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Masters Program in Public Health, Universitas Sebelas Maret

Meta-Analysis

Associations between Anxiety, Depression, and Poor Quality of Sleep on the Risk of Irritable Bowel Syndrome: A Meta-Analysis

Cendekia Airedeta Mulianda[1)], Bhisma Murti[1)], Hanung Prasetya[2)]

[1)]Masters Program in Public Health, Universitas Sebelas Maret
[2)]Study Program of Acupuncture, Health Polytechnics, Ministry of Health Surakarta.

ABSTRACT

Background: Risk factors for Irritable Bowel Syndrome (IBS) are mental disorders such as anxiety and depression, while sleep disorders affect 50% of patients with IBS. The condition of IBS if it is chronic can have a negative impact on quality of life and work productivity. The purpose of this study was to estimate the relationship between anxiety, depression and poor sleep quality with the risk of irritable bowel syndrome by means of a systematic review and meta-analysis study.
Subjects and Method: This article was prepared using systematic review and meta-analysis studies. This study uses the PICO Model. Meta-analytic studies were conducted by searching for articles from databases in electronic form using Google Scholar, PubMed, Springerlink, Sciencedirect, and the Cochrane Library. An article search was conducted on 15-30 October 2022. The keywords used were "irritable bowel syndrome" or "IBS" or "Functional gastrointestinal disorder" or "Anxiety" or "Depression" or "Mental Disorders" or "Psychological stress" or "Sleep quality" or "Sleep disturbances" or "Cross-Sectional". The inclusion criteria for this study were complete articles using a Cross-Sectional study, with the year of publication 2009-2022. Analysis of the articles in this study used RevMan 5.3 software.
Results: A total of 30 cross-sectional studies from Asia were selected for systematic review and meta-analysis. The data collected shows that anxiety increases 1.53 times and depression 1.29 times with the risk of IBS while poor sleep quality increases the risk of IBS by 1.80 times. This data is considered statistically significant. The results showed that Anxiety (aOR=1.53; 95% CI=1.23 to 1.90; p=0.001), Depression (aOR=1.29; 95% CI=1.05 to 1.59; p=0.02), Poor sleep quality (aOR=1.80; 95% CI=1.48 to 2.19; p<0.001).
Conclusion: The relationship between anxiety-depression mental disorder and poor sleep quality is felt to be statistically significant in causing irritable bowel syndrome.

Keywords: irritable bowel syndrome, risk factors, anxiety, depression, sleep quality

Correspondence:
Cendekia Airedeta Mulianda. Masters Program in Public Health, Universitas Sebelas Maret. Jl. Ir. Sutami 36A, Surakarta 57126, Central Java, Indonesia. Email: c.airedeta@gmail.com. Mobile: +628-2336712311.

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BACKGROUND

Irritable Bowel Syndrome (IBS) is a group of symptoms of functional digestive disorders characterized by recurrent abdominal pain (RAP) associated with changes in bowel or defecation patterns without evidence of underlying damage. There is usually constipation, diarrhea, or a combination of the two. May be accompanied by complaints of flatulence or distension (Vork, 2021). A multina-

tional epidemiological study conducted in 2021, found that more than 40% of people worldwide have FGID (Sperber et al., 2021). According to several population based studies, it has been reported that the prevalence of IBS) is around 10% and is increasing in Asian countries (Song et al., 2018).

The biopsychosocial model influences the interaction of the brain and gut which is thought to be a precipitating factor for IBS. In susceptible individuals (eg, those with a genetic predisposition or exposure to environmental factors), abnormal stress responses, and in combination with psychological distress (eg, anxiety, depression, or somatization). Causing an infectious or inflamematory response can alter intestinal permeability and initiate a cascade of events (eg, infiltration of inflammatory cells, local edema, and release of cytokines or chemokines) that produce IBS symptoms (Ford et al., 2017).

Anxiety, depression, or somatization can also mediate changes in gut permeability, immune system, and microbiome, leading to the development of IBS symptoms (Ford et al., 2017). IBS patients who suffer from psychological comorbidities have a higher risk of impaired social functioning, decreased medication adherence, poor quality of life, and an increased risk of suicidal behavior (Zamani et al., 2019).

Sleep disorders affect 50% of patients with IBS. Objective sleep disturbance is a key factor in the onset of IBS symptoms. Sleep quality was also associated with IBS-specific HRQOL. One study found the effect of sleep disturbances on bowel activity, observing associations between sleep disturbances and somatic pain, depression, and anxiety. Recent studies have shown that sleep disturbances can directly increase visceral hypersensitivity and gastrointestinal symptoms (Patel et al., 2016).

Sleep disturbance affects the body's physiological functions, including increasing proinflammatory cytokines and cortisol levels, while at the same time reducing parasympathetic tone. Physiological effects are highly relevant to inflammatory bowel conditions. Previous studies suggest that poor sleep is more common in IBS patients, but little is known about the impact of sleep disturbance on individual IBS symptoms (Patel et al., 2016).

The diagnosis of IBS was determined based on the Rome Criteria, the Rome III Criteria introduced in 2006 with the most significant change being the classification of IBS by sub-type, which based on stool consistency rather than stool frequency, and includes IBS-C (constipation), IBS-D (diarrhoea), IBS-M (mixed) and IBS-U (no subtype). (Lacy and Patel, 2017). The last revision was Rome IV in 2016 (Drossman and Hasler, 2016):

Recurrent abdominal pain, average ≥1 day per week, within the last 3 months with onset ≥6 months before diagnosis, associated with 2 or more of the following symptoms:

1. Associated with defecation
2. Changes in the frequency of defecation
3. Changes in stool consistency

The patient does not have any of the following warning signs:

1. Palpable abdominal mass/lymphadenopathy
2. Age >50 years without history of colon cancer screening before obvious gastrointestinal bleeding
3. Pain or urge to defecate nocturnally
4. Unintentional weight loss family history of inflammatory bowel disease/colorectal cancer
5. Changes in the pattern of defecation in the last few days

This study aimed to estimate the relationship between anxiety, depression and poor sleep quality with the risk of irritable bowel syndrome with meta-analysis study.

SUBJECTS AND METHOD

1. Study Design

The meta-analysis was performed with the PRISMA flowchart using Google Scholar, PubMed, Springerlink, Sciencedirect, and the Cochrane Library databases. The keywords used were ("Iritable Bowel Syndrome" OR IBS OR "Functional gastrointestinal der") AND Anxiety AND Depression OR ("Mental Disorders" OR "Psychological stress") AND ("Sleep quality" OR "Sleep ces") AND (Cross-Sectional). It found 30 dies with a cross-sectional study design blished in 2009-2022 that met the inclusion criteria. Analysis was performed with man 5.3 software.

2. Steps of Meta-Analysis

The meta-analysis was carried out through 5 steps as follows:

1) Formulate research questions using the PICO model. Population: general public adolescents and adults; Intervention: anxiety, depression and poor sleep quality Comparison: no anxiety, no depression and good sleep quality; and Outcome: Irritable Bowel Syndrome
2) Search for primary study research articles from libraries or electronic databases, namely Google Scholar, PubMed, Springerlink, Sciencedirect, and Cochrane Library.
3) Conduct screening and quality assessment of primary research articles.
4) Extracting and analyzing data into RevMan 5.3 software.
5) Interpret the results and draw conclusions

3. Inclusion Criteria

This research article is a full-text paper using a cross-sectional study design, which analyzes the relationship between anxiety, depression and poor sleep quality with the risk of IBS. The relationship measure used is OR. The analysis used multivariate with adjusted odds ratio (aOR) and 95% confidence interval. The research subjects were adolescents and adults.

4. Exclusion Criteria

Articles published other than in English, non cross-sectional study designs, and articles published before 2009.

5. Operational Definition of Variables

Irritable Bowel Syndrome (IBS) is a group of symptoms of functional digestive disorders characterized by recurrent abdominal pain associated with changes in bowel or defecation patterns, without evidence of underlying damage.

Anxiety is a state of uncontrollable, pervasive, unpleasant and persistent negative influence, characterized by worrying anticipation of unpredictable and unavoidable future danger, and accompanied by physiological symptoms of tension and increased alertness. constantly.

Depression is a mood disorder that causes persistent feelings of sadness, hopelessness, loss of interest, and decreased energy.

Poor sleep quality is when a person takes more than 30 minutes to fall asleep, or wakes up more than once during the night, or takes more than 20 minutes to fall back asleep after waking up.

6. Study Instruments

The study adopted PRISMA flow diagrams and used a critical appraisal checklist cross-sectional study (Joanna Briggs Institute, 2017).

7. Data Analysis

Data analysis carried out using the RevMan 5.3. Forest plots and funnel plots are used to determine the size of the relationship and the heterogeneity of the data. The fixed effect model is used for homogeneous data, while the random effect model is used for heterogeneous data across studies.

RESULTS

The search results for articles related to the relationship between anxiety, depression

and poor sleep quality with the risk of irritable bowel syndrome resulted in 30 articles in a cross-sectional study which can be seen in Figure 1. PRISMA Diagram.

The total articles in the initial search process were 2,740 articles with details of 1,254 Google Schoolar database articles, 516 PubMed database articles, 391 Direct Science database articles, 368 Springerlink database articles and 211 Cochrane Library database articles. From a total of 352 eligible full text articles, 30 articles were included in the synthesis meta-analysis. Full text articles included in the exclusion criteria are due to the following reasons:

1. The study intervention was not anxiety, depression and poor sleep quality. Instead, other IBS risk factor interventions include: Age, gender, food consumption, and family history
2. The outcome of the study was not irritable bowel syndrome but other types of Functional Gastrointestinal Disorder (FGID) and inflammatory bowel disease.
3. Does not include the Adjusted Odds Ratio (aOR).

Figure 2 shows the area of the primary study articles in countries on the Asian continent, 1 article from Indonesia, 1 article from Japan, 6 articles from South Korea, 1 article from China, 1 article from Taiwan, 1 article from India, 1 article from Singapore, 2 articles from Malaysia, 5 articles from Iran, 1 article from Mongolia, 5 articles from Saudi Arabia, 2 articles from Jordan and 3 articles from Egypt.

Assessment of study quality was carried out quantitatively and qualitatively, this study used a critical appraisal checklist cross-sectional study Joanna Briggs Institute. Critical appraisal which consists of 8 questions. Each answer "Yes" is given a score of 2, the answer "Unclear" is given a score of 1 and the answer "No" is given a score of 0.

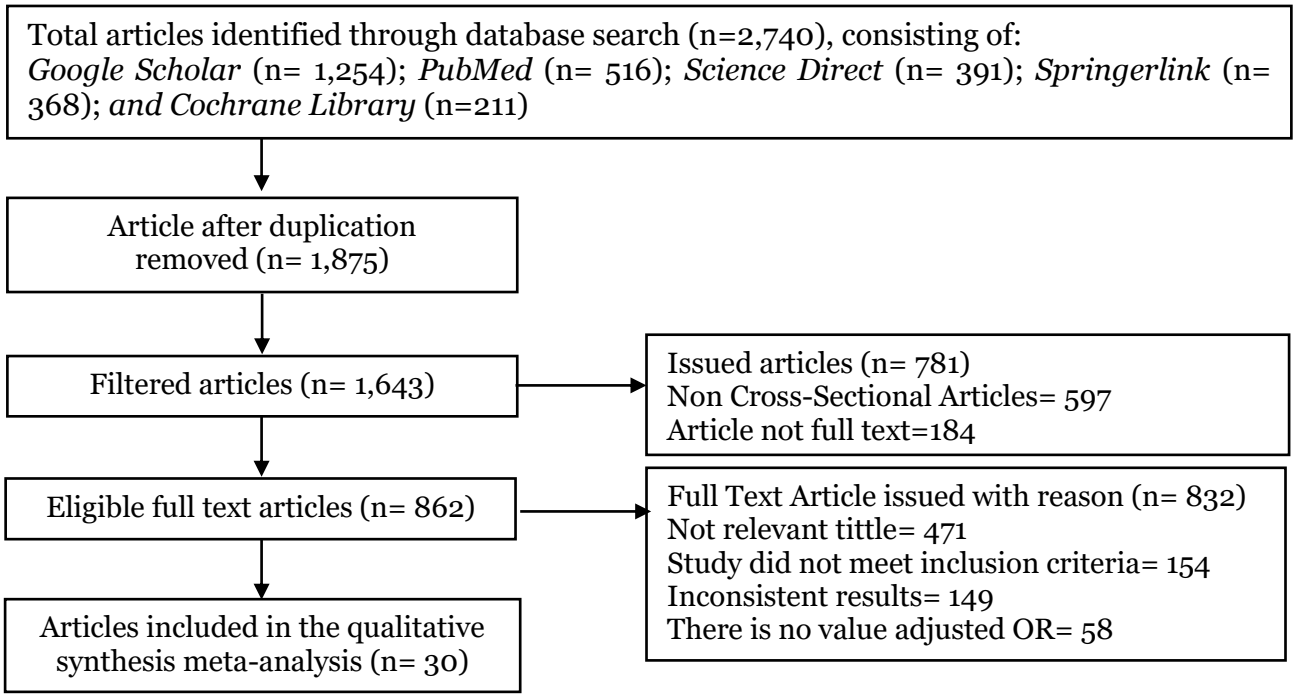

Figure 1. PRISMA flowchart associations between anxiety, depression, and poor quality of sleep on the risk of irritable bowel syndrome

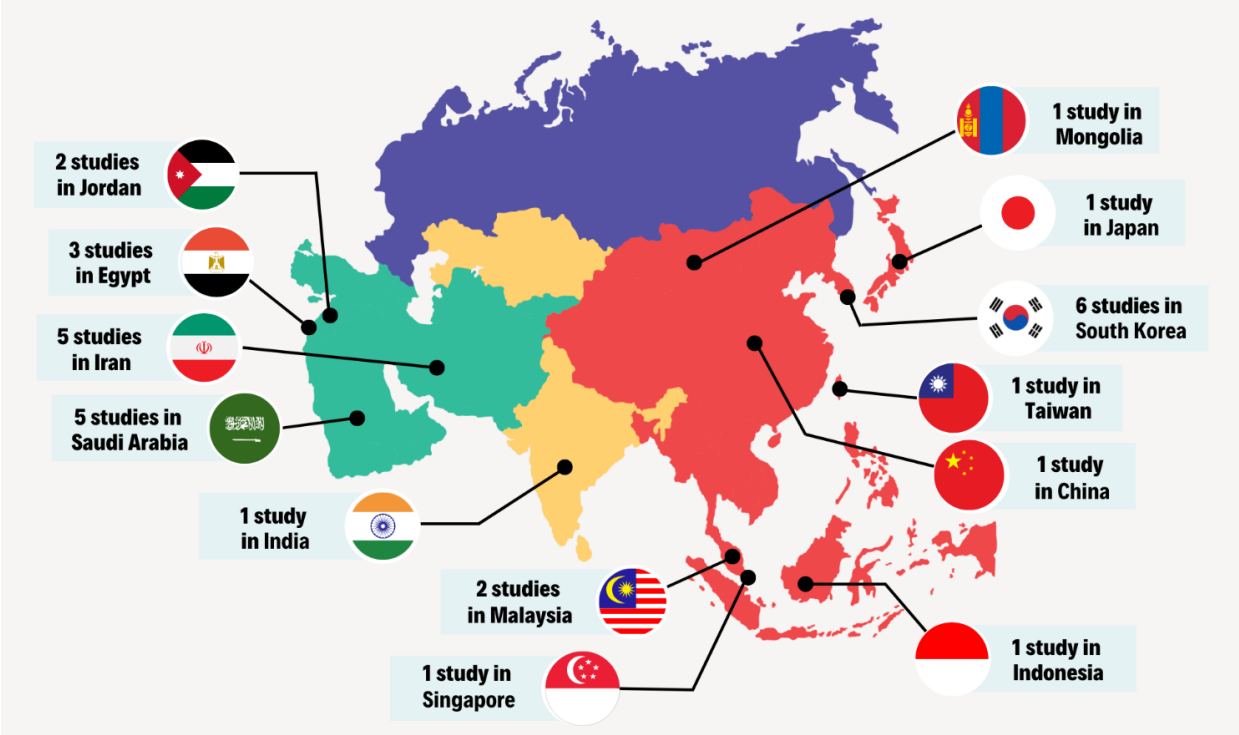

Figure 2. Map of study area on associations between anxiety, depression, and poor quality of sleep on the risk of irritable bowel syndrome

Table 1 shows the assessment of study quality by checklist of cross-sectional studies. Based on the answers from the quality assessment, the total score of the answers ranged from 15 to 16 scores, this indicates that the quality of the article is feasible for meta-analysis.

Table 2 shows the description of each article that will be included in the meta-analysis study, as many as 30 articles used a cross-sectional study that analyzed the relationship between anxiety, depression and poor sleep quality with the risk of irritable bowel syndromes.

Table 1. Results of the quality assessment with a cross-sectional study design of associations between anxiety, depression, and poor quality of sleep on the risk of irritable bowel syndrome

Studies	Question Criteria								
	1	2	3	4	5	6	7	8	Total
Son et al. (2009)	2	2	2	2	2	1	2	2	15
Wang et al. (2012)	2	2	2	2	2	2	2	2	16
Roohafza et al. (2016)	2	1	2	2	2	2	2	2	15
Wang et al. (2016)	2	2	2	2	2	2	2	2	16
Ibrahim et al. (2016)	2	2	2	2	2	2	2	2	16
Abdelsalam (2018)	2	2	2	2	2	1	2	2	15
Elhosseiny et al. (2019)	2	2	2	2	2	2	2	2	16
Jiang et al. (2019)	2	2	2	2	2	2	2	2	16
Sarkar et al. (2020)	2	2	2	2	1	2	2	2	15
Alvand et al. (2020)	2	2	2	2	2	2	2	2	16

Studies	Question Criteria								
	1	2	3	4	5	6	7	8	Total
Seger et al. (2020)	2	2	2	2	2	2	2	2	16
Nanda and Sungono (2020)	2	2	2	2	1	2	2	2	15
Oksoo et al. (2021)	2	2	2	2	2	1	2	2	15
Yousef et al. (2021)	2	2	2	2	2	2	2	2	16
Selim et al. (2022)	2	2	2	2	2	2	2	2	16
Jadallah et al. (2022)	2	2	2	2	2	1	2	2	15
Sharawy et al. (2022)	2	2	2	2	2	2	2	2	16
Alqahtani and Mahfouz (2022)	2	2	2	2	2	2	2	2	16
Hye et al. (2013)	2	2	2	2	2	2	2	2	16
Koh et al. (2014)	2	2	2	2	2	1	2	2	15
Yamamoto et al. (2015)	2	2	2	2	2	2	2	2	16
Lim et al. (2017)	2	2	2	2	2	2	2	2	16
Ibrahim et al. (2018)	2	2	2	2	1	2	2	2	15
Park et al. (2018)	2	2	2	2	2	2	2	2	16
Kim et al. (2018)	2	2	2	2	2	2	2	2	16
Zargar et al. (2019)	2	2	2	2	2	2	2	2	16
Albutaysh et al. (2020)	2	2	2	2	2	2	2	2	16
Chen et al. (2020)	2	2	2	2	2	1	2	2	15
Abdallah and Sharafeddin (2021)	2	2	2	2	2	2	2	2	16
Maghsoudi et al. (2022)	2	2	2	2	1	2	2	2	15

Description of the question criteria:

1 = Are the criteria for inclusion in the sample clearly defined?
2 = Are the research subjects and settings explained in detail?
3 = Is exposure measured in a valid and reliable way?
4 = What are the standard criteria used for measuring objective conditions?
5 = Were confounding factors identified?
6 = Was a strategy for dealing with confounding factors stated?
7 = Are the results measured in a valid and reliable way?
8 = Was proper statistical analysis used?

Answer score description:

0 = No
1 = Can't tell
2 = Yes

Table 2. Summary of primary cross-sectional study with each PICO (N=126,053)

Article	Country	Sample	Rome IBS	P	I	C	O
Son et al. (2009)	South Korea	405	II	Adolescent girls from 5 high schools (grades X–XII) in Korea in August and September 2007.	Anxiety	Not anxiety	IBS
Wang et al. (2012)	Singapore	464	III	Participants of the National Foundation for Digestive Diseases Symposium held at the Raffles City Convention Centre, Singapore on, 2010.	Anxiety	Not anxiety	IBS

Article	Country	Sample	Rome IBS	P	I	C	O
Roohafza et al. (2016)	Iran, Mongolia	4,763	III	Staff Medical Sciences Isfahan University of Medical Sciences Year 2011 and Mongolian Medical University students living in campus dormitoryes April to May 2013.	Anxiety and Depression	Not anxiety and not depression	IBS
Wang et al. (2016)	Saudi Arabia, Malaysia	6,105	III	Nurse at King Abdulaziz University Hospital, Jeddah, Saudi Arabia, 2014 to 2015.	Anxiety and depression	Not anxiety and not depression	IBS
Ibrahim et al. (2016)	Egypt, China India	229	III	Staff of Medical Sciences Isfahan University of Medical Sciences Year 2011 and Mongolian Medical University students living in campus dormitories April to May 2013 and Nurse at King Abdulaziz University Hospital, Jeddah, Saudi Arabia, 2014 to 2015.	Anxiety, depression, and poor sleep quality	Not anxiety, not depression, and good sleep quality	IBS
Abdulsalam (2018)	Iran Malaysia	20	III	Nursing student, Faculty of Nursing at MAHSA University Malaysia, in March to July 2017.	Anxiety and depression	Not anxiety and not depression	IBS
Elhosseiny et al. (2019)	Indonesia	400	III	Student of the Faculty of Medicine, Ain Shams University, located in El-Abassyia, Cairo, Egypt, academic year 2017 to 2018.	Anxiety	Not anxiety	IBS
Jiang et al. (2019)	Korea South	2,449	III	New students of Huazhong University of Science and Technology in Wuhan City.	Anxiety and depression	Not anxiety and not depression	IBS
Sarkar et al. (2020)	Jordan, Saudi Arabia	70	III	Student of the Faculty of Medicine, Ain Shams University, located in El-Abassyia, Cairo, Egypt, academic year 2017–2018.	Anxiety and depression	Not anxiety and not depression	IBS
Alvand et al. (2020)	Jordan Egypt	1,849	III	Residents in 29 cities aged 20-65 years. Through the Comprehensive Integrated Health information system. In October 2016 to November 2018.	Anxiety and depression	Not anxiety and not depression	IBS
Seger et al. (2020)	Saudi Arabia, Korea	372	IV	Medical students Semester 6-9 at private universities in Malaysia, period August-December 2018.	Anxiety and depression	Not anxiety and not depression	IBS
Nanda and Sungono (2020)	South Korea	168	IV	Pelita Harapan University Jakarta medical student class of 2016-2018.	Anxiety and depression	Not anxiety and not depression	IBS
Oksoo et al. (2021)	Japan	890	IV	Participants in the Korea Nurses' Health Study (KNHS) program. Female nurses aged 20-45 years working in Korean hospitals in 2013-2014.	Poor sleep quality	Not poor sleep quality	IBS
Yousef et al. (2021)	Iran, Saudi Arabia	396	IV	Student of the Faculty of Medicine, at Jordan University of Science and Technology (JUST). For 4 months from November 2019-February 2020.	Anxiety and depression	Not anxiety and not depression	IBS
Selim et al. (2022)	South Korea	434	IV	Participants in public settings including malls, markets, and parks were randomly selected, recruited from all five districts of the northern, eastern, western, southern, and central districts of Riyadh, Arabia	Anxiety and depression	Not anxiety and not depression	IBS

Article	Country	Sample	Rome IBS	P	I	C	O
Jadallah et al. (2022)	Iran, Saudi Arabia	1,135	III	Student of the Faculty of Medicine, Jordan University of Science and Technology, and the Faculty of Medicine, Yarmouk University.	Anxiety and poor sleep quality	Not anxiety and good sleep quality	IBS
Sharawy et al. (2022)	Taiwan, Egypt	182	III	Undergraduate or Masters medical students and aged ≥18 years at Tanta and Kafr El-Sheikh Universities, Egypt, in the 2020-2021 academic year	Anxiety and depression	Not anxiety and not depression	IBS
Alqahtani and Mahfouz (2022)	Iran, South Korea	1,680	IV	Saudi Arabian Society. Participants were randomly recruited using a self-reporting questionnaire, during the period in 2019.	Anxiety and depression	Not anxiety and not depression	IBS
Hye et al. (2013)	Singapore	277	III	Nurses and nursing assistants working at Ewha Womans University Hospital, Mok-dong. In December 2010-February 2011.	Poor sleep quality	Good sleep quality	IBS
Koh et al. (2014)	Iran	301	III	Nurses and nursing assistants working at Seoul National University Boramae Medical Center. In July 2012-February 2013.	Poor sleep quality	Good sleep quality	IBS
Yamamoto et al. (2015)	Mongolia, Saudi Arabia	98,411	III	Middle and high school students in Japan. Research data taken in 1996; 2000; 2004; 2007; and 2008.	Poor sleep quality and depression	Good sleep quality and not depression	IBS
Lim et al. (2017)	Malaysia	240	III	A doctor who has experienced 24-hour on-call shifts, who works at Seoul's Boramae University National Hospital 2015 to 2016.	Poor sleep quality	Good sleep quality	IBS
Ibrahim et al. (2018)	Egypt, China	525	III	Paramedic student enrolled at King Abdulaziz University, Jeddah, Saudi Arabia, during the 2016-2017 academic year.	Poor sleep quality and depression	Good sleep quality and not depression	IBS
Park et al. (2018)	India, Iran	420	III	Students at four universities located in Seoul, Gyeonggi-do, and Chungcheong Province. In May and June 2017.	Anxiety and Poor sleep quality	Not anxiety and good sleep quality	IBS
Kim et al. (2018)	Malaysia	2,251	III	Participants in the Korean Genomic Epidemiology Study (KoGES) conducted at the Ansan Hospital of Korea University, June 2001-January 2003.	Poor sleep quality	Good sleep quality	IBS
Zargar et al. (2019)	Indonesia	115	III	IBD patients with IBS who have been in remission at outpatient gastroenterology departments and private gastroenterology offices from 2007 to 2016.	Poor sleep quality	Good sleep quality	IBS
Albutaysh et al. (2020)	Korea	767	IV	Undergraduate students from all regions of Saudi Arabia. In February to June 2018	Poor sleep quality	Good sleep quality	IBS
Chen et al. (2020)	South Jordan	360	III	Patients from the Hualien Tzu Outpatient Clinic of Hualien Tzu Chi Medical Center. In December 2015 to February 2016.	Poor sleep quality and depression	Good Sleep quality And not depression	IBS
Abdallah dan Sharafeddin (2021)	Saudi Arabia	275	IV	Patient with IBS attending the Internal Medicine outpatient clinic, Zagazig University Hospital in 2019	Poor sleep quality	Good sleep quality	IBS
Maghsoudi et al. (2022)	Jordan	100	IV	Medical student at Isfahan university, Iran. Period January 2018 to March 2019.	Poor sleep quality	Good sleep quality	IBS

Tabel 3. Adjusted Odds Ratio (OR) association between anxiety with the risk of irritable bowel syndrome

Studies	aOR	95%CI	
		Lower Limit	Upper Limit
Son et al. (2009)	3.86	0.99	15.05
Wang et al. (2012)	2.39	1.57	3.64
Roohafza et al. (2016)	2.36	1.87	2.98
Wang et al. (2016)	2.38	1.38	4.11
Ibrahim et al. (2016)	2.08	0.77	5.62
Abdelsalam (2018)	1.10	0.97	1.26
Elhosseiny et al. (2019)	1.48	0.85	2.58
Jiang et al. (2019)	0.81	0.59	1.11
Sarkar et al. (2020)	0.98	0.94	1.02
Alvand et al. (2020)	5.50	0.80	37.81
Seger et al. (2020)	1.00	0.39	2.56
Nanda and Sungono (2020)	1.79	0.57	5,58
Yousef et al. (2021)	1.41	0.56	3.56
Selim et al. (2022)	1.87	1.28	2.73
Jadallah et al. (2022)	1.88	1.30	2.72
Sharawy et al. (2022)	4.24	1.03	17.53
Alqahtani and Mahfouz (2022)	0.52	0.38	0.72
Park et al. (2018)	2.02	1.02	4.00

Tabel 4. Adjusted Odds Ratio (OR) association between depression with the risk of irritable bowel syndrome

Studies	aOR	95%CI	
		Lower Limit	Upper Limit
Roohafza et al. (2016)	2.08	1.71	2.53
Wang et al. (2016)	1.00	0.53	1.87
Ibrahim et al. (2016)	0.71	0.25	2.02
Abdelsalam (2018)	0.86	0.75	0.99
Jiang et al. (2019)	1.26	0.64	2.48
Sarkar et al. (2020)	0.69	0.51	0.93
Alvand et al. (2020)	5.10	0.70	37.15
Seger et al. (2020)	4.75	1.81	12.47
Nanda and Sungono (2020)	2.57	1.13	5.88
Yousef et al. (2021)	1.95	0.82	4.63
Selim et al. (2022)	0.96	0.60	1.54
Sharawy et al. (2022)	23.27	2.99	181.00
Alqahtani and Mahfouz (2022)	0.77	0.54	1.12
Yamamoto et al. (2015)	1.62	1.56	1.68
Ibrahim et al. (2018)	1.57	1.05	2.35
Chen et al. (2020)	1.07	1.02	1.12

Tabel 5. Adjusted Odds Ratio (OR) association between poor sleep quality with the risk of irritable bowel syndrome

Studies	aOR	95%CI	
		Lower Limit	Upper Limit
Ibrahim et al. (2016)	2.92	1.31	6.51
Oksoo et al. (2021)	4.15	2.52	6.82
Jadallah et al. (2022)	1.76	1.13	2.74
Hye et al. (2013)	4.13	1.82	9.40
Koh et al. (2014)	1.90	0.87	4.15
Yamamoto et al. (2015)	1.35	1.29	1.41
Lim et al. (2017)	4.17	1.92	9.06
Ibrahim et al. (2018)	1.64	1.11	2.42
Park et al. (2018)	2.01	1.16	3.48
Kim et al. (2018)	1.31	0.75	2.29
Zargar et al. (2019)	0.89	0.82	0.97
Albutaysh et al. (2020)	3.16	1.85	5.38
Chen et al. (2020)	1.19	1.08	1.31
Abdallah and Sharafeddin (2021)	2.79	1.07	7.29
Maghsoudi et al. (2022)	1.30	0.20	8.45

The forest plot shows that there is very high heterogeneity (I^2= 100%; p<0.001), so the data analysis uses the random effect model. Individuals who experience anxiety have a 1.53 times greater risk of developing irritable bowel syndrome than individuals who do not experience anxiety. This data was found to be statistically significant (aOR=1.53; 95% CI= 1.32 to 1.90; p=0.001) (Figure 3).

The funnel plot in Figure 4 shows that the distribution of effect estimates between studies is asymmetric, that is, there is more distribution to the right of the vertical line than to the left. This funnel plot shows that there is publication bias and that publication bias tends to overestimate the actual effect (over estimate).

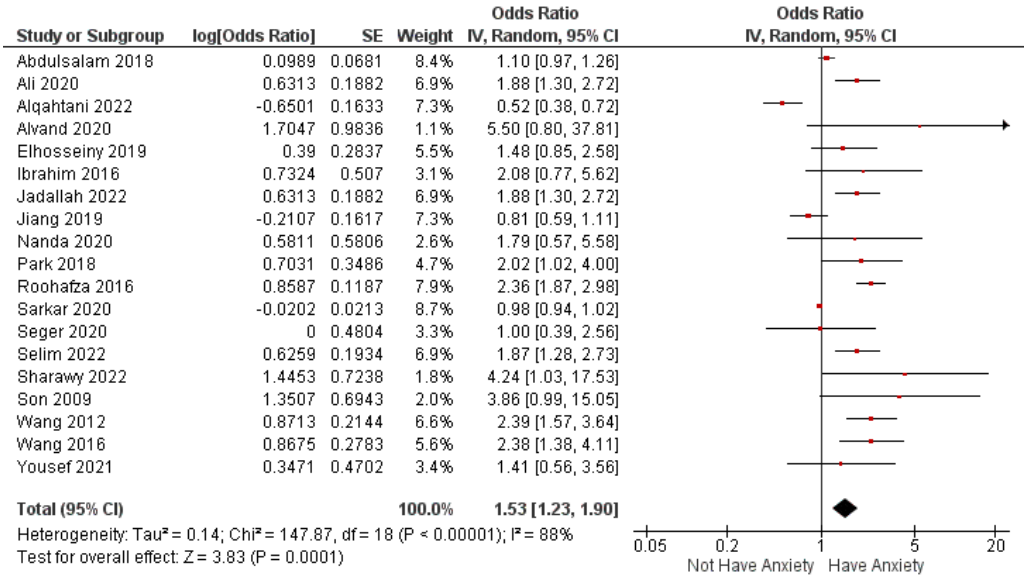

Figure 3. Forest plot anxiety with the risk of irritable bowel syndrome

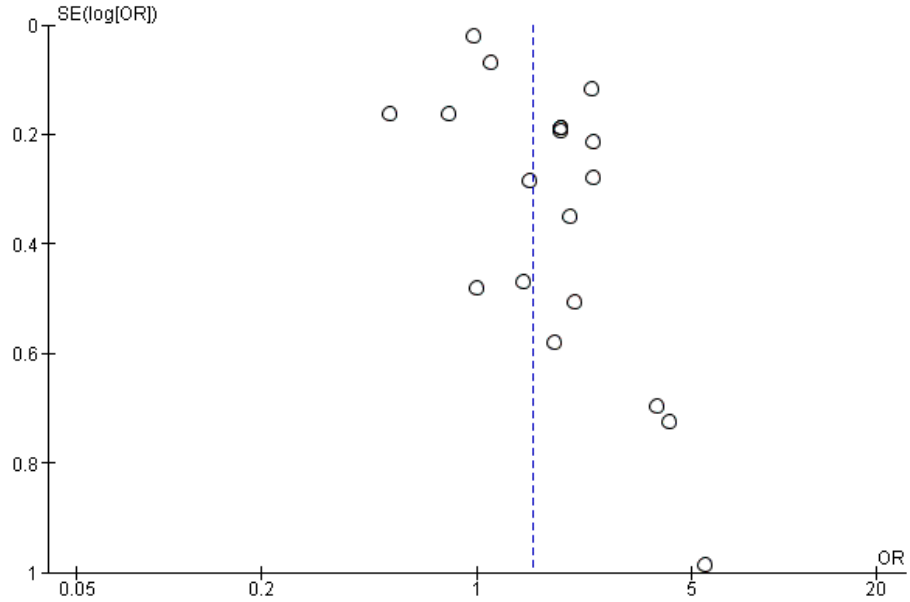

Figure 4. Funnel plot anxiety with the risk of irritable bowel syndrom

The forest plot in Figure 5 shows that there is very high heterogeneity (I^2= 100%; p<0.001), so the data analysis on the forest plot uses the random effect model. Individuals who experience depression have a 1.29 times greater risk of developing irritable bowel syndrome than individuals who do not experience depression. This data was found to be statistically significant and the results were statistically significant (aOR=1 .29; 95% CI= 1.05 to 1.59; p=0.020).

The funnel plot in Figure 6 shows that the distribution of effect estimates between studies is asymmetric, that is, there are more distributions to the left of the vertical line than to the right. This funnel plot shows that there is publication bias and this publication bias tends to overestimate the actual effect.

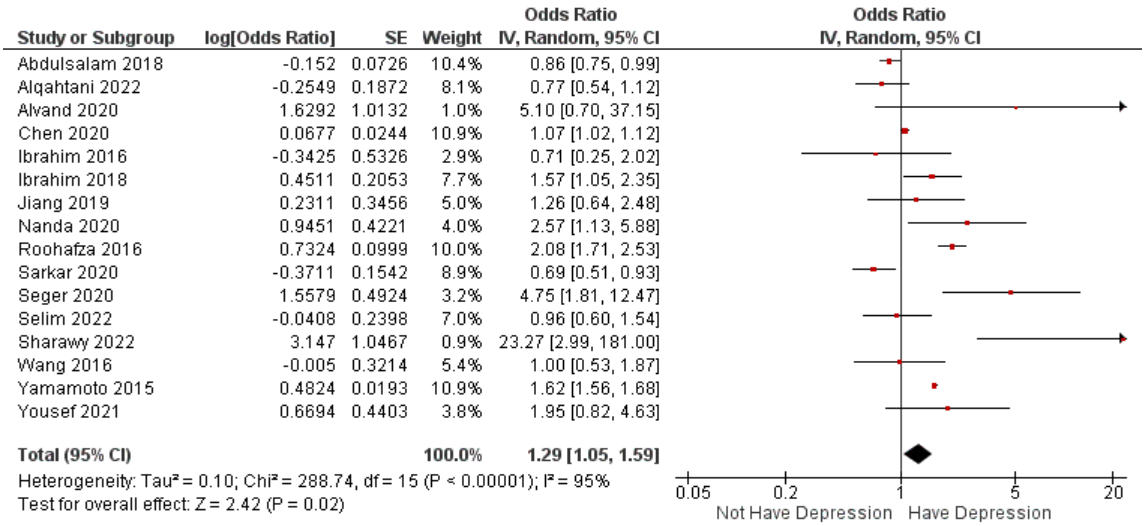

Figure 5. Forest plot depression with the risk of irritable bowel syndrome

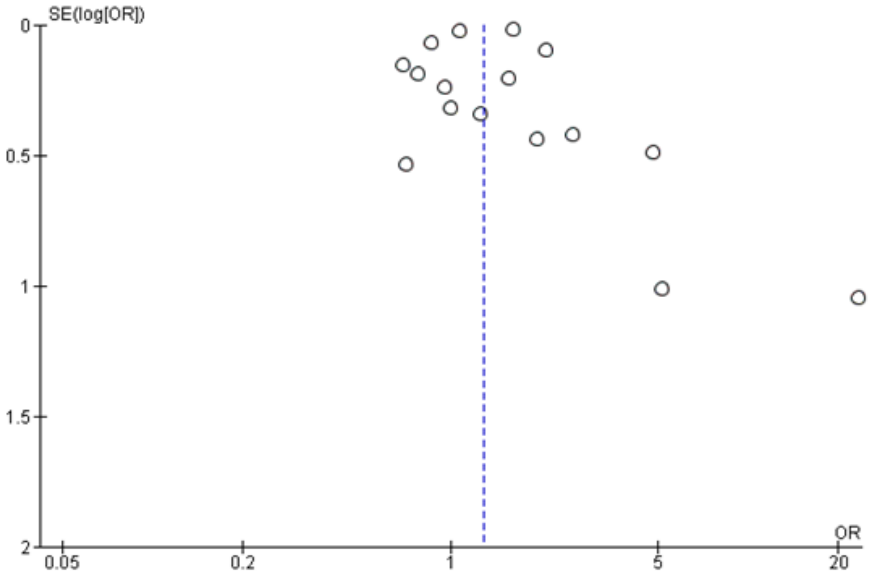

Figure 6. Funnel plot depression with the risk of irritable bowel syndrome

The forest plot in Figure 7 shows that there is very high heterogeneity (I^2=100%; p<0.001), so the data analysis on the forest plot uses the random effect model. Individuals who experience poor sleep quality have a risk of irritable bowel syndrome, 1.80 times greater than individuals who do not experience normal sleep quality. and the result was statistically significant (aOR=1.80; 95% CI= 1.48 to 2.19; p<0.001).

The funnel plot in Figure 8 shows that the distribution of effect estimates between studies is asymmetric, that is, there is more distribution to the right of the vertical line than to the left. This funnel plot shows that there is publication bias and that publication bias tends to overestimate the actual effect (over estimate).

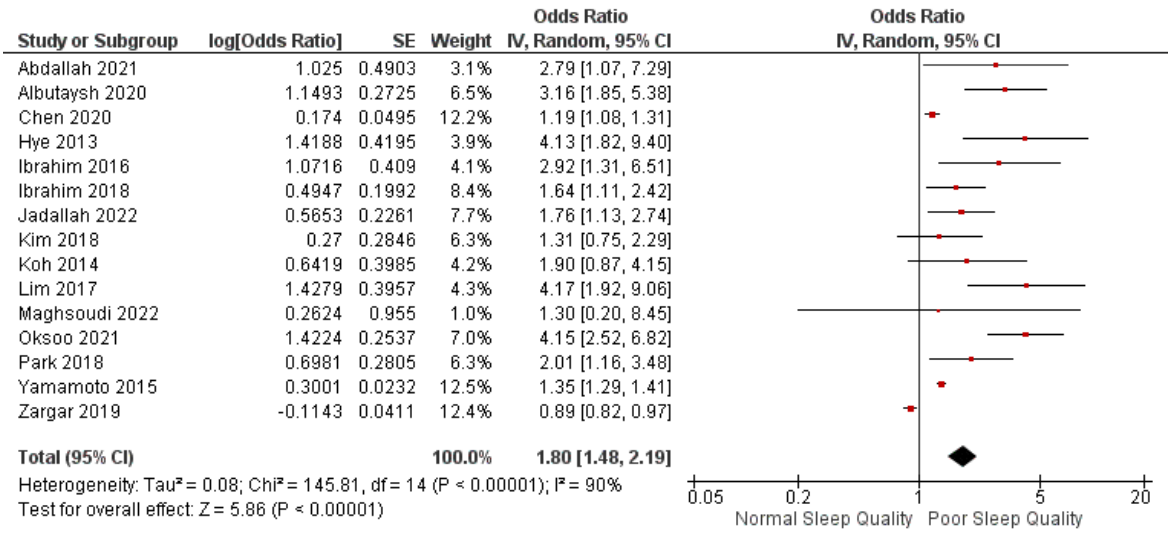

Figure 7. Forest plot of poor sleep quality with the risk of irritable bowel syndrome

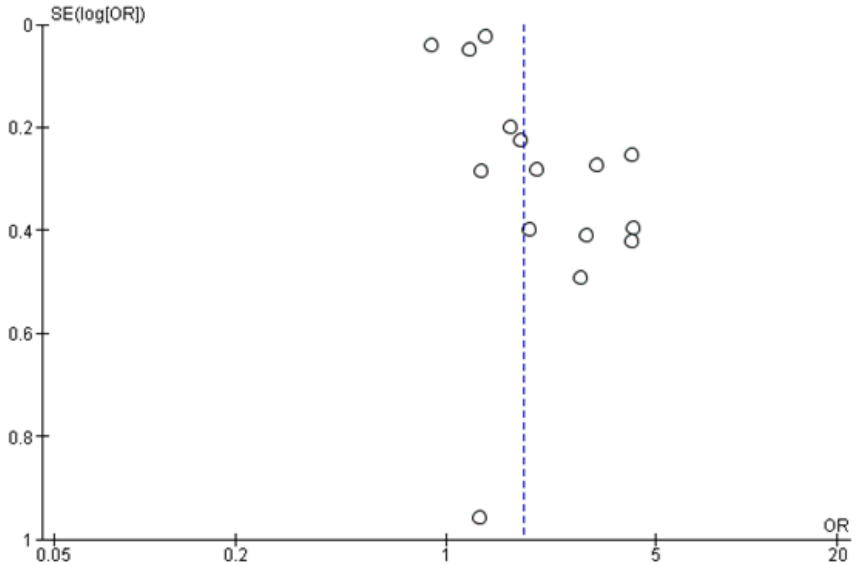

Figure 8. Funnel plot of poor sleep quality with the risk of irritable bowel syndrome

DISCUSSION

1. The Relationship between Anxiety and Depression with the Risk of Irritable Bowel Syndrome

Several studies have reported that there is a relationship between IBS and psychiatric disorders, including neurosis, anxiety, depression and dysfunctional cognition. In a large randomized controlled trial found that 44% of IBS patients had mental disorders, the most common disorder conditions being anxiety and depression (Roohafza et al., 2016).

Anxiety can increase the risk of Irritable Bowel Syndrome, these results are in accordance with the hypothesis. A meta-analysis of 30 articles showed that individuals who experience anxiety have a 1.53 times greater risk of developing Irritable Bowel Syndrome than individuals who do not experience anxiety (aOR=1.53; 95% CI= 1.32 to 1.90; p=0.001). Heterogeneity of effect estimation between primary studies showed I^2=88% (p<0.001) so the analysis used the Random Effect Model (REM).

Depression in IBS patients is felt to be more severe than healthy individuals. In one study, six Gastrointestinal symptoms including abdominal pain, diarrhea, bloating, constipation, loss of appetite, and vomiting coexisted with the psychiatric state of the patients namely major depression (13.4%), panic disorder (12.5%) and agoraphobia (17.8%), in IBS patients psychiatric conditions are commonly found with 2 or more GI symptoms (Roohafza et al., 2016).

Depression can increase the risk of Irritable Bowel Syndrome, these results are in accordance with the hypothesis. A meta-analysis of 30 articles shows that individuals who experience depression have a 1.29 times greater risk of developing Irritable Bowel Syndrome than individuals who do not experience depression. These data (aOR= 1.29; 95% CI= 1.05 to 1.59; p= 0.02). The heterogeneity of effect estimation between primary studies showed I^2 = 95% (p<0.001) so the analysis used the Random Effect Model (REM).

One of the etiologies that underlies the relationship between anxiety and depression in increasing the risk factors for IBS is dysfunction in the interaction of the brain and gut (Gut-Brain Axis). The IBS hypothesis has two models according to the bottom-up model, abdominal symptoms affect anxiety and depression secondarily and according to the top-down model, psychological factors such as stress, and depression themselves influence physiological factors such as motor function, sensory thresholds, and gut stress reactivity through vagal and sympathetic afferent pathways (Banerjee et al., 2017).

Daily activities are related to the recurrence rate of IBS and can increase if followed by criteria, anxiety, or panic disorder (Ballou and Keefer, 2017). Thus, looking for comorbid anxiety and depression in patients with IBS will not only help in understanding this disease better in terms of better treatment outcomes (Banerjee et al., 2017).

2. The Relationship between Poor Sleep Quality and the Risk of Irritable Bowel Syndrome

Sleep disorders affect 50% of patients with IBS. Objective sleep disturbance is a key factor in the onset of IBS symptoms. Sleep quality was also associated with IBS-specific HRQOL. One study found the effect of sleep disturbances on bowel activity, observing associations between sleep disturbances and somatic pain (ie, back pain, headaches, neck pain), depression, and anxiety. Recent studies have shown that sleep disturbances can directly increase visceral hypersensitivity and gastrointestinal symptoms (Patel et al., 2016).

Poor Sleep Quality can increase the risk of Irritable Bowel Syndrome, these results are in accordance with the hypothesis. A meta-analysis of 30 articles showed that individuals who experience poor sleep quality have a 1.80 times greater risk of developing Irritable Bowel Syndrome than individuals who do not experience poor sleep quality (aOR=1.80; 95% CI=1.48 to 2.19; p<0.001). The heterogeneity of effect estimation between primary studies showed I^2= 88% (p<0.001) so the analysis used the Random Effect Model (REM).

The bidirectional relationship between IBS and sleep disturbances results from disease exacerbations. Disruption of circadian rhythms can significantly disrupt gut-brain communication pathways, which can cause changes in cortisol levels that are first early in sleep and peak just before awakening, while at the same time reducing parasympathetic reflexes. Sleep can strengthen long-term memory in the immune system and increase the activity of the complement system (Zargar et al., 2019).

Previous studies shown, sleep quality disturbances are associated with functional gastrointestinal disorders, one of which is IBS. In a study in Saudi Arabia found a statistically significant relationship between IBS and poor sleep quality (aOR= 1.76; p=0.016) (Jadallah, 2022). Another study used Pittsburgh Sleep Quality Index to investigate 956 correspondents with sleep disorders, sleep disturbances were found to be significantly associated with IBS (OR= 1.51; p=0.043) (Hye et al., 2013). In a study from Italy, the authors investigated the relationship between sleep quality and severity of bowel symptoms in 142 IBS patients who met the Rome III criteria. Authors in the study reported a strong positive correlation between the severity of IBS symptoms and sleep disturbances (Bellini et al., 2011).

AUTHOR CONTRIBUTION

Scholar Airedeta Mulianda as the main researcher who chose the topic, conducted a search for data collection in this study. Bhisma Murti and Hanung Prasetya conducted data analysis and reviewed research documents.

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CONFLICT OF INTEREST

There is no conflict of interest in this study.

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