Medical Science

pISSN 2321–7359; eISSN 2321–7367

Irritable bowel syndrome prevalence and health-related quality of life in women with polycystic ovary syndrome at tertiary hospitals in Riyadh, Saudi Arabia

Sulaiman A Al Shammari[1]✉, **Renad Abdulaziz Al Mogren**[2], **Meaad Faiz Al Nofaie**[2], **Rahaf Turki Al Shammari**[2], **Renad Bader Alfirm**[2], **Gharam Saud Julaidan**[2]

To Cite:
Al-Shammari SA, Al-Mogren RA, Al-Nofaie MF, Al-Shammari RT, Alfirm RB, Julaidan GS. Irritable bowel syndrome prevalence and health-related quality of life in women with polycystic ovary syndrome at tertiary hospitals in Riyadh, Saudi Arabia. Medical Science, 2022, 26, ms76e1987.
doi: https://doi.org/10.54905/disssi/v26i121/ms76e1987

Author Affiliation:
[1]Department of Family and Community Medicine, Saudi Society of Men Health, College of Medicine, King Saud University, Saudi Arabia
[2]College of Medicine, King Saud University, Saudi Arabia

✉**Corresponding author**
Professor and Consultant of Family Medicine; Department of Family and Community Medicine, College of Medicine,
King Saud University, Riyadh, Saudi Arabia
ORCID: https://orcid.org/0000-0001-9596-5590
Email: amsahsa@gmail.com

Peer-Review History
Received: 25 November 2021
Reviewed & Revised: 26/November/2021 to 18/January/2022
Accepted: 19 January 2022
Published: 24 February 2022

Peer-review Method
External peer-review was done through double-blind method.

URL: https://www.discoveryjournals.org/medicalscience

ABSTRACT

Objective: To assess the prevalence of irritable bowel syndrome (IBS) and its subtypes in patients with polycystic ovary syndrome (PCOS), determine its associated factors, and compare the quality of life (QOL) of PCOS patients with and without IBS. *Method:* The cross-sectional study was conducted between February 2021 and June 2021 on patients attending outpatient family medicine and Obstetrics and Gynecology clinics at a tertiary hospital in Riyadh, Saudi Arabia. The participants comprised women aged ≥18 years with a confirmed PCOS diagnosis. They completed an online questionnaire about their sociodemographic information, body mass index, the Rome IV Diagnostic Questionnaire (R4DQ), and IBS-QOL questionnaire; the Bristol Stool Scale was also used. *Results:* Of the 291 participants, the majority (92.4%) was below 45 years old, 61.9% were unmarried, and 47.8% were students. IBS was diagnosed in 49 (16.8%) patients, which was associated with poor sleep quality ($p = 0.005$) and emotional stress ($p = 0.006$). IBS-constipation and IBS-diarrhea accounted for 24.5% and 12.2% of participants, respectively. In PCOS patients, the IBS subgroup obtained the lowest QOL scores ($p = 0.009$). In addition, a low QOL score was associated with dysphoria ($p < 0.001$), interference with activity ($p < 0.02$), and relationship ($p < 0.003$). *Conclusion:* Women who have PCOS are more likely to suffer from IBS. Poor sleep quality and emotional stress are two factors that contribute to IBS development. Both conditions have a significantly lower quality of life, particularly those affected by dysphoria, interference with activity, and interpersonal relationships.

Keywords: Irritable bowel, polycystic ovary, quality of life, R4DQ, Bristol stool

1. INTRODUCTION

Approximately 5 percent to 10 percent of reproductive-aged women are affected by polycystic ovary syndrome (PCOS) (Mathur et al., 2010). Anovulation is the most common cause of infertility in the world, according to the World Health Organization, with an incidence ranging between 55% and 91% (Diamanti-Kandarakis, 2008). PCOS is characterized by high androgen levels, amenorrhea or oligomenorrhea, and polycystic ovaries on ultrasound, excluding other factors (Goudas et al., 1997; Lim et al., 2019). An increased risk of PCOS is noted in different ethnicities. To the best of our knowledge, studies investigating the prevalence of PCOS in Saudi Arabia are unavailable. According to a study conducted in 2013 on unmarried female students aged 18–28 years who had hirsutism, acne, and menstrual irregularities, the prevalence of PCOS was estimated to be 53.7 percent in the study participants (Guraya, 2013).

Women suffering from PCOS are frequently overweight or obese. Excess weight worsens PCOS symptoms, whereas losing weight may help alleviate these symptoms (Kiddy et al., 1992; Singh et al., 2020). Similar to PCOS, IBS is the most common functional gastrointestinal disorder in the world, affecting 10 percent to 20 percent of adults (Kim et al., 2018; Lacy et al., 2017; Masuy et al., 2019). A study on Saudi undergraduate students reported that 15.8% were diagnosed with IBS (Al Butaysh et al., 2020). It is widely recognized that women are more likely than men to suffer from IBS, which is thought to be caused by fluctuations in sex hormone levels (Kim et al., 2018; Soares, 2014; Al Butaysh et al., 2020; Sperber et al., 2017). It is possible that this is due to physiologic differences and different medical care-seeking behaviors (Kim et al., 2018). IBS manifests as abdominal pain accompanied by altered bowel movement frequency and consistency (constipation or diarrhea) and bloating (Camilleri, 2021; Alanazi et al., 2021).

Patients with IBS also report increased absenteeism from work (Frändemark et al., 2018) and disruption of interpersonal relationships, (Nguyen et al., 2018) including reluctance to engage in sexual intercourse (Ballou et al., 2019). Feelings of anxiety over experiencing symptoms publicly can be a perceived hindrance towards making social or traveling plans in an IBS patient's life. A previous study has reported a lower quality of life (QOL) in these patients than in the general population (Bazarganipour et al., 2020). Furthermore, IBS is more prevalent in PCOS patients. In a study of PCOS patients at a tertiary hospital in Spain, 29.7% of women had IBS (Sánchez-Ferrer et al., 2020).

We hypothesize that approximately 20% of patients diagnosed with PCOS display symptoms of IBS. Moreover, an association between IBS prevalence in PCOS patients and patients' stress levels was observed. The most common subtype of PCOS is constipation-predominant IBS. We hypothesized those PCOS patients who meet the IBS diagnostic criteria have an inferior QOL than those who do not. To the best of our knowledge, only few studies have investigated the relation between IBS and PCOS in Saudi Arabia. Therefore, determining how prevalent is IBS in PCOS patients will allow us to better understand the nature of these two diseases. Therefore, the present investigation aimed to assess the prevalence of IBS and its subtypes in patients with PCOS, determine its associated factors, and compare the QOL of PCOS patients with and without IBS.

2. METHODS

A cross-sectional study was conducted in Saudi Arabia between February and June 2021. The researchers recruited women who were at least 18 years of age and were visiting outpatient family medicine and OB/GYN clinics in the largest Riyadh tertiary hospitals. The single proportion equation estimated the sample size to be 246. The proportion considered was 0.20, with a precision of 5%, a confidence level of 95%, and Za of 1.96. Anticipating a 20% nonresponse rate, the targeted sample size was increased to 295. The proportion was estimated based on previous literature on IBS prevalence in women with PCOS, which is 20.7% (Bazarganipour et al., 2020). All participants had a confirmed PCOS diagnosis. The investigators excluded known cases of significant chronic illnesses such as diabetes, thyroid dysfunction, hyperprolactinemia, adrenal hyperplasia, Cushing's disease, liver disease, kidney disease, cancer, or autoimmune disease. Subjects with other known gastrointestinal diseases were also excluded.

The invited participants completed an electronic questionnaire about sociodemographic information (age, education, marital status, and occupation), the Rome IV Diagnostic Questionnaire (R4DQ), and IBS-QOL questionnaire, and the Bristol Stool Scale was also used. PCOS diagnosis and body mass index (BMI) were confirmed from the patients' medical records. The IBS-QOL questionnaire was developed as an instrument to assess the health-related QOL of patients with IBS. The IBS-QOL questionnaire is obtainable in multiple languages, including Arabic, and takes an average of 10 min to complete (Patrick et al., 1998). Each of the 34 items of the IBS-QOL questionnaire has a five-point response scale: extremely, quite a bit, moderately, slightly, and not at all. It also has eight subscale scores: body image worries, food avoidance and dysphoria, as well as concerns about health, interference with physical activity, relationships, sexuality and social reaction (Patrick et al., 1998). The Arabic version of the R4DQ questionnaire was

used to diagnose IBS. Accordingly, the patient must have experienced recurrent abdominal pain for at least one day a week for at least six months in the past three months.

In addition, the complaint should fulfill at least two of the following criteria: (i) the pain is related to defecation, (ii) onset is associated with stool frequency change, and (iii) onset is associated with stool appearance change (Lacy et al., 2017). The investigators used the medical seven-point scale (Bristol Stool Scale) to classify human feces. In addition, a diagrammatic and text definition for the seven stool types has been added to help patients describe their fecal patterns (constipation, diarrhea, constipation and diarrhea) (Lewis et al., 1997).

The study was piloted with 20 PCOS patients before distribution. The patients who participated in the pilot study provided comments concerning clarity, comprehension, and time required to complete the questionnaire. Therefore, pilot questionnaires were not included in the final study. The final self-administered questionnaire comprised 31 questions and took approximately 10–15 min to complete. The participants provided informed consent electronically by clicking on the "agreeing to participate" tick box. Participants' confidentiality and anonymity were ensured by allocating every participant a code number for analysis. No incentives or rewards were provided to the participants. Using the SPSS version 24.0 statistical software, (IBM Corp., Armonk, NY, USA) categorical and quantitative variables were described by means, standard deviations, frequencies, and percentages. For bivariate analysis, the chi-square test, Mann-Whitney U test, and Student's t-test were performed based on the type of study and outcome variables. Statistical significance was set at $p < 0.05$.

3. RESULTS

Over 5 months, 291 women with PCOS were recruited for this study. The patients' sociodemographic characteristics according to the IBS Rome IV criteria classification are presented in Table 1. Majority of patients (92.4%) were below 45 years old, 61.9% were unmarried, 47.8% were students, and 64.6% had a hand income of less than 5,000 Saudi riyals per month. Based on the R4DQ criteria, IBS was diagnosed in 49 patients (16.8%). There were no statistically significant differences between the various sociodemographic groups of patients with IBS.

Table 1 Patients' sociodemographic information using the IBS Rome criteria classification

Characteristics	Total 291 (100%)	IBS		P-value
		No 242 (83.2%)	Yes 49 (16.8%)	
Age				
<30 years old	211 (72.5)	177 (83.9)	34 (16.1)	
30–44 years old	58 (19.9)	44 (75.9)	14 (24.1)	
>45 years old	22 (7.6)	21 (95.5)	1 (4.5)	0.09
Marital status				
Unmarried	180 (61.9)	144 (80.0)	36 (20.0)	
Married	111 (38.1)	98 (88.3)	13 (11.7)	0.06
Occupation				
Government employee	55 (18.9)	47 (85.5)	8 (14.5)	
Private sector employee	34 (11.7)	28 (82.4)	6 (17.6)	
Student	139 (47.8)	111 (79.9)	28 (20.1)	
Unemployed	63 (21.6)	56 (88.9)	7 (11.1)	0.40
Income				
<5,000	188 (64.6)	154 (81.9)	34 (18.1)	
5,001–10,000	49 (16.8)	39 (79.6)	10 (20.4)	
10,001–15,000	29 (10.0)	26 (89.7)	3 (10.3)	
>15,000	25 (8.6)	23 (92.0)	2 (8.0)	0.40

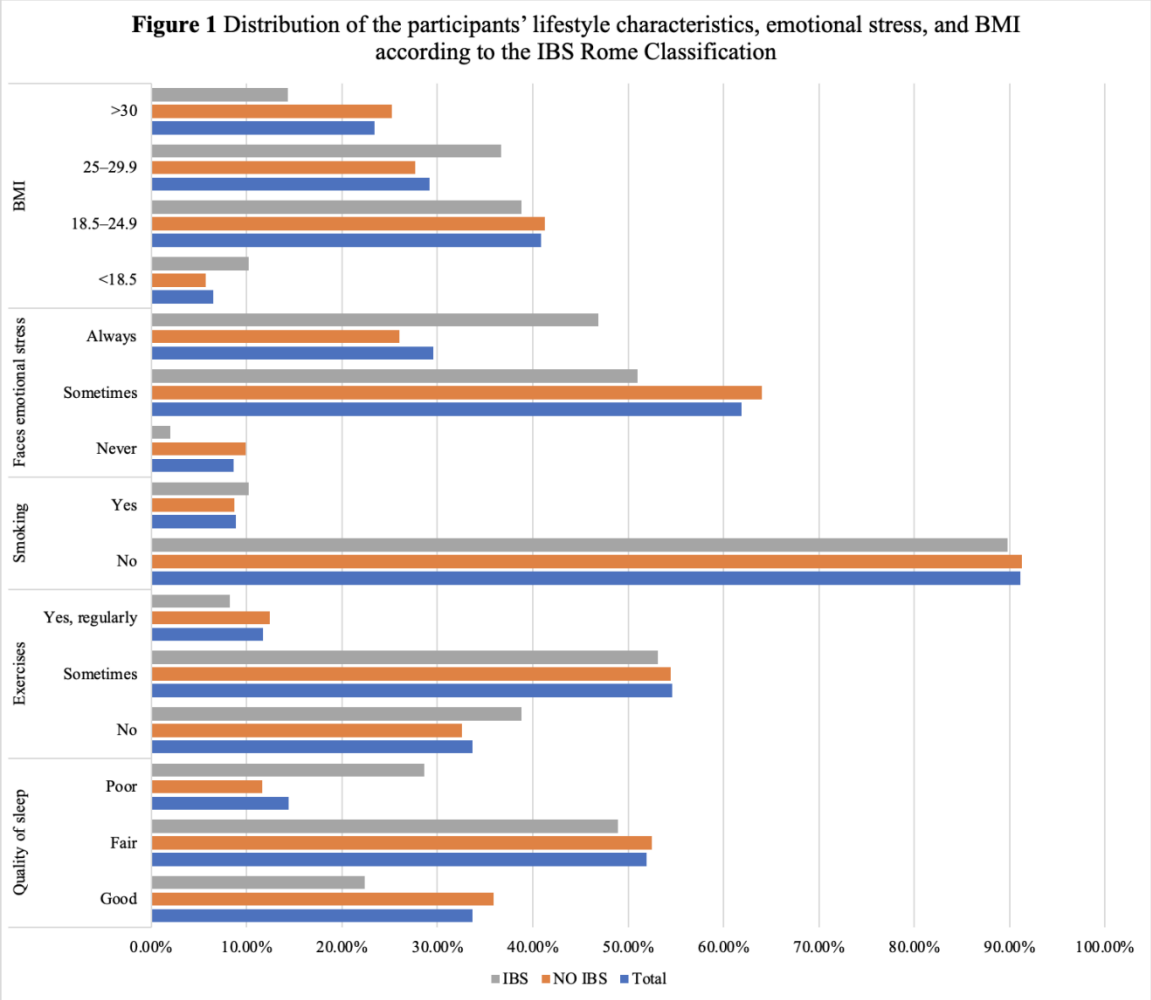


Figure 1 Distribution of the participants' lifestyle characteristics, emotional stress, and BMI according to the IBS Rome Classification

Table 2 and Figure 1 show the participants' lifestyle, emotional stress, and BMI according to the IBS Rome classification. Poor sleep quality was present in 14.4% of participants, smoking in 8.9%, and emotional stress in 29.6%. PCOS patients who did not exercise accounted for 33.7%, whereas 52.6% were overweight or obese. A comparison of the IBS prevalence rate and some lifestyle characteristics, emotional stress, and BMI showed that IBS was more commonly present in participants who self-reported having poor sleep quality ($p = 0.005$) and emotional stress ($p = 0.006$). Lack of exercise, cigarette smoking, and various BMI groups did not show statistically significant differences.

Table 2 Distribution of the participants' lifestyle characteristics, emotional stress, and BMI according to the IBS Rome Classification

Variables	Total 291 (100%)	IBS		P-value
		No 242 (83.2%)	Yes 49 (16.8%)	
Quality of sleep				
Good	98 (33.7)	87 (35.9)	11 (22.4)	
Fair	151 (51.9)	127 (52.5)	24 (48.9)	
Poor	42 (14.4)	28(11.6)	14 (28.6)	0.005
Exercises				
No	98 (33.7)	79 (32.6)	19 (38.8)	
Sometimes	159 (54.6)	133 (54.5)	26 (53.1)	
Yes, regularly	34 (11.7)	30 (12.4)	4 (8.2)	0.57
Smoking				
No	265 (91.1)	221 (91.3)	44 (89.8)	
Yes	26 (8.9)	21 (8.7)	5 (10.2)	0.73

Faces emotional stress				
Never	25 (8.6)	24 (9.9)	1 (2.0)	
Sometimes	180 (61.9)	155 (64.0)	25 (51.0)	
Always	86 (29.6)	63 (26.0)	23 (46.9)	0.006
BMI				
<18.5	19 (6.5)	14 (5.7)	5 (10.2)	
18.5–24.9	119 (40.9)	100 (41.3)	19 (38.8)	
25–29.9	85 (29.2)	67 (27.7)	18 (36.7)	
>30	68 (23.4)	61 (25.2)	7 (14.3)	0.20
Mean + SD	26.3 + 6.9	26.5 + 7.1	25.3 + 5.8	0.20

Based on the Scale uesd, 24.5% women were in the first and second ranks (separate hard lumps, like nuts and sausage-shaped, but lumpy) that match with that of constipation, whereas 63.3% of participants were in the third, fourth, and fifth ranks (like a sausage but with cracks on its surface; a sausage or snake, smooth and soft; and soft blobs with clear-cut edges, respectively) that matches with IBS-diarrhea (IBS-D) and IBS-constipation (IBS-C). The sixth and seventh ranks for IBS-D (fluffy pieces with ragged edges, a mushy stool, and watery, no solid pieces) were reported by 12.2% of women (Table 3).

Table 3 Patients' IBS subtype and Bristol Stool Scale scores

IBS subtype, Bristol Stool Scale	Total 291 (100%)	IBS	
		No 242 (83.2%)	Yes 49 (16.6%)
Both diarrhea and constipation, third, fourth, and fifth rank (like a sausage but with cracks on its surface; a sausage or snake, smooth and soft; and soft blobs with clear-cut edges respectively) IBS-M	109 (37.5%)	78 (32.2%)	31 (63.3%)
Usually constipation, first and second rank (separate hard lumps, like nuts and sausage-shaped, but lumpy) IBS-C	78 (26.8%)	66 (27.3%)	12 (24.5%)
Usually diarrhea, sixth and seventh rank (fluffy pieces with ragged edges, a mushy stool and watery, no solid pieces) IBS-D	33 (11.3%)	27 (11.2%)	6 (12.2%)
Not specified	71 (24.4%)	71 (29.3%)	0.0
P-value	0.001		

Table 4 shows the comparison of the IBS-QOL scores in the patient subgroups. A significant difference in the overall QOL scores was observed between PCOS patients with IBS and those without IBS ($p = 0.009$). Moreover, significant differences were observed in three subgroups, that is, dysphoria ($p < 0.001$), interference with activity ($p < 0.02$), and relationship ($p < 0.003$). In PCOS patients, the lowest QOL scores belonged to the IBS subgroup. Twenty-five participants did not experience any emotional stress. The remaining 266 subjects reported facing multiple causes of stress, either always or sometimes (Table 5) and (Figure 2).

Table 4 Comparison of the IBS-QOL scores in the patient subgroups, n = 291

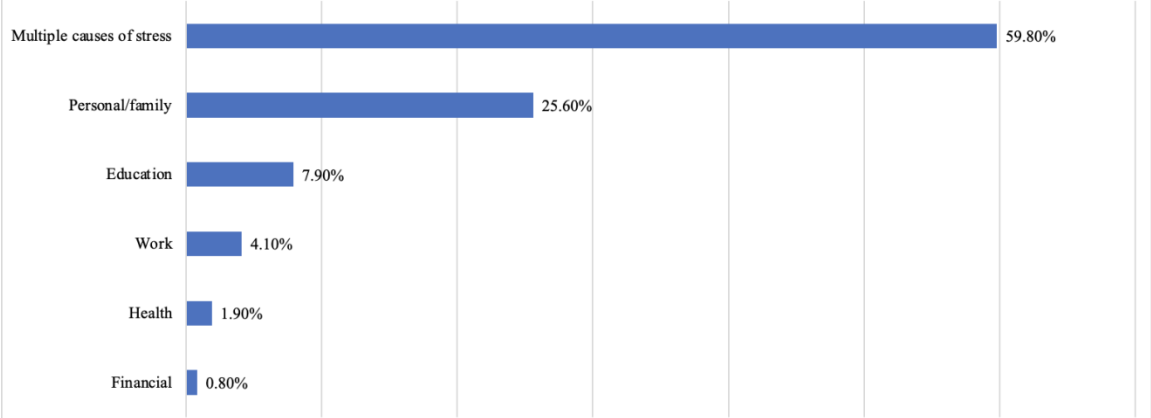
	PCOS		P-value
	IBS 49 (16.8%)	No IBS 242 (83.2%)	
Overall	65.7+24.5	77.6+20.9	0.009
Dysphoria	66.2+30.6	80.5+22.3	0.001
Interference with activity	63.6+27.6	78.4+21.9	0.02
Body image disturbance	55.4+27.1	71.2+25.5	0.51
Health worry	62.6+28.0	73.5+25.8	0.26
Food avoidance	62.6+28.0	67.8+28.6	0.74

Social reaction	67.5+27.5	78.1+24.3	0.18
Sexual problems	84.9+25.9	86.2+22.9	0.65
Relationship problems	74.1+28.2	84.4+21.9	0.003

Table 5 The most probable cause of facing emotional stress always or sometimes, n = 266

Personal/family	68 (25.6)
Education	21 (7.9)
Work	11 (4.1)
Health	5 (1.9)
Financial	2 (0.8)
Multiple causes of stress	159 (59.8)

Figure 2 The most probable cause of facing emotional stress always or sometimes, n = 266



4. DISCUSSION

IBS was diagnosed in 49 (16.8%) patients with PCOS based on the R4DQ criteria. This finding was slightly higher than the values reported (Al Butaysh et al., 2020) in Saudi undergraduate students (15.8%), medical students and interns in the city of Jeddah, Saudi Arabia (Hasosah et al., 2017). However, this is consistent with the reported 10%–20% of adults affected by IBS. Nevertheless, the current finding (16.8%) was lower than that published in a previous study, which showed that IBS symptoms occurred in 20.7% of patients with PCOS (Bazarganipour et al., 2020). Moreover, it is lower than the previously reported 41.7% prevalence of IBS in PCOS subjects (Mathur et al., 2010). Several issues may contribute to the wide range reported in these studies, which use different diagnostic criteria for IBS. Moreover, socioeconomic status and cultural differences play a role in its prevalence. Furthermore, Developed countries have a higher percentage of IBS patients than developing countries (Black et al., 2020).

The higher prevalence of IBS among women with PCOS in child bearing years than that in the general population, as reported in the present study and the previous literature, suggests the strong association between IBS and PCOS. Statistically significant differences were not observed between IBS and the various sociodemographic groups. IBS was not significantly linked to anincreased BMI, despite the finding that 23.4% were obese (BMI ≥ 30). However, obesity among the participants was similar to the national prevalence of obesity (25.5%) among Saudi women (BMI ≥ 30). This finding differs from a previous study in which women with PCOS and IBS symptoms had a higher BMI than those with PCOS who did not have IBS symptoms (Mathur et al., 2010) Studies on the association between obesity and IBS are unclear and conflicting (Akhondi et al., 2019).

Obesity is now linked to a variety of health disorders that can negatively influence people's QOL, exert pressure on health care services, and cost the country's money. This evidence emphasizes the importance of focusing more attention on obesity in Saudi Arabia (Althumiri et al., 2021). A healthy lifestyle is an essential component of health promotion, including a good night's sleep and regular exercise. Only 33.7% of participants were satisfied with their sleep quality. The remaining participants perceived their sleep quality as poor or fair. Poor sleep quality was found in 14.4% of individuals, and it was more prevalent among IBS patients than among non-IBS patients. IBS was more commonly present in participants who self-reported poor sleep quality ($p = 0.005$). This finding is consistent with that in the literature, as a high percentage of individuals with IBS have sleep disturbances, (Al Butaysh et al., 2020; Buchanan et al., 2014) suggesting that sleep disruption may directly impact gastrointestinal (GI) symptoms. A previous

study reported that one in every three adults suffers from a short sleep duration of <7 hours per night, putting Saudi women at risk for serious health problems (Al-Tannir et al., 2016; Ahmed et al., 2017).

Cigarette smoking was reported by 8.9% of participants. The proportion of smokers with IBS was higher than those without IBS. However, this result was not statistically significant. Our investigation did not find previous observational studies that showed the association of cigarette smoking with a higher IBS prevalence and an independent determinant for IBS (Al Butaysh et al., 2020; Talley et al., 2021). Overall, 33.7% of the PCOS participants did not exercise, with no statistically significant differences observed between IBS and non-IBS patients. However, a survey in the Gulf Cooperation Council countries, including Saudi Arabia, revealed that the prevalence of physical inactivity among women is reaching an alarming level, ranging from 50.7% to 98.7% (Alshaikh et al., 2017). Furthermore, regular exercise has emerged as a protective factor against IBS symptoms (Al Butaysh et al., 2020).

In our study, 29.6% of the patients faced emotional stress at all times. Moreover, stress was higher among patients with IBS ($p < 0.01$). Emotional stress was associated with an increased risk of IBS ($p = 0.006$) in the study participants. This finding was consistent with the literature that reported, women with PCOS are more likely to suffer from IBS because of their higher levels of anxiety and stress. Other observations have stated that stressful conditions, acute and chronic, were associated with increased IBS symptoms (AlButaysh et al., 2020; Bazarganipour et al., 2020; Umrani et al., 2021).

IBS is a stress-sensitive condition; therefore, management should focus on medical counseling for stress and stress-induced responses. PCOS can cause infertility and lead to psychological manifestations such as low self-esteem, depression, and anxiety (Lim et al., 2019). Based on the Stool Scale, 24.5% of PCOS women matched with IBS-C. In contrast, 12.2% of women were matched with IBS-D, 24.5% of PCOS women matched with IBS-C. In contrast, 12.2% of women were matched with IBS-D, 24.5% of PCOS women matched with IBS-C. In contrast, 12.2% of women were matched with IBS-D. Furthermore, 63.3% of women had IBS-D and IBS-C.

In the present study, IBS-C was more common than IBS-D. A previous study arrived at the same conclusion (Bazarganipour et al., 2020). This observation is related to the alteration of hormones in patients with PCOS, which interferes with bowel function. A significant difference was observed in overall QOL scores between PCOS patients with IBS and those without IBS ($p = 0.009$). Patients with IBS had poor QOL compared with that in the other groups. This study's findings are comparable to those of a prior conclusion. IBS significantly affects women's QOL because it imposes significant social and economic expenses due to medical care and work absenteeism (Bazarganipour et al., 2020). Moreover, the areas of QOL greatly affected by IBS were dysphoria ($p < 0.001$), interference with activity ($p < 0.02$), and relationship ($p < 0.003$).

This finding is consistent with a previous study reporting dysphonia as the most affected area. A diminished QOL was noted in women with IBS, with increased anxiety, depression, and fatigue (Kim et al., 2018; Zafari et al., 2020).

Limitations

While the observations noted are interesting, the study population is mainly from a single center and is not representative of the general population. Another limitation is that using a self-administered questionnaire during the Covid-19 pandemic may result in low reporting bias.

5. CONCLUSION

IBS is common in women with PCOS. Risk factors for IBS include poor sleep quality and emotional stress. In addition, PCOS patients with IBS experience significantly poor QOL, particularly those affected by dysphoria, interference with activity, and relationships. Since many of the IBS risk factors are modifiable, primary care is the optimal setting for health promotion and disease prevention. Hence, a family physician and his team should not miss counseling patients and motivating them to participate in healthy lifestyle activities. Future studies should include large subjects, multiple centers, and regions to detect differences between groups.

Acknowledgement

We would like to thank the participants who contributed to our study.

Author Contributions

All authors contributed to the conception and design of study, acquisition of data, analysis and/or interpretation of data, drafting and revising the manuscript. All authors approve of this version of the manuscript to be published.

Ethical Approval

The study was approved by the Institutional Review Board of King Saud University Medical City (Research Project No. E-21-5832).

Funding

The study did not receive any external funding.

Conflict of interests

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

REFERENCES AND NOTES

1. Ahmed AE, Al-Jahdali F, AlALwan A, Abuabat F, Salih SB, Al-Harbi A, Barahoon S, Khan M, Ali YZ, Al-Jahdali H. Prevalence of sleep duration among Saudi adults. Saudi Med J 2017; 38(3):276.
2. Akhondi N, Memar Montazerin S, Soltani S, Saneei P, Hassanzadeh Keshteli A, Esmaillzadeh A, Adib P. General and abdominal obesity in relation to the prevalence of irritable bowel syndrome. Neurogastroenterol Motil 2019; 31(4):e13549.
3. Al Butaysh OF, Al Quraini AA, Almukhaitah AA, Alahmdi YM, Alharbi FS. Epidemiology of irritable bowel syndrome and its associated factors in Saudi undergraduate students. Saudi J Gastroenterol 2020; 26(2):89.
4. Alanazi EO, Alshammri WO, Hammad SM, Mohammed AE. Prevalence and risk factors for irritable bowel syndrome among high school female students in northern borders region, Saudi Arabia. Medical Science 2021;25(109):556-564
5. Alshaikh MK, Filippidis FT, Al-Omar, HA, Rawaf S, Majeed A, Salmasi AM. The ticking time bomb in lifestyle-related diseases among women in the Gulf Cooperation Council countries; review of systematic reviews. BMC Public Health 2017; 17:17.
6. Al-Tannir MA, Kobrosly SY, Al-Badr AH, Salloum NA, Altannir YM, Sakkijha HM. Characterizing sleeping habits and disturbances among Saudi adults. Saudi Med J 2016; 37(12):1372.
7. AlthumiriNA BM, AlMousa N, AlJuwaysim MF, Almubark RA, BinDhim NF, Alkhamaali Z, Alqahtani SA. Obesity in Saudi Arabia in 2020: Prevalence, Distribution, and Its Current Association with Various Health Conditions. Healthcare (Basel, Switzerland) 2021; 9(3):8.
8. Ballou S, McMahon C, Lee H-N, Katon J, Shin A, Rangan V, Singh P, Nee J, Camilleri M, Lembo A, Iturrino J. Effects of irritable bowel syndrome on daily activities vary among subtypes based on results from the IBS in America Survey. Clin Gastroenterol Hepatol 2019; 17(12):2471-8. e3.
9. Bazarganipour F, Taghavi S-A, Asemi Z, Allan H, Khashavi Z, Safarzadeh T, Pourchangiz S, Zare F, Ghasemi S, Karimi Z, Kutenaee MA. The impact of irritable bowel syndrome on health-related quality of life in women with polycystic ovary syndrome. Health Qual Life Outcomes 2020; 18(1):1-6.
10. Black CJ, Ford AC. Global burden of irritable bowel syndrome: trends, predictions and risk factors. Nat Rev Gastroenterol Hepatol 2020; 17(8):473-86.
11. Buchanan DT, Cain K, Heitkemper M, Burr R, Vitiello MV, Zia J, Jarrett M. Sleep measures predict next-day symptoms in women with irritable bowel syndrome. J Clin Sleep Med 2014; 10(9):1003-9.
12. Camilleri M. Diagnosis and Treatment of Irritable Bowel Syndrome: A Review. JAMA 2021; 325(9):865-77.
13. Diamanti-Kandarakis E. Polycystic ovarian syndrome: pathophysiology, molecular aspects and clinical implications. Expert Rev Mol Med 2008; 10:e3.
14. Farideh ZZ, Mehdi NM, Masomeh M, Marzieh M. Assessment the health-related quality of life in women with polycystic ovary syndrome. TUMJ 2020; 78:528- 536
15. Frändemark Å, Törnblom H, Jakobsson S, Simrén M. Work productivity and activity impairment in irritable bowel syndrome (IBS): a multifaceted problem. ACG 2018; 113(10):1540-9.
16. Goudas VT, Dumesic DA. Polycystic ovary syndrome.Endocrinol.Metab. Clin N Am 1997; 26(4):893-912.
17. Guraya SS. Prevalence and ultrasound features of polycystic ovaries in young unmarried Saudi females. J Microsc Ultrastruct 2013; 1(1-2):30-4.
18. Hasosah MY, Alamri SA, Al-Husayni FA, Aljedaani RM, Zwawy MA, Al-Zahrani AA. Prevalence of Irritable Bowel Syndrome among Medical Students and Interns in Jeddah, Saudi Arabia. J Clin Med Case Stud 2017; 2(4).
19. Kiddy DS, Hamilton-Fairley D, Bush A, Short F, Anyaoku V, Reed MJ, Franks S. Improvement in endocrine and ovarian function during dietary treatment of obese women with polycystic ovary syndrome. Clin Endocrinol 1992; 36(1):105-11.
20. Kim YS, Kim N. Sex-gender differences in irritable bowel syndrome. J Neurogastroenterol Motil 2018; 24(4):544.

21. Lacy BE, Patel NK. Rome criteria and a diagnostic approach to irritable bowel syndrome. J Clin Med 2017; 6(11):99.
22. Lewis SJ, Heaton KW. Stool form scale as a useful guide to intestinal transit time. Scand J Gastroenterol 1997; 32(9):920-4.
23. Lim SS, Hutchison SK, Van Ryswyk E, Norman RJ, Teede HJ, Moran LJ. Lifestyle changes in women with polycystic ovary syndrome. Cochrane Db Syst Rev 2019; 3:CD007506.
24. Masuy I, Pannemans J, Tack J. Irritable bowel syndrome: diagnosis and management. Minerva gastroenterologica e dietologica 2019; 65: 153-62.
25. Mathur R, Ko A, Hwang LJ, Low K, Azziz R, Pimentel M. Polycystic ovary syndrome is associated with an increased prevalence of irritable bowel syndrome. Dig Dis Sci 2010; 55(4):1085-9.
26. Nguyen M, Malone MM, Bailey A, Lapum J. Women's experiences of intimate relationships while living with irritable bowel syndrome. Gastroenterol Nurs. 2018; 41(6):516-24.
27. Patrick DL, Drossman DA, Frederick IO, DiCesare J, Puder KL. Quality of life in persons with irritable bowel syndrome: development and validation of a new measure. Dig Dis Sci 1998; 43(2):400-11.
28. Sánchez-Ferrer ML, Adoamnei E, Prieto-Sánchez MT, Mendiola J, Corbalán-Biyang S, Moñino-García M, Palomar-Rodríguez JA, Torres-Cantero AM. Health-related quality of life in women with polycystic ovary syndrome attending to a tertiary hospital in Southeastern Spain: a case-control study.Health Qual. Life Outcomes 2020; 18(1):1-10.
29. Singh D, Arumalla K, Aggarwal S, Singla V, Ganie A, Malhotra N. Impact of Bariatric Surgery on Clinical, Biochemical, and Hormonal Parameters in Women with Polycystic Ovary Syndrome (PCOS). Obesity surgery 2020; 30(6).
30. Soares RL. Irritable bowel syndrome: a clinical review. WJG 2014; 20(34):12144.
31. Sperber AD, Dumitrascu D, Fukudo S, Gerson C, Ghoshal UC, Gwee KA, Hungin APS, Kang J-Y, Minhu C, Schmulson M, Bolotin A, Friger M, Freud T, Whitehead W. The global prevalence of IBS in adults remains elusive due to the heterogeneity of studies: a Rome Foundation working team literature review. Gut 2017; 66(6):1075-82.
32. Talley NJ, Powell N, Walker MM, Jones MP, Ronkainen J, Forsberg A, Kjellström L, Hellström PM, Aro P, Wallner B, Agréus L, Andreasson A. Role of smoking in functional dyspepsia and irritable bowel syndrome: three random population-based studies. Aliment Pharmacol Ther 2021; 54(1):32-42.
33. Umrani S, Jamshed W, Rizwan A. Association between Psychological Disorders and Irritable Bowel Syndrome. Cureus 2021; 13(4).