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Discussion on the Relationship Among Sexual Health and Sleep Quality, Depressive Symptoms in Perimenopausal and Postmenopausal Women

Shenglan Zuo
Shanghai Jiao Tong University
Wenjuan Liu
Shanghai Jiao Tong University
Furui Jin
Shanghai Jiao Tong University
Lishi Huang
Shanghai Jiao Tong University
Zhiling Guo
Shanghai Jiao Tong University
Shuting Lu
Shanghai University of Medicine & Health Sciences
Longmei Jin
Shanghai Jiao Tong University
Baisong Wang
Shanghai Jiao Tong University
Qian Zhou
zhouqian2020860163.com

Shanghai Jiao Tong University

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Abstract

Objective:To study the prevalence and types of sexual problems in perimenopausal and postmenopausal women, and to explore their relationship with sleep quality and anxiety-depressive symptoms, aiming to provide a basis and ideas for the treatment of sexual problems in this population.

Methods: A total of 1572 women aged 40-60 who visited the clinic for menopausal symptoms were selected. Quantitative assessments of sexual function, sleep quality, anxiety, and depressive symptoms were conducted using the Female Sexual Function Index (FSFI), Pittsburgh Sleep Quality Index (PSQI), Generalized Anxiety Disorder Scale (GAD-7), and Patient Health Questionnaire-9 (PHQ-9). Multiple linear regression analysis and a mediation effect model were used to analyze the interactions between sexual function, sleep quality, and anxiety-depressive symptoms, with anxiety and depressive symptoms as mediating variables.

Results: The overall prevalence of sexual dsyfunction in perimenopausal and postmenopausal women was 61.4%. The prevalence rates of decreased sexual desire, sexual arousal disorder, vaginal lubrication disorder, orgasmic disorder, and dyspareunia were 59.5%, 51.5%, 51.0%, 51.4%, and 41.4%, respectively. There were no significant differences in sleep quality, anxiety, or depressive symptoms between the two groups.The overall prevalence of sexual problems and the prevalence in each dimension were significantly higher in postmenopausal women than in perimenopausal women ($P<0.01$). The occurrence of Female Sexual Dysfunction (FSD) was related to the women's age, menopausal status, depressive symptoms, and sleep quality. Depressive symptoms had a mediating effect between sleep quality and sexual dysfunction. The indirect effect of sleep disorders affecting sexual dysfunction through depressive symptoms accounted for 44.83%.

Conclusion: The prevalence of sexual problems is high among middle-aged women, and it is higher in postmenopausal women than in perimenopausal women. The prevalence is significantly correlated with age, menopausal status, depressive symptoms, and sleep quality. Clinically, improving depressive symptoms and sleep quality in middle-aged women can ameliorate sexual-related problems, thereby enhancing sexual satisfaction and quality of life for middle-aged and elderly women.

1. Introduction

Female Sexual Dysfunction (FSD) refers to a spectrum of psychophysiological problems related to sexual desire, arousal, orgasm, and pain during intercourse, which not only cause significant distress to patients but may also affect interpersonal and family relationships. According to the classification of the American Psychiatric Association's Fifth Edition (DSM-5)[1], FSD is categorized into hypoactive sexual desire disorder, sexual arousal disorder, orgasmic disorder, and genito-pelvic pain/penetration disorder. Epidemiological studies suggest a wide range in the prevalence of FSD, with reports by Kammerer-Doak and Rogers showing rates between 25% and 63%[2].

Sexual health is one of the basic elements of life health and well-being. Dissatisfaction with sexual life negatively impacts the quality of life and well-being of women of any age. The prevalence of sexual dysfunction increases significantly with age, having a non-negligible impact on the intimate relationships and quality of life of middle-aged women. A study conducted in the United States among women aged 18 and older[3] showed that 43% of participants reported experiencing sexual problems, with 12% considering these problems causing personal distress. Middle-aged women (45–64 years) were more commonly affected than younger or older women. A community survey in Australia found[4] that the prevalence of low sexual desire in middle-aged women was 69.3%, and the prevalence of Hypoactive Sexual Desire Disorder (HSDD) was 32.2%. A survey in South Korea showed[5] that the prevalence of HSDD in women over 40 years was 56%. In mainland China ,an assessment using the Female Sexual Function Index(FSFI) in 25,446 women aged 20–70[6] indicated an FSD prevalence of 29.7%, with the prevalence of 39.8% among women aged 40–70. These epidemiological studies all suggest that sexual problems are common among perimenopausal and postmenopausal middle-aged and elderly women.

The causes of FSD are complex, involving psychosocial factors, interpersonal relationships, disease-related physiological changes, and other aspects. Perimenopausal and postmenopausal women are particularly susceptible to FSD, and the physiological changes during the menopausal transition may play a key role in its development[7]. Furthermore, sleep disturbances and neuropsychiatric symptoms (e.g. depression and anxiety) are closely related to sexual dysfunction[8, 9]. Studies have shown that anxiety and depressive moods mediate the relationship between hot flashes, night sweats, and sleep quality[10], suggesting that anxiety and depression might also play a mediating role in the relationship between sleep disturbances and sexual dysfunction. Based on this, the purpose of this study is to investigate the prevalence and types of sexual problems in middle-aged and elderly women in the Shanghai region and to verify whether anxiety and depressive moods mediate the relationship between sleep quality and sexual problems.

2. Methods

2.1. Study population

This retrospective study was conducted at the International Peace Maternity and Child Health Hospital(IPMCH), Shanghai Minhang Maternal and Child Health Hospital, and Jinhui Town Community Health Service Center in Fengxian District, Shanghai.

From January 2021 to July 2023, we enrolled women who sought medical attention for menopausal issues at the menopausal clinics and traditional Chinese medicine gynecology clinics. Participants all officially consented both verbally and in writing to participate in the study,and the study was approved by the Ethic Committee.The inclusion criteria: 1) Age 40–60; 2) For those with menstruation: a change in menstrual frequency more than twice in 10 months and a change greater than 7 days; 3) Cessation of

menstruation for ≥ 1 year; 4) Ability to complete the Female Sexual Function Index questionnaire, sleep, and psychological scales.

2.2. Research Methods

Participants' sexual function, sleep quality, anxiety, and depressive symptoms were quantitatively assessed using the Female Sexual Function Index (FSFI), Pittsburgh Sleep Quality Index (PSQI), Generalized Anxiety Disorder Scale (GAD-7), and Patient Health Questionnaire-9 (PHQ-9). The survey was conducted by a professionally trained full-time investigator.

The Female Sexual Function Index(FSFI) is an internationally recognized tool for assessing female sexual function, and the validity of its Chinese version has been clinically verified, showing good reliability and validity. The FSFI contains 19 questions covering six domains: desire, subjective arousal, lubrication, orgasm, satisfaction, and pain; each domain can be assessed independently or considered comprehensively. Each domain consists of 2 to 4 questions, with a maximum score of 6 per domain and a total score of 36. A higher score indicates better sexual function. Clinical cutoff values determined by studies vary across countries; recent research suggests 23.45 as the clinical cutoff for the FSFI in Chinese women^[11]^. This study referenced this cutoff value, and the cutoff values for each dimension are listed in Table 1.

Table 1
FSFI Scoring Table

Domain	Question Nos.	Score Range	Cutoff Value
Desire	1–2	1–5	2.7
Subjective Arousal	3–6	0–5	3.15
Lubrication	7–10	0–5	4.05
Orgasm	11–13	0–5	3.8
Satisfaction	14–16	0(1)-5	-
Pain	17–19	0–5	3.8

The Pittsburgh Sleep Quality Index (PSQI) consists of 19 self-rated items and 5 other-rated items, where the 19th self-rated item and the 5 other-rated items are not included in the total score. The 18 self-rated items participating in the scoring can be combined into 7 components covering sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Each component is rated on a scale of 0–3. The scores of each component are summed to obtain the total PSQI score. A higher score indicates poorer sleep quality. This scale has high reliability and validity in assessing sleep quality[12].

The Patient Health Questionnaire-9 (PHQ-9)[13] is widely used in clinical screening and research to assess depressive symptoms. The scale contains 9 items, also using a Likert four-point rating method,

with scores ranging from "Not at all" (0) to "Nearly every day" (3). The scores for each item are summed to obtain a total score ranging from 0 to 27. A higher total score indicates more severe depression. Specifically, 0–4 indicates no depression, 5–9 mild depression, 10–14 moderate depression, 15–19 moderately severe depression, and 20–27 severe depression.

The Generalized Anxiety Disorder-7 (GAD-7)[14] has good reliability and is used to screen and assess the severity of anxiety symptoms in study subjects. The scale contains 7 items, using a Likert four-point rating method, with scores ranging from "Not at all" (0) to "Nearly every day" (3). The scores for each item are summed to obtain a total score ranging from 0 to 21. A higher total score indicates more severe anxiety. Specifically, 0–4 indicates no anxiety, 5–9 mild anxiety, 10–13 moderate anxiety, 14–18 moderately severe anxiety, and 19–21 severe anxiety.

2.3 Statistical analysis

SPSS 24.0 was used for statistical analysis. Continuous variables were expressed as mean ± standard deviation(SD), and categorical variables were expressed as frequencies and percentages. Multivariate analysis was performed using multivariate logistic regression methods, with a two-sided($\alpha = 0.05$) as the significance level. The mediation effect model was constructed using AMOS 24.0 software for fitting, and the Bootstrap method was used to test the mediation effect. A P-value less than 0.05 was considered statistically significant.

3. Results

3.1 Basic Information: This study included 1572 participants with an average age of (50.02 ± 4.73) years. There were 611 menopausal women, accounting for 38.9%, and 961 perimenopausal women, accounting for 61.1%. 451 women had chronic diseases such as hypertension, diabetes, hyperlipidemia, and thyroid disease, accounting for 28.7%. The basic information of the patients is shown in Table 2.

Table 2
Basic Information of Subjects (n = 1572)

Variable	Total Number	Percentage (%)
Age(years)		
40–45	283	18.0
46–50	575	36.6
51–55	511	32.5
56–60	203	12.9
Menopausal Status		
Yes	611	38.9
No	961	61.1
Marital Status		
Married	1544	98.2
Unmarried/Other	28	1.8
Childbearing History		
None	36	2.3
One child or more	1536	97.7
Chronic Diseases		
Yes	451	28.7
No	1121	71.3

3.2 Sexual Function and Prevalence in Various Dimensions among Subjects

The survey results revealed that 15.5% (243 participants) obtained an "indeterminate" score due to no sexual activity in the past 4 weeks,while 84.5% (1329 subjects) completed the FSFI assessment. Among them who completed the FSFI assessment, 38.6% (513/1329) had an FSFI score > 23.45, and 61.4% (816/1329) had an FSFI score < 23.45. 59.5% (961/1572) of women had low sexual desire, 51.5% had sexual arousal disorder, 51.0% vaginal lubrication disorder, 51.4% had orgasmic disorders, and 41.4% had sexual pain.Comparisons of the prevalence of FSD and that of each dimension between perimenopausal and postmenopausal women were detailed in Table 3. The results showed significant differences in the prevalence of FSD and each dimension between the two groups. Postmenopausal

women had higher prevalence rates for sexual problems in all dimensions compared to perimenopausal women, and the differences were statistically significant (P < 0.01;See Table 3.).

Table 3
Comparison of FSD Prevalence and Prevalence in Various Dimensions between Perimenopausal and Postmenopausal Women(n%)

Dimension	Total Prevalence	Perimenopausal	Postmenopausal	Statistic Value	P-value
FSD	61.4	51.9	77.0	83.202	< 0.01
Sexual desire disorder	59.5	52.8	70.0	46.338	< 0.01
Sexual arousal disorder	51.5	43.9	64.1	51.157	< 0.01
Vaginal lurication disorder	51.0	41.0	67.4	87.858	< 0.01
Orgasm disorder	51.4	34.4	64.5	55.708	< 0.01
Sexual pain	41.4	33.5	54.4	56.395	< 0.01

3.3 Sleep Quality and Anxiety-Depressive Symptoms of Subjects

Among all respondents,1464(93.1%) people completed the sleep quality scale,. The overall PSQI score for sleep quality was (7.03 ± 4.32).Of these 616(42.1%) people had a PSQI ≥ 8. 1448(98.0%) people completed the GAD-7, and 1444(92.1%) people completed the PHQ-9,. There were no significant differences in the three symptoms (anxiety, depression, insomnia) between the perimenopausal and postmenopausal groups. (See Table 4.).

Table 4
Comparison of Prevalence of Anxiety, Depression, and Insomnia Symptoms between Perimenopausal and Postmenopausal Women (n%)

Severity	Total(%)	Perimenopausal(%)	Postmenopausal(%)	P-value
GAD-7 Score				
No GAD (0–4)	64.6	64.1	65.3	χ^2=0.675
Mild GAD (5–9)	25.4	26.1	24.3	P = 0.879
Moderate GAD (10–14)	6.1	5.9	6.0	
Severe GAD (15–21)	3.9	3.9	4.0	
PHQ-9 Score				
No Depression (0–4)	64.3	63.4	65.7	χ^2=7.706
Mild Depression (5–9)	25.2	26.4	23.3	P = 0.103
Moderate Dep (10–14)	7.1	7.3	6.7	
Mod Severe Dep (15–19)	1.9	2.0	1.8	
Severe Dep (20–27)	1.5	0.9	2.5	
PSQI				
< 8 points	57.9	58.5	57.1	χ^2=0.278
≥ 8 points (Insomnia)	42.1	41.5	42.9	P = 0.598

3.4. Multiple Linear Regression Analysis of Risk Factors for FSD

Using the FSFI score as the dependent variable and age, menopausal status, PHQ-9 total score, GAD-7 total score, and PSQI as independent variables, multiple linear regression analysis was performed. The results showed that the FSFI score of the participants was related to age, menopausal status, depression, and sleep quality [(all $P < 0.05$, See Table 5.)].

Table 5
Multiple Linear Regression Analysis of Risk Factors for FSD in Perimenopausal and Postmenopausal Women

variables	*β*	*SE*	Wald χ^2	*P*
Age	-0.161	0.044	-3.641	< 0.01
Menopausal Status	-3.279	0.492	-6.662	< 0.01
GAD Total	0.034	0.070	0.483	0.629
PHQ Total	-0.315	0.074	-4.264	< 0.01
PSQI Total	-0.179	0.059	-3.020	0.03

3.5. Mediation Effect Model of the Impact of Sleep Quality and Depressive Symptoms on Female Sexual Function

This study used PSQI as the independent variable, PHQ as the mediating variable, and FSFI as the latent variable with its six dimensions as observed variables to construct a mediation effect model. The model fit indices included $\chi^2/df = 27.129$, GFI = 0.900, CFI = 0.920, TLI = 0.883, NFI = 0.918, RFI = 0.879, RMSEA = 0.150. These indices indicate a satisfactory model fit, and the standardized coefficients of each path were statistically significant ($P < 0.01$) (see Table 6).

The significance of the mediation effect was tested via the Bootstrap method. The results showed that the direct effect, indirect effect, and total effect of PSQI on FSFI were statistically significant ($P < 0.01$), thus confirming the partial mediating effect of PHQ between PSQI and FSFI. The indirect effect of PSQI affecting FSFI through PHQ accounted for 44.83% of the total effect (-0.013 / -0.029)(see picture 1).

Table 6
Mediation Effect Model of the Impact of Sleep Quality and Depression on Female Sexual Function

Effect	Path	Non-Std Path	Std Path	Std Error	*P*-value	95% CI	
						Lower	Upper
Direct Effect	PSQI → FSFI	-0.017	-0.105	0.006	0.003	-0.028	-0.005
Indirect Effect	PSQI → PHQ → FSFI	-0.013	-0.080	0.003	0.000	-0.019	-0.006
Total Effect	-	-0.029	-0.185	0.005	0.000	-0.039	-0.019
Indirect Effect Percentage: -0.013 / -0.029 = 44.83%							

Picture 1 Mediation Effect Model of the Impact of Sleep Quality and Depression on Female Sexual Function

Direct Effect: -0.017, Indirect Effect: -0.013, Total Effect: -0.029

4. Discussion

4.1 Prevalence of Sexual Problems among Middle-aged Women in Shanghai

This study demonstrated that 84.5% of middle-aged women in southern Shanghai who were enrolled had sexual activity in the past 4 weeks, while 61.4% of them had a FSFI total score < 23.45, indicating that perimenopausal and postmenopausal middle-aged women still generally have sexual needs, but sexual problems are already quite prominent; The prevalence of specific sexual dysfunctions was as follows: sexual desire disorder 59.5%, sexual arousal disorder 51.5%, lubrication disorder 51.0%, orgasmic disorder 51.4%, and dyspareunia 41.4%. A survey study in Malaysia found[15]: the prevalence of sexual dysfunction among middle-aged Malaysian women was 68.8%, with decreased desire 85.2%, arousal disorder 71.1%, lubrication disorder 66.9%, orgasmic disorder 61.2%, and dyspareunia 60.8%. The prevalence of sexual dysfunction among middle-aged women in Shanghai was 61.4%, slightly lower than Malaysia's 68.8%, but both exceed 60%, indicating that this problem is common among middle-aged women and may be closely related to physiological, psychological, and sociocultural factors. Shanghai, as an economically developed region in China, has higher awareness of sexual health and better access to medical resources, potentially leading to earlier problem identification and help-seeking. In contrast, some populations in the Malaysian study might delay seeking treatment due to limited medical conditions, leading to worsened symptoms. Decreased desire was significantly higher in Malaysia (85.2%) than in Shanghai (59.5%). This may be related to menopausal hormonal changes, psychological stress (such as family role burden), or cultural repression. Arousal and Lubrication Disorders, both regions exceeded 50%, suggesting physiological factors (such as declining estrogen levels) are the main triggers, requiring attention to menopausal health management. Orgasmic Disorder and Dyspareunia,proportions were higher in Malaysia (61.2%/60.8% vs. 51.4%/41.4%), which may be related to lack of sex education, partner cooperation, or untreated gynecological diseases (such as vaginal atrophy, inflammation). Sexual dysfunction in middle-aged women represents a highly prevalent but often overlooked health issue that calls for multi-dimensional intervention combining physiological, psychological, and sociocultural aspects.

4.2 Comparison of Sexual Problem Prevalence between Perimenopausal and Postmenopausal Women

This study shows that perimenopausal and postmenopausal women in southern Shanghai exhibit a high prevalence of sexual problems across all dimensions, and the prevalence is significantly higher in postmenopausal women than in perimenopausal women ($P < 0.01$). This may be related to the significant decline in estrogen levels subsequent to menopause leading to urogenital atrophy, which in turn causes dyspareunia, inhibition of sexual desire, and avoidance of sexual activity. The study conducted by Ruan X[16] et al. suggests that the severity of genitourinary syndrome of menopause is

significantly related to menopausal status and the duration of menopause, with longer postmenopausal duration associated with more severe symptoms.

4.3 Exploration of Multifactorial Influences of Menopause-Related Symptoms on Female Sexual Dysfunction (FSD)

The causes of Female Sexual Dysfunction (FSD) are multifactorial in etiology, encompassing psychosocial, interpersonal, pathological, and pharmacological aspects. Age and menopausal status[17] play a key role in this regard and are independent influencing factors for FSD. Common physiological discomforts in perimenopausal and postmenopausal women include sleep disorders, anxiety-depressive symptoms, hot flashes, night sweats, etc. This study, through multiple linear regression analysis, found that FSD occurrence was related to women's age, menopausal status, depressive symptoms, and sleep quality.

Multiple studies suggest[18, 19]: depressive mood and sleep quality are influencing factors for FSD in perimenopausal and postmenopausal women. US community survey data indicates[20] that among women aged 45–54 years, depressive symptoms and poor overall health status are closely related to sexual dysfunction, and women with hypoactive sexual desire are more prone to negative emotions such as frustration and anxiety. A systematic review indicated[21] that sexual dysfunction in menopausal women is closely related to mood disorders, and women with sleep apnea and insomnia are at an elevated risk of developing sexual dysfunction. Studies have shown[22] that women using Selective Serotonin Reuptake Inhibitors (SSRIs) have a higher prevalence of sexual dysfunction, possibly because SSRIs modulate other neurotransmitter systems such as nitric oxide (NO), noradrenergic, and dopamine, thereby triggering sexual dysfunction. Kling[23] et al.'s research indicates that poor sleep quality not only affects health but is also associated with female FSD. Women with sexual dysfunction have higher rates of depression and anxiety, and women with anxiety disorders also have a significantly higher chance of developing sexual dysfunction[24].

Dorani F et al.'s research shows[25] that there is a complex interrelationship between the three sets of symptoms—depression, sleep disorders, and sexual dysfunction—but the causal relationship is unclear. This study used a mediation effect model to further explore the relationship among sleep quality, sexual dysfunction, and depressive symptoms. The results of the present sturdy revealed that depressive symptoms have a partial mediating effect on the relationship between sleep quality and sexual dysfunction. The indirect effect of sleep quality affecting sexual dysfunction through depressive symptoms accounts for 44.83%. It is well known that sleep disorders are the most common menopause-related symptom among Chinese perimenopausal and postmenopausal women[10]. Yanwei Zheng et al.'s study found the prevalence of sleep disorders among Chinese perimenopausal women to be 47.5%[12], and the perimenopausal period is also an age group with a high incidence of depressive symptoms. This study reminds us to also pay attention to the sexual function and sexual life satisfaction of this population. Women with sleep disorders or depressive symptoms often do not proactively mention their

sexual life; we should to ask actively, screen proactively, detect early, and intervene early. Improving sleep and depressive symptoms may also improve patients' sexual health status, thereby enhancing the quality of life for middle-aged women.

In conclusion,this study conducted a comparative analysis of various dimensions of sexual function in perimenopausal and postmenopausal women in the Shanghai area, finding a high prevalence of sexual problems in this population, and that postmenopausal women have significantly higher rates than perimenopausal women. This study is the first to exploy a mediation effect model to confirm the mediating effect of depressive symptoms between sleep quality and sexual dysfunction. This finding helps understand the relationship among sleep quality, sexual dysfunction, and depressive symptoms, providing a new perspective and theoretical basis for improving sexual function in perimenopausal and postmenopausal women. This study also has some limitations: First, it is a cross-sectional survey study and cannot prove causality. Second, the scoring results in this study mainly rely on participants' self-perception, which may have subjective perception bias. Future research could employ multiple methods, particularly objective assessments of sleep quality.

Abbreviations

FIFI
Female Sexual Function Index
PSQI
Pittsburgh Sleep Quality Index
GAD-7
Generalized Anxiety Disorder Scale
PHQ-9
Patient Health Questionnaire-9.

Declarations

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Authors contributions

Conception and design of the research:QZ.Acquisition of data:SLZ,QZ,FRJ,LSH,ZLG,STL,LMJ. Analysis and interpretation of data:SLZ,WJL, QZ, BSW. Statistical analysis: BSW, QZ. Obtaining funding:QZ. Drafting the manuscript:SLZ,WJL. Revision of manuscript for important intellectual content: ZSW,WJL,QZ. All authors read and approved the fnal manuscript.

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Availability of data and materials

The datasets used and/or analysed during the current study are available from

the corresponding author on reasonable request.

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by Ethics Committee for Medical Research of

International Peace Maternity and Child Health Hospital (GKLW 2020-30). All

the subjects signed the informed consent form.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Figures

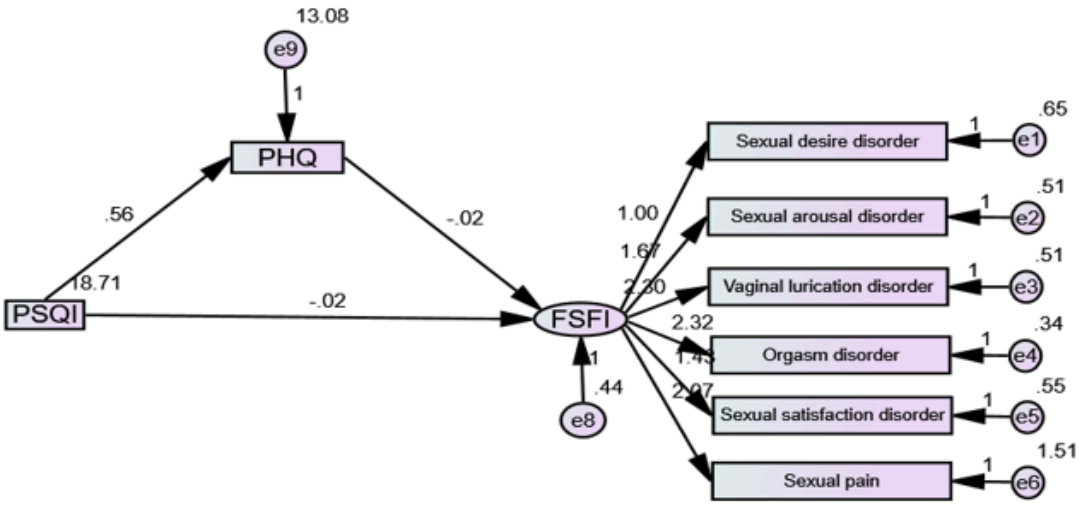


Figure 1

Picture 1 *Mediation Effect Model of the Impact of Sleep Quality and Depression on Female Sexual Function*
Direct Effect: -0.017, Indirect Effect: -0.013, Total Effect: -0.029