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# **Sexual dysfunction in women with newly diagnosed thyroid dysfunction: a novel report from Basrah, Iraq**

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## **Abstract**

Thyroid dysfunction has been proposed as a potential contributor to Female Sexual Dysfunction (FSD), yet its impact, particularly in subclinical and autoimmune forms, remains controversial, especially in culturally conservative populations. This study aimed to assess the relationship

between newly diagnosed thyroid dysfunction and sexual function among married, premenopausal women in Basrah, Iraq, using the Arabic version of the Female Sexual Function Index (FSFI). Out of 673 women aged 20–48 years presenting with sexual complaints, 229 with clinically confirmed FSD were enrolled. Of these, 42 were newly diagnosed with thyroid dysfunction, either overt or subclinical, autoimmune or non-autoimmune, and served as the case group. In contrast, 187 women with normal thyroid function served as controls. Hormonal profiling included Thyroid-Stimulating Hormone (TSH), free thyroxine (FT4), total testosterone (TT), sex hormone-binding globulin (SHBG), calculated free testosterone (cFT), estradiol (E2), and prolactin (PRL). FSFI domain scores and hormonal parameters were compared across groups and subgroups. Subclinical and overt thyroid dysfunction were identified in 8.3% and 10.04% of the cohort, respectively. FSFI scores were significantly low across all domains in both groups. Although the orgasm domain ( $p = 0.043$ ) and total FSFI score ( $p = 0.020$ ) showed statistical significance, the overall clinical impact was limited due to the uniformly low scores. Hormonal levels, including PRL, TT, SHBG, cFT, and E2, did not differ significantly between groups, except for higher E2 levels among women with autoimmune thyroid dysfunction ( $p = 0.026$ ). No significant differences in FSFI scores were observed between autoimmune and non-autoimmune groups, or between autoimmune hypothyroidism and autoimmune hyperthyroidism. These findings suggest that thyroid dysfunction, whether overt, subclinical, or autoimmune, does not appear to be a major determinant of FSD in this population. The results support a multifactorial origin of FSD and underscore the need for culturally sensitive, interdisciplinary approaches to better understand and manage sexual health concerns among women in conservative societies.

## **Introduction**

Thyroid dysfunction, whether overt or subclinical, is increasingly recognized as a contributing factor to Female Sexual Dysfunction (FSD).<sup>1</sup> It has been observed to affect a wide range of

sexual domains, including desire, arousal, and lubrication, particularly in women with overt thyroid disorders.<sup>2-6</sup>

Subclinical thyroid dysfunction and autoimmune thyroiditis, however, have not been thoroughly explored in terms of their potential impact on sexual function. While some studies suggest that subclinical hypothyroidism may be linked to reduced desire or arousal, others report no significant difference in FSFI scores. Similarly, autoimmune thyroiditis may influence sexual function via inflammatory or hormonal mechanisms, but findings remain inconclusive. Notably, there are no prior reports assessing the prevalence or impact of these conditions on FSD among women in Basrah, Iraq, emphasizing the relevance of the current study.<sup>3,5-7</sup>

The alterations in hormonal balance caused by thyroid dysfunction may influence sexual function through changes in Sex Hormone-Binding Globulin (SHBG) levels or disruptions to the thyroid-prolactin (PRL) axis.<sup>8,9,10</sup>

Additionally, thyroid hormones may directly interact with receptors located in ovarian and vaginal tissues, influencing local tissue metabolism, vascularization, and lubrication. These hormones can modulate estrogen responsiveness and influence nitric oxide production, affecting genital blood flow and smooth muscle relaxation. Such effects contribute to FSD through both peripheral mechanisms, like impaired genital sensation, lubrication, and discomfort, and central mechanisms involving altered neurotransmitter signaling that regulates sexual desire, arousal, and orgasm.<sup>3,8-10</sup>

Psychological and autonomic disturbances associated with thyroid dysfunction, such as heightened anxiety, depressive symptoms, mood swings, fatigue, and autonomic dysregulation, may further contribute to FSD by reducing sexual motivation, lowering self-esteem, and increasing pain perception during intercourse. These neuropsychological effects are well-documented among women with both hypo- and hyperthyroid states.<sup>2,6,8,11</sup>

Moreover, thyroid hormone receptors have been identified in both ovarian and vaginal tissues, and their dysregulation may disrupt reproductive tissue development, cellular turnover, and local endocrine signaling, leading to direct impairment of female sexual function.<sup>12</sup>

This study aims to evaluate the impact of newly diagnosed thyroid dysfunction, including both overt and subclinical forms, as well as autoimmune thyroiditis, on FSD among married,

premenopausal women aged 20 to 48 years in Basrah, Iraq. Although biologically within the reproductive age range, this demographic is specifically defined here as premenopausal to indicate the absence of menopausal transition symptoms. This group has been underrepresented in regional and international research, and the study seeks to provide focused insights into the complex relationship between thyroid health and female sexual function within this culturally unique population.

## **Materials and Methods**

From September 2018 to January 2021, a total of 673 married, premenopausal women aged 20 to 48 years (mean age:  $31.8 \pm 7.0$  years) who presented with sexual complaints were evaluated at the Faiha Specialized Diabetes, Endocrine, and Metabolism Center (FDEMC) in Basrah, Iraq. Although the center is specialized in metabolic and endocrine disorders, the women enrolled in this study were not all patients with diabetes or metabolic syndromes; rather, they were referred for endocrine consultation due to newly detected thyroid abnormalities or unexplained sexual dysfunction. Comprehensive assessments included detailed medical history, physical examination, and hormonal profiling. Evaluated parameters included age, age at marriage, marriage duration, parity, body mass index (BMI), and menstrual regularity. Details regarding menstrual regularity, parity, and reproductive history were collected through direct clinical interviews during enrollment. BMI was classified into three categories based on WHO standards: normal ( $<25 \text{ kg/m}^2$ ), overweight ( $25\text{--}29.9 \text{ kg/m}^2$ ), and obese ( $\geq 30 \text{ kg/m}^2$ ).

Age at marriage and duration of marriage were included as potential psychosocial and relational factors influencing sexual health, particularly in a cultural context where early marriage is common and relationship duration may impact sexual satisfaction or dysfunction.

### ***Inclusion and exclusion Criteria***

Women were included if they were within the reproductive age range, premenopausal, defined by the presence of regular menstrual cycles (intervals of 21–35 days) and absence of menopausal

symptoms such as vasomotor instability, amenorrhea exceeding 12 months, or elevated Follicle-Stimulating Hormone (FSH) levels in ambiguous cases, and currently married, and reported at least one ongoing sexual concern (e.g., decreased desire, difficulty with arousal, or painful intercourse).<sup>10</sup>

Exclusion criteria were strictly applied to minimize confounders affecting sexual function. They included: confirmed menopausal status, pregnancy or postpartum period, use of hormonal or anti-hormonal therapies, prior gynecological or endocrine surgery within the last 6 months, primary infertility, history of psychiatric illness, known malignancies, and congenital genital anomalies.

Of the 673 women screened, 229 met the clinical criteria for FSD based on initial history and were invited to complete the Female Sexual Function Index-Arabic version (ArFSFI). Laboratory testing was performed to assess thyroid status. Based on hormonal and antibody profiles, 42 women were identified with newly diagnosed thyroid dysfunction (either overt or subclinical, and autoimmune or non-autoimmune), and formed the case group. The remaining 187 women with normal thyroid function served as the control group. Figure 1 outlines participant inclusion, exclusion, and final group allocation flow.

### ***Participants***

Out of the initial cohort, 229 women met the clinical criteria for FSD based on their presenting complaints and clinical history—such as persistent low libido, difficulty with arousal or orgasm, or dyspareunia—and were invited to complete the ArFSFI. Those with a total FSFI score  $\leq 26.55$  were classified as having FSD and included in the study. Hormonal tests were then conducted in the morning under fasting conditions to measure free thyroxine (FT4), thyrotropin (TSH), total testosterone (TT), SHBG, estradiol (E2), and prolactin (PRL).

All tests were performed using an Electrochemiluminescence Immunoassay (ECLIA) on the Roche Cobas e411 Analyzer (Roche Diagnostics, Mannheim, Germany). The adopted reference ranges—based on manufacturer instructions and validated internal laboratory standards—were as

follows: TSH (0.27–4.2  $\mu$ IU/mL), FT4 (0.93–1.7 ng/dL), TT (15–46 ng/dL), SHBG (18–86 nmol/L), E2 (27–136 pg/mL), and PRL (4–30 ng/mL). (Roche Diagnostics, 2021; reference values from the Cobas e411 reagent package inserts).

Subclinical hypothyroidism was defined as elevated serum TSH levels (4.5–10 mU/L) with normal FT4 concentrations, while subclinical hyperthyroidism was defined by suppressed TSH levels with normal FT4 and T3 values. Autoimmune thyroid dysfunction was identified based on positive thyroid peroxidase (TPO) antibodies or thyrotropin receptor antibodies (TRAb), irrespective of thyroid hormone levels, by the clinical framework proposed by Cooper and Biondi.<sup>13</sup>

We used the online calculator provided by the International Society for the Study of the Aging Male (ISSAM) to estimate calculated Free Testosterone (cFT) (<http://www.issam.ch/freetesto.htm>). The FDEMC's reference range for this study was 1.2–6.4 pg/mL.

Women diagnosed with thyroid dysfunction, including both hyperthyroidism and hypothyroidism, were re-evaluated within one week to confirm the diagnosis. Thyroid dysfunction was further classified based on hormonal profiles and the presence of thyroid autoantibodies; Anti-Thyroid Peroxidase (TPO-Ab) and Thyrotropin Receptor Antibodies (TRAb) were measured to identify autoimmune thyroid conditions.

### ***The case versus control groups***

We diagnosed 42 women with thyroid dysfunction, including subclinical hypothyroidism (n=18), subclinical hyperthyroidism (n=1), overt hypothyroidism (n=8), and overt hyperthyroidism (n=15). These women constituted the case group, while the remaining 187 women with normal thyroid function were the control group.

### ***Female Sexual Function Index (FSFI) scoring***



We used the ArFSFI Scoring.<sup>14</sup> FSFI has 19 multiple-choice questions and is a standard tool for assessing women's main dimensions of sexual function in the last month (past four weeks). These dimensions include desire, arousal, lubrication, orgasm, satisfaction, and pain. The questions are scored from 0 to 5 points. The values of each domain were added and then multiplied by a correction factor to obtain the total score, which ranges from 2 to 36 points. A total score below 26.55 points suggests FSD. The domains' cut-off points were (desire=4.28, arousal=5.08, lubrication=5.45, orgasm=5.05, satisfaction=5.04, and pain=5.51), and scores less than or equal to these values indicated sexual problems in that domain.<sup>15</sup>

The laboratory results were revealed to the interviewing endocrinologist after completing the FSFI scoring to achieve the best results without any subjective effect.

### ***Assessment***

We analyzed ArFSFI domain scores alongside biochemical parameters, including serum levels of TSH, FT4, TT, cFT, SHBG, E2, and PRL as well as selected personal characteristics such as age, BMI, parity, age at marriage, marriage duration, and menstrual regularity. Subgroup analyses among women with thyroid dysfunction were conducted in two stages: first, we compared women with autoimmune thyroid dysfunction, identified by positive TPO or TRAb, to those with non-autoimmune thyroid dysfunction; second, we compared those with autoimmune hypothyroidism to those with autoimmune hyperthyroidism.

### ***Statistical analysis***

Statistical analysis was conducted using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize the study variables. Categorical data were presented as frequencies and percentages. At the same time, continuous variables were reported as means or medians with Standard Error of the Mean (SEM), rather than standard deviation, due to the wide variability in some hormonal values. Between-group comparisons were conducted using the independent samples t-test for continuous variables and the Chi-square test for categorical variables. A two-tailed p-value of  $\leq 0.05$  was considered statistically

significant. No correlation analyses were performed, as the study design was based on group comparisons rather than predictive modeling.

## Results

Of the 229 women diagnosed with female sexual dysfunction (FSD), 42 were newly diagnosed with thyroid dysfunction. These included subclinical hypothyroidism (n=18), subclinical hyperthyroidism (n=1), overt hypothyroidism (n=8), and overt hyperthyroidism (n=15). The remaining 187 women with normal thyroid function served as the control group (Table 1). Among those with thyroid dysfunction, 21 cases (50%) were classified as autoimmune in origin, based on positive anti-TPO or TRAb antibody results. Overall, the prevalence of subclinical thyroid dysfunction in the FSD cohort was 8.3%, while overt thyroid dysfunction accounted for 10.04%.

Although the ArFSFI questionnaire evaluates sexual function over the previous four weeks, the reported "duration of FSD before presentation" represents the number of months during which women had experienced ongoing sexual concerns—such as diminished desire, impaired arousal, or dyspareunia—before seeking medical evaluation. This parameter was obtained from clinical history to better capture the chronicity of sexual dysfunction in the study population.

The case and control groups were closely matched in terms of age, BMI, parity, marriage duration, and duration of FSD symptoms. As shown in Table 2, FSFI scores were markedly reduced across all domains in both groups, averaging approximately one-third of the domain-specific cutoff values. No significant differences were observed between the groups regarding PRL, total testosterone, SHBG, calculated free testosterone (cFT), or estradiol (E2) levels (Table 2).

While mean FSFI scores were slightly higher in the thyroid dysfunction group for domains such as desire, arousal, lubrication, and satisfaction, only the orgasm domain ( $p=0.043$ ) and the total FSFI score ( $p=0.020$ ) demonstrated statistically significant differences. This indicates that although thyroid dysfunction may have a modest influence on certain aspects of sexual function, it does not consistently affect all domains (Table 2).

Hormonal comparisons between the thyroid dysfunction and control groups revealed significantly elevated TSH and FT4 levels in the thyroid dysfunction group, consistent with their diagnostic classification. In contrast, no significant differences were observed in PRL, TT, SHBG, cFT, or E2, suggesting the absence of a direct endocrine mechanism explaining the sexual dysfunction in these women. Likewise, demographic parameters, including age, BMI, duration of FSD, and marriage duration, showed no statistically significant differences between the groups (Table 2).

When subgrouped by thyroid autoimmunity status, women with autoimmune thyroid dysfunction did not differ significantly from those with non-autoimmune dysfunction in any FSFI domain scores. This pattern extended to most hormonal parameters. However, E2 levels, although within the normal range for both groups, were significantly higher among women with autoimmune thyroid dysfunction compared to their non-autoimmune counterparts ( $p=0.026$ ), as shown in Table 3.

Subgroup analysis within the thyroid dysfunction cohort showed no significant differences in FSFI domain scores between women with autoimmune and non-autoimmune thyroid dysfunction. Sexual function remained markedly impaired across all domains—desire, arousal, lubrication, orgasm, satisfaction, and pain—in both subgroups, without statistically meaningful variation. Only estradiol (E2) levels differed significantly among the hormonal markers, with higher mean E2 observed in the autoimmune subgroup ( $p=0.026$ ), though values remained within the normal reference range for both groups. No significant differences were found in TSH, FT4, PRL, TT, SHBG, or cFT levels, nor in demographic characteristics such as age, BMI, marriage duration, or duration of FSD symptoms (Table 3).

This pattern persisted when comparing women with autoimmune hypothyroidism to those with autoimmune hyperthyroidism. As shown in Table 4, no statistically significant differences were observed across FSFI domains, hormonal profiles, or demographic variables, indicating similar sexual dysfunction severity regardless of the type of autoimmune thyroid disorder.

Further stratification of women with autoimmune thyroid dysfunction into those with autoimmune hypothyroidism ( $n=15$ ) and autoimmune hyperthyroidism ( $n=6$ ) revealed no statistically significant differences in total FSFI scores or any of the individual sexual domains. Although the hyperthyroid subgroup showed numerically higher scores in arousal and

satisfaction, these differences did not reach statistical significance. Likewise, the two groups' hormonal parameters, including prolactin, total testosterone, SHBG, calculated free testosterone, and estradiol, were comparable. While estradiol levels were higher in the autoimmune hyperthyroid subgroup, the difference was not significant ( $p=0.159$ ). Demographic and clinical characteristics, including age, BMI, duration of FSD, and marriage duration, also showed no meaningful variation, indicating that the severity of sexual dysfunction was similar regardless of the specific autoimmune thyroid subtype.

## Discussion

To the best of our knowledge, this is the first study from Iraq to investigate the association between newly diagnosed thyroid dysfunction and female sexual dysfunction (FSD). Our findings revealed that sexual function was markedly impaired across all FSFI domains (desire, arousal, lubrication, orgasm, satisfaction, and pain) in both the thyroid dysfunction and control groups, regardless of thyroid status.

This profound reduction in sexual function scores remained consistent whether using the total score cutoff of 28.1 proposed by Anis *et al.*<sup>14</sup> or the original threshold of 26.55 by Rosen *et al.*<sup>15</sup> However, due to the absence of domain-specific cutoffs in the Arabic version, we relied on the validated domain thresholds provided by Rosen *et al.*<sup>15</sup> to guide more accurate interpretation.

Although Table 2 showed statistically significant differences in the orgasm domain and total FSFI scores between groups, these findings may have limited clinical relevance in the context of universally low domain scores. The consistent reduction across all domains suggests that broader factors, such as psychological distress or sociocultural barriers to sexual health, may have influenced how participants perceived and reported their symptoms.

It is also possible that, when finally given a structured and private environment to discuss sexual concerns, participants may have unintentionally overemphasized the severity of their dysfunction. This could reflect accumulated emotional burden, cultural inhibition, or the novelty of discussing such topics openly in a clinical setting.

The strict exclusion criteria could impact our results. In our study setting, discussions related to sexual function are often considered culturally sensitive and socially stigmatized. To respect

participants' privacy and minimize discomfort, the ArFSFI was not administered to all 673 women initially screened. Instead, we first identified women who met predefined clinical criteria suggestive of FSD based on their complaints and medical history. Only these 229 women were then invited to complete the ArFSFI questionnaire. Consequently, we did not collect FSFI domain scores for the remaining women who did not meet FSD criteria, and thus no comparative sexual function data are available for them.

FSD was identified in 34.0% of the screened population, with 229 out of 673 women meeting the diagnostic criteria. This prevalence is notably lower than that reported in similar studies from Iran (52%) and Egypt (52.8%).<sup>16,17</sup> Several factors may explain this discrepancy, including variations in cultural norms surrounding the discussion of sexual health, differences in study design, and the diagnostic thresholds applied. Our study used the FSFI total score cutoff of 26.55, while other studies may have used alternative values or broader definitions of FSD. Additionally, conservative sociocultural attitudes in southern Iraq may discourage women from disclosing sexual concerns, potentially leading to underreporting and an artificially lower prevalence.

Hormonal levels—including PRL, TT, SHBG, cFT, and E2—were comparable between women with and without thyroid dysfunction and remained within normal reference ranges across both groups. This lack of significant hormonal variation persisted during subgroup analyses comparing autoimmune versus non-autoimmune thyroid dysfunction, as well as autoimmune hypothyroidism versus autoimmune hyperthyroidism. Although FSFI scores were uniformly low, no direct correlation analysis was conducted between individual hormone levels and sexual function domains. This was because the study was primarily designed as a comparative, group-based analysis rather than a correlational or predictive model. Additionally, given the small sample size of the thyroid dysfunction subgroups (especially when stratified by autoimmune status), the statistical power for meaningful correlation analysis would have been limited, increasing the risk of spurious or non-reproducible associations.

Several studies have reported varying relationships between hypothyroidism and female sexual function. Veronelli *et al.* and Oppo *et al.* found a significant reduction in total FSFI scores and all individual domains in hypothyroid women compared to healthy controls.<sup>6,18</sup> Interestingly, the FSFI scores reported in their studies were substantially higher than those observed in our cohort,

despite showing similar patterns of dysfunction. This discrepancy may be attributed to distinct population characteristics, including ethnic, socioeconomic, and cultural differences that influence how women perceive, experience, and report sexual problems. For instance, women in Iraq may face stronger sociocultural taboos surrounding sexual health, leading to delayed help-seeking, underreporting, or exaggeration of symptoms once given a clinical outlet. Differences in healthcare access, relationship dynamics, educational background, and psychosocial stressors may also contribute to variations in sexual health outcomes between populations. In the same context, Oppo *et al.* additionally demonstrated a significant inverse relationship between circulating FT4 and TSH levels and the severity of sexual desire reduction in hypothyroid women.<sup>6</sup> At the same time, Pasquali *et al.* observed that the impact of hypothyroidism appeared to be limited to three specific domains: desire, arousal, and lubrication.<sup>5</sup>

The positive autoimmunity profile did not demonstrate a notable impact between women with hypo- and hyperthyroidism, with FSFI scores comparable to those of the control group, aligning with the findings of Pasquali *et al.*<sup>5</sup>

In 2010, Atis *et al.* from Turkey reported that rates of FSD were significantly higher among women with hypothyroidism, including both overt and subclinical forms.<sup>4</sup> At the time, these findings contributed to ongoing debate about the extent to which mild thyroid dysfunction could impact sexual health, particularly given the limited number of studies and inconsistent diagnostic criteria. However, over the past 15 years, a growing body of evidence has helped clarify this relationship. Contemporary research suggests that while overt hypothyroidism is consistently associated with reduced sexual function, particularly in domains such as desire and arousal, the role of subclinical hypothyroidism remains less certain. Some studies, such as those by Krysiak *et al.*,<sup>3</sup> support a modest detrimental effect, particularly when autoimmunity is present, while others, including recent Asian studies, have found no significant association.<sup>7,19</sup> Today, it is generally acknowledged that the impact of thyroid dysfunction on FSD is likely multifactorial, influenced by the degree of thyroid derangement, presence of autoimmunity, and individual psychosocial or cultural contexts.

In 2015, two studies reported conflicting results regarding the impact of subclinical hypothyroidism on female sexual function. Krysiak *et al.*, in a cohort of Polish women, found that both autoimmune thyroiditis and subclinical hypothyroidism were associated with lower

total FSFI scores and reduced performance across multiple specific sexual domains—particularly desire, arousal, and satisfaction. Their findings support the hypothesis that the combined influence of mild thyroid hormone abnormalities and thyroid autoimmunity may exert an additive negative effect on sexual function, with each factor contributing independently and synergistically to the observed dysfunction.<sup>3</sup> In contrast, Hong *et al.*, in a study of Korean middle-aged women, found no significant differences in either total or domain FSFI scores between women with subclinical hypothyroidism and euthyroid controls. They concluded that subclinical hypothyroidism was not a significant risk factor for FSD and found no correlation between thyroid hormone levels and sexual dysfunction, regardless of age.<sup>7</sup>

These contrasting findings may reflect differences in ethnicity, study design, sample characteristics, and sociocultural context. Compared to Krysiak *et al.* cohort,<sup>3</sup> our study population had a higher burden of overall sexual dysfunction but a lower prevalence of subclinical thyroid dysfunction. Like Hong *et al.*,<sup>7</sup> we did not observe any significant associations between subclinical thyroid dysfunction and FSFI scores in our Iraqi cohort. However, unlike both studies, our population was younger, newly diagnosed, and drawn exclusively from women already presenting with sexual complaints, potentially influencing the baseline severity of dysfunction and its reported hormonal associations.

Later in 2018, Luo *et al.* from China concluded that subclinical hypothyroidism does not elevate TSH to a threshold capable of inducing hyperprolactinemia, a potential intermediary mechanism linking thyroid dysfunction to female sexual dysfunction.<sup>19</sup> This finding supports the results of Hong *et al.*, who similarly found no association between subclinical hypothyroidism and reduced FSFI scores in Korean women.<sup>7</sup> Our findings align with these two Asian studies, as we also did not observe a significant relationship between subclinical thyroid dysfunction and sexual function. However, our population showed a lower prevalence of subclinical hypothyroidism (8.3%) compared to Luo *et al.*'s<sup>19</sup> cohort (~12%) and Hong *et al.*'s<sup>7</sup> (~10%), and much lower domain FSFI scores overall. This discrepancy may be attributed to differences in population selection, as our cohort consisted exclusively of women already presenting with FSD symptoms. At the same time, the other two studies included broader community or outpatient populations. Additionally, we used the Arabic version of the FSFI with validated domain and total cut-off scores. In contrast, the other studies used either the original English or translated versions, which may introduce subtle variations in scoring interpretation and cultural responsiveness.

No notable increase in PRL levels was observed across the different forms of hypothyroidism in our cohort. This suggests that FSD in these women was unlikely to be mediated by hyperprolactinemia secondary to elevated TSH. While Krysiak *et al.* reported a modest rise in PRL in women with subclinical hypothyroidism and autoimmune thyroiditis,<sup>3</sup> their population characteristics and hormonal thresholds differed from ours. In our sample, PRL values remained within the normal reference range and did not differ significantly between women with and without thyroid dysfunction, nor among the autoimmune subgroups. Therefore, our findings suggest that PRL does not play a central role in the observed sexual dysfunction in this population.

Wang and Wang demonstrated that thyroid autoimmunity did not significantly influence the FSFI pain domain among women with thyroid dysfunction.<sup>20</sup> They postulated that alterations in arousal were not sufficient to impact pain perception, especially when lubrication remained at suboptimal but functional levels. In their meta-analysis, they also reported that hypothyroidism—both overt and subclinical—was associated with reductions across most FSFI domains, particularly desire and arousal, but found no consistent relationship with autoimmunity or pain.

The impact of hyperthyroidism on FSD parallels that of hypothyroidism, though the literature remains inconclusive. Some studies suggest a negative effect on desire and arousal, while others report no significant association.<sup>3-6</sup> In our study, we did not perform correlation analyses between FSFI domains and hormone levels but conducted group-wise comparisons instead. These revealed no significant differences in FSFI domain scores between women with hyperthyroidism and those with normal thyroid function. Nonetheless, both groups exhibited uniformly low scores across all FSFI domains, indicating a high baseline burden of sexual dysfunction independent of thyroid status.

Pasquali *et al.* observed that the effect of hyperthyroidism on FSD was primarily mediated through a significant reduction in sexual desire, with lesser involvement of other FSFI domains.<sup>5</sup> In our study, although we evaluated all FSFI domains individually, we did not observe a statistically significant difference in the desire domain between women with hyperthyroidism and the control group. Therefore, we could not confirm the domain-specific patterns described



by Pasquali *et al.*,<sup>5</sup> and the causal relationship between hyperthyroidism and reduced sexual desire remains uncertain in our population.

Atis *et al.* described significantly lower total and domain FSFI scores among women with overt hyperthyroidism compared to controls. However, the mean FSFI scores reported in their study, though reduced, were still approximately twice as high as those observed in our cohort. They attributed this dysfunction to several factors, including a higher prevalence of depression, increased SHBG levels, and consequent reductions in FT and E2. Despite these proposed mechanisms, not all their associations reached statistical significance.<sup>2</sup>

Gabrielson *et al.*<sup>8</sup> later expanded on Atis *et al.*'s<sup>2</sup> hypothesis by providing stronger evidence for an indirect relationship between hyperthyroidism and FSD. They suggested elevated SHBG preferentially binds androgens over estrogens, leading to relative hyperestrogenism. Additionally, they emphasized the independent role of psychiatric comorbidities—such as anxiety, irritability, and depression—in mediating sexual dysfunction in hyperthyroid women.

In our study, women with active psychiatric illness were excluded during initial screening based on clinical history. However, we did not apply formal psychiatric evaluations or validated screening tools to assess subclinical symptoms such as anxiety or mood disturbances. This may represent an unmeasured confounder, especially considering the strong psychological influences on sexual function. Oppo *et al.* also highlighted this complexity by reporting inconclusive evidence on whether thyroid hormones directly affect sexual domains, emphasizing the multifactorial nature of FSD in thyroid disorders.<sup>6</sup>

Women with hyperthyroidism may experience menstrual irregularities and infertility, which can further contribute to FSD.<sup>21</sup> In our study, menstrual irregularities were reported in 40.5% of women in the thyroid dysfunction group (n=17) and 34.2% in the control group (n=64). Although somewhat lower than expected, these rates may reflect underreporting due to social taboos or recall bias. Additionally, many women with subclinical thyroid dysfunction may still have regular cycles, contributing to a lower apparent prevalence.

We could not isolate the impact of infertility on FSD in our sample, as women with primary infertility were excluded to avoid confounding due to non-thyroid reproductive disorders. Although parity was documented for all participants, there was no significant difference between the case and control groups. Therefore, its influence on FSD could not be confirmed in this

cohort. While other studies, such as that by Çayan *et al.*, suggest that multiparity may contribute to FSD,<sup>22</sup> our findings did not support a similar trend.

The strength of our study lies in its stringent inclusion criteria and the blinding of thyroid status during FSFI administration, which helped reduce subjective bias. Although participant matching was not performed in a 1:1 ratio, the groups were unintentionally well-balanced in key variables such as age, BMI, FSD duration, and marriage duration. This approximate matching likely minimized confounding influences and allowed a more focused evaluation of the potential impact of thyroid dysfunction on sexual function.

This study has several limitations. First, we did not include a comparison group of healthy women without sexual dysfunction, which limits our ability to contrast our findings with the broader population. Due to sociocultural constraints, we were unable to administer the FSFI questionnaire to women without active sexual complaints, making this an initial exploratory step rather than a community-wide assessment. Second, the generalizability of our findings is limited, as the study was conducted in a single urban hospital in Basrah, with participants predominantly drawn from similar socioeconomic and cultural backgrounds. The lack of diversity in the setting and sample may not reflect the wider female population across Iraq. Additionally, many women with sexual dysfunction may remain undiagnosed or untreated due to social stigma, embarrassment, or limited access to specialized care.

Furthermore, although we excluded major confounding variables, such as menopause, psychiatric illness, malignancy, recent surgery, and hormonal therapy, we did not formally assess other potential contributors to FSD, such as metabolic syndrome, insulin resistance, cardiovascular disease, or use of medications like antidepressants. These unmeasured variables could have influenced both sexual function and thyroid status, and should be considered in future studies.

## **Conclusions**

This study highlights the high prevalence of markedly low FSFI scores among premenopausal women with FSD, regardless of thyroid function status. Although women with thyroid dysfunction exhibited slightly higher mean FSFI scores in some domains, these differences were

inconsistent or clinically meaningful. Given that no significant associations were observed between reproductive hormone levels and sexual function in the primary or subgroup analyses, our findings do not support a direct hormonal causative role for thyroid dysfunction in FSD. Instead, they underscore the likelihood of a multifactorial origin, where psychological, cultural, and social determinants may play a more dominant role. Future research should adopt comprehensive, interdisciplinary approaches to explore these contributing factors and clarify the mechanisms underlying FSD in diverse populations.

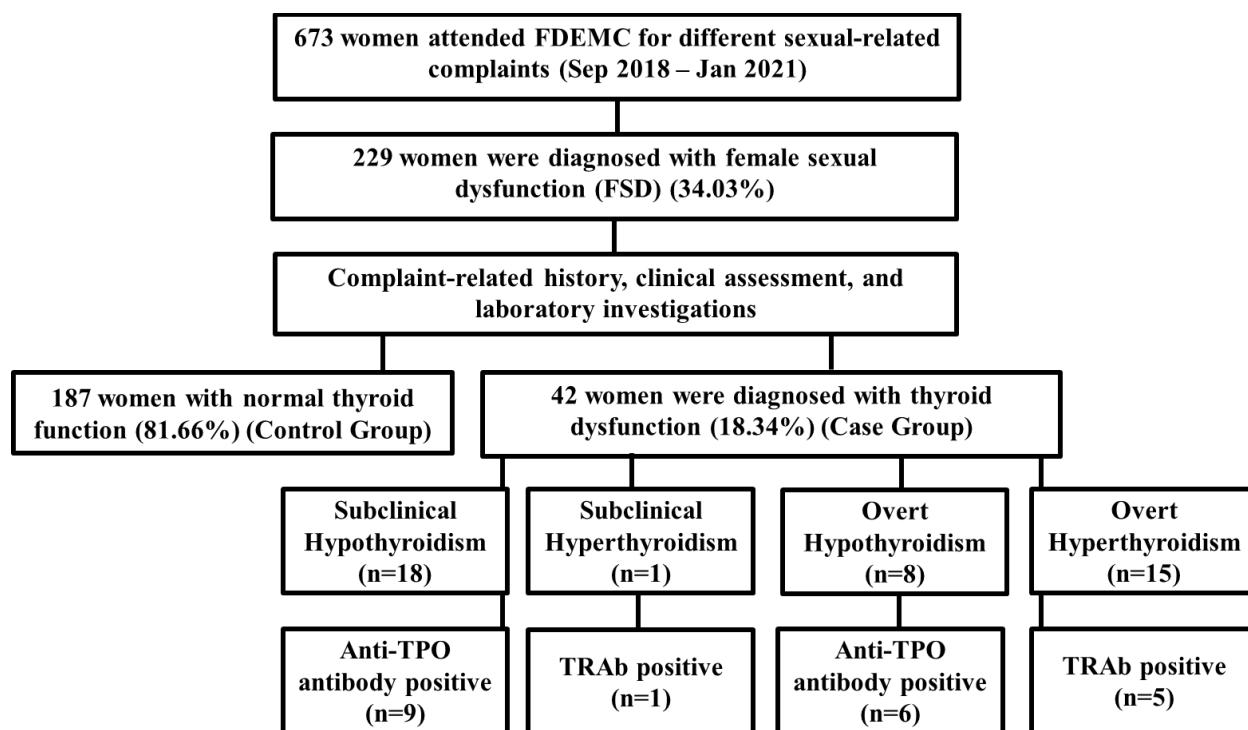
Given these insights, several important directions for future research are warranted. First, broader studies across diverse regions and populations are essential to establish a more accurate understanding of FSD prevalence and contributing factors. Second, future work should include comparison groups of women without sexual dysfunction to allow for meaningful benchmarking and normative FSFI scoring. Third, longitudinal studies are needed to assess the natural history of FSD in women with thyroid disorders and determine any long-term associations. Moreover, interdisciplinary approaches that integrate psychological, endocrinological, gynecological, and sociocultural perspectives may offer a more comprehensive understanding of FSD. Well-designed interventional trials should also evaluate whether treating thyroid dysfunction leads to measurable improvements in sexual function. Culturally sensitive research methods are crucial to overcome social stigmas and to better understand the barriers preventing women from seeking help for sexual health issues. Finally, developing advanced, culturally tailored diagnostic tools could enhance the accuracy and acceptance of FSD screening in conservative populations.

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**Figure 1.** Flowchart of the study showing inclusion, exclusion, and classification of married premenopausal women presenting with sexual complaints. FDEMC, Faiha Specialized Diabetes Endocrine and Metabolism Center; FSD, Female sexual dysfunction; TPO, thyroid peroxidase; TRAb, Thyrotropin Receptor Antibodies; TSH, thyrotropin-stimulating hormone.

Table 1. General characteristics of the enrolled women with female sexual dysfunction (n=229).

Variables		Thyroid dysfunction (n=42)	Control group (n=187)
Age years	mean (SD)	31.9 (7.4)	31.75 (6.68)
	Range	20 - 47	20 - 47
BMI Mean (SD) (kg/m <sup>2</sup> )		27.59 (2.13)	27.75 (2.22)
BMI Categories n (%)	Normal BMI	2 (4.7)	15 (8)

	Overweight	34 (81)	133 (71.1)
	Obesity	6 (14.3)	39 (20.9)
Age at marriage Mean $\pm$ SD years		21.33 (4.26)	20.61 (3.72)
Marriage duration Mean (SD) years		10.57 (7.12)	11.13 (6.29)
Menstrual Irregularities n (%)		17 (40.5)	64 (34.2)
Parity Mean (SD)		3 (2)	3 (2)
Duration of FSD before presentation months	Mean $\pm$ SD	8 (2)	8 (2.5)
	Range	6 - 12	6 - 12

Abbreviations: BMI, Body mass index; FSD, Female sexual dysfunction; SD, standard deviation;

Table 2. Comparison between female sexual dysfunction in women with and without thyroid dysfunction (n=229).

Parameters		Thyroid dysfunction (n=42)	Control group (n=187)	Sig. (2-tailed)	95% Confidence interval of the Difference	
					Lower	Upper
Mean FSFI Domains Score (SD)	Desire	2.07 (0.81)	1.90 (0.78)	0.192	-0.44-	0.09
	Arousal	2.22 (0.84)	1.96 (0.91)	0.093	-0.56-	0.04
	Lubrication	2.1 (0.70)	1.88 (0.78)	0.088	-0.48-	0.03
	Orgasm	1.94 (0.63)	1.69 (0.73)	0.043	-0.49-	-0.01-
	Satisfaction	2.12 (0.71)	1.91 (0.78)	0.104	-0.47-	0.04
	Pain	2.03 (0.60)	1.89 (0.69)	0.220	-0.37-	0.09
	Total score	12.49 (2.58)	11.23 (3.27)	0.020	-2.32-	-0.20-
Hormonal investigation	TSH $\mu$ IU/mL	5.64 (5.59)	3.06 (1.29)	<0.001	-3.47-	-1.69-
	FT4 ng/dL	1.44 (0.80)	1.12 (0.14)	<0.001	-0.44-	-0.20-

s Mean (SD)	PRL ng/mL	30.05 (4.01)	30.94 (11.41)	0.620	-2.64-	4.41
	TT ng/dL	32.5 (18.74)	31.11 (17.20)	0.642	-7.27-	4.50
	SHBG nmol/L	41.99 (39.52)	36.41 (27.74)	0.280	-15.75-	4.58
	cFT ng/dL	.61 (.43)	.59 (0.38)	0.816	-0.15-	0.12
	E2 pg/mL	74.93 (21.50)	79.59 (20.10)	0.181	-2.19-	11.52
Others Mean (SD)	Age years	31.90 (7.42)	31.75 (6.68)	0.893	-2.45-	2.14
	BMI kg/m2	27.59 (2.13)	27.75 (2.22)	0.684	-0.59-	0.90
	Marriage Duration years	10.57 (7.12)	11.13 (6.29)	0.610	-1.61-	2.73
	FSD Duration years	8.21 (2.10)	8.42 (2.52)	0.619	-0.62-	1.03

Abbreviations: BMI, Body mass index; cFT, Calculated free testosterone; E2, Estradiol; FSD, Female sexual dysfunction; FSFI, Female Sexual Function Index; FT4, Free thyroxine; PRL, Prolactin; SD, standard deviation; SHBG, Sex hormone-binding globulin; TT, total testosterone; TSH, thyrotropin-stimulating hormone.

Table 3. Subgroup analysis of autoimmunity in women with thyroid dysfunction and Female Sexual Dysfunction (n = 42).

Parameters		Autoimmune thyroid diseases (n=21)	Non- autoimmune thyroid diseases (n=21)	Sig. (2- tailed)	95% Confidence Interval	
					Lower	Upper
Mean FSFI Domains Score (SD)	Desire	2.00 (0.77)	2.14 (0.86)	0.573	-0.65-	0.37
	Arousal	2.11 (0.86)	2.33 (0.82)	0.413	-0.74-	0.31
	Lubrication	2.14 (0.85)	2.06 (0.55)	0.698	-0.36-	0.53
	Orgasm	1.81 (0.68)	2.08 (0.56)	0.172	-0.65-	0.12
	Satisfaction	1.94 (0.67)	2.31 (0.72)	0.099	-0.80-	0.07



	Pain	1.87 (0.65)	2.19 (0.50)	0.078	-0.69-	0.04
	Total score	11.88 (2.86)	13.10 (2.17)	0.126	-2.81-	0.36
Hormonal investigations Mean (SD)	TSH $\mu$ IU/mL	6.89 (5.89)	4.39 (5.11)	0.149	-0.94-	5.94
	FT4 ng/dL	1.19 (0.77)	1.68 (0.76)	0.044	-0.97-	-0.01-
	PRL ng/mL	30.38 (4.70)	29.71 (3.27)	0.596	-1.86-	3.19
	TT ng/dL	31.67 (16.92)	33.33 (20.79)	0.777	-13.49-	10.16
	SHBG nmol/L	33.03 (17.13)	50.96 (52.35)	0.144	-42.22-	6.37
	cFT ng/dL	0.62 (0.40)	0.60 (0.47)	0.883	-0.25-	0.29
	E2 pg/mL	82.24 (22.56)	67.62 (18.07)	0.026	1.87	27.37
Others Mean (SD)	Age years	33.57 (6.31)	30.24 (8.19)	0.147	-1.23-	7.89
	BMI kg/m <sup>2</sup>	27.4930 (2.57)	27.70 (1.63)	0.761	-1.54-	1.14
	Marriage Duration years	12.24 (7.60)	8.90 (6.35)	0.131	-1.03-	7.70
	FSD Duration (years)	8.76 (2.12)	7.67 (1.96)	0.090	-0.18-	2.37

Abbreviations: BMI, Body mass index; cFT, Calculated free testosterone; E2, Estradiol; FSD, Female sexual dysfunction; FSFI, Female Sexual Function Index; FT4, Free thyroxine; PRL, Prolactin; SD, standard deviation; SHBG, Sex hormone-binding globulin; TT, total testosterone; TSH, thyrotropin-stimulating hormone.

Table 4. Subgroup analysis of women with FSD and overt autoimmune thyroid dysfunction (n=21).

Parameters		Autoimmune hypothyroidis m (n=15)	Autoimmune hyperthyroidis m (n=6)	Sig. (2- tailed)	95% Confidence Interval	
					Lower	Upper
Mean FSFI	Desire	1.92 (0.76)	2.20 (0.82)	0.464	-1.06-	0.50
Domains	Arousal	1.98 (0.88)	2.45 (0.77)	0.266	-1.33-	0.39

Score (SD)	Lubrication	2.22 (0.95)	1.95 (0.49)	0.522	-0.60-	1.14
	Orgasm	1.79 (0.74)	1.87 (0.55)	0.814	-0.78-	0.62
	Satisfaction	1.84 (0.71)	2.20 (0.55)	0.279	-1.04-	0.32
	Pain	1.81 (0.71)	2.00 (0.51)	0.565	-0.85-	0.48
	Total score	11.56 (3.06)	12.67 (2.33)	0.437	-4.02-	1.81
Hormonal investigation s Mean (SD)	PRL ng/mL	30.93 (5.51)	29.00 (0.001)	0.408	-2.85-	6.72
	TT ng/dL	36.07 (17.62)	20.67 (8.55)	0.057	-0.52-	31.32
	SHBG nmol/L	37.24 (18.15)	22.52 (8.12)	0.074	-1.58-	31.02
	cFT ng/dL	0.68 (0.44)	0.46 (0.18)	0.250	-0.17-	0.62
	E2 pg/mL	77.80 (24.97)	93.34 (9.18)	0.159	-37.72-	6.65
Others Mean (SD)	Age years	33.27 (6.01)	34.33 (7.58)	0.736	-7.60-	5.46
	BMI kg/m2	27.42 (2.53)	27.67 (2.90)	0.848	-2.91-	2.41
	Marriage Duration years	11.07 (7.55)	15.17 (7.57)	0.275	-11.74-	3.54
	FSD Duration years	9.27 (2.25)	7.50 (1.05)	0.084	-0.261-	3.79

Abbreviations: BMI, Body mass index; CFT, Calculated free testosterone; E2, Estradiol; FSD, Female sexual dysfunction; FSFI, Female Sexual Function Index; FT4, Free thyroxine; PRL, Prolactin; SD, standard deviation; SHBG, Sex hormone-binding globulin; TT, total testosterone; TSH, thyrotropin-stimulating hormone.