CODEN [USA]: IAJPBB ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

http://doi.org/10.5281/zenodo.2560554

Available online at: http://www.iajps.com ***Research Article***

PREVALENCE OF IRRITABLE BOWEL SYNDROME (IBS) IN ADULTS AND ITS RELATION TO CHANGING IN THE ALTITUDE INTAIF, SAUDIARABIA: A CROSS SECTIONAL STUDY

Mohammed Abdullah Alzahrani [1], Ghasham Salem Almarzoqi[1]*, Ziyad Atiah Almalki[1], Hatim Ahmed Jawad [1], Khaled Mastor Alosaimi [1], Abdulrahman Ghurmullah Almalki [2].

[1]College of Medicine, Taif University, Taif, Saudi Arabia, [2]Community Medicine Department, Taif University, Taif, Saudi Arabia.

Abstract:

Background:*Irritable bowel syndrome (IBS) is a common functional gastrointestinal (GI) disorder with a prevalence of 10% worldwide. There is a noteworthy lack of data from Africa, Eastern Europe and Arab countries especially Saudi Arabia. To date, no report about the effect of Altitude on IBS has been published. Therefore, we aimed to assess the association between altitude and IBS in terms of incidence and symptom severity.*

Methods:*We conducted this cross-sectional study in Taif and Jeddah, Saudi Arabia, in the period from January to February 2018. ROME IV criteria were used to define and classify different subtypes of IBS in patients (>18 years old) with no history of red flag symptoms or any other structural GI disease. Multiple logistic regression analysis was used to determine the significant risk factors of IBS.*

Results:*1802 patients were included in the analysis. IBS showed a prevalence rate of 31.7%. Females had a higher rate of IBS (52.3% vs 47.7%, P-value =0.058). IBS with mixed bowel habits (IBS-M) is the most prevalent type (36.9%). 75.7% of patients had increased severity of symptoms with high altitude. Spicy food is the most common food type to trigger IBS symptoms (32.1%). Living in low altitude (Jeddah) showed a decreased risk of developing IBS compared to high altitude (Taif) (OR =0.07; 95% CI: 0.05-0.09). Patients with no family history were at lesser risk of having IBS (OR =0.47; 95% CI: 0.36-0.63). Lack of physical activity and advancing in age are associated with an increase in the risk of IBS (OR =3.19; 95% CI: 2.34-4.34) (OR =1.01; 95% CI: 1-1.03), respectively.*

Conclusions:*Age, city, residence, marital status, occupation, average monthly income, family history, and physical activity are significant risk factors of IBS. High altitude increases the risk of developing IBS. These findings require further confirmation.*

Keywords: *Irritable bowel syndrome,Altitude,ROME IV criteria,Saudi Arabia.*

Corresponding author:

Dr. Ghasham Salem Almarzoqi

College of Medicine, Taif University, Taif, Saudi Arabia

Phone (or Mobile) No.: +966564481300, Email: dr.ghasham@hotmail.com

QR code

Please cite this article in press Ghasham Salem Almarzoqi et al., ***Prevalence Of Irritable Bowel Syndrome (Ibs) In Adults And Its Relation To Changing In The Altitude Intaif, Saudiarabia: A Cross Sectional Study.,*** *Indo Am. J. P. Sci, 2019; 06(02).*

INTRODUCTION:

Irritable bowel syndrome (IBS) is a common functional gastrointestinal (GI) disorder in which chronic abdominal pain or discomfort is associated with irregularity in stool form and passage in the absence of any organic cause. [1] The cardinal clinical features include recurrent/episodic abdominal pain associated with altered bowel habits; bloating and distension. IBS has no identifiable organic cause and no reliable diagnostic biomarker; thus, the diagnosis is only based on clinical features alone. Therefore, the ROME criteria have been developed to provide uniformity and reproducibility in the clinical definition and diagnosis of IBS. The recent ROME IV diagnostic criteria (published in 2016) defines clearly IBS and divides it into four subtypes: IBS with predominant constipation (IBS-C), IBS with predominant diarrhoea (IBS-D), IBS with mixed bowel habits (IBS-M), and unclassified IBS (IBS-C). [2] IBS is more prevalent in women than in men and has an onset between late teens to twenties, decreasing with age.[3,4] Women are 2-4 times more likely to develop IBS compared to men. [3,5] Many internal and external factors may attribute to the etiology of IBS. The role of food in the pathogenesis of IBS remains unclear, and the effects of food ingestion on the gut-brain axis, immune system, gut microbiota, and digestive process are still under investigation. [6] However, 50% of patients with IBS report postprandial exacerbation of symptoms either as a direct or deferred reaction. [7-9] IBS has a prevalence rate of 10% worldwide. [10] However, little is known about IBS prevalence in Arab countries, especially Saudi Arabia. [11] A cross sectional study conducted among medical students in King Abdulaziz University, Jeddah, Saudi Arabia, using the ROME III criteria revealed a prevalence rate of IBS of 31.8%. [12] More recently, another study conducted in Saudi Arabia showed a prevalence rate of 21% of IBS among medical students. [13] Gastrointestinal disorders are a common occurrence in populations residing in or visiting High Altitude. However, thorough epidemiological studies in this field are lacking due to the remoteness of the terrain, scattered sparse population and the fact that many of these are not urgent life threatening conditions. [14] For the purposes of this study, Taif city (1454 meters above sea level) is classified as a high altitude city, while Jeddah (17 meters above sea level) is defined as low altitude city.To the best of our knowledge, there is no report on the effect of Altitude on IBS incidence or symptom severity. Therefore, we conducted this study to estimate the prevalence of IBS and to assess the relationship between altitude and IBS at the level of two cities: Taif and Jeddah, Saudi Arabia.

METHODS:

This is a cross sectional study to estimate the prevalence ofin adults and its associated risk factors; especially, change in altitude. The study wasconducted in in two of the main cities of the western region of Saudi Arabia; Taif and Jeddah cities during the January 2018 to February 2018. The sample size was calculated according to the total number of the general population of Taif and Jeddah cities using the creative research systems website (https://www.surveysystem.com/sscalc.htm) to calculate a representative sample. The sample size should be 384 with a confidence level (CL) of 95% and confidence interval of 5%. The study included all adult patients (age > 18) living in Taif or Jeddah with no restriction to gender, language, nationality and educational level. Patients with red flag symptoms (bloody stool, Anorexia, Weight loss, Pain Awakening from sleep) or have been diagnosed with structural GIT disease, were excluded from the study.

The study subjects were explained the purpose of thestudy and informed consent was taken from the subjects.A pilot study over 30 participants was performed to test understanding of the participants with determining time needed to answer the questionnaire. The questionnaire used consist of 33 questions having four major sections; demographic data, factors associated with IBS, Rome IV criteria (with determining IBS subtype) and relation to change of altitude.

Data were analysed using Statistical Package for Social Sciences (SPSS), version 25.0 (IBM Inc., Chicago, USA). Descriptive statistics were performed using means and standard deviations, numbers and percentages, depending on data type. For comparison between groups, the chi-square test, and, in case of small values, the Fisher's exact test, was used for nominal data and the Student's t test for independent samples was used for continuous data.Furthermore, multivariate logistic regression was used for analyses to test association between different factors and IBS. These associations were expressed as odds ratio (OR) with 95% confidence intervals (CI). All tests were double-sided, and the level of significance was set at P-value < 0.05.

RESULTS:

The study included 1802 participants with 572 suffering from IBS and 1230 are free. Percentages of both males and females were almost the same with 51% and 49%, respectively. Most of the patients were Saudi (81.58%) living in a city (98.01%) with 49.67% of them being single. Moreover, many of them did not have a regular physical activity (64.54%), did not have any family

member with IBS(75.25%) and only 11.27% were smokers. The most prevalent educational level was bachelor's degree (38.57%) followed by high School or less (30.36%) with only 7.60% being illiterate. Interestingly, there was a statistically significance difference between IBS patient and their normal peers in the aspects of age, city, nationality, residence, marital status, employment status, Monthly income, smoking, physical activity, frequency of visiting a doctor and having a family member with IBS. (Table 1).

The most Prevalent (36.9%)IBS subtype was mixed (IBS-M) followed by diarrheal type (26.6%) (IBS-D), Unknown (21.7%) (IBS-U) and constipation (14.9%), respectively. For Abdominal pain, nearly half of the patients had most of the days (45.1%) which is usually associated with bowl movement (51.2%), change in stool consistency (52.3%) and frequency (33.9%). Furthermore, 75.7% of the patients showed increased severityof the symptoms with high altitude and 71.2% showed decreased severity when being at low altitude. In the same context, spicy foods showed has the highest rate (32.1%) in aspects of triggering IBS symptoms. It was followed by beans (23.1%), dairy products (23.1), fast food (19.2%), chocolate (1.3%) and coffee (1.3%), respectively. (Figure 1).

Multivariate logistic regression analysis showed that the prevalence of IBS was significantly associated with age, city, residence, marital status, occupation, average monthly income, family history of IBS and physical activity. Participants living in Jeddah (low attitude) had less risk of having IBS than their peers in Taif (OR = 0.07; 95% CI: 0.05–0.09). Similarly, single participant (OR = 0.53; 95% CI: 0.29–0.79), non-working students (OR = 0.49; 95% CI: 0.31–0.77) and people who finds their income "enough" (OR = 0.32; 95% CI: 0.19–0.54) were in a decreased risk of developing IBS than their peers. Interestingly, participants with no family history of IBS had a diminished risk of developing IBS compared to those with a positive history (OR = 0.47; 95% CI: 0.36–0.63).On the other hand, participants living in the city (OR = 2.35; 95% CI: 1.55–3.58), having no regular physical activity (OR = 3.19; 95% CI: 2.34–4.34) and with advancing in age (OR = 1.01; 95% CI: 1–1.03); had an increased risk of developing IBS. (Table 2).

DISCUSSION:

The results of this study show a relatively high prevalence of IBS of 31.7% in our study population. This rate is somewhat comparable to what has been reported in the literature. A meta-analysis conducted in 2012 using variable diagnostic criteria (Manning, ROME I, ROME II) reported an overall prevalence rate of 11.2%, ranging from 1.1% to 45%. [10] Moreover, in 2016, a systematic review of IBS in Arab countries (Saudi Arabia, Egypt, Iran) showed a prevalence rate ranging from 8.9% to 31.8%. [15] In the same context, a cross-sectional study conducted in Jeddah, Saudi Arabia among medical students revealed a high prevalence of IBS (ROME III) of 31.8%. [12] Meanwhile, another study conducted in Qassim region, Saudi Arabia reported a prevalence rate of IBS (ROME III) of 40.7% among school teachers. [16] More recently, a literature review carried out by the ROME foundation reported an overall pooled prevalence of 8.8%, however, they stated that such rates different substantially at a country level from 1.1% in France and Iran to 35.5% in Mexico. [11] Such differences may be attributed to variation in sample sizes, settings, diagnostic criteria, method of data collection, and overall research methodology.
Based on ROME IV classification of IBS subtypes, [2] IBS with mixed bowel habits (IBS-M) was the most prevalent type in our study followed by IBS with predominant diarrhea (IBS-D), unclassified (IBS-U), and IBS with predominant constipation (IBS-C), respectively.

In aspects of triggering IBS symptoms, our analysis revealed that spicy food had the highest rate of provoking IBS symptoms followed by beans, dairy products, and fast food, respectively. Carbohydrates and fatty foods, together with caffeine, alcohol and spices are reported to be potential triggers of IBS. [17] However, to date, only a few studies have examined the effect of different foods on triggering IBS symptoms. A cross sectional study across a large sample of Iranian adults found that consumption of spicy food increased the risk of developing IBS by a 2-fold, compared to patients not consuming any spicy food. [18] Diet has been widely known to play a significant role in the pathophysiology of IBS as food allergy/ hypersensitivity, poorly absorbed carbohydrates and fiber, and obesity co-morbidity. [19] Such relationship is attributed to the effect of diet on intestinal microbiota, inflammation, motility, permeability, and visceral hypersensitivity. [20] However, due to the lack of adequately powered and well-designed randomized controlled trials pertaining to dietary intervention in IBS, more work is needed to address this address this point and to provide more clear-cut guidance. [6]

Our results show that IBS was slightly more prevalent in females. A systematic review pooling the results of 80 studies showed that the prevalence of IBS was higher for women than men. However, the exact reason behind this difference remains uncertain. [10] A possible explanation for this might lie in the various socio-cultural features of

included patients such as health care seeking behaviour, or it may be due to actual biological differences. It is also notable that several, if not all, comorbid diseases related to IBS also share to this female prevalence. Most common diseases are fibromyalgia, [21] migraine, [22] other functional GI disorders such as functional dyspepsia, [23] chronic pelvic pain, [24] chronic fatigue syndrome, [25] and depression; [26] all have sex ratio skewed towards female gender. [27] Also, various hypotheses have been proposed to explain the higher prevalence of IBS in women; higher serotonin synthesis in the brain, [28] Female sex hormones' effect on gastrointestinal motility. [29]

Age, city, residence, marital status, occupation, average monthly income, family history of IBS, and physical activity are significant risk factors of IBS, based on our multivariate logistic regression model. Advancing in age showed a slight increase in the risk of contracting IBS in our population. Another study detected an increase in the incidence of IBS with age. [30] This could be explained by the fact that older patients are more likely to have medical encounters due to their higher risk of multiple illnesses. [31] Therefore, the potential exists that the high risk and incidence of IBS in older patients may be a reflection of the increased healthcare seeking behaviour. Single/unmarried patients had a reduced risk of developing IBS in our study. Evidence suggests that marital status is a significant determinant of IBS. Controversially, Mansouri et al. reported a higher prevalence and risk of IBS in single and divorced people than in their married counterparts. [32] Such differences could be attributable to the varying amount of responsibilities and the subsequent stresses they behold in these groups. Our results show that participants with enough monthly income had reduced risk of developing IBS. Our finding is consistent with what has been reported in another study which stated that low income and low overall socioeconomic condition is associated with IBS. [33] Stress in these low income/ not enough income groups could play a role. Our analysis revealed that participants with no family history of IBS had a diminished risk of developing IBS. Evidence suggests a familial role of IBS among the general population. [34,35] The strength of this association does vary somewhat by relationship to proband, but the lack of association in spouses support either a possible genetic underlying aetiologyor a shared household environmental exposure as an underlying cause of IBS. [35] Lack of physical activity resulted in more than triple the risk of developing IBS in our population. Our results go in line with a randomized controlled trial conducted among the general population which showed that physical activity led to much fewer complaints in terms of symptoms. [36] Supporting the protective effect of regular physical activity in case of IBS, many studies demonstrated that physical activity is shown to improve IBS symptoms whereby physical active IBS patients have much less symptom exacerbation. [17,36] Moreover, it is reported to relive gas-related symptoms in patients suffering from abdominal bloating. [37]

Gastrointestinal disorders are a common occurrence in populations residing in or visiting High Altitude. However, thorough epidemiological studies in this field are lacking due to the remoteness of the terrain, scattered sparse population and the fact that many of these are not urgent life threatening conditions. [14] To the best of our knowledge, this is the first study to address the altitude as a contributable factor to IBS in terms of occurrence and symptom severity. Upon analysing the effect of changes in altitude on the magnitude of IBS symptoms, majority of our patients showed an increase in the severity of the symptoms with high altitude, while most patients living at a low altitude had a reduction in symptom severity. In the multivariate regression model, patients living in Jeddah (low altitude) had a significant substantial reduction in the risk of developing IBS compared to their peers living in Taif (higher altitude). Further studies are needed to determine the accuracy of our finding and to examine the effect of altitude on the pathophysiology of IBS.

Our study has several strengths. First, we ruled out all patients who had organic/structural GIT disorders. Second, the data were of high quality. Third, the large sample size in our study allowed us to evaluate subpopulations and to determine the effect of different risk factors on developing IBS. On the other hand, we faced several limitations. One of which is that data were collected through self-administered questionnaires. Moreover, other factors known to be associated with IBS were not addressed, such as depression, stress, anxiety, alcohol consumption, and smoking.

In conclusion, our population had a prevalence rate of IBS of 31.7%. The most prevalence IBS subtype is IBS with mixed bowel habits. Age, city, residence, marital status, occupation, average monthly income, family history, and physical activity are risk factors of IBS. High altitude was associated with increase in the severity of IBS symptoms, while patients living in low altitude had reduced risk of developing IBS. We recommend that Altitude as an attributable risk factor to IBS should be furtherly and thoroughly addressed in future work.

ACKNOWLEDGEMENTS:
The authors would like to thank our collecting data

team Dr. Alhanoufsalim, Dr. Ahmed AlGhamdi,Dr. ZainelabdinElaidarous, Dr. Areej Abdullah, Dr. AlbandariAlThubaiti, Dr. JehanSarriyah, Dr. AbdulhameedSarriyah, Dr. Abdullah Al-Sharif and Dr. RaadAlsharif, without them our work wouldn't have been possible. We would like to also thank Taif University and the Family Medicine Department as well as the Community Medicine Department for their guidance and support throughout the work.

DECLARATIONS:

Funding: None
Conflict of interest: No conflict of interest
Ethical approval: Approved by the ethical committee of Taif University

REFERENCES:

1. Mearin F, Lacy BE, Chang L, et al. Bowel Disorders. *Gastroenterology.* 2016.
2. Drossman DA, Hasler WL. Rome IV—functional GI disorders: disorders of gut-brain interaction. *Gastroenterology.* 2016;150(6):1257-1261.
3. Choung RS, Locke GR, 3rd. Epidemiology of IBS. *Gastroenterology clinics of North America.* 2011;40(1):1-10.
4. Whitehead WE, Drossman DA. Validation of symptom-based diagnostic criteria for irritable bowel syndrome: a critical review. *The American journal of gastroenterology.* 2010;105(4):814-820; quiz 813, 821.
5. Chang L, Heitkemper MM. Gender differences in irritable bowel syndrome. *Gastroenterology.* 2002;123(5):1686-1701.
6. Hayes PA, Fraher MH, Quigley EMM. Irritable Bowel Syndrome: The Role of Food in Pathogenesis and Management. *Gastroenterology & Hepatology.* 2014;10(3):164-174.
7. Cabre E. Irritable bowel syndrome: can nutrient manipulation help? *Current opinion in clinical nutrition and metabolic care.* 2010;13(5):581-587.
8. Morcos A, Dinan T, Quigley EM. Irritable bowel syndrome: role of food in pathogenesis and management. *Journal of digestive diseases.* 2009;10(4):237-246.
9. Ragnarsson G, Bodemar G. Pain is temporally related to eating but not to defaecation in the irritable bowel syndrome (IBS). Patients' description of diarrhea, constipation and symptom variation during a prospective 6-week study. *European journal of gastroenterology & hepatology.* 1998;10(5):415-421.
10. Lovell RM, Ford AC. Global prevalence of and risk factors for irritable bowel syndrome: a meta-analysis. *Clinical Gastroenterology and Hepatology.* 2012;10(7):712-721. e714.
11. Sperber AD, Dumitrascu D, Fukudo S, et al. 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):1075-1082.
12. Ibrahim NKR, Battarjee WF, Almehmadi SA. Prevalence and predictors of irritable bowel syndrome among medical students and interns in King Abdulaziz University, Jeddah. *Libyan Journal of Medicine.* 2013;8(1):21287.
13. Alaqeel MK, Alowaimer NA, Alonezan AF, Almegbel NY, Alaujan FY. Prevalence of irritable bowel syndrome and its association with anxiety among medical students at King Saud bin Abdulaziz University for Health Sciences in Riyadh. *Pakistan journal of medical sciences.* 2017;33(1):33.
14. Anand A, Sashindran V, Mohan L. Gastrointestinal problems at high altitude. *Tropical Gastroenterology.* 2006;27(4):147.
15. Alosaimi M, Ali A, Razzak HA. Epidemiology of Irritable Bowel Syndrome; A Systematic Review of Literature. *Journal of Health Informatics in Developing Countries.* 2016;10(1).
16. AlKhalifah MI, Al-Aql AM, Al-Mutairi MS, et al. Prevalence of irritable bowel syndrome among Qassim school teachers, and its impact on their performance and life duties. *Saudi medical journal.* 2016;37(7):817.
17. Costanian C, Tamim H, Assaad S. Prevalence and factors associated with irritable bowel syndrome among university students in Lebanon: Findings from a cross-sectional study. *World Journal of Gastroenterology : WJG.* 2015;21(12):3628-3635.
18. Esmaillzadeh A, Keshteli AH, Hajishafiee M, Feizi A, Feinle-Bisset C, Adibi P. Consumption of spicy foods and the prevalence of irritable bowel syndrome. *World Journal of Gastroenterology : WJG.* 2013;19(38):6465-6471.
19. El-Salhy M, Gundersen D. Diet in irritable bowel syndrome. *Nutrition journal.* 2015;14(1):36.
20. Ibrahim NK. A systematic review of the prevalence and risk factors of irritable bowel syndrome among medical students. *Turk J Gastroenterol.* 2016;27(1):10-16.
21. McCarberg BH. Clinical overview of fibromyalgia. *American Journal of Therapeutics.* 2012;19(5):357-368.
22. Lipton RB, Stewart WF, Scher AI. Epidemiology and economic impact of migraine. *Current medical research and opinion.* 2001;17(sup1):s4-12.
23. Flier SN, Rose S. Is functional dyspepsia of particular concern in women? A review of gender differences in epidemiology, pathophysiologic mechanisms, clinical

presentation, and management. *The American journal of gastroenterology*. 2006;101(s3):S644.
24. Walker E, Gelfand A, Gelfand M, Green C, Katon W. Chronic pelvic pain and gynecological symptoms in women with irritable bowel syndrome. *Journal of Psychosomatic Obstetrics & Gynecology*. 1996;17(1):39-46.
25. Dinos S, Khoshaba B, Ashby D, et al. A systematic review of chronic fatigue, its syndromes and ethnicity: prevalence, severity, co-morbidity and coping. *International journal of epidemiology*. 2009;38(6):1554-1570.
26. Grigoriadis S, Erlick Robinson G. Gender issues in depression. *Annals of Clinical Psychiatry*. 2007;19(4):247-255.
27. Unruh AM. Gender variations in clinical pain experience. *Pain*. 1996;65(2-3):123-167.
28. Park DW, Lee OY, Shim SG, et al. The Differences in Prevalence and Sociodemographic Characteristics of Irritable Bowel Syndrome According to Rome II and Rome III. *Journal of neurogastroenterology and motility*. 2010;16(2):186-193.
29. Wald A, Van Thiel DH, Hoechstetter L, et al. Gastrointestinal transit: the effect of the menstrual cycle. *Gastroenterology*. 1981;80(6):1497-1500.
30. Talley NJ, O'Keefe EA, Zinsmeister AR, Melton LJ. Prevalence of gastrointestinal symptoms in the elderly: a population-based study. *Gastroenterology*. 1992;102(3):895-901.
31. Camilleri M, Lee JS, Viramontes B, Bharucha AE, Tangalos EG. Insights into the pathophysiology and mechanisms of constipation, irritable bowel syndrome, and diverticulosis in older people. *Journal of the American Geriatrics Society*. 2000;48(9):1142-1150.
32. Mansouri A, Rarani MA, Fallahi M, Alvandi I. Irritable bowel syndrome is concentrated in people with higher educations in Iran: an inequality analysis. *Epidemiology and Health*. 2017;39:e2017005.
33. Bytzer P, Howell S, Leemon M, Young L, Jones MP, Talley N. Low socioeconomic class is a risk factor for upper and lower gastrointestinal symptoms: a population based study in 15 000 Australian adults. *Gut*. 2001;49(1):66-72.
34. Heitkemper MM, Kohen R, Jun S-E, Jarrett ME. Genetics and gastrointestinal symptoms. *Annual review of nursing research*. 2011;29(1):261-280.
35. Saito YA, Petersen GM, Larson JJ, et al. Familial aggregation of irritable bowel syndrome: a family case–control study. *The American journal of gastroenterology*. 2010;105(4):833.
36. Johannesson E, Simren M, Strid H, Bajor A, Sadik R. Physical activity improves symptoms in irritable bowel syndrome: a randomized controlled trial. *The American journal of gastroenterology*. 2011;106(5):915-922.
37. Villoria A, Serra J, Azpiroz F, Malagelada JR. Physical activity and intestinal gas clearance in patients with bloating. *The American journal of gastroenterology*. 2006;101(11):2552-2557.

Table 1: Distribution of baseline socio-demographic and behavioural characteristics and factors associated with irritable bowel syndrome prevalence n (%)

Variable		IBS		Not IBS		Total		P-Value¶
		N	%	N	%	N	%	
Age		37 (14.25)		34 (14.10)		35 (14.21)		< 0.001¥,**
City	**Jeddah**	79	13.81%	786	63.90%	865	48.00%	< 0.001**
	Taif	493	86.19%	444	36.10%	937	52.00%	
Nationality	**Non-Saudi**	38	6.64%	289	23.50%	327	18.15%	< 0.001**
	Saudi	534	93.36%	941	76.50%	1475	81.85%	
Residence	**City**	526	91.96%	1078	87.64%	1604	89.01%	0.006*
	Town/Village	46	8.04%	152	12.36%	198	10.99%	
Gender	**Female**	299	52.27%	584	47.48%	883	49.00%	0.058
	Male	273	47.73%	646	52.52%	919	51.00%	
Marital Status	**Single**	232	40.56%	663	53.90%	895	49.67%	< 0.001**
	Married	239	41.78%	424	34.47%	663	36.79%	
	Divorced	46	8.04%	80	6.50%	126	6.99%	
	Widow	55	9.62%	63	5.12%	118	6.55%	
Number of people in the house	**0-5**	328	57.34%	690	56.10%	1018	56.49%	0.189
	5-10	218	38.11%	457	37.15%	675	37.46%	
	> 10	26	4.55%	83	6.75%	109	6.05%	
Employment Status	**Unemployed**	117	20.45%	222	18.05%	339	18.81%	< 0.001**
	Unable to work due to disability	39	6.82%	50	4.07%	89	4.94%	
	Student (not working)	85	14.86%	282	22.93%	367	20.37%	
	Student (working)	55	9.62%	157	12.76%	212	11.76%	
	Employed	243	42.48%	447	36.34%	690	38.29%	
	Retired	33	5.77%	72	5.85%	105	5.83%	
Average Monthly Income	**No income**	38	6.64%	122	9.92%	160	8.88%	< 0.001**
	Enough	178	31.12%	528	42.93%	706	39.18%	
	Less than enough	278	48.60%	442	35.93%	720	39.96%	
	More than enough	78	13.64%	138	11.22%	216	11.99%	
Educational Level	**Illiterate**	50	8.74%	87	7.07%	137	7.60%	0.062
	High school / or less	165	28.85%	382	31.06%	547	30.36%	

	Diploma	94	16.43%	158	12.85%	252	13.98%	
	Bachelor's	222	38.81%	473	38.46%	695	38.57%	
	Master	27	4.72%	89	7.24%	116	6.44%	
	PHD	14	2.45%	41	3.33%	55	3.05%	
Number of rooms in your house	**1-3**	175	30.59%	312	25.37%	487	27.03%	0.006*
	4-6	235	41.08%	494	40.16%	729	40.46%	
	7-9	110	19.23%	248	20.16%	358	19.87%	
	10 or more	52	9.09%	176	14.31%	228	12.65%	
Smoking	**No**	432	75.52%	764	62.11%	1196	66.37%	< 0.001**
	Yes	140	24.48%	466	37.89%	203	11.27%	
Regular Physical Activity	**No**	458	80.07%	705	57.32%	1163	64.54%	< 0.001**
	Yes	114	19.93%	525	42.68%	639	35.46%	
Family Members Diagnosed with IBS	**No**	522	91.26%	1103	89.67%	1625	90.18%	< 0.001**
	Yes	48	9.00%	46	10.00%	94	10.00%	
Abdominal/Pelvic Surgery	**No**	476	83.22%	1023	83.17%	1499	83.19%	0.981
	Yes	96	16.78%	207	16.83%	303	16.81%	
Visiting Doctor	**I do not see a doctor**	162	28.32%	265	21.54%	427	23.70%	< 0.001**
	Only as needed	326	56.99%	825	67.07%	1151	63.87%	
	Regularly (check-ups)	84	14.69%	140	11.38%	224	12.43%	
Family Members Diagnosed with IBS	**No**	391	68.36%	965	78.46%	1356	75.25%	< 0.001**
	Yes	181	31.64%	265	21.54%	446	24.75%	

Table 2: Multivariate logistic regression analysis of risk factors of IBS.

Variables	Regression co-efficient (β)	Standard error (S_β)	Wald chi-square	P-value	AOR (95% CI)
Intercept	-1.20	0.69	3.05	0.081	-
Age	0.01	0.01	3.92	0.048*	1.01 (1-1.03)
City (Jeddah)	-2.66	0.15	311.88	< 0.001**	0.07 (0.05-0.09)
Residence (City)	0.86	0.21	16.14	< 0.001**	2.35 (1.55-3.58)
Gender (Female)	0.10	0.13	0.63	0.428	1.11 (0.86-1.44)
Marital Status (Single)	-0.64	0.31	4.21	0.040*	0.53 (0.29-0.97)
Occupation (Student/Not working)	-0.72	0.23	9.68	0.002*	0.49 (0.31-0.77)
Average Monthly Income (Enough)	-1.15	0.27	17.94	< 0.001**	0.32 (0.19-0.54)
Educational Level	0.13	0.47	0.08	0.778	1.14 (0.45-2.87)
Smoking	-0.09	0.27	0.10	0.753	0.92 (0.54-1.57)
No Family History of IBS	-0.75	0.14	27.40	< 0.001**	0.47 (0.36-0.63)
No Regular Physical Activity	1.16	0.16	54.22	0	3.19 (2.34-4.34)

AOR= Adjusted OR; * P-value < 0.05; ** P-value < 0.001

Figure 1: Prevalence of IBSsubtypes, associated symptoms and triggering factors (%)