	(74/98) 75.5%	(64/106) 60.4%	0.045
Hysteria	Mean	6.0 ± 3.0 (5.4–6.6)	5.7 ± 2.9 (5.1–6.2)	0.531
	Prevalence	(79/98) 80.6%	(79/106) 74.5%	0.424

$P = 0.035$), obsession (19/28, 67.9%, $P = 0.014$), somatization (24/28, 85.7%, $P = 0.001$), and depression (26/28, 92.9%, $P = 0.005$) domains of the MHQ questionnaire. Women not diagnosed with FSD in the MetS group reported significantly higher prevalence of pathological scores in the somatization [40/79 (50.6%) vs. 30/97 (30.9%), $P = 0.018$] domain of the MHQ questionnaire compared with their counterparts in the HC group. No differences in MHQ scores were found among FSD women of the two groups. In order to evaluate which factors were independently associated with sexual function impairment, a logistic regression with backward Wald method was performed using waist circumference, high triglycerides, anxiety, obsession, somatization, and depression domains as covariates. The logistic regression showed that high triglycerides (odds ratio [OR] 3.097; 95% confidence interval [CI] 1.272–7.542; $P = 0.026$) and somatization (OR 7.068; 95% CI 2.291–21.812; $P = 0.001$) were independently associated to FSD in premenopausal women.

Discussion

In the present study, we evaluated the impact of MetS and psychopathological variables on sexual function, in sexually active premenopausal women. We found an increased prevalence of FSD in MetS women compared with healthy subjects. The number of cardiovascular risk factors for MetS was inversely correlated with FSFI score. MetS women scored higher in the somatization and depressive domains compared with HC women.

In this study, the evaluation of sexual function was carried out using the FSFI questionnaire, a widely used and validated self-report for the assessment of sexual function over the previous 4 weeks [18,20,21]. A significantly lower FSFI global score in women diagnosed with MetS compared with healthy women was detected, thus suggesting a contribution of MetS to the impairment of sexual response in young women. Additionally, as showed in Figure 1, the distribution of total FSFI score was wider in the MetS group when compared with the HC group, probably reflecting a possible different impact of each metabolic or cardiovascular defect on women's sexuality as well as the number of criteria simultaneously present in each woman, as also suggested by the significant correlation between the FSFI score and the number of criteria for MetS. The cutoff value of 26.5 to detect dysfunctional FSFI score was used according to previous studies. In this way, the study can be comparable, considering that our women were <50 years of age [21,27]. We detected an increased prevalence of FSFI pathological score in premenopausal women affected by MetS compared with women presenting none, one, or two risk factors for MetS. Prevalence of FSFI pathological score was 29.2% in healthy women in agreement with previous reports [28], whereas it significantly increased to 44.9% in women affected by MetS. The analysis of individual domains of the FSFI showed that women with MetS scored significantly lower in the domain of desire, arousal, lubrication, and orgasm. These results are particularly interesting if considering the vascular impairment associated to cardiometabolic risk factors [3]. In this regard, it has been hypothesized that the endothelial dysfunction linked to cardiovascular and metabolic disease may affect genital vascular blood flow thus impairing some domains of the female sexual response such as arousal and lubrication [3]. These data are in agreement and have expanded previous studies from others and from our group, performed in premenopausal and post-

menopausal women with MetS [13–15]. Only one study by Kim et al., in which sexual function was assessed only using the FSFI questionnaire, an association between FSD and MS could not be found [16]. The reasons for this difference may be found in the ethnic background of the patients, recruitment bias and/or severity of the MS affecting recruited women.

In our study, the FSDS questionnaire was also administered to fully meet the requirements of the expanded definition of FSD, which suggests that personal distress related to sexual life is an essential criterion for the diagnosis of FSD [1]. Although slightly higher in the MetS group, no statistically significant differences were found in the FSDS score or in the prevalence of pathological score among the two groups. However, when the results from FSDS were combined with that of the FSFI questionnaire (a woman was defined as dysfunctional if the FSFI was ≤26.5 and the FSDS was ≥15) the prevalence of sexually dysfunctional women remained higher in the MetS group when compared with the HC group. Indeed, the prevalence of FSD was 8.5% in the HC group, reaching 19.4% in women affected by MetS ($P = 0.026$). These results suggest that alterations of at least some domains of female sexuality were not necessarily distressing for MetS women and defining these subjects as dysfunctional may be, at least in some cases, inappropriate. As further confirmation of this hypothesis, no differences were detected in the satisfaction domain of the FSFI questionnaire between the two groups. Some authors suggest a close relationship between satisfaction and personal distress, and this observation seems also to be confirmed by our results. However, it should be noted that these two factors may be also independent according to the clinical context in which they are assessed [29]. Therefore, we believe that a comprehensive evaluation of women sexuality must include both the assessment of satisfaction and of the related personal distress to reach a more accurate diagnosis of FSD.

No data on sexual function in premenopausal MetS women is present in literature using the combined FSFI and FSFS questionnaires to fully define FSD [1]. Therefore, these preliminary results need to be expanded and confirmed by further studies.

The significant positive association found between the number of risk factors for the MetS and the FSFI score further emphasizes the important role of MetS in the pathophysiology of FSD. Moreover, the AUROC of MetS criteria against FSD, although not clinically relevant, but significantly different from the reference line, further strengthens the association between MetS and FSD and additionally suggests that cardiometabolic risk factors may predispose to FSD through an additive effect, progressively worsening the woman's sexual function.

The influence of psychopathological dimensions on female sexual function has been suggested but their contribution has been poorly explored in the field of MetS-related FSD [30]. We found that women with MetS scored significantly higher in the somatization and depression domains when compared with healthy women. These results are in agreement with previously reported observations that suggest a direct link between metabolic disorders and psychopathological alterations [31,32]. In order to investigate the contribution of MetS and psychosomatic alterations to the onset of FSD, we performed a multivariate regression analysis, including as covariates all cardiometabolic and psychosomatic disturbances that were found to be significantly associated to FSD. Interestingly, both somatization and higher triglycerides were independently associated with the presence of sexual dysfunction, suggesting a role of both these factors on sexual functionality. The higher score in the somatisation domain of the MetS women not diagnosed with sexual dysfunction compared with the HC group may also suggest that this psychopathological aspect is more linked to MetS and may precede and contribute to the development of sexual dysfunction in MetS women. On the other hand, we cannot rule out that FSD itself facilitates the development of somatisation disorders as an expression of a maladaptive response to unrecognized sexual problems in this group of women. Psychopathological aspects and their association with female sexuality in healthy and pathological conditions deserve further study. These observations would also suggest that treatment of sexual dysfunction in MetS women needs to be holistic and include not only the physical but also the psychological aspects that are closely connected.

As expected, incidence of sexual intercourse was higher in the HC women and highly correlated with global and FSFI domain scores. Additionally, a significant, though moderate, negative association was found with FSDS and somatization score of the MHQ questionnaire. These data may indicate that sexual problems due to metabolic dysfunctions may affect the psychological and sexual behavior of these women.

The contribution of high triglycerides to the development of FSD has already been reported in literature both in postmenopausal and premenopausal women [11,14]. Although the biological mechanism through which high triglycerides and dyslipidemias in general could affect sexual function in women have not yet been clarified. It is possible to speculate that vasculogenic alterations at the vaginal and clitoral level linked to this metabolic defect may contribute to the onset of FSD [33,34].

Some limitations of the present study need to be addressed. First, the study population is not very large, type II error was thus possible in the interpretation of statistical significance and therefore our conclusions need to be confirmed in wider cohorts. Second, although the assessment of circulating hormonal levels would have probably strengthened our results and could have shed new light on the link between sexual dysfunction and MetS, we did not have this information available. Third, we selected women from those attending our clinic for regular checkups. These were all Caucasian and we used strict exclusion criteria such as irregular menstrual cycle and drug intake. This selection, although eliminating confounding factors, may affect the generalizability of our sample. On the other hand, having access to clinical records allowed for exclusion of many confounding variables that could have affected the results in other studies, an important strength of this study.

Conclusions

In this study, we evaluated sexual function in MetS women, considering both physiological and psychological dimensions. Our results indicate a higher prevalence of sexual dysfunction in MetS women compared with HC women. A number of risk factors for MetS are positively associated with FSD and higher triglycerides seem to be the strongest predictors of sexual dysfunction. However, also the psychopathological dimension of somatisation is strongly associated with sexual dysfunction in MetS women. These results suggest that both physiological and psychological dimensions are strongly related to female sexual function.

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