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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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EVALUATION OF SEXUAL DISORDERS IN DIABETIC WOMEN BEFORE MENOPAUSE: ASSOCIATED FACTORS AND DETERMINATING THRESHOLDS

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Abstract.

Aim: To determine associated factors of sexual dysfunction (SD) in sexually active premenopausal diabetic women, and to evaluate the performance of the Female Sexual Function Index (FSFI) items in screening and diagnosis of SD using the Receiver Operating Characteristic (ROC) curves.

Methods: This was a cross-sectional descriptive study including sexually active, premenopausal diabetic women followed at the National Institute of Nutrition of Tunis from May 2023 to October 2023. SD was assessed using the FSFI. ROC curves were used to determine significant thresholds of each item of the score for the screening of SD.

Results: A total of 147 patients were included (mean age: 40.14 years ± 6.29), of whom 52.4% had type 2 diabetes, which had been present for an average of 14.38 ± 6.67 years. The prevalence of SD was found to be 51%. Factors associated with SD included sedentary lifestyle (p=0.001), peripheral arterial disease (p=0.04), duration of diabetes (p=0.018) and history of fetal or neonatal loss (p<0.001). After multivariate analysis, independent factors associated with SD included only the history of fetal or neonatal loss (OR=0.06; p=0.002). The satisfaction domain had the highest diagnostic value for SD, with an area under the curve of 0.930, p<0.001.

Conclusion: More than half of diabetic women suffer from SD. Both organic and psychological factors contribute to this issue. Screening for this complication in daily practice is mandatory to ensure a healthy quality of sexual life.

Key words. Diabetes mellitus, sexual dysfunction, female sexual function index, Receiver operating characteristic (ROC) curve.

Introduction.

Diabetes mellitus represents a growing burden on public health. The number of people affected by diabetes is increasing due to demographic growth, aging, urbanization, and the rising prevalence of obesity and physical inactivity [1]. Sexual dysfunction (SD) is one of the chronic complications of diabetes [2]. According to a recent meta-analysis, the prevalence of sexual disorders in diabetic women ranges from 26% to 70% [2]. It can manifest as a decrease in libido, dyspareunia or vulvodynia, orgasm disorders, and vaginismus [3-5].

While male sexual disorders have been the subject of numerous international studies and are now well-known and treated, those in diabetic women remain underestimated, if not unknown or unspoken [6-8].

Knowledge, prevention, and treatment of the factors associated with SD could improve the sexual health and quality of life of women with diabetes.

The aims of our study were:

- To identify the factors associated with SD in this population.
- To evaluate the performance of the Female Sexual Function Index (FSFI) items in screening and diagnosis of SD using the Receiver Operating Characteristic (ROC) curves.

Materials and Methods.

We conducted a cross-sectional, observational, and descriptive study on diabetic patients followed in the National Institute of Nutrition and Food Technology in Tunis from May 2023 to October 2023. The study included patients aged between 18 and 50 years, non-menopausal, sexually active (heterosexual relationship for at least 1 year) and having regular menstrual cycles (+/- 7 days) with Type 1 Diabetes (T1D) existing for over 5 years or Type 2 Diabetes (T2D) for over one year, who consented to participate in the study.

We excluded pregnant or breastfeeding women, illiterate patients, those taking "combined oral contraceptive pill or psychotropic or suffering from severe organ failure, neoplasms, or poorly controlled endocrine disorders, as well as women whose husbands had a sexual disorder. Patients with incomplete medical records or incomplete questionnaires were also excluded.

The minimum number of patients required for the study of the prevalence of SD in premenopausal diabetic women was calculated using Cochran's formula [$n = z^2 \times p \times (1-p) / i^2$] with a margin of error (i) tolerated up to 8% and based on a prevalence of SD (p) of 28.7% according to recent research [9]. We collected data regarding the general characteristics of the population, comorbidities, obstetrical and gynecological history, and diabetes characteristics from medical records and the interview conducted with the patients on the day of the survey. To determine the level of physical activity, we used the validated Arabic version of the International Physical Activity Questionnaire (IPAQ) as an index of weekly energy expenditure, based on the frequency (number of times per week), duration (in minutes per hour), and intensity of physical activity [10].

We assessed female sexual function using the Female Sexual Function Index (FSFI) score, in its validated Arabic version (ArFSFi) [11]. The questionnaire was self-administered. It evaluates sexual function over the past 4 weeks and consists of 19 items, with each question leading to a response graded from 0 to 5 points, except for the first item (scored from 1 to 5). The areas assessed include desire, arousal, lubrification, orgasm, satisfaction, and pain. The higher the score, the better the sexual relationship. The minimum score is 2, and the maximum score is 36. A score ≤ 26.55 indicates SD, while a score > 26.55 indicates normal sexual function [12].

Ethical Considerations.

Before starting our study, we obtained approval from the ethics committee of the National Institute of Nutrition in Tunis. All the patients included in the study gave their informed and voluntary consent after being informed of the objectives of the work. The confidentiality of the data was respected. We declare that we have no conflicts of interest related to this work.

Statistical Analysis.

For descriptive statistics, quantitative variables were expressed as means, medians, and standard deviations, while qualitative variables were expressed as frequencies population) and percentages. For analytical statistics, we used the Chi-square test to compare percentages and the Student's t-test to compare means.

Diagnostic accuracy was tested using Receiver Operating Characteristic (ROC) curves. The area under the curve (AUC) was evaluated to determine the diagnostic performance of parameters in different groups. An AUC of 1 indicates perfect discrimination, while an AUC of 0.5 or lower means the result is not informative and the discrimination is similar to random chance. The diagnostic contribution is weak for an AUC between 0.5 and 0.7, moderate for an AUC between 0.7 and 0.9, and strong for an AUC above 0.9. We used IBM SPSS Statistics version 25.0 software with the Youden index to calculate sensitivities and specificities for thresholds. The significance level was set at $p \leq 0.05$.

Results.

The study included 147 patients with an average age of 40.14 years ± 6.29 recruited following the flow chart represented in Figure 1. The age group 35-40 years was the most represented in our study. All the women included were married. The majority of diabetic women (75%) had a secondary level of education and a medium socio-economic status (N=95). More than half (61%) of the study population were housewives.

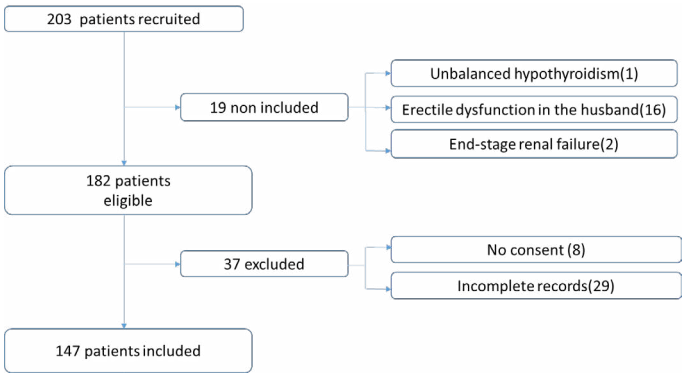

Figure 1. *Flow chart Diagram.*

One hundred and twenty-eight patients had low physical activity (66.3%), of which 72 were sedentary. The average weight of the population was 71.3 ± 13 kg, with a minimum of 47 kg and a maximum of 107 kg. The average body mass index (BMI) was 27.46 ± 6.96 kg/m², with extremes ranging from 16.96 to 41.8 kg/m². History of abortion, stillbirth, and neonatal death were reported by three, seven, and two patients, respectively. More than half of the population (57.1%, n=84) did not use any contraceptive methods. The number of patients with Type 2 diabetes was 77 (52.4%). The average duration of diabetes was 14.38 ± 6.67 years, with a range from 1 to 45 years. The average of the last three HbA1c values was 8.44 ± 3.34%. About 57% of patients had an HbA1c level that was outside the specific therapeutic target. Approximately two-thirds of the population (64.2%, n=95) were on conventional insulin therapy. Microangiopathy was predominantly represented by diabetic retinopathy (23.8%), and macroangiopathy by peripheral artery disease (PAD) (2.8%). Hypertension, dyslipidemia, and celiac disease were found in 15.6%, 47.6%, and 6.7% of cases, respectively. The average total score on the ArFSFI questionnaire for female sexual disorders was 24.85 ± 5.95, with a minimum score of 2 and a maximum score of 36. More than half of the population (51%) had SD. The most affected domain was "Desire." The various female sexual disorders are summarized in Table I.

Table 1. *Mean Scores of the Different Items from the ArFSFI Questionnaire.*

Item	Mean Score [min-max]	Sexual Dysfunction		p
		Yes (N=75)	No (N=72)	
Desire	3.43±0.99 [1.2-5.4]	4.01±0.65	2.87±0.95	**<0.001**
Arousal	3.76±1.26 [0-5.7]	4.38±0.66	3.17±1.14	**0.006**
Lubrication	4.36±1.15 [0-6]	4.87±0.77	3.87±1.24	**0.009**
Orgasm	4.43±1.25 [0-6]	5.26±0.64	3.64±1.19	**<0.001**
Satisfaction	4.69±1.46 [0.48-6]	5.73±0.59	3.70±1.36	**<0.001**
Pain	3.92±1.35 [0-6]	4.49±1.11	3.37±1.35	**0.004**

The associations between the general characteristics of the population and the clinico-biological characteristics with SD are presented in Tables II and III, respectively. Factors associated with SD included sedentary lifestyle (p=0.001), peripheral arterial disease (p=0.04), duration of diabetes (p=0.018) and history of fetal or neonatal loss (p<0.001). The multivariate analysis of those parameters using logistic regression retained only the history of abortion, stillbirth, and neonatal death (OR = 0.06, 95% CI [0.001 – 0.334], p = 0.002) as independent factors associated with SD. Additionally, we used ROC curves to determine the threshold values for the domains of the FSFI between the diabetic population with and without SD (Figure 2). The most significant parameter of this score was satisfaction (AUC = 0.930, 95% CI = [0.884- 0.976]), followed by orgasm (AUC = 0.907, 95% CI = [0.861 - 0.954]), arousal (AUC = 0.839, 95% CI = [0.776 - 0.903]), desire (AUC = 0.829, 95% CI = [0.764 - 0.894]), lubrication (AUC = 0.765, 95% CI = [0.687 - 0.843]), and pain (AUC = 0.730, 95% CI = [0.650 - 0.811]). Based on these results, we deduced the following:

- A desire domain score ≤ 3.6 confirms impairment with a sensitivity of 93.1% and specificity of 56%.
- An arousal domain score ≤ 3.75 confirms impairment with a sensitivity of 75% and specificity of 70.7%.
- A lubrication domain score ≤ 4.35 confirms impairment with a sensitivity of 77.8% and specificity of 64%.
- - An orgasm domain score ≤ 4.6 confirms impairment with a sensitivity of 81.9% and specificity of 74.7%.

Table 2. *Associations of General Characteristics of the Population with Sexual Dysfunction.*

General Characteristics	Sexual Dysfunction (N)		p
	Yes	No	
Education Level			0.468
Primary or Secondary	62	56	
University	13	16	
Employment Status			0.591
Unemployed	47	42	
Employed	28	30	
Socioeconomic Status			
Low	28	24	0.193
Medium or High	47	48	
Sedentary Lifestyle			**<0.001**
Yes	50	22	
No	25	50	
BMI (Average in kg/m²)	27.12 ± 5.06	27.81 ± 4.87	0.614

BMI: Body Mass Index.

Table 3. *Associations of Clinical-Biological and Psychological Factors of the Population with Sexual Dysfunction.*

Variables	Sexual Dysfunction (N)		
	Yes	**No**	**p**
Comorbidity			
Hypertension	12	11	0.904
Dyslipidemia	41	29	0.08
Celiac Disease	5	8	0.367
Anemia	36	27	0.198
Gynecological Obstetric History			
Abortion, IUFD, ND	49	14	**<0.001**
Episiotomy	25	24	0. 724
Contraception			0.448
Hormonal	18	19	
Mechanical	8	5	
Diabetes Characteristics			
Diabetes Type			0.671
Type I	34	36	
Type II	39	38	
Treatment			0.123
Oral Hypoglycemic Drugs (OHD)	33	18	
Insulin or OHD + Insulin	39	46	
Glycemic Control			0,053
Achieved	25	36	
Not Achieved	47	35	
Retinopathy			0.163
Yes	22	14	
No	53	58	
Nephropathy			0.463
Yes	14	17	
No	61	55	
Peripheral Neuropathy			0.490
Yes	6	9	
No	52	53	
Lower Limb Arteritis			**0.04**
Yes	4	0	
No	72	66	
Coronary Artery Disease			0.560
Yes	1	2	
No	70	69	
Stroke (Cerebrovascular Accident)			0.09
Yes	2	0	
No	73	72	

IUFD: Intrauterine Fetal Death, ND: Neonatal death.

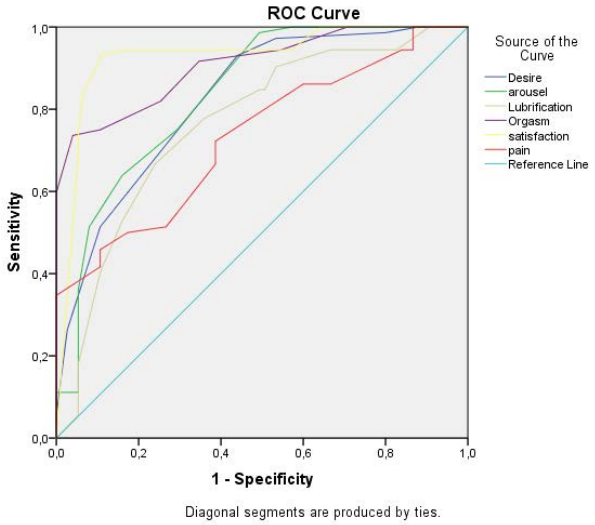

Figure 2. *Area Under the Curve of FSFI score parameters in the diagnosis of sexual dysfunction.*

- - A satisfaction domain score ≤ 4.9 confirms impairment with a sensitivity of 93.1% and specificity of 89.3%.

- - A pain domain score ≤ 3.75 confirms impairment with a sensitivity of 72% and specificity of 61.3%.

Discussion.

SD in diabetic women is often underestimated and underdiagnosed. In the present study, we assessed the prevalence of female SD in the premenopausal diabetic population and its associated factors. According to an Italian meta-analysis, sexual disorders are more frequent in diabetic women than in healthy controls [13]. The higher frequency of SD in the diabetic population can be explained by hyperglycemia. Hyperglycemia, by reducing mucosal hydration of vaginal tissue leads to poor lubrication and dyspareunia [14]. Furthermore, the decrease in nitric oxide production due to vascular dysfunctions associated with diabetes reduces vaginal vascular relaxation [15]. Additionally, hyperglycemia can potentially lead to dyspareunia due to the increased incidence of genitourinary disorders and infections. The symptoms of these infections (burning, itching, vaginal dryness, or vaginal discharge, pain, general discomfort

in the pelvic floor), sexual abstinence recommended in the context of certain therapies, and the psychological distress involved could cause vaginal discomfort and dyspareunia [14]. However, the prevalence of SD in diabetic women varies in the literature. Actually, in the studies by Mannai et al. and Haugstvedt et al., the prevalences of SD were higher than those found in our study [16,17]. This could be, among other factors, related to the fact that our study did not include postmenopausal women. Indeed, symptoms such as vaginal dryness and pain can be caused by low estrogen levels [18]. The large disparity in the prevalence rates of SD between studies could also be explained by variations in the screening tools used and the lack of a standardized definition of this concept. Indeed, there are many scales used to assess female sexual function, such as the Brief Index of Female Sexual Functioning (BISF-W), the Derogatis Interview for Sexual Function (DISF/DISF-SR), and the Female Sexual Distress Scale (FSDS) [19]. However, even when comparing studies that used the same FSFI questionnaire as a tool for screening SD, heterogeneity in results has been observed. This could be partly due to the different thresholds set by the authors. While the cut-off is generally 26.5, in some studies, it varies between 26 and 27 [20,21].

Additionally, the FSFI is a self-administered questionnaire, and its effectiveness could be influenced by the cultural level of the patients. Therefore, in our study, we chose not to include illiterate patients. However, we noticed that some studies included these patients, and the questionnaire was not self-administered to them [22]. Furthermore, the FSFI is quite a long questionnaire, which may partly explain the number of incomplete questionnaires and, consequently, the heterogeneity of the results. Nowadays, shorter questionnaires have recently been developed to study sexual function, including the FSFI-6 and the Female Sexual Dysfunction Index 6 (FSDI-6) [23,24].

In our study, desire and arousal were the most impaired sexual domains, followed by pain, lubrication, orgasm, and satisfaction. These results align with those found by Gupta et al. and Cichoka et al., who observed that the desire domain was the most affected, with averages of 3.6 and 3.94 in cohorts of 426 women with T2D and 169 women with T1D, respectively [2,9]. Rabori et al. reported even lower scores in the desire and lubrication domains (2.66±1.46 and 2.83±1.55, respectively) [25]. The study by Cauwenberghe et al. showed that the most frequently reported issues were reduced sexual desire (T1D: 22% (53/242), T2D: 15% (15/103)), lubrication problems (T1D: 19% (45/242), T2D: 14% (14/103)), and orgasm dysfunction (T1D: 16% (38/242), T2D: 15% (15/103) [26]. In a meta-analysis published in 2023, Hashim et al. showed that the most affected sexual domain in women with T1D was pain, followed by satisfaction, orgasm, lubrication, arousal, and desire [27].

In our study, an association between SD and sedentary behavior was observed. According to Cichocka et al., patients who engaged in regular physical activity had better acceptance of the disease ($p = 0.003$) and fewer painful sexual experiences ($p = 0.01$). A similar relationship was demonstrated by Flotyńska et al., who reported that, in a group of physically active women with T1D, higher FSFI scores were obtained compared to the group with low physical activity levels. This difference particularly affected lubrication and orgasm [28]. Indeed, physical activity has a beneficial effect on the circulatory system. It increases blood flow to the pelvic organs. Better blood circulation enhances lubrication and genital sensitivity to stimulation and arousal in women [29]. Furthermore, physical inactivity promotes overweight [30]. The hormonal and inflammatory responses induced by cytokines secreted by adipocytes (TNF-alpha, IL-6, and leptin) contribute to the onset of SD. These mediators are linked to oxidative stress, which can have adverse effects on overall fertility in women [31]. However, we did not demonstrate a significant association between overweight and SD, which contrasts with the results of other studies [32-34]. Carrilho PJ et al. ont demonstrated that an increase in BMI can lead to physical deficiencies and psychological disorders related to body image perception, thus affecting sexual quality of life [35]. Conversely, weight loss and body sculpting have been shown to improve body image self-perception and provide better self-esteem, which promotes a better sexual quality of life [36].

Zamponi et al. and Sachdeva et al. showed that diabetic patients at the stage of chronic complications had lower FSFI scores compared to those without any complications [13,37]. Indeed, peripheral neuropathy, retinopathy, diabetic foot, nephropathy, and autonomic cardiopathy have been described as factors negatively impacting overall quality of life, including sexual quality [13,16,27,38]. In our study, only the presence of peripheral artery disease was associated with female SD.

We found a statistically significant relationship between a history of abortion and/or neonatal death and SD. A study including 110 women with a history of fetal loss found that 52.73% had SD, especially affecting the desire (4.15 ± 1.21) and orgasm (3.82 ± 1.48) domains [39]. The authors explain this relationship by the psychological impact of fetal loss [39]. As a matter of fact, the interaction between psychiatric disorders, such as depression, and sexual health has been demonstrated in several previous publications. Depression was often one of the factors associated with SD in diabetic patients, regardless of the type of diabetes [11,36,49,55,56]. In a 2024 study, Ören et al. showed a significant association between depression and female SD in both T1D ($p < 0.001$) and T2D ($p < 0.001$) [40].

In our study, the diagnostic power of the different domains of the FSFI for diagnosing SD was evaluated using ROC curves. The satisfaction domain had the highest diagnostic performance (AUC = 0.930), followed by the orgasm domain with an AUC of 0.907. The arousel, desire, lubrication, and pain domains had respective AUCs of 0.839, 0.829, 0.765, and 0.730. As previously mentioned, according to a recent evaluation of the FSFI score after 20 years of use, clinical thresholds for the arousel, lubrication, orgasm, and satisfaction domains have not yet been determined, except for the desire domain. Indeed, a threshold score of 5 in the desire domain would maximize both the sensitivity and specificity for diagnosing SD [41]. To assess the impairment of a specific subdomain, different authors primarily based their evaluation on comparisons with a control group [13,16,38,42-44]. Only one study specified the "cut-off" values for the FSFI domains adopted, without mentioning the methodology or reference used in this regard [45].

The main limitation of the study would be its monocentric nature. Indeed, there is a likely selection bias related to the recruitment methods of the patients. All the patients were recruited from the same public hospital structure. Therefore, the sample was not representative of all diabetic women in Tunisia.

However, this study has certain strengths:

- Our study is also the first to evaluate, through ROC curves, the diagnostic performances of the domains of the ArFSFI, as well as their discriminating thresholds in detecting SD in a population of young diabetic women. A simplified questionnaire focusing mainly on the items with higher accuracy, which are satisfaction and orgasm as identified in our study, could serve as a faster screening tool for SD and a potential avenue for future research.

- We used validated questionnaires emphasizing the objectivity of the study.

Conclusion.

The issue of SD in women with diabetes, while significant, is often overlooked. This SD is complex and multifactorial. Organic and, particularly, psychological factors appear to act in synergy in its pathogenesis. Therefore, in light of our results and the data from the literature, we recommend fighting sedentary lifestyles and promoting regular physical activity, early screening for psychological consequences related to gynecological-obstetric trauma, especially fetal or neonatal loss, preventing diabetes complications, establishing regular psychological follow-up for diabetic patients, promoting sexual education, emphasizing communication within couples, and encouraging diabetologists to integrate sexual health into the overall care of diabetic patients. However, further studies with larger cohorts seem necessary.

Conflict of interest.

The authors declare that there is no conflict of interest.

The manuscript has been read and approved by all the authors and the requirements for authorship have been met.

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