Caspian Journal of Neurological Sciences
http://cjns.gums.ac.ir

Brain-Behavioral Systems and Psychological Distress in Women with Hypoactive Sexual Desire Disorder

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ARTICLE INFO

Article type:
Original Article

Article history:
Received: 11 June 2016
Accepted: 21 December 2016
Available online: 30 December 2016
CJNS 2016; 2 (7): 10-18

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ABSTRACT

Background: Hypoactive sexual desire disorder is the most common sexual disorder among women, which interferes with their various functions. Activity of brain-behavioral and psychological distress systems are considered among factors affecting sexual function.

Objectives: The present study aimed to compare women with hypoactive sexual desire and normal women in terms of brain-behavioral and psychological systems.

Materials and Methods: In the present causal-comparative study, 37 women with hypoactive sexual desire and 37 normal women were purposively selected with maximum matching in terms of demographic variables from among eligible women attending health centers across Alborz Province in Iran. Data were collected using the following scales: behavioral inhibitory/activation scales (BIS/BAS) and depression, anxiety, stress (DASS) and were analyzed using multivariate analysis (MANOVA) in SPSS software version22.

Results: The results obtained showed that mean score of women with hypoactive sexual desire was significantly lower compared with normal women in brain-behavioral activation system (drive, response to reward and pleasure seeking), but significantly higher in behavioral inhibitory system. Furthermore, women with hypoactive sexual desire obtained higher scores which indicate worse conditions than normal women in the components of psychological distress including anxiety, depression and stress.

Conclusion: Women with hypoactive sexual desire have weaker behavioral inhibitory/activation systems and higher levels of anxiety, depression, and stress compared to normal women. Given these results, it is recommended that greater attention be paid to factors such as brain-behavioral and psychological distress systems in prevention and treatment programs for hypoactive sexual desire.

Keywords: Sexual Dysfunctions, Psychological; Women

➢ *Please cite this paper as:*
Alipour F, Hasani J, Bodaghi E, Bodaghi M, Saeedpour S. Brain-Behavioral Systems and Psychological Distress in Women with Hypoactive Sexual Desire Disorder. Caspian J NeurolSci2016; 2(7): 10-18.

Introduction

Hypoactive sexual desire disorder (HSDD) in women refers to less interest in sexual activity compared to spouse or sexual partner. Loss of sexual desire leads to considerable distress and seriously affects interpersonal communications. One out of ten women suffers from HSDD. This disorder affects 8.9% of 18-44 year-old women, and increases to 20% after menopause [1]. In the fifth edition of Diagnostic and Statistical Manual of Mental Disorders (DSM-5), this disorder is diagnosed with the lack of interest in sexual activities, absence of erotic thoughts or fantasies, lack of initiating sexual activity with spouse or sexual partner, loss of interest and enjoyment during sexual activity, loss of sexual interest in responding to internal and external stimuli, and substantial psychological distress. These symptoms should persist for at least six months, and should not be caused by other psychological disorders or physical diseases [2].

HSDD directly affects the quality of life and marital satisfaction of couples or sexual partners, and its subsequent psychological distress can lead to interpersonal problems and threaten psychological health of both partners [3]. Psychological distress that can manifest as anxiety, depression, and stress can present in both psychiatric disorders and medical diseases [4]. Chronic HSDD in women can affect sexual life of their spouses, and eventually lead to HSDD in spouses [5]. Sexual disorders in women have always been associated with anxiety and depression, which may contribute to recurrence and initiation of the next episode of sexual disorders in women who have recovered from HSDD [6]. The relationship between these factors can be reciprocal, such that persistence of this disorder can cause depression and anxiety, and depression and anxiety symptoms can contribute to vulnerability to this disorder [7]. Women experiencing depression suffer loss of sexual desire [8]. Therefore, anxiety and depression are considered as co-morbid disorders with HSDD in DSM-5 [2]. Anxiety can exacerbate this disorder by causing muscle tension, shortness of breath, palpitation, attention biased toward performance, and overestimation of the problem. Individual's concern about his/her performance can worsen the problem. Suffering from attention biased toward performance and problematic signs and preoccupation of mind with worry will naturally lead to poor performance, and the slightest negative feedback can seriously obviate performance and quality of the encounter [9].

In this respect, the personality theory proposed for sexual desire and its various levels is a double control model, in which, sexual responses are determined by the interaction between arousal and inhibition. In fact, individual's responses stem from inhibitory and emotional processes. The contribution of sympathetic and parasympathetic nervous system has also been proposed in this theory [10]. The theory of Brain-Behavioral systems also provides a more comprehensive explanation for the process of sexual interactions. Gray used his theory to explain bio-sensitivities as the context for development of disorders [11]. He provided a biological model of personality by reviewing animal studies in Reinforcement Sensitivity Theory (RST), which explains personal differences at biological level. Each of these brain-behavioral systems recalls different emotional reactions such as fear and

anxiety. Behavioral Inhibitory System (BIS) responds to conditional stimuli of punishment and lack of reward and also to new and inherently frightening stimuli. This system is also associated with negative emotions such as anxiety, despair, and sadness. In neurological aspect, the constructions associated with this system are located in the hippocampal septal system. The three main parts of this structure include hippocampal formation, septal area (comprising medial and lateral septal areas) and Papez circuit [12].

Behavioral inhibitory system produces inhibitory and avoidance responses through the activity of noradrenergic and serotonergic neurotransmitters [13]. Behavioral activation system (BAS) responds to conditional stimuli of reward and lack of punishment. Activity of BAS is associated with positive emotions such as hope, peace of mind, and happiness. BAS is divided into three subsets: seeking pleasure, response to reward, and drive [14]. Key neurological components of BAS include basal ganglia (ventral and dorsal striatum body, and ventral and dorsal pallidum), dopaminergic fibers that ascend mesencephalon (substantia nigra and A10 nucleus) and reach to basal ganglia, and thalamic nuclei that are closely associated with basal ganglia [15]. These brain-behavioral systems are associated with negative emotions, depression and anxiety [16]. BIS inhibits sexual desire by suppressing positive sexual desires, fantasies, positive emotions and sexual stimuli and by affecting novelty seeking and expression of emotions and desires [17]. In a review study, Sharon et al. investigated the prevalence, factors, and treatment of HSDD in women, and reported that they are different from normal women in terms of neurotransmitters associated with reward and reinforcement such as dopamine, and have lower levels of sexual excitement seeking, and that successful treatment of this disorder positively affects individual's excitement seeking and inhibitions [18]. In a review study, Bancroft *et al.* examined inhibitory and arousal role in sexual desire, and reported that compared to normal women, women with HSDD suffer from high levels of behavioral and emotional inhibition and low levels of excitement seeking and arousal [10].

Given all the above, it seems that investigating the action of brain-behavioral systems in HSDD and also investigating anxiety and depression, which are the most common co-morbidities in women's HSDD, can contribute toward better understanding and explanation of pathology and treatment of this disorder. Thus, the present study aimed to investigate brain-behavioral and psychological distress systems in women with HSDD.

Materials and Methods

The present causal comparative study recruited women with HSDD (n=37) and normal women (n=37). The sample size was determined according to the mean value from previous similar studies. Health centers across Alborz Province were visited and after necessary coordination with authorities, women suspected of this disorder were identified using Female Sexual Function Index. Initial selection was performed according to study inclusion and exclusion criteria, including no physical illness, no use of psychiatric medications, one year since last childbirth, and acquired HSDD diagnosed by a physician with no organic reason). Samples were ultimately selected after semi-structured diagnostic interview of HSDD based on

DSM-5 conducted by two senior clinical psychologists, and confirmation of lack of anxiety, depression, addiction, and abuse during childhood. Normal women were selected from those with no diagnosis of HSDD, and with maximum matching for demographic variables attending Alborz Province health centers. Written consents were obtained from eligible women, and explanations were provided regarding the process of the study. The researcher was actively present when participants were responding to questions, in order to prevent random answers and to answer their possible questions. Data were collected, and recorded and analyzed in SPSS-22 using descriptive statistics and multivariate analysis. The following questionnaires were used in the present study:

Demographic questionnaire: This researcher-made questionnaire was used to obtain data such as age, education, occupation, marital status.

Behavioral inhibitory/activation systems scale: BIS/BAS contains 24 items, with scoring based on Likert scale. Of these 24 items, 7 belong to BIS, and 13 to BAS. BAS has three subscales, including drive (4 items), pleasure seeking (4 items), and responding to reward (5 items). The last 4 items are diversion items, which are not scored. Reported coefficient of alpha is 77% for BIS, 73% for responding to reward, 76% for drive, and 71% for pleasure seeking [19]. Internal consistency (reliability) of the Persian version of this scale is reported 78% for BIS and 71% for BAS, and its test-retest reliability, 68% for BAS and 71% for BIS [20].

Depression, Anxiety, Stress Scale (DASS): DASS has been developed to measure negative emotions of depression, anxiety, and stress over the last three weeks. DASS subscales have been confirmed through factor analysis, with Eigen values 2.89, 1.23, and 9.07 respectively, and reported Cronbach's alpha 0.92, 0.95, and 0.97 respectively [21]. Test-retest reliability of the Persian version of DASS subscales were reported 0.8, 0.76, and 0.77, with Cronbach's alpha 0.81, 0.74, and 0.78 respectively [22].

Results

Mean age of women with HSDD was 33.27±4.61 years, which was higher than mean age in normal women (31.75±3.52) years, but not statistically significantly (p=0.172). Mean education level in the normal group (13.48±3.69) was higher than that in HSDD group (11.86±3.92), but not statistically significant (p=0.147). Of HSDD women, 33 (89%) and of normal women, 31 (84%) had employed husbands.

Two groups were compared in terms of behavioral inhibitory/activation systems and psychological distress using multivariate variance analysis. First, random data were assessed according to their conversion into standard Z scores.

In comparing two groups in terms of behavioral inhibitory/activation systems, Levine test range [F (1.72)=0.08-0.94; p>0.05] and Kolmogorov-Smirnov (0.14-0.65) indicated homogeneity of variance and normal distribution of variables. Also, M-Box test results [F (28-18064.029)=1.48; p>0.01] showed homogeneity of covariance matrix of dependent variables in groups. The Wilks'-Lambda multivariate test result [F (7-66)=18.41; p<0.001] was significant. Table 1 presents values of F from one-way variance analysis, and mean and standard deviation of behavioral inhibitory/activation systems.

Table 1. Mean, standard deviation, and one-way variance analysis results in comparing HSDD* and normal women in terms of behavioral inhibitory/activation systems

Variable		Group	Mean	Standard deviation	F df=(1, 78)	H^2
Inhibitory/activation systems	Drive	HSDD	9.45	2.56	36.44***	0.31
		Normal	12.87	3.14		
	Responding to reward	HSDD	14.32	3.44	24.19***	0.26
		Normal	17.46	4.78		
	Pleasure seeking	HSDD	11.92	2.83	41.62***	0.35
		Normal	15.78	4.11		
	Behavioral inhibition	HSDD	21.03	5.35	59.20***	0.42
		Normal	16.84	4.61		
N=37 in each group *Hypoactive Sexual Desire Disorder						

According to Table 1, mean scores of sexually hypoactive women in drive, responding to reward, and pleasure seeking activation systems were significantly lower compared to normal women (p<0.001), yet their mean scores in inhibitory systems were significantly higher (p<0.001).

In comparing the two groups in terms of behavioral inhibitory/activation systems and psychological distress, Levine test range [F (1.78)=0.36-1.72; p>0.05] and Kolmogorov-Smirnov (0.45-0.87) indicated homogeneity of variance and normal distribution of variables. Also, M-Box test results [F (105-18954.068)=1.29; p>0.01] showed homogeneity of covariance matrix of dependent variables in groups. The Wilks'-Lambda multivariate test result [F (14-65)=2.44; p<0.001] was significant. Table 2 presents values of F from one-way variance analysis, and mean and standard deviation of psychological distress.

Table 2. Mean, standard deviation, and one-way variance analysis results in comparing HSDD* and normal women in terms of psychological distress

Variable	Group	Mean	Standard deviation	F df=(1, 78)	H^2
Anxiety	HSDD	16.35	3.79	74.61***	0.48
	Normal	10.08	2.54		
Depression	HSDD	14.89	3.63	23.74***	0.25
	Normal	10.24	2.88		
Stress	HSDD	15.51	4.86	18.72**	0.21
	Normal	12.40	3.22		
N=37 in each group *Hypoactive Sexual Desire Disorder					

According to Table 2, mean score of HSDD women in anxiety, depression, and stress variables was significantly higher compared to normal women (p<0.001). The highest difference between the two groups pertained to anxiety.

Discussion

The results obtained showed that HSDD women suffer from significantly higher levels of anxiety, depression and stress compared with normal women. This result concurs with those obtained in studies conducted by some other researchers [7,23-25]. Sexual dysfunction has always been a sign of depression. Feelings of despair, sadness and shame have always been proposed as the most important causes of recurrence of sexual hypoactivity [6]. Depression can disturb cognition and make an impression on sexual performance and relationship, such that

sexually hypoactive women suffer from feelings of shame, inadequacy, guilt, and negative anticipation of future performance during sexual relationship [24]. Anxiety as an obsessive concern about adequacy of sexual performance is one of the most powerful determinants of sexual dysfunction. By overestimating the problem and exacerbating this vicious cycle, worry and anxiety have huge roles in the persistence of this disorder. Anxiety forces these women to constantly assess their bodily signs and performance, and consider their problem disastrous with the slightest related trigger [7]. Anxiety can suppress sexual desire in women and act as a mechanism to turn off emotions. Anxiety can be considered the basis for women's HSDD in the form of concern about details of intimacy, feeling guilty, misunderstanding and incorrect information about sexual relationship [23].

The present study results also showed that sexually hypoactive women scored significantly higher compared to normal women in drive, responding to reward, and pleasure seeking behavioral activation systems. These results concur with those found in previous studies on the neuropsychological background of this disorder [10, 18].

Sexual response is the result of interaction between inhibitory and stimulating factors that may act independently. Loss of sexual desire may be caused by inadequate stimulation process, or due to increased inhibition of desire or sexual response. Inhibition of desire or sexual response may be a healthy adaptive reaction to a stressful relationship or specific life circumstances that protect the individual against risk, regret, or threatening sexual behaviors. The three factors that may affect sexual stimulation or inhibition include life relationships and circumstances (for instance, marital problems, stress, and tiredness), conducts and history of sexual life (for instance, tendency to react to sexual problems via inhibition of sexual desire as a result of learnt behaviors, cultural effects and past hurts) and physical and medical factors such as menopause, use of medication and other medical diseases. This model provides a framework for understanding possible causes of HSDD, which reduces factors considered or sexual stimulation processes, or increases inhibitory processes [18].

Based on the theory of brain-behavioral systems, Gray proposed the hypothesis that psychiatric disorders are induced by the dysfunction (hyperactivity or hypoactivity) in one of the systems or their interaction. Since his proposal, researchers have proposed the hypothesis that abnormal sensitivity of these systems is indicative of readiness and predisposition in many psychopathologic forms [26]. Therefore, the assumption is that behavioral activation and inhibition systems can explain a wide range of disorders. Many studies have supported this idea; for example, Gray assumed that neurotic anxiety and depression are the result of overactive inhibitory system; he believes that depression is the result of hypoactivity of behavioral activation system. Overactive behavioral inhibitory system leads to anxious personality traits and predisposes individuals to particular anxiety disorders [27].

Structurally, behavioral activation system contains several dopaminergic pathways and cortico-striato-pallido-thalamic axis. Two behavioral components of this system include turning to (actively seeking reward) and active avoidance (avoiding outcome). Behavioral inhibitory system is induced by the activity of afferent, noradrenergic and

serotoninergic pathways [28]. The results from a recent study using functional brain scan indicate that the structural activity associated with behavioral inhibitory system (septal-hippocampal, brain stem, Papez circuit, and orbital-frontal cortex) is significantly higher in women with HSDD compared to normal women [29]. On the other hand, activity of structures associated with behavioral activation system (frontal cortex, amygdala, and basal ganglia) is significantly lower in sexually hypoactive women compared to normal women [30]. The present study results are totally in agreement with the results of neuropsychology studies on HSDD, such thathypoactivity of behavioral activation system and hyperactivity of behavioral inhibitory systems in sexually hypoactive women accord with neuropsychology results obtained in previous studies. The present study results show that behavioral inhibition and psychological distress are among factors associated with hypoactive sexual desire. Thus, these factors should be considered for treatment programs of this disorder because review of literature also shows that treatments have been successful if they reinforce excitement seeking and sensitivity to amplification in these individuals and reduce various dimensions of inhibition such as cognitive, emotional, and behavioral.

Study Limitations

Limitations included small sample size, pen and paper tools, and non-assessment of sexual status of participants' spouses. It is therefore recommended that future studies assess these limitations, and also investigate medical interventions based on brain-behavioral systems and psychological distress.

Conclusion

Women with HSDD have weaker behavioral inhibitory/activation systems compared to normal women, and have higher levels of anxiety and depression. It is hoped that as a fresh step in studies on the psychological aspect of sexual hypoactivity, the present study results can reveal the need for greater attention to the role of brain-behavioral systems and psychological distress as factors affecting understanding and pathology of HSDD.

Acknowledgements

We thank all health centers in Alborz Province, including Shahid Eskandari and Shahid Turkian in Alborz Province for their cooperation in the present study.

Conflict of Interest

The authors have no conflict of interest.

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