Critical Comments in Biomedicine
https://ccbjournal.ssu.ac.ir
eISSN: 2717-0403

Systematic Review

DOI: https://doi.org/10.18502/ccb.v3i1.9410

The Relationship between Obsessive-Compulsive Disorder and Irritable Bowel Syndrome: A Systematic Review and Meta-Analysis

Omran Davarinejad [1], Tahereh Mohammadi Majd [2], Yahya Salimi [3*], Masoumeh Abbasi [4], Maryam Shirzadi [5], Ehsan Zereshki [6]

Received: 28 Nov 2021 **Accepted:** 18 Jan 2022
Published 2022 Volume 3, Issue 1,

Abstract

Introduction: Irritable bowel syndrome (IBS) might be associated with psychiatric disorders such as obsessive-compulsive disorder (OCD). This meta-analysis was conducted to compare the rate of OCD among patients with IBS and otherwise healthy controls.

Methods: This study was conducted using a meta-analysis approach. International databases including PubMed, Web of Science, and Scopus, as well as the Google Scholar search engine were searched from 1985 to August 2020 to find the related studies. The standardized mean difference (SMD) of OCD between case and control groups was calculated and pooled by using a random-effects model. In addition, meta-regression and sub-group analysis were performed to identify variables that possibly explain the heterogeneity.

Results: A total of 5167 patients including 1451 IBS patients for case and 3716 for control group entered 15 related studies were included in the analysis. Based on the results of the random effects analysis, the rate of obsessive-compulsive disorder in IBS patients in case group was higher than the control group (Pooled standardized mean difference, 0.76, I^2 = 87.8%; 95% CI, 0.54-0.98; P <0.001). Egger's (P = 0.083) and Begg's (P = 0.09) tests did not show significant publication bias. Subgroup analysis also revealed that the type of studies and IBS diagnostic criteria were identified as factors affecting heterogeneity.

Conclusion: The present meta-analysis demonstrated that the obsessive-compulsive disorder score in IBS patients was higher than the control group, regardless of subgroup analysis or meta-regression. Due to the significant relationship between these two disorders, psychiatrists and gastroenterologists can provide strategies and techniques for individual or group treatment of obsessive-compulsive disorder in patients with IBS based on the cognitive-behavioral therapy.

Keywords: Irritable Bowel Syndrome, Obsessive-Compulsive, OCD, IBS, Meta-Analysis

How to Cite: Davarinejad O, Mohammadi Majd T, Salimi Y, Abbasi M, Shirzadi M, Zereshki E. The Relationship between Obsessive-Compulsive Disorder and Irritable Bowel Syndrome: A Systematic Review and Meta-Analysis. Critical Comments in Biomedicine. 2022; 3(1): e1023.

✉ **Yahya Salimi**
Yahya.salimi@kums.ac.ir

[1] Clinical Research Development Center, Imam Khomeini and Mohammad Kermanshahi and Farabi Hospitals, Kermanshah University of Medical Sciences, Kermanshah, Iran.
[2] Department of Biostatistics, School of Health, Kermanshah University of Medical Sciences, Kermanshah, Iran.
[3] Social Developing and Health Promotion Research Center, Health Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran.
[4] Department of Health Information Technology, School of Paramedical, Kermanshah University of Medical Sciences, Kermanshah, Iran.
[5] Clinical Research Development Center Imam Khomeini and Mohammad Kermanshahi and Farabi Hospitals, Kermanshah University of Medical Sciences, Kermanshah, Iran.
[6] Student Research Committee, School of Public Health, Kermanshah University of Medical Sciences, Kermanshah, Iran.

Introduction

Irritable Bowel Syndrome (IBS) is a functional disorder in the gastrointestinal tract [1], characterized by abdominal pain or painful defecation, which is divided into three categories of constipation, diarrhea, and both [2]. Drowsiness, low back pain, headache, symptoms of frequent urination, frequent urination at night, incomplete bladder emptying, and painful menstruation in women are also some of the non-gastrointestinal symptoms of IBS [3, 4].

The exact cause of IBS is not known [5], but some believe that IBS is a bio-psychosocial disorder influenced by factors such as abnormal sensory-motor activity of the intestine, and the central nervous system dysfunction. Others

believe that IBS is not a psychiatric disorder, but factors such as genetics, immune, biological, and inflammatory problems, environmental stressors, and childhood sexual and physical abuse can play an important role in interactions between the intestine and the brain, in addition to visceral sensitivity [6-8]. Its prevalence in the United States and Europe is approximately 5%–10%, [9] and in Iran, it is 6%, [10].

The results of studies on psychological state have shown a high rate of introversion in patients with IBS, where patients usually perceive life events negatively, and show a stronger reaction to stress compared to non-patients [11]. The results of some studies indicated that approximately 40 to 90% of patients with IBS have major psychosocial problems [6, 12]. The frequency of comorbidity regarding psychiatric disorders and IBS is significant. Disorders such as mood swings, anxiety, major depression, panic, post-traumatic stress, somatization, hypochondriasis, as well as obsessive-compulsive disorder are common in patients with IBS. This comorbidity increases the severity and frequency of symptoms and the patient's dysfunction [13-15]. According to some studies, patients with IBS have a history of mental disorders such as obsessive–compulsive disorder (OCD) throughout their lives. In fact, this psychological disorder has been mentioned as the underlying cause of IBS; so, there is a coherent relationship between these two diseases [14, 16].

The OCD is one of the most common anxiety disorders in psychiatry, manifested by constant obsessive thoughts and repetitive behaviors. In OCD, disturbing and unwanted thoughts or images cause anxiety and repetitive behaviors, and mental actions are performed to reduce unpleasant feelings [17, 18].

The comorbidity of psychological disorders such as obsessive-compulsive disorder in patients with IBS has adverse effects on patients. Along with psychological aggravating factors, the symptoms of IBS also intensify, which is associated with pain, social dysfunction, decreased adherence to treatment, poor quality of life [19], and an increased risk of suicidal behaviors [20].

Considering the role of psychological, physical and social factors in patients with IBS, high prevalence of the disorder, and the lack of a meta-analysis in this field, it was necessary to investigate the relationship between IBS and OCD. By recognizing the association between IBS and psychiatric disorders, psychotherapy strategies can be identified, the necessary skills for patients can be provided, and thus, the cost of treatment courses can be reduced. It also helps mental health professionals to provide appropriate and targeted supports and treatment interventions for patients, and improve their quality of life. Therefore, this study aimed to investigate the association between IBS and OCD using systematic review and meta-analysis methods.

Methods

This was a systematic review and a meta-analysis study conducted based on Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [21].

Searching Strategy

Two researchers independently searched international databases including PubMed, Web of Science and Scopus, as well as the Google Scholar search engine to retrieve published English and Persian papers from 1985 to August 2020. In addition, the references list of all relevant papers were manually searched and used for additional relevant studies. The search strategy in Pubmed was as follow:

("Mental health"[tiab] OR "OCD"[tiab] OR "obsessive compulsive disorder"[tiab] OR "Obsessive-Compulsive Disorders"[tiab] OR "psychiatric symptom"[tiab] OR "psychiatric factors"[tiab] OR "psychiatric aspects"[tiab] OR "Psychopathological symptom"[tiab] OR "Psychosocial factors"[tiab] OR "psychological aspects"[tiab]) AND ("IBS" [tiab] OR "Irritable bowel syndrome"[tiab]) AND (1980:2020[dp]). For other databases this search strategy was modified.

Inclusion and Exclusion Criteria and Study Selection

The results of searching databases were entered into the End-Note X7 software (Thomson Reuters, Philadelphia, PA, USA) while duplicate studies were excluded from the study.

The criteria for including the paper in the meta-analysis were case-control and cross-sectional studies, as well as measuring the mean score of OCD in patients with IBS using the standard SCL-90-R questionnaire. Exclusion criteria were case report and case series studies, systematic review of intervention studies, not being available in English, failure to measure the mean score of OCD, having a mental health score without presenting an obsessive score, studies other than case-control and cross-sectional design, and being only available as abstract of conference proceedings.

Assessing Methodological Quality

Two authors independently evaluated the quality of articles based on the Mixed Methods Appraisal Tool (MIXED) scale [22]. The quality score ranged from 1 to 5, and scores less than 2 indicated the low quality of the article. Disagreements were resolved by discussion with a third reviewer. The quality assessment scores were not used for inclusion or exclusion of the papers.

Data Extraction

Two authors independently reviewed the papers and extracted data into a predefined Excel form. The following information was extracted from each article: first author, year of study, country of study, IBS diagnosis criteria, type of mental health assessment questionnaire (OCD dimensions), number of patients in case and control groups, mean and standard deviation of OCD scores in IBS and control groups, type of control group, and quality assessment score. To obtain the mean standard deviation of the papers which reported a 95% confidence interval the following formula was used[23]:

$$SD=\sqrt{N}(U-L)\div 4.128$$

Moreover, the following formula was used to obtain the standard deviation in the studies that reported IQR[23]:

$$SD=\frac{IQR}{1.35}$$

Statistical Analysis

The standardized mean difference (SMD) and the corresponding 95% confidence interval (CI) were calculated. A random-effects model was used to integrate SMD. The statistical heterogeneity between studies was assessed using Q (with a conservative P value of 0.10) and I^2 statistics. Moreover, a subgroup analysis was performed based on the types of study, control group, and IBS diagnostic index. The publication bias was assessed by visual evaluation of the funnel diagram and the Begg's and Egger's test. All statistical analyses were performed with Stata version 11.0 (StataCorp LLC, College Station, TX, USA). For Begg's and Egger's tests, p values less than 0.1 were regarded to have statistical significance, but for other tests, p-values of less than 0.05 were considered as significant.

Results

In the initial search by two researchers, 1312 papers related to IBS and OCD were found (PubMed, n = 339; Scopus, n =467; WOS, n = 497; other sources, n = 10), Out of which, 486 studies were excluded due to duplication (studies extracted by the two researchers with the same title, authors' names and published journal). The full texts of 831 papers were reviewed, from which 797 were excluded due to their irrelevance to this study. Of the remaining papers, 2 were excluded according to the interventional approach, 10, because of not reporting the mean score of OCD or only reporting the total score of mental health, and 7 papers due to the lack of a full text. In this meta-analysis, in 9 case–control [24-31] and 6 cross-sectional studies [32-37] the mean of OCD was measured. The results of the subgroup analysis demonstrated that there was a difference

between the mean scores of OCD based on the type of study being case-control (Pooled SMD, 1.12; 95% CI 0.73-1.52) and cross-sectional (Pooled SMD, 0.42; 95% CI 0.22-0.62), such that the mean score of OCD in case control studies was higher than cross-sectional studies.

Finally, 15 eligible studies entered the meta-analysis process (**Figure 1**).

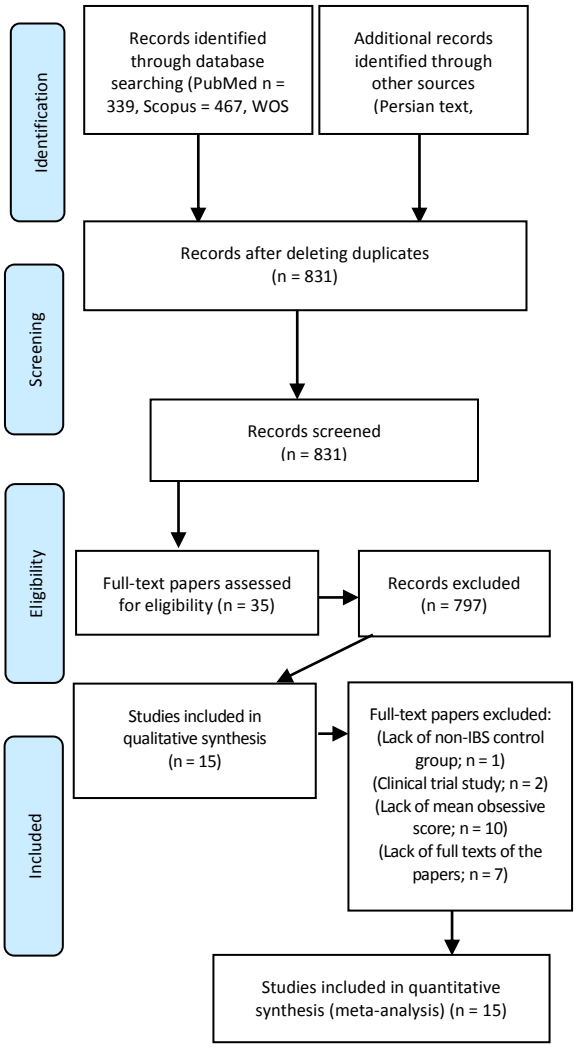

Figure 1. PRISMA Flowchart Showing the Search and Study Selection Strategy

Characteristics of the Included Studies

A total of 5,167 participants was analyzed, including 1451 IBS patients in case groups and 3716 in control groups who were collected from 15 studies. General characteristics of the studies are shown in **Table 1**. There was one paper from Australia, China, Germany, Hungary, Italy, Sweden, and Turkey, two were from Korea and USA and four papers were from Iran. Six studies were cross-sectional and nine were case-control. In nine studies, the control group was healthy participants and in 5 studies.

In the study by Fadai et al [24], a control group including individuals was referred to the other clinics due to medical problems rather than gastrointestinal ones. The control group was selected from patients admitted to internal medicine clinics with complaints other than gastrointestinal symptoms, or they were referred from other gastroenterologists [25, 29, and 37]. Also in the study by Sers et al [28], only patients diagnosed with having ulcerative colitis (UC) were included in the control group.

The mean age of patients in case and control groups in 9 studies were 35.79 and 36.33, respectively. The mean age of participants by group was not reported in three studies. Women accounted for 64.34% of the patients in 11 studies, but it was not clear in 3 studies. The IBS diagnostic criteria and the number of studies were as follows: 8 studies with Rome III criteria, 2 studies using Rome II criteria, and one study using Rome I criteria, respectively. Three studies also diagnosed IBS through Coping Strategies Questionnaire, diagnosis of gastroenterologists, and Bowel disease questionnaire. In all of the studies, the mean score of OCD was evaluated using the SCL-90 questionnaire (**Table 1**).

The Obsessive-Compulsive Disorder Level in IBS Patients

The mean score of OCD in this study was higher in the IBS groups than in the control groups and the difference was significant (Pooled SMD: 0.76; 95% CI, 0.54-0.98; P <0.001). In addition, the between-heterogeneity was shown to be high (I^2 = 87.8%) (**Figure 2**).

Publication bias

To examine the publication bias, two tests of Egger (P = 0.083); (Begg P = 0.09) and Funnel plot were performed and indicated that although an asymmetry was seen in the funnel plot, the publication bias was not significant (**Figure 3**).

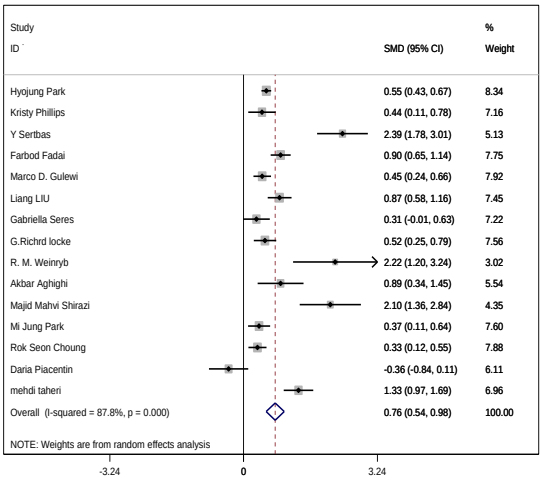

Figure 2. Forest Plot of OCD Levels in Irritable Bowel Syndrome (IBS) Patients

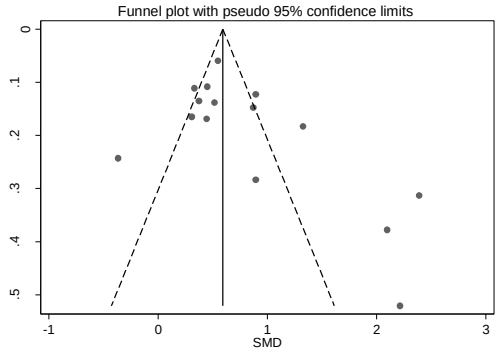

Figure 3. Funnel Plot of OCD Levels in Irritable Bowel Syndrome (IBS) Patients.

Sensitivity analysis

Sensitivity analysis was performed using sequential omission of studies from the analysis, and integrated SMD did not deviate significantly through sequential omission of any of the studies.

Meta-regression Analysis

The year of publication and the proportion of women in the IBS group were entered meta-regression as potential confounding factors. According to the results of meta-regression analysis, the year of publication was not significantly associated with the heterogeneity (p = 0.99). Another potential confounder was the proportion of women in the case group (%), and the results for meta-regression was not significant (p = 0.85) (**Table 2**).

Sub-Group Analysis

Based on the results of sensitivity analysis, the type of diagnostic index for IBS, the type of studies (case-control and cross-sectional), and the type of control group (healthy-unhealthy) were included in the subgroup analysis as possible confounders.

Based on the results of subgroup analysis regarding the type of control group (**Figure 4**), the mean score of OCD in the healthy control group (pooled SMD 0.77; 95% CI 0.543 -1.008) and in the unhealthy control group (**Figure 5**), (Pooled SMD 0.71; 95% CI 0.13-1.30), was higher compared to patients, but the difference between the two subgroups was not significant and had little effect on heterogeneity of the results (**Table 3**). Also, regarding the subgroup analysis, based on other variables, the age of IBS group and control group, and female proportion in IBS group, the authors found no significant difference was between the IBS group and the control group.

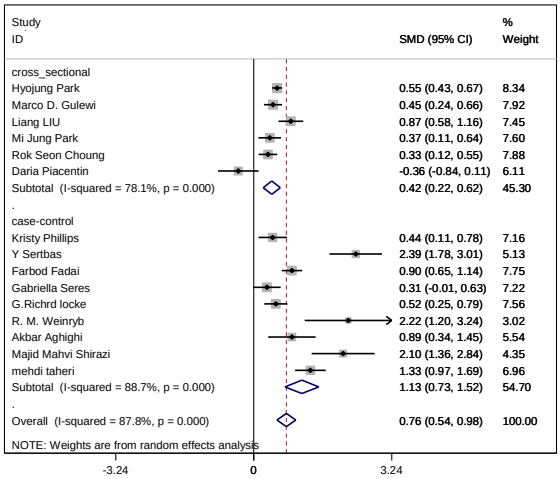

Figure 4. Sub-Group Analysis Based on the Type of Studies (case-control and cross-sectional)

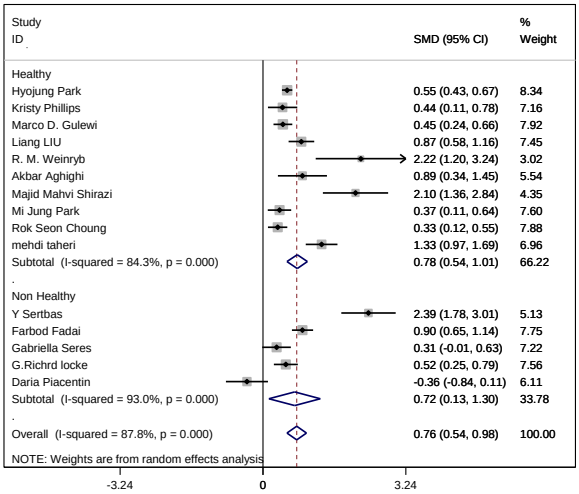

Figure 5. Sub-Group Analysis Based on the Type of Control Group (healthy-unhealthy)

Table 1. Characteristics of Studies Included in the Meta-analysis

Study author	Study Year	Country	Criteria IBS	SCORE	Sample size IBS	Mean IBS	SD_IBS	Sample size control	Mean control	SD_control	Type of control group	Age _IBS	Age control	Female proportion in IBS group (%)	Study Type
Hyojung Park[35]	2011	Korea	Rome III	4	356.00	1.43	0.75	1521.00	1.04	0.71	Healthy			59.30	Cross sectional
Kristy Phillips[27]	2013	Australia	Rome III	2	82.00	0.70	0.43	67.00	0.54	0.36	Healthy	44	39	95.00	Case-control
Y Sertbas[29]	2012	Turkey	Rome III	3	50.00	0.88	0.44	50.00	0.33	0.23	Unhealthy	-	-	68.00	Case-control
Farbod Fadai[24]	2015	Iran	Rome III	4	153.00	1.30	0.86	163.00	0.70	0.67	Unhealthy	36	33	62.00	Case-control
Marco D. Gulewi[32]	2013	German	Rome III	3	176.00	1.02	0.71	181.00	0.75	0.60	Healthy	23	24	51.70	Cross sectional
Liang LIU[33]	2014	China	Rome III	3	59.00	1.16	0.84	281.00	0.62	0.62	Healthy	-	-	17.90	Cross sectional
Gabriella Seres[28]	2008	Hungary	other	2	88.00	1.12	0.79	66.00	0.91	0.68	Unhealthy	42	39		Case-control
G.RichR.D Locke[25]	2004	Minnesota	other	5	103.00	50.60	8.88	119.00	46.00	8.88	Unhealthy	33	38	73.00	Case-control
R. M. Weinryb[31]	2003	Sweden	Rome I	5	17.00	1.23	0.79	17.00	0.41	0.37	Healthy	34	34	88.00	Case-control
Akbar Aghighi[38]	2019	Iran	other	3	30.00	8.32	2.24	30.00	6.23	2.34	Healthy	-	-	-	Case-control
Majid Mahvi Shirazi[26]	2013	Iran	Rome II	3	30.00	1.71	0.77	30.00	0.85	0.41	Healthy	-	-	-	Case-control
Mi Jung Park[36]	2011	Korea	Rome III	5	59.00	51.62	10.29	724.00	47.42	11.21	Healthy	21	21	67.80	Cross sectional
Rok Seon Choung[39]	2009	Minnesota	Rome II	4	106.00	54.00	9.00	355.00	51.00	9.00	Healthy	47	58	49.10	Cross sectional
Daria Piacentin[37]	2011	Italy	Rome III	3	56.00	0.60	0.85	26.00	1.00	1.10	Unhealthy	42	42	76.00	Cross sectional
Mehdi Taheri[30]	2011	Iran	Rome III	3	86	12.15	7.97	86	6.76	4.06	Healthy	56		-	Case-control

IBS, irritable bowel syndrome; SD, Standard Deviation

Table 2. The Result of Meta-regression Analysis and the Pooled Standard Mean Difference for Obsessive Compulsive Disorder

Variable	No. of studies	Coefficient	Std. Err.	t	P>t	0.950		tau2	I-squared residual	Adj R-squared
						l	u			
Study year	15	-0.0001	0.053	-0.00	0.99	-0.116	0.116	0.50	88.00%	-9.84%
Female proportion in IBS group	11	0.002	0.012	0.19	0.49	-1.26	2.43	0.53	88.29%	-16.39%

Table 3. The Result of Sub-Group Analysis and the Pooled Standard Mean Difference for Obsessive Compulsive Disorder

Variable	No. of Studies	Sub-group	SMD (95% CI)	Heterogeneity statistic	Degrees of freedom	P	I-squared**	Tau-squared
Criteria for IBS	15	Rome III	0.72(0.45 - 1.00)	79.29	8	0.000	89.9	0.1529
		Other	0.50 (0.24- 0.77)	3.27	2	0.195	38.8	0.0213
		Rome I	2.21 (1.19 - 3.23)	0.00	0	0.000	0	0.0000
		Rome II	1.17 (-0.54 - 2.90)	20.09	1	0.000	95.0	1.4788
		Overall	0.76(0.54 - 0.98)	115.07	14	0.000	87.8	0.1481
Control group type	15	Healthy	0.77 (0.54 - 1.00)	57.28	9	0.000	84.3	0.1013
		Unhealthy	0.71 (0.13 - 1.30)	57.37	4	0.000	93.0	0.4000
		Overall	0.76 (0.54 -0.98)	115.07	14	0.000	87.8	0.1481
Study Type	15	case-control	0.42 (0.22- 0.62)	22.81	5	0.000	78.1	0.0457
		Cross sectional	1.12 (0.73- 1.52)	71.06	8	0.000	88.7	0.3006
		Overall	0.76 (0.54 - 0.98)	115.07	14	0.000	87.8	0.1481

Discussion

Based on the findings of this meta-analysis, OCD in people with IBS was higher than those in the control group and the difference was significant. The mean score of OCD in IBS patients was higher in 14 studies [24-36, 38] and in only one study, it was lower than the control group [37].

However, this result does not indicate which type of study is better or worse, but it seems that this difference may be due to the fact that case-control and cross-sectional studies are methodologically and practically different from each other. Case control studies may be able to identify more differences due to pre- matching and randomization, which requires further investigation.

Different types of IBS diagnostic criteria have been used in the studies of input for this meta-analysis; therefore, the confounding effect of the diagnostic criteria for IBS was also analyzed based on the subgroup analysis.

Based on the results, the Pooled SMD was obtained from 9 studies with diagnostic criteria of Rome III [24, 27, 29, 30, 32, 33, 35-37]; (Pooled SMD 0.50; 95% CI 0.24-0.77), 2 studies with diagnostic criteria Rome II [26, 34], (Pooled SMD 1.17; 95% CI -0.54-2.90), and one study with diagnostic criteria Rome I, (33); (Pooled SMD 2.21; 95% CI 1.19- 3.23). Also based on Coping Strategies Questionnaire, [28], diagnosis of gastroenterologists [38], and the Bowel Disease Questionnaire [25] Pooled SMD 0.72; 95% CI 0.45-1.007 was obtained.

Rome III index had the lowest mean and Rome I had the highest mean. According to the sub-group Analysis, the Rome II diagnostic index was the most heterogeneous. It is recommended that researchers pay attention to the quality of their work when using diagnostic tools.

Several studies have assessed the association between IBS and psychological factors in Eastern countries [40-42].This study indicated that OCD is associated with IBS. It can be stated that although IBS is a common gastrointestinal disease, it is associated with psychiatric disorders because the brain and intestines form a two-way relationship between the autonomic nervous system and the hypothalamic-pituitary-adrenal axis. As a result, patients with psychiatric disorders develop IBS [43, 44]. According to the DSM-5, IBS is listed in the category of psychological factors affecting medical disorders, which also indicates the role of psychological factors in this syndrome. They play an important role in the course and clinical consequences of IBS [45].

One of the limitations of the present study was evaluating the mean of obsession only based on the SCL-90 questionnaire. Another limitation was the impossibility of reviewing the related non-English language papers.

Conclusion

This is a meta-analysis on the relationship between IBS and OCD.

The findings of this study indicate a higher OCD score in patients with IBS, and there is a significant relationship between OCD and the type of study, criteria for IBS and control group. Therefore, gastroenterologists, psychiatrists and psychologists sought help to treat this group of patients, and the treatments should be performed as a team.

Furthermore, it is suggested that other prospective studies examine the association between IBS and other psychiatric disorders to confirm the current findings.

Abbreviations

IBS: Irritable Bowel Syndrome

OCD: Obsessive-compulsive disorder

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

SMD: Standardized Mean Difference

MMAT: Mixed Methods Appraisal Tool

Acknowledgments

The researchers wish to thank the deputy of Kermanshah University of Medical Sciences for approving this project. We also extend our

thanks to clinical research development center of Imam Khomeini and Mohammad Kermanshahi and Farabi Hospitals affiliated to Kermanshah University of Medical Sciences for their kind support.

Authors' contributions

OD, YS, MA, MSH contributed to the design. TMM, EZ contributed to the statistical analysis and participated in most of the study steps. OM, YS, MSH and MA prepared the manuscript. All authors have read and approved the content of the manuscript.

Ethical Approval

This project was registered under the Code of Ethics IR.KUMS.REC.1399.901 at the Research Department of Kermanshah University of Medical Sciences.

Funding source

There was no financial support.

Conflict of Interest

The authors declared no conflict of interest.

References

[1] Drossman DA. **Functional gastrointestinal disorders: history, pathophysiology, clinical features, and Rome IV**. *Gastroenterology*. 2016; 150(6):1262-79. e2

[2] Spiller R, Aziz Q, Creed F, Emmanuel A, Houghton L, Hungin P, et al. **Guidelines for the management of Irritable Bowel Syndrome**. *Gut*. 2007

[3] Heidelbaugh JJ, Stelwagon M, Miller SA, Shea EP, Chey WD. **The spectrum of constipation-predominant irritable bowel syndrome and chronic idiopathic constipation: US survey assessing symptoms, care seeking, and disease burden**. *The American journal of gastroenterology*. 2015;110(4): 580-7

[4] Quigley E, Fried M, Gwee K, Olano C, Guarner F, Khalif I, et al. **Irritable bowel syndrome: A global perspective**. *Arab J Gastroentrol*. 2010;11:53-62

[5] Barbara G, Cremon C, De Giorgio R, Dothel G, Zecchi L, Bellacosa L, et al. **Mechanisms underlying visceral hypersensitivity in irritable bowel syndrome**. *Current gastroenterology reports*. 2011;13:308-15

[6] Drossman DA, Camilleri M, Mayer EA, Whitehead WE. **AGA technical review on irritable bowel syndrome**. *Gastroenterology*. 2002; 123(6):2108-31

[7] Jones M, Dilley J, Drossman D, Crowell M. **Brain–gut connections in functional GI disorders: anatomic and physiologic relationships**. *Neurogastroenterology & Motility*. 2006;18(2):91-103

[8] Levy RL, Olden KW, Naliboff BD, Bradley LA, Francisconi C, Drossman DA, et al. **Psychosocial aspects of the functional gastrointestinal disorders**. *Gastroenterology*. 2006;130(5):1447-58

[9] Singh R, Salem A, Nanavati J, Mullin GE. **The role of diet in the treatment of irritable bowel syndrome: a systematic review**. *Gastroenterology Clinics*. 2018; 47(1):107-37

[10] PDibajnia P, Moghadasin M, KeykhayeFarzaneh MM. **The Study of the relationship between psychological disorders with Irritable bowel syndrome.** *Pajouhandeh J*. 2012;18:30-3

[11] Raiesifar Z, Moradbeygi K, Tahery N, Baraz S, Shirzadegan R, Darabiyan P, et al. **The Prevalence of Irritable Bowel Syndrome Symptoms in High School Students in Abadan City in 2016**. *Journal of Research in Medical and Dental Science*. 2018;6(5):170-6

[12] Talley NJ. **Conquering irritable bowel syndrome: a guide to liberating those suffering with chronic stomach or bowel problems**: *PMPH-USA*; 2005

[13] Cohen H, Jotkowitz A, Buskila D, Pelles-Avraham S, Kaplan Z, Neumann L, et al. **Post-traumatic stress disorder and other co-morbidities in a sample population of patients with irritable bowel syndrome**. *European journal of internal medicine*. 2006;17(8):567-71

[14] Gros DF, Antony MM, McCabe RE, Swinson RP. **Frequency and severity of the symptoms of irritable bowel syndrome across the anxiety disorders and depression**. *Journal of anxiety disorders*. 2009;23(2): 290-6

[15] Quigley EM, Fried M, Gwee K-A, Khalif I, Hungin A, Lindberg G, et al. **World Gastroenterology Organisation global guidelines irritable bowel syndrome: A global perspective update September 2015**. *Journal of clinical gastroenterology*. 2016; 50(9): 704-13

[16] Masand PS, Keuthen NJ, Gupta S, Virk S, Yu-Siao B, Kaplan D. **Prevalence of irritable bowel syndrome in obsessive–compulsive disorder**. *CNS spectrums*. 2006;11(1):21-5

[17] Morein-Zamir S, Fineberg N, Robbins T, Sahakian B. **Inhibition of thoughts and actions in obsessive-compulsive disorder: extending the endophenotype?** *Psychological medicine*. 2010;40(2): 263-72

[18] Robbins TW, Vaghi MM, Banca P. **Obsessive-compulsive disorder: puzzles and prospects**. *Neuron*. 2019;102(1):27-47

[19] Rezaie A, Buresi M, Lembo A, Lin H, McCallum R, Rao S, et al. **Hydrogen and methane-based breath testing in gastrointestinal disorders: the North American Consensus**. *The American journal of gastroenterology*. 2017;112(5):775-84

[20] Brown LA, Wakschal E, Russman-Block S, Boisseau CL, Mancebo MC, Eisen JL, et al. **Directionality of change in obsessive compulsive disorder (OCD) and suicidal ideation over six years in a naturalistic clinical sample☆**. *Journal of affective disorders*. 2019;245:841-7

[21] Moher D, Shamseer L, Clarke M, Ghersi D, Liberati A, Petticrew M, et al. **Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement**. *Systematic reviews*. 2015;4:1

[22] Hong QN, Pluye P, Fàbregues S, Bartlett G, Boardman F, Cargo M, et al. **Mixed methods appraisal tool (MMAT), version 2018**. *Registration of copyright*. 2018;34(4): 285-91

[23] Wan X, Wang W, Liu J, Tong T. **Estimating the sample mean and standard deviation from the sample size, median, range and/or interquartile range**. *BMC medical research methodology*. 2014;14:1-13

[24] Farbod F, Farzaneh N, Bijan M-D, Mehdi G, Nosratollah N. **Psychological features in patients with and without irritable bowel syndrome: A case–control study using Symptom Checklist-90-Revised**. *Indian journal of psychiatry*. 2015;57:68

[25] Locke III GR, Weaver AL, Melton III LJ, Talley NJ. **Psychosocial factors are linked to functional gastrointestinal disorders: a population based nested case-control study**. *American Journal of Gastroenterology*. 2004;99:350-7

[26] Mahvi-Shirazi M, Ahmadi E, Ali MS. **Mental health levels in IBS, IBD and healthy people: A comparative study**. *Journal of Science and today's world*. 2013;2:549-58

[27] Phillips K, Wright BJ, Kent S. **Psychosocial predictors of irritable bowel syndrome diagnosis and symptom severity**. *Journal of psychosomatic research*. 2013;75(5):467-74

[28] Seres G, Kovács Z, Kovács Á, Kerékgyártó O, Sárdi K, Demeter P, et al. **Different associations of health related quality of life with pain, psychological distress and coping strategies in patients with irritable bowel syndrome and inflammatory bowel disorder**. *Journal of clinical psychology in medical settings*. 2008;15: 287

[29] Sertbas Y, Belli H, Piskinpasa N, Ural C, Akbudak M, Sertbas M, et al. **Assesment of psychiatric symptoms and co-morbidities in patients with irritable bowel syndrome**. *West Indian Med J*. 2012;61(5):544

[30] Taheri M, Hasani J, Molavi M. **Psychological health among patients with irritable bowel syndrome, patients with organic gastrointestinal disorders, and normal individuals: A comparative study**. *Journal of Research in Behavioural Sciences*. 2012;10(2):90-8

[31] Weinryb R, Österberg E, Blomquist L, Hultcrantz R, Krakau I, Åsberg M. **Psychological factors in irritable bowel syndrome: a population-based study of patients, non-patients and controls**. *Scandinavian journal of gastroenterology*. 2003;38(5):503-10

[32] Gulewitsch MD, Enck P, Schwille-Kiuntke J, Weimer K, Schlarb AA. **Mental strain and chronic stress among university students with symptoms of irritable bowel syndrome**. *Gastroenterology Research and Practice*. 2013;2013

[33] Liu L, Xiao Q-f, Zhang Y-l, Yao S-k. **A cross-sectional study of irritable bowel syndrome in nurses in China: prevalence and associated psychological and lifestyle factors**. *Journal of Zhejiang University-SCIENCE B*. 2014;15(6):590-7

[34] Locke III GR, Zinsmeister AR, Schleck CD, Talley NJ. **Psychosocial distress and somatic symptoms in community subjects with irritable bowel syndrome: a psychological component is the rule**. *The American journal of gastroenterology*. 2009;104:1772

[35] Park H, Lim S. **Frequency of irritable bowel syndrome, entrance examination-related stress, mental health, and quality of life in high school students**. *Gastroenterology Nursing*. 2011;34(6):450-8

[36] Park M-J, Lee K-S, Jeong J-S, Kim J-H, Choi J-A, Shin G-S, et al. **The prevalence, subtypes and risk factors of irritable bowel syndrome by ROME III among Korean university students**. *Journal of Korean Biological Nursing Science*. 2011;13(1):61-71

[37] Piacentino D, Cantarini R, Alfonsi M, Badiali D, Pallotta N, Biondi M, et al. **Psychopathological features of irritable bowel syndrome patients with and without functional dyspepsia: a cross sectional study**. *BMC gastroenterology*. 2011;11:94

[38] Aghighi A, Soleimani I, Zadegan A. **THE COMPARISON OF MENTAL PATHOLOGY DIMENSIONS OF PATIENTS WITH IRRITABLE BOWEL SYNDROME WITH NON-DIABETIC PATIENTS IN GASTROENTEROLOGY CLINICS OF TEHRAN**. *The J Urmia Nurs Midwifery Fac*. 2019;17(4):251-9

[39] Choung RS, Locke GR, 3rd, Zinsmeister AR, Schleck CD, Talley NJ. **Psychosocial distress and somatic symptoms in community subjects with irritable bowel syndrome: a psychological component is the rule**. *Am J Gastroenterol*. 2009;104(7):1772-9

[40] Gwee K-A, Wee S, Wong M-L, Png DJ. **The prevalence, symptom characteristics, and impact of irritable bowel syndrome in an Asian urban community**. *LWW*. 2004;99(5):924-31

[41] Si J-M, Wang L-J, Chen S-J, Sun L-M, Dai N. **Irritable bowel syndrome consulters in Zhejiang province: the symptoms pattern, predominant bowel habit subgroups and quality of life**. *World journal of gastroenterology*. 2004;10(7):1059-64

[42] Xiong L, Chen M, Chen H, Xu A, Wang W, Hu P. **A population-based epidemiologic study of irritable bowel syndrome in South China: stratified randomized study by cluster sampling**. *Alimentary pharmacology & therapeutics*. 2004;19(11):1217-24

[43] Cho HS, Park JM, Lim CH, Cho YK, Lee IS, Kim SW, et al. **Anxiety, depression and quality of life in patients with irritable bowel syndrome**. *Gut and liver*. 2011;5(1):29-36

[44] Guthrie E, Barlow J, Fernandes L, Ratcliffe J, Read N, Thompson DG, et al. **Changes in tolerance to rectal distension correlate with changes in psychological state in patients with severe irritable bowel syndrome**. *Psychosomatic Medicine*. 2004; 66(4):578-82

[45] Kellner R. **Psychosomatic syndromes, somatization and somatoform disorders**. *Psychotherapy and psychosomatics*. 1994;61(1-2):4-24