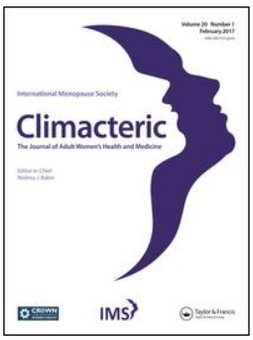

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ORIGINAL ARTICLE

The association between sexual dysfunction and metabolic syndrome among Turkish postmenopausal women

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ABSTRACT

Objective: The aim of this study is to determine the association between sexual dysfunction and metabolic syndrome (MS) among Turkish postmenopausal women

Methods: In total, 290 postmenopausal women between the ages of 50 and 70 years and 265 premenopausal women between the ages of 30 and 49 years who applied to Menopause and Gynecology Clinics at Marmara University-affiliated Pendik Education and Research Hospital, Istanbul, Turkey were included in this prospective survey. Sexual function was assessed using the Female Sexual Function Index (FSFI). A FSFI total score of <26.5 was suggestive of sexual dysfunction. MS was assessed by the National Cholesterol Education Program Adult Treatment Panel III criteria.

Results: Sexual dysfunction prevalence among postmenopausal women was 64.6% in relation to 42.1% in premenopausal women ($p = 0.001$). MS prevalence was 13.5% among premenopausal women and 15.5% among postmenopausal women ($p = 0.57$). The total FSFI score and each score in the desire, arousal, lubrication, orgasm, satisfaction, and dyspareunia domains of the FSFI did not differ between premenopausal and postmenopausal women, regarding the MS status. In the premenopausal group, 45.7% of women without MS and 37% of women with MS had lower sexual dysfunction ($p = 0.40$); whereas in the postmenopausal group, 62.2% of women without MS and 77.4% of women with MS had lower sexual function ($p = 0.22$).

Conclusion: In our study population, the rate of sexual dysfunction increased in postmenopausal women in contrast to premenopausal women. The MS status did not make a difference in terms of sexual dysfunction either in premenopausal or postmenopausal women. Since our survey was conducted in a tertiary medical center which gave medical care service to women from middle and low socioeconomic classes, our results should be confirmed by a large multicenter survey enrolling women from all different socioeconomic classes.

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Female Sexual Function Index; menopause; metabolic syndrome; sexual dysfunction

Introduction

Menopausal transition constitutes anatomic, physiological, and psychological changes which often have negative effects on female sexuality[1]. During this period of a woman's life, an increase in arterial blood pressure, weight gain with central fat accumulation, serum lipid changes toward an atherogenic profile, and an increased tendency for type 2 diabetes might occur. As a result, the postmenopausal status with all of these possible metabolic changes might be a risk for metabolic syndrome (MS)[2–5].

According to the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) criteria, MS is diagnosed if three of five factors are present (central obesity, elevated blood pressure, high serum fasting glucose, low serum high-density lipoprotein [HDL] cholesterol, and high serum triglyceride levels), and carries a two-fold increased risk for cardiovascular events[6]. Insulin resistance and increased risk for type 2 diabetes mellitus and cardiovascular disease are independently associated with sexual dysfunction[7]. Our group found the prevalence of MS as 15% and 19% in premenopausal and postmenopausal women, respectively[8].

Any condition which prevents the individual from experiencing satisfaction from sexual activity results in sexual dysfunction[9]. Female sexual dysfunction (FSD) is characterized by disturbances in the psychophysiological changes associated with the sexual response cycle in women, leading to disorders of sexual desire, arousal, orgasm, and pain[10]. FSD is a multidimensional disorder that has biological, psychological, and social determinants. It affects a woman's life, both during premenopausal and postmenopausal periods. The female sexual response cycle is a complex process relying on several factors, including vascular, neurological, hormonal, and psychogenic factors. The disruption of any of these factors may lead to FSD[11,12].

Among the various determinants of female sexual function, MS has been previously investigated for its impact on FSD, partly due to its high and increasing global prevalence.

Available data in the literature are conflicting in terms of the association between MS and FSD. One reason would be

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that both of these conditions are multifactorial and their prevalence differs between different populations. The current diagnostic tools for both FSD and MS also vary between the studies. In some of the previous studies MS was found to be associated with FSD, and the prevalence of FSD was reported higher in women with MS in comparison with healthy controls[13–16]. Furthermore, FSD was found more often in both premenopausal and postmenopausal women with MS[17]. On the contrary, another study found that the only factor associated with poor sexual function was increased age and MS was not associated with poor sexual function[18].

In this study we aimed to determine the association between sexual dysfunction and MS among Turkish premenopausal and postmenopausal women, and to investigate the effect of MS components on FSD.

Materials and methods

Patient selection

In total, 290 postmenopausal women between the ages of 50 and 70 years and 265 premenopausal women between the ages of 30 and 49 years who applied to Menopause and Gynecology Clinics at Marmara University-affiliated Pendik Education and Research Hospital, Istanbul, Turkey were included in this prospective survey. The flow chart of participants is shown in Figure 1. Postmenopause was defined as the absence of menstruation for the preceding 12 months or more[19].

Exclusion criteria

The exclusion criteria included the presence of acute infection or chronic inflammatory disease; the use of drugs that can affect metabolism, such as β-blockers, glucocorticoids, diuretics, lipid lowering agents, antidiabetic agents, antiresorptive agents, and anticoagulants; the use of alcohol; and drug abuse.

Metabolic syndrome

MS was assessed by the NCEP ATP III criteria[20]. MS was diagnosed if three of the following five factors were present according to the NCEP criteria; hypertension (diastolic blood pressure ≥85mmHg, systolic blood pressure ≥130mmHg), central obesity (waist ≥88cm), HDL ≤50mg/dl, triglycerides ≥150mg/dl, and fasting glucose ≥110mg/dl. Systolic blood pressure and diastolic blood pressure were measured twice on both arms using a calibrated aneroid sphygmomanometer after the subject had been resting in the supine position for at least 5 min; the average of two measurements was used in the analysis. Venous blood was collected into vacutainer tubes (Becton & Dickinson) after overnight fasting and centrifuged within 4 h. Serum glucose, total cholesterol, HDL-cholesterol, and triglyceride levels were analyzed via the spectrophotometric method (Roche Diagnostic Gmbh, Mannheim, Germany).

The Female Sexual Function Index

Sexual function was assessed using the Female Sexual Function Index (FSFI). This instrument is composed of 19

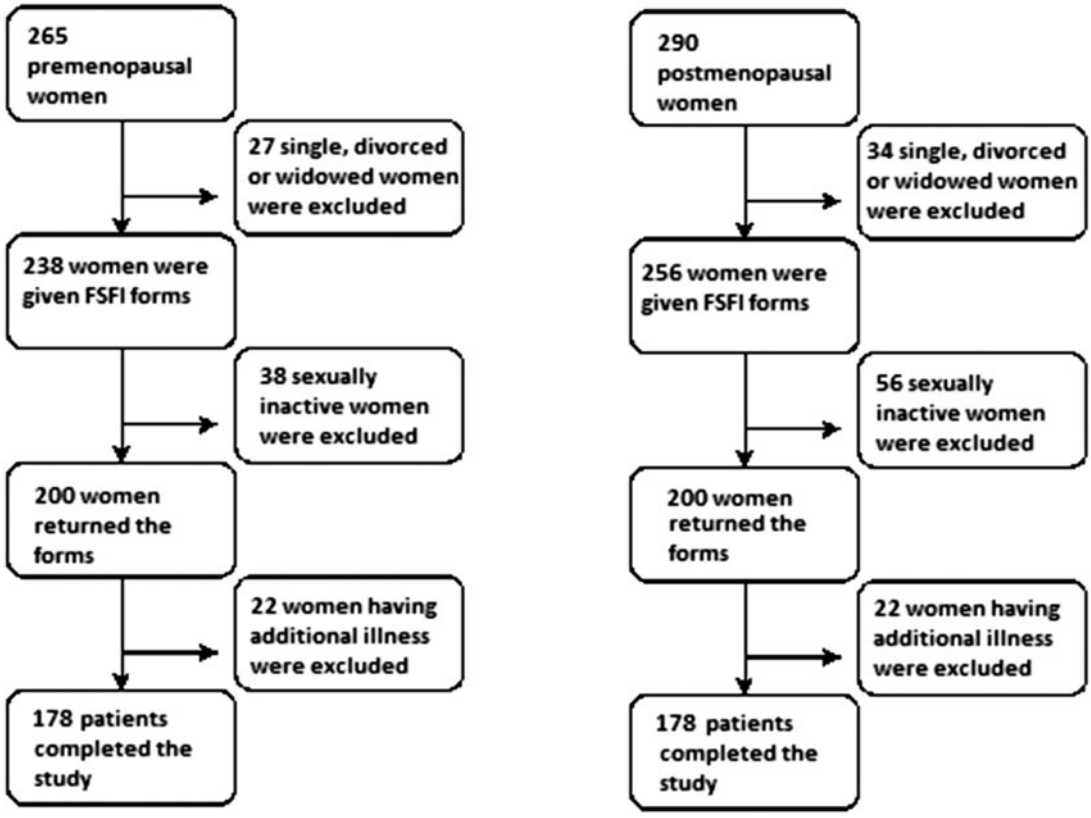

Figure 1. Flow chart of participants. FSFI, Female Sexual Function Index.
Left: represents premenoposal women, right: postmenopausal women included to the study.

questions grouped into six domains: desire, arousal, lubrication, orgasm, satisfaction, and dyspareunia. The FSFI is used to evaluate female sexual function in the previous 4 weeks. Each question can provide a score varying from 0 to 5. Scores obtained for questions in each domain are summed up and multiplied by a constant factor to provide individual domain scores. The total FSFI score is the sum of scores obtained for each domain. Lower total FSFI scores are indicative of low sexual function[21]. A FSFI total score of 26.55 or less is suggestive of sexual dysfunction (lower sexual function). The Turkish version of the FSFI has been validated for the Turkish population[22].

Total testosterone (TT) and dehydroepiandrosterone sulfate (DHEA-S) levels were analyzed by electrochemiluminesence immunoassay (Elecsys systems 1010/2010/modular Analytics E170; Elecsys module). The free androgen index (FAI) was calculated with the formula FAI = (total testosterone / sex hormone binding globulin) × 100[23]. Body mass index (BMI) was calculated as weight (kg) divided by square of height (m)[24].

Statistical analyses

All analyses used StataSE 10.0 (StataCorp, College Station, TX, USA). Demographic characteristics were expressed using descriptive statistics. The *t*-test and Fischer exact test were used for continuous variables and the chi-square test was used for categorical variables. Results were expressed as mean and standard deviation, and $p < 0.05$ was considered statistically significant. Correlations between variables were calculated by Spearman test. Multivariable logistic regression modeling was used to compute the odds ratios of variables predictive of sexual dysfunction. The independent variables were systolic blood pressure, diastolic blood pressure, waist circumference, HDL-cholesterol, triglyceride, and fasting glucose.

Results

The characteristics of the premenopausal and postmenopausal groups with subgroup analysis of MS are presented in Table 1. The postmenopausal patients had significantly higher levels of systolic and diastolic blood pressure, BMI, waist circumference, waist/hip ratio, serum LDL-cholesterol, total cholesterol, triglyceride, and fasting glucose than the premenopausal group. The postmenopausal patients had significantly lower levels of serum DHEA-S, androstenedione (AS), TT, and FAI.

In the postmenopausal group, DHEA-S was positively correlated with the FSFI score ($p = 0.037$) but there was no correlation between the FSFI score and AS, TT, sex hormone binding globulin, and FAI.

The prevalence of MS among premenopausal and postmenopausal groups was 13.5% and 15.5%, respectively ($p = 0.57$).

The premenopausal group had significantly higher scores in all domains of the FSFI (Table 2). When subgroup analysis of sexual dysfunction among both the premenopausal and postmenopausal women was done taking into consideration the MS status, there was no significant difference between groups (premenopausal without MS vs. with MS, 45.7% vs. 37%, respectively [$p = 0.40$]; postmenopausal without MS vs. with MS, 62.2% vs. 77.4%, respectively [$p = 0.22$]).

The comparison of FSFI domains between women with MS and without MS both in premenopausal and postmenopausal women is presented in Table 3.

In order to determine the association between MS parameters and sexual dysfunction, multivariate analysis was performed. None of the MS parameters was correlated with sexual dysfunction, as presented in Table 4.

Discussion

Sexual function is a multidimensional process which has psychological, biological, and interpersonal factors[10]. FSD is a

Table 1. Patient characteristics between groups.

	Premenopausal group			*Postmenopausal group*		
Characteristic	*MS* − (n = *154*)	*MS* + (n = *24*)	p-*Value*	*MS* − (n = *151*)	*MS* + (n = *27*)	p-*Value*
Age (years)	40.64 ± 5.65	41.88 ± 5.61	0.29	56.50 ± 5.28	55.41 ± 5.71	0.30
Systolic blood pressure (mmHg)	117.26 ± 11.52	120.26 ± 11.29	0.21	122.43 ± 15.22	127.65 ± 10.21	0.07
Diastolic blood pressure (mmHg)	72.08 ± 6.66	74.48 ± 7.49	0.09	74.48 ± 5.81	81.16 ± 7.62	0.001
Mean arterial pressure (mmHg)	87.14 ± 6.65	89.74 ± 8.27	0.07	90.46 ± 6.96	96.65 ± 7.77	0.001
Waist circumference (cm)	86.05 ± 13.58	102.33 ± 10.75	0.001	91.13 ± 14.29	103.29 ± 9.87	0.001
Weight (kg)	73.94 ± 12.31	81.55 ± 13.76	0.004	75.88 ± 9.98	80.29 ± 11.05	0.03
Body mass index (kg/m^2)	29.50 ± 23.06	31.90 ± 6.17	0.59	29.13 ± 4.15	31.73 ± 5.06	0.002
Total cholesterol (mg/dl)	176.41 ± 38.49	195.48 ± 44.95	0.02	196.02 ± 53.64	222.29 ± 73.20	0.02
LDL-cholesterol (mg/dl)	97.34 ± 35.08	135.28 ± 99.35	0.001	111.23 ± 48.72	147.56 ± 78.44	0.001
HDL-cholesterol (mg/dl)	57.05 ± 12.02	42.11 ± 6.05	0.001	57.84 ± 13.61	44.65 ± 9.53	0.001
Triglyceride (mg/dl)	106.59 ± 48.87	257.52 ± 174.84	0.001	122.82 ± 42.66	225.80 ± 147.30	0.001
Fasting glucose (mg/dl)	86.27 ± 10.82	107.56 ± 38.58	0.001	91.51 ± 27.17	103.84 ± 36.13	0.03
Androstenedione (ng/ml)	1.75 ± 1.13	1.80 ± 1.35	0.83	1.16 ± 0.82	1.19 ± 0.80	0.83
DHEA-S (μg/dl)	146.32 ± 86.53	115.94 ± 88.72	0.09	102.93 ± 56.13	95.34 ± 77.07	0.52
Total testosterone (ng/ml)	0.56 ± 0.72	0.31 ± 0.20	0.08	0.34 ± 0.28	0.32 ± 0.19	0.81
Sex hormone binding globulin (nmol/l)	41.90 ± 24.77	46.74 ± 38.00	0.38	37.54 ± 20.48	34.07 ± 17.96	0.38
Free androgen index	1.97 ± 1.08	1.09 ± 1.01	0.14	1.53 ± 1.61	1.31 ± 1.61	0.74

Data presented as mean ± standard deviation. DHEA-S, dehydroepiandrosterone sulfate; HDL, high-density lipoprotein; LDL, low-density lipoprotein; MS, metabolic syndrome.

Table 2. Sexual function domains between premenopausal and postmenopausal women.

Domain	*Premenopausal women (n = 178)*	*Postmenopausal women* (n = *178)*	p-*Value*
Desire	3.8 ± 1.2	2.7 ± 1.1	0.0001
Arousal	4. 0 ± 1.3	2.7 ± 1.5	
Lubrication	4.4 ± 1.5	2.9 ± 1.6	
Orgasm	4.2 ± 1.5	2.8 ± 1.7	
Satisfaction	4.2 ± 1.4	2.8 ± 1.6	
Pain	4.6 ± 1.5	3.0 ± 1.7	
Sexual dysfunction	75 (42.1%)	115 (64.6%)	0.0001

Data presented as mean ± standard deviation or *n* (%).

Table 3. Difference of FSFI domains between premenopausal and postmenopausal women with MS and without MS.

	Premenopausal women			*Postmenopausal women*		
Domain	*MS*– (n = *154*)	*MS*+ (*n* = *24*)	p-*Value*	*MS*– (n = *151*)	*MS*+ (n = *27*)	p-*Value*
Desire	3.75 ± 1.18	3.84 ± 1.04	0.65	2.70 ± 1.08	2.44 ± 0.93	0.10
Arousal	3.87 ± 1.32	3.96 ± 1.36	0.62	2.67 ± 1.46	2.55 ± 1.32	0.34
Lubrication	4.25 ± 1.55	4.53 ± 1.47	0.81	2.87 ± 1.62	2.58 ± 1.48	0.18
Orgasm	4.09 ± 1.57	4.27 ± 1.36	0.71	2.74 ± 1.70	2.53 ± 1.57	0.26
Satisfaction	4.14 ± 1.41	4.39 ± 1.42	0.80	2.80 ± 1.60	2.50 ± 1.42	0.17
Pain	4.46 ± 1.63	4.49 ± 1.70	0.54	2.98 ± 1.67	3.06 ± 1.59	0.60

Data presented as mean ± standard deviation. FSFI, Female Sexual Function Index; MS, metabolic syndrome.

Table 4. Multivariate analysis between sexual dysfunction and MS parameters.

	Odds ratio	p-*Value*	*95% confidence interval*
Postmenopausal group			
Systolic blood pressure (mmHg)	0.50	0.620	0.6136537–2.269268
Diastolic blood pressure (mmHg)	1.53	0.125	0.7776881–7.901897
Waist circumference (cm)	1.06	0.290	0.9895664–1.035692
HDL-cholesterol (mg/dl)	1.21	0.227	0.9911667–1.038084
Triglyceride (mg/dl)	0.45	0.650	0.9960825–1.006315
Fasting glucose (mg/dl)	−1.30	0.192	0.9822187–1.003614
Premenopausal group			
Systolic blood pressure (mmHg)	1.82	0.068	0.9349934–6.419706
Diastolic blood pressure (mmHg)	0.64	0.524	0.4260244–5.347267
Waist circumference (cm)	0.43	0.666	0.9836128–1.026175
HDL-cholesterol (mg/dl)	−1.17	0.240	0.9611194–1.009993
Triglyceride (mg/dl)	−1.16	0.245	0.9940529–1.001525
Fasting glucose (mg/dl)	−0.77	0.440	0.9763569–1.01045

Data presented as mean ± standard deviation. HDL, high-density lipoprotein; MS, metabolic syndrome.

health problem that impairs the quality of life in women. At least one sexual problem is the complaint among 43% of women[9]. On the basis of the National Health and Social Life Survey, nearly 50% of women in the United States have FSD[25]. The prevalence has been given as various percentages[9]. This diversity in numbers may be explained by differences in the study designs, sociodemographic characteristics of the society in which the studies were conducted, or the different tools used to evaluate the FSD. In our study we found the prevalence of FSD was 42.1% among premenopausal women and 64.6% in the postmenopausal group.

Age and postmenopausal status are considered risk factors for FSD[9,26]. We found significantly higher FSD in postmenopausal patients, as previously reported in the current literature[14,16,17]. The total FSFI score and each score for individual domains were lower in the postmenopausal group. The decrease in functional capacity of tissues and organs together with alteration in hormones can be the reason for the increased FSD prevalence in postmenopausal women[27].

The relationship between androgen levels and FSD is controversial. Davis et al.[28] did not find association between androgens and FSD. Çoşar et al.[29] showed that there was a correlation between sexual satisfaction and free testosterone level in perimenopausal women. We found no difference in serum TT, DHEA-S levels, and FAI score between women with MS and without MS, among either the premenopausal group or the postmenopausal group.

The relationship between MS and FSD is not clear. The Princeton III Consensus suggested that an association between female sexual function and cardiovascular and metabolic disorders did exist but they suggested that more research was needed to clarify the impact of MS on sexuality[30]. Similarly, Ponholzer et al.[31] reported that MS was an independent risk factor for impaired sexual desire among 538 women with a mean age of 44 years, with an age-adjusted odds ratio of 3.3 (95% confidence interval, 1.5–7.3). However, in the postmenopausal group none of the investigated aspects of FSD was related to MS. Moreover, Kim et al.[1] suggested that MS may have little impact on sexual function in middle-aged to old-aged women. After adjustment for major confounding factors, MS and the MS components were found not to be independent risk factors for FSD. Furthermore, Lee et al.[32] reported that sexual problems were not associated with MS in general, or with individual risk factors for MS, or some of the MS components. Similarly, we did not find any impact of MS and the MS components on FSD. None of the domains of FSFI was affected by the presence of MS either in premenopausal or postmenopausal groups.

On the other hand, some studies suggested MS as a risk factor for FSD. For instance, Esposito and Giugliano[13] showed that premenopausal women with MS had reduced total FSFI scores. However, they had no results for the postmenopausal group. Next, Martelli et al.[14] compared 105 healthy postmenopausal controls with 103 postmenopausal women having MS. The prevalence of low scores in every FSFI domain and the total FSFI scores were higher in MS women than in healthy controls. In the same manner, Alvisi et al.[15] evaluated

the impact of MS and psychopathological variables on sexual function, in sexually active premenopausal women. They found an increased prevalence of FSD in MS women when compared with healthy subjects.

The pathophysiologic mechanism underlying the association between MS and FSD is not clearly defined. The first phase of female sexual response is mediated by a combination of neuromuscular and vasocongestive events including increased clitoral diameter and length as well as increased vaginal lubrication, wall engorgement, and luminal diameter[33,34]. Atherosclerosis of the arterial bed supplying the female pelvic anatomy can lead to decreased vaginal engorgement and clitoral insufficiency syndrome resulting in vasculogenic FSD[35,36].

Furthermore, the relationship between the individual components of MS and FSD is also controversial. Accordingly, higher serum triglyceride levels were linked to a significantly higher risk of developing FSD[14]. Likewise, women with long-term hypertension have been reported to suffer more from FSD compared with non-hypertensive women or women with newly diagnosed hypertension[37,38]. Besides, women with impaired glucose intolerance, insulin resistance, or type 2 diabetes mellitus have been associated with the development of sexual dysfunction[39].

Studies on postmenopausal women found lower levels of sexual desire and less frequent penile–vaginal intercourse. These were associated with more body fat and wider waist and hips[40,41]. In a study with 120 healthy adults aged between 18 and 38 years, the measures of slimness (smaller waist and/or hips) were correlated with more frequent penile–vaginal intercourse by both men and women[42]. In another study in which 82 female patients had undergone weight reduction surgery, 63% of the patients stated that they enjoyed sex more postoperatively, whereas this number was 12% before the surgery[43]. On the other hand, in another study where 20 morbidly obese female patients were planning to undergo gastric bypass surgery, sexual function did not seem to be affected when compared to age-matched controls[44].

One hundred and twenty premenopausal women with MS were compared with 80 age and body weight matched controls. Women with MS had a reduced mean total FSFI score when compared with the control group[28]. As a matter of fact, Kadioglu et al.[45] found no difference in either total FSFI or FSFI domain scores between different BMI categories. In addition, Kim et al.[1] suggested that diabetes, dyslipidemia, and hypertension were not associated with FSD. Similarly, we found no association between FSD and individual MS components in multivariate analysis in both premenopausal and postmenopausal groups.

One of the limitations of our study is that the survey was conducted only in one center. Our tertiary center provides healthcare to a middle to low-class population. In order to reflect the prevalence in the general Turkish population, multicenter surveys should better be designed. Second, the psychological, behavioral, and social characteristics of the participants could have been more deeply questioned since these could have a profound impact on FSD. Namely, additional questionnaires regarding those issues could have been used. Third, the small number of MS patients detected in each group should be verified in other healthcare settings. Nevertheless, the current literature points out that the incidence varies substantially by age and ethnicity in both men and women. Anand et al.[46], in multiethnic communities in Canada, found the incidence to be 42% among Native Americans, 26% among South Asians, 22% among Europeans, and 11% among Chinese. Ford et al.[5] found the unadjusted and age-adjusted prevalence of MS as 21.8% and 23.7%, respectively, according to the NCEP ATP III diagnostic criteria. Figueiredo Neto et al.[47] showed that there was a higher prevalence of MS among menopausal women, but the difference was not statistically significant after adjustment for age. Casiglia et al.[48] found a higher prevalence of MS components among postmenopausal women, but the difference disappeared after an adjustment for age.

Conclusion

FSD is a multidimensional disorder related to biological, psychological, and social determinants. There are numerous confounding factors which may influence the condition. Even though some studies consider MS to affect the psychological and sexual behavior of women, the evidence is not of good quality. MS either in the premenopausal or postmenopausal period does not seem to influence FSD in Turkish women. However large-scale multicenter surveys are necessary to determine the situation in each division of society.

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