

# From Knowledge to Action: Pharmacists' Cognitive and Practical Responses to Micronutrient Deficiency in Irritable Bowel Syndrome Patients

Hala Saad Bash\*

\*Department of Pharmacognosy, College of Pharmacy, University of Babylon, Hillah, Iraq ;

[hala.saad@uobabylon.edu.iq](mailto:hala.saad@uobabylon.edu.iq), ORCID: <https://orcid.org/0000-0002-8675-350X>

\*Corresponding author: Hala Saad Bash, Department of Pharmacognosy, College of Pharmacy, University of Babylon, Hillah, Iraq; E-mail: [hala.saad@uobabylon.edu.iq](mailto:hala.saad@uobabylon.edu.iq) ; Tel.: +964-07708050971.

## Abstract

*Background: Globally, irritable bowel syndrome (IBS) influences an estimated 4% to 10% of the population. Patients with IBS are vulnerable to micronutrient deficiencies as a result of inadequate dietary intake and impaired intestinal absorption. Aims: This study aimed to assess pharmacists' knowledge, attitude, and practice (KAP) regarding micronutrient deficiencies among patients with IBS, as well as to ascertain factors associated with KAP scores. Methods: This study was a cross-sectional study conducted between October 2025 and March 2026. Data were collected from pharmacists working in community pharmacies in Babil Province. The KAP questionnaire comprised of four sections. Results: The total of 66 out of 80 pharmacists were included in this cross-sectional survey. The results demonstrated that the high proportion of pharmacists had moderate knowledge (36.4%), moderate attitude (65.2%), and good practice (51.5%). A significant positive correlation was reported between scores for knowledge and attitude and between knowledge and practice scores. A significant positive correlation was also demonstrated between attitude and practice scores. Conclusion: The present study demonstrated that the high proportion of pharmacists had moderate knowledge and attitudes as well as good practice regarding micronutrient deficiencies.*

**Keywords:** Attitude, irritable bowel syndrome, knowledge, micronutrient deficiencies, practice

## Introduction

One of the prevalent chronic gastrointestinal disorder is irritable bowel syndrome (IBS). It is characterized as a dysfunction of brain-gut interaction and associated with a decrease in patients' quality of life [1][2]. Globally, IBS influences an estimated 4% to 10% of the population. The altered bowel habits, abdominal pain, diarrhea or constipation are the common features of IBS. IBS exhibits in three primary bowel habit prototypes: constipation-principal IBS, diarrhea-principal IBS, and mixed-type IBS [3]. Several evidences indicate that many factors attributed to pathophysiology of IBS, including visceral hypersensitivity, triggering of immune system, food sensitivities, decreased in gut motility, gut microbiome alteration [4]. Patients with IBS are vulnerable to micronutrient deficiencies as a result of inadequate dietary intake and impaired intestinal absorption. Deficiencies are particularly common for vitamin D, B-complex vitamins, iron, and zinc. These micronutrients play essential roles in immune regulation, neurological function, and cellular metabolism; consequently, their deficiency has been associated with cognitive impairment, and dysfunction of multiple organ systems [5][6]. Several studies have demonstrated an inverse association

between serum level of vitamin D and the severity of IBS symptoms, implying that higher levels of vitamin D may related to milder psychological symptoms. Vitamin D is considered to improve the IBS manifestations through improving immune function and reducing psychological symptoms [7][8][9]. A study conducted among patients with IBS indicated that zinc deficiency may reduce the digestion and absorption of carbohydrates and could be associated with pathology of IBS [10].

Since there are no specific biomarkers or laboratory tests for the specific diagnosis of IBS, this highlights the significant role of pharmacists in patients education and in the reduction and prevention of drug-related problems (DRPs) [11][12]. Most studies have demonstrated the impact of clinical or community pharmacists' knowledge, attitude and practices (KAP) on the management of patients with IBS [12][13][14]. However, there is a lack of studies assessing pharmacists' KAP regarding micronutrient deficiencies in IBS. Therefore, the enhancement of IBS treatment approaches as well as reduction of hospitalization necessitate an improvement of proficiencies of pharmacists in the future studies. This study aimed to assess pharmacists' KAP regarding micronutrient deficiencies among patients with IBS, as well as to ascertain factors associated with KAP scores.

## **Materials and Methods**

### **Study Design and Settings**

This study was a cross-sectional study conducted between October 2025 and March 2026. Data were collected from pharmacists working in community pharmacies in Babil Province. The study employed an online questionnaire developed based on an extensive review of the literature regarding micronutrients deficiency among patients with IBS [5][10][12][15][16]. All pharmacists who had worked in community pharmacies for at least one month, despite of whether they also held roles in hospital, clinical, or academic settings, and who authorized to contribute in the study were included. Pharmacists who were not working in community pharmacies or who declined to participate were excluded. The total of 66 out of 80 pharmacists were included in the study after excluding those who participated in the pilot study and those who refused or did not complete the questionnaire. Ethical approval for the conduct of the study was obtained from College of Pharmacy, University of Babylon. Participation was voluntary, and participants' anonymity and confidentiality were strictly preserved.

### **Data Collection**

The KAP questionnaire comprised of four sections. Pharmacists' socio-demographic characteristics, including age, gender, educational qualification, years of experience in pharmacy practice, type of practice setting, and whether they had received any formal training in nutrition or dietary supplement counseling, were addressed in the first section. The subsequent three sections, involving 30 items. Each 10 items have assessed pharmacists' knowledge, attitude, and their practices concerning micronutrient deficiency associated with IBS. The validity of the questionnaire was reported by Pharmacy specialists. Additionally, the questionnaire demonstrated adequate reliability (Cronbach's alpha = 0.82) as a consequence of a pilot study performed among 10 pharmacists.

### **Statistical Analysis**

The Statistical Package for Social Sciences (SPSS, version 24) was employed in analysis of the data of research. The normality test was employed to evaluate the distribution of data. For expression of continuous data, median and interquartile range was employed. The frequency (N) and percentage (%) were utilized for representation of categorical data. For evaluating the score of knowledge, the one point was indicated for each correct answer. The total knowledge's score (0 to 10) was categorized into three categories according to Bloom's cutoff points, involving poor (0 to 5), moderate (6 to 7), and good (8 to 10). The total scores for both of attitude and practice were ranged from 10 to 50 as each item was assigned according to 5 points Likert scale. The total score was presented as three categories, involving poor (10 to 33), moderate (34 to 41), and good (42 to 50). A statistical significant results were exhibited at p-value smaller than 0.05.

Spearman's correlation test was employed for evaluation of association between scores of KAP. The factors affecting on knowledge, attitude, as well as practice scores were investigated through utilization of Kruskal-Wallis and Mann-Whitney U tests.

## Result and discussion

### Results

About 66 out of 80 online questionnaires were included in the research, the response rate was reported responsible (82.5%). The participants were male (56.1%) and female (43.9%). Table 1 demonstrated that 47% of the pharmacists were aged  $\leq 25$  years, followed by 45.5% aged 26-30 years, while only 7.6% were aged 31-40 years. Regarding educational qualifications, the majority of participants confined a Bachelor of Pharmacy (B.Pharm) degree. A smaller proportion of respondents held postgraduate degrees, including (12.1% and 4.5%) 12.1% holding a Doctor of Philosophy (Ph.D.) and 4.5% having a Master of Science (M.Sc.), degree. The majority of respondents (53%) specified having one to three years of experience in pharmacy practice. Additionally, 19.7% had less than one years of experience, and 18.2% had four to six years of experience. A smaller proportion of participants (9.1%) indicated seven to ten years of experience. On the other hand, the high proportion of respondents (63.6%) worked in community pharmacists only. The 21.2%, 9.1%, and 6.1% of respondents have held additional roles in hospital, clinical, and academic setting, respectively. The majority of participants (59.1%) reported having participated in nutrition training, while 40.9% indicated that they had not received any such training.

**Table 1. Pharmacists' socio-demographic and clinical characteristics (n=66)**

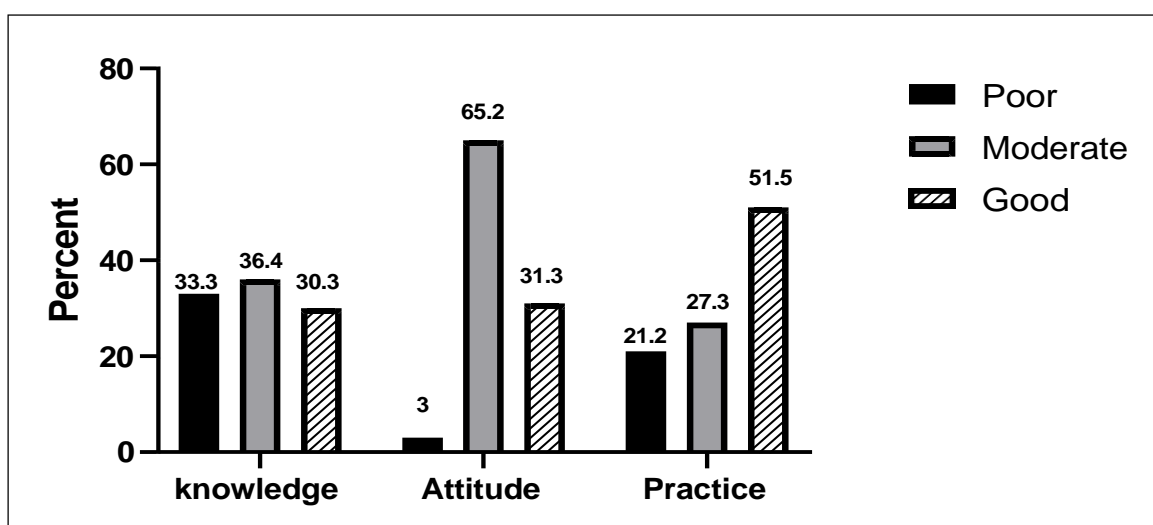
Variable	Subcategories	Frequency (N)	Percent (%)
Age	$\leq 25$	31	47
	26-30	30	45.5
	31-40	5	7.6
Gender	Male	37	56.1
	Female	29	43.9
Educational qualification	B.Pharm	55	83.3
	M.Sc.	3	4.5
	Ph.D.	8	12.1
Pharmacy practice experience (years)	<1	13	19.7
	1-3	35	53
	4-6	12	18.2
	7-10	6	9.1
Practice setting type	Community	42	63.6
	Hospital	14	21.2
	Clinical	6	9.1
	Academic	4	6.1
Participation in formal nutrition training	Yes	39	59.1
	No	27	40.9
Abbreviations: B.Pharm (Bachelor of Pharmacy), M.Sc. (Master of Science), Ph.D. (Doctor of Philosophy).			

Table 2 showed that the median knowledge score of pharmacists was six out of ten (IQR=3). The median attitude score was 40.5 out of 50 (IQR=6.25). Finally, the median practice score was 42 out of 50 (IQR=9.25).

**Table 2. Demonstration of Pharmacists' knowledge, attitude, and practice scores (n=66)**

Variable	Median	IQR
Total score of knowledge	6	3
Total score of attitude	40.5	6.25
Total score of practice	42	9.25
IQR= Interquartile range (Q75-Q25)		

When the KAP scores were categorized into three levels (poor, moderate, and good), the finding of this research revealed that the majority of pharmacists exhibited moderate knowledge (36.4%), followed by 33.3% who verified poor knowledge and 30.3% who exhibited good knowledge regarding micronutrient deficiency among patients with IBS. Regarding attitudes concerning micronutrient deficiency, the analysis exhibited that the highest proportion of pharmacists (65.2%) had a moderate level of attitude, while a smaller proportion (31.8%) exhibited a good attitude. Only 3% of pharmacists had a poor attitude. In terms of practice, the results revealed that the majority of pharmacists (51.5%) demonstrated good practice in managing patients with IBS who suffer from micronutrient deficiency. Lower proportion of participants demonstrated moderate (27.3%) and poor (21.2%) levels of practice as shown in Fig.1.

**Fig. 1. Clustered bar chart of knowledge, attitude, and practice categories (n=66)**

Spearman's rank correlation analysis was performed to assess associations among KAP scores. The results demonstrated a statistically significant weak positive correlation between knowledge and attitude scores ( $r = 0.281$ ,  $p = 0.023$ ) and between knowledge and practice scores ( $r = 0.244$ ,  $p = 0.048$ ). Furthermore, a statistically significant moderate positive correlation between attitude and practice scores ( $r = 0.515$ ,  $p < 0.001$ ). These findings propose that pharmacists' attitude may persuade their practices in managing micronutrient deficiencies among patients with IBS as illustrated in Table 3.

**Table 3. Correlation among knowledge, attitude, and practice scores among pharmacists (n = 66)**

Variables	r	p-value
Knowledge and Attitude scores	0.281	0.023*
Knowledge and Practice scores	0.244	0.048*
Attitude and Practice scores	0.515	< 0.001*
r = Spearman's rank correlation coefficient ( $\rho$ ), * Statistically significant at $p < 0.05$ .		

Table 4 reported that age, gender, educational qualification, periods of experience in pharmacy practice, types of practice setting, and participation in nutrition training were not significantly associated with knowledge and attitude scores. On the other hand, participation in nutrition training was just demographic variable significantly associated with pharmacists' practice ( $p = 0.02$ ). Other variables, involving age, gender, talents in education, periods of experience in pharmacy practice, and types of practice setting, were

not significantly associated with practice score.

**Table 4. Association between demographic variables with knowledge, attitude, and practice scores**

Variable	N (%)	Knowledge score Median[IQR]	Attitude score Median[IQR]	Practice score Median[IQR]
<b>Age</b>				
≤25	31 (47%)	6 [3]	40 [5]	42 [9]
26-30	30 (45.5%)	6 [3]	41 [8]	40.5 [11]
31-40	5 (7.6%)	5 [3]	41 [5]	43 [8]
<i>p</i> -value <sup>a</sup>		0.55	0.74	0.272
<b>Gender</b>				
Male	37 (56.1%)	6 [3]	40 [9]	40 [11]
Female	29 (43.9%)	7 [3]	41 [5]	42 [8]
<i>p</i> -value <sup>b</sup>		0.27	0.93	0.64
<b>Educational qualification</b>				
B.Pharm	55 (83.3%)	6 [3]	40 [5]	42 [9]
M.Sc.	3 (4.5%)	6	44	42
Ph.D.	8 (12.1)	6 [5]	39 [10]	40.5 [12]
<i>p</i> -value <sup>a</sup>		0.94	0.88	0.89
<b>Pharmacy practice experience (years)</b>				
<1	13 (19.7%)	6 [3]	41 [4]	42 [5]
1-3	35 (53.0%)	6 [3]	40 [6]	42 [10]
4-6	12 (18.2%)	6.5 [2]	43.5 [8]	39.5 [10]
7-10	6 (9.1%)	5 [1]	36.5 [7]	42 [15]
<i>p</i> -value <sup>a</sup>		0.19	0.16	0.51
<b>Practice setting type</b>				
Community	42 (63.6%)	6 [3]	40 [6]	41 [10]
Hospital	14 (21.2%)	6.5 [3]	41 [6]	43 [7]
Clinical	6 (9.1%)	5 [1]	39 [8]	41 [10]
Academic	4 (6.1%)	8 [4]	43.5 [16]	44.5 [6]
<i>p</i> -value <sup>a</sup>		0.174	0.726	0.08
<b>Participation in formal nutrition training</b>				
Yes	39 (59.1%)	6 [3]	41 [7]	43 [6]
No	27 (40.9%)	6 [2]	40 [5]	40 [9]
<i>p</i> -value <sup>b</sup>		0.54	0.6	0.02*
* Statistically significant at $p < 0.05$ , <sup>a</sup> Kruskal-Wallis test, <sup>b</sup> Mann-Whitney U test				

## Discussion

Micronutrient deficiencies, including vitamin B12, Vitamin B9, iron, and vitamin D was prevalent among 50% of patients with IBS [17]. As the essential responsibilities of pharmacists in the monitoring and mitigation of micronutrient deficiencies, evaluating their KAP is important for determining gaps and enlightening targeted educational interventions, consequently improving patient counseling training and clinical outcomes among patients with IBS [18].

The present study revealed that the majority of pharmacists had a moderate knowledge (36.4%) regarding micronutrient deficiency among patients with IBS, whereas 33.3% showed poor knowledge and 30.3% exhibited good knowledge. These findings specify the presence of a gap in pharmacists' knowledge regarding micronutrients deficiencies, which may influence the appropriateness of their dietary recommendation. Although no directly comparable studies were indicated, similar trends were demonstrated in studies evaluating understanding of pharmacists concerning micronutrients or vitamin deficiencies. A similar finding was reported by Suleiman and colleagues' research, which found that a higher proportion of pharmacists (37%) demonstrated good knowledge regarding the importance of

nutrition as a therapeutic approach for diseases in general, although the study did not specifically address IBS [19]. Another Sudanese study conducted among pharmacists demonstrated that the majority (78.6%) had a good understanding of IBS and its diagnosis; however, they reported inadequate knowledge regarding the role of nutrition and lifestyle modification in managing the disease [16]. On the other hand, considering the pharmacists' attitudes in monitoring and managing of micronutrients deficiencies and their role in providing consultation about proper usage of dietary supplements and avoiding their side effects, the study demonstrated that the highest proportion of pharmacists (65.2%) had a moderate level of attitude, while a smaller proportion (31.8%) exhibited a good attitude. Only 3% of pharmacists had a poor attitude. Similar study reported that the majority of pharmacists (55%) exhibited positive attitude regarding IBS [16]. Another study conducted among Turkish community pharmacists revealed that, despite of their positive attitudes with regard to celiac disease, their knowledge and practice endured insufficient [20]. The present research findings demonstrated that the majority of pharmacists (51.5%) practically good in managing patients with IBS who suffer from micronutrient deficiency. These results were harmonious with earlier research, that has exhibited that a high proportion of pharmacists are confident that the combination of nutritional and pharmacological approaches are effective in the treatment of various diseases [21]. However, other studies have indicated findings that dissimilar to the present study, demonstrating insufficient expertise among pharmacists regarding micronutrients deficiencies as well as celiac disease [20][22].

The pharmacists' knowledge regarding micronutrient deficiencies influences on their attitude and practice in managing patients with IBS as reported in the results of the present study. The results reported a statistically significant weak positive correlation between knowledge and attitude scores and between knowledge and practice scores. Furthermore, a statistically significant moderate positive correlation between attitude and practice scores. These results are coherent with those of a cross-sectional study conducted among pharmacists and physicians to assess their KAP regarding IBS, which demonstrated that their knowledge significantly inspired both attitudes and practices, as well as the influence of attitudes on practice [23]. The findings of the present study were not parallel with study conducted among pharmacists about recommended dosage of micronutrients that reported the uncorrelated relationship between their knowledge and attitudes [24].

Regarding the factors affecting the pharmacists' KAP, the present study exhibited that age, gender, educational qualification, periods of experience in pharmacy practice, types of practice setting, and participation in nutrition training were not significantly associated with knowledge and attitude scores. The present study was parallel with previous study conducted among pharmacists exhibited that their knowledge regarding recommended daily need for micronutrients does not influenced by their educational level or periods of experience or practice [24]. This study was not consistent with another study conducted among Ethiopian pharmacists revealed that age, education level, years of work in pharmacy are significantly influence on pharmacists' knowledge considering nutritional supplements [25]. Another study indicated that the majority of pharmacists are female and demonstrated a good knowledge [16].

The present study demonstrated that participation in nutrition training was just demographic variable significantly associated with pharmacists' practice. The present study was inconsistent with previous studies, which indicated that confidence of pharmacist in their experience, pharmacists' gender, their educational skills, economic factor, and practice setting are the motivated factors that impact on their practice [26][27][28][29]. The limited sample size as well as participation of pharmacists of a specific city were the major limitations of this research. A study conducted in several cities and with participation of larger pharmacists are suggested in future researches.

## **Conclusions**

The present research exhibited that the majority of pharmacists exhibited moderate knowledge, moderate attitude, and good practice regarding the aspect of micronutrient deficiency accompanying with IBS. Furthermore, their knowledge was significantly correlated with their attitudes and their practices. Finally, this study highlights the responsibilities of pharmacists for motivation of quality of life among IBS patients.

## **Acknowledgment**

The author provided gratitude for all pharmacists who participated in this study.

## **Conflict of interest**

None to declare.

## References

- [1] E. A. Mayer, H. J. Ryu, and R. R. Bhatt, “The neurobiology of irritable bowel syndrome,” *Mol. Psychiatry*, vol. 28, no. 4, pp. 1451–1465, 2023.
- [2] K.-Y. Huang, F.-Y. Wang, M. Lv, X.-X. Ma, X.-D. Tang, and L. Lv, “Irritable bowel syndrome: Epidemiology, overlap disorders, pathophysiology and treatment,” *World J. Gastroenterol.*, vol. 29, no. 26, pp. 4120–4135, Jul. 2023, doi: 10.3748/wjg.v29.i26.4120.
- [3] K. B. Greer and S. Sultan, “Irritable Bowel Syndrome,” *Ann. Intern. Med.*, vol. 178, no. 8, pp. ITC113–ITC128, Aug. 2025, doi: 10.7326/ANNALS-25-01965.
- [4] S. Bek, Y. N. Teo, X. Tan, K. H. R. Fan, and K. T. H. Siah, “Association between irritable bowel syndrome and micronutrients: A systematic review,” *J. Gastroenterol. Hepatol.*, vol. 37, no. 8, pp. 1485–1497, 2022.
- [5] B. Roth, E. Larsson, and B. Ohlsson, “Poor intake of vitamins and minerals is associated with symptoms among patients with irritable bowel syndrome,” *J. Gastroenterol. Hepatol.*, vol. 37, no. 7, pp. 1253–1262, 2022.
- [6] M. Camilleri and A. C. Ford, “Irritable Bowel Syndrome: Pathophysiology and Current Therapeutic Approaches,” *Handb. Exp. Pharmacol.*, vol. 239, pp. 75–113, 2017, doi: 10.1007/164\_2016\_102.
- [7] A. Abbasnezhad *et al.*, “Association of serum vitamin D concentration with clinical symptoms and quality of life in patients with irritable bowel syndrome,” *J. Am. Coll. Nutr.*, vol. 38, no. 4, pp. 327–333, 2019.
- [8] K. C. Cara, S. F. Taylor, H. F. Alhmly, and T. C. Wallace, “The effects of vitamin D intake and status on symptom severity and quality-of-life in adults with irritable bowel syndrome (IBS): a systematic review and meta-analysis,” *Crit. Rev. Food Sci. Nutr.*, vol. 65, no. 25, pp. 4994–5007, 2025.
- [9] M. Abuelazm *et al.*, “The effect of vitamin D supplementation on the severity of symptoms and the quality of life in irritable bowel syndrome patients: a systematic review and meta-analysis of randomized controlled trials,” *Nutrients*, vol. 14, no. 13, p. 2618, 2022.
- [10] I. A. Hujoel, “Nutritional status in irritable bowel syndrome: a North American population-based study,” *JGH Open*, vol. 4, no. 4, pp. 656–662, 2020.
- [11] H. S. Bash and I. S. Rabea, “Impact of clinical pharmacist intervention on tamoxifen-related problems among breast cancer women in Babil Province,” *Pharmakeftiki*, vol. 37, no. 2S, 2025.
- [12] L. Mahmoudi, M. Shafiekhani, H. Dehghanpour, and R. Niknam, “Community pharmacists’ knowledge, attitude, and practice of Irritable Bowel Syndrome (IBS): the impact of training courses,” *Adv. Med. Educ. Pract.*, pp. 427–436, 2019.
- [13] V. D. Thong, N. Ngoc Phuc, and B. T. H. Quynh, “Effectiveness of educational intervention carried out by clinical pharmacists for the quality of life of patients with irritable bowel syndrome: a randomized controlled trial,” *JGH Open*, vol. 5, no. 2, pp. 242–248, 2021.
- [14] F. Lupascu, L. A. Herciu, S.-M. Tatarusanu, I.-M. Vasincu, and L. Profire, “The role of the pharmacist in the prevention of gastrointestinal diseases,” *Rom. J. Pharm. Pract.*, vol. 14, pp. 7–10, 2021.
- [15] S. L. Gold, L. G. Rabinowitz, L. Manning, L. Keefer, W. Rivera-Carrero, S. Stanley, *et al.*, “High prevalence of malnutrition and micronutrient deficiencies in patients with inflammatory bowel disease early in disease course,” *Inflamm. Bowel Dis.*, vol. 29, no. 3, pp. 423–429, 2023.

- [16] T. E.-D. A. Hummada, A. M. D. Daf-Elseed, S. A. A. Ali, F. A. Y. Ebrahim, D. J. M. A. Hassan, G. O. H. Abd El-Raheem, and M. A. H. Al Amin,, “Knowledge, attitude and practice of community pharmacists toward irritable bowel syndrome, Sudan,” *Sci. African*, vol. 23, p. e02023, 2024.
- [17] R. Weisshof and I. Chermesh, “Micronutrient deficiencies in inflammatory bowel disease,” *Curr. Opin. Clin. Nutr. Metab. Care*, vol. 18, no. 6, pp. 576–581, 2015.
- [18] B. Shah and S. Shah, “Practical recommendations on micronutrient deficiencies in gastrointestinal diseases,” *J. Nutr. Res.*, vol. 11, no. 2, pp. 53–61, 2023.
- [19] M. A. Suleiman, I. Abdulwase, K. A. Tukur, Z. B. Umar, S. S. Muhammad, M. M. Ladan, *et al.*, “Evaluating the competency of community pharmacists in identifying and managing malnourished patients: A cross sectional survey,” *Explor. Res. Clin. Soc. Pharm.*, vol. 12, p. 100341, 2023.
- [20] E. A. Orunç and M. Arslan, “Evaluation of knowledge, attitudes, and practices of community pharmacists toward celiac disease,” *J. Fac. Pharm. Ankara Univ.*, vol. 47, no. 3, pp. 935–943, 2023.
- [21] E. A. Belachew, B. S. Shibe, A. M. Tefera, and S. A. Wondm, “Community pharmacy professionals’ knowledge, attitude, and practice toward nutrition and lifestyle counseling in Gondar City, Ethiopia,” *SAGE Open Med.*, vol. 12, p. 20503121241256570, 2024.
- [22] M. Medhat, N. Sabry, and N. Ashoush, “Knowledge, attitude and practice of community pharmacists towards nutrition counseling,” *Int. J. Clin. Pharm.*, vol. 42, no. 6, pp. 1456–1468, 2020.
- [23] T. Wang, C. Wu, L. Wang, and Y. Tang, “Knowledge, attitude, and practice of healthcare professionals towards irritable bowel syndrome: a multicenter, cross-sectional study,” *Sci. Rep.*, vol. 14, no. 1, p. 29128, 2024.
- [24] R. Soni, V. Shah, S. Kapadia, N. Chavda, and T. Yogi, “Knowledge of recommended dietary allowances for micronutrients among health professionals of Ahmedabad City, India,” *Int. J. Manag. Public Policy Res.*, vol. 2, no. SpecialIssue, pp. 10–17, 2023.
- [25] Y. K. Emiru, Y. B. Belay, G. K. Bizuneh, and H. G. Tegegn, “Community pharmacists’ knowledge, attitude, and professional practice behaviors towards dietary supplements: results from multi-center survey in Ethiopia,” *Nutr. Diet. Suppl.*, vol. 11, pp. 59–68, 2019, doi: 10.2147/NDS.S222114.
- [26] S. M. Ajabnoor, S. Zaher, R. Malatani, and H. Jawa, “Exploring the practice of nutritional support during hospitalization across physicians, dietitians, and pharmacists based in Saudi Arabia,” *Front. Nutr.*, vol. 10, p. 1149727, 2023.
- [27] J. F. Mertens, E. S. Koster, V. H. M. Deneer, M. L. Bouvy, and T. van Gelder, “Factors influencing pharmacists’ clinical decision making in pharmacy practice,” *Res. Social Adm. Pharm.*, vol. 19, no. 9, pp. 1267–1277, Sep. 2023, doi: 10.1016/j.sapharm.2023.05.009.
- [28] J. K. Jackson, S. Y. Hussainy, and C. M. J. Kirkpatrick, “Identification of major factors in Australian primary care pharmacists’ practice environment that have a bearing on the implementation of professional models of practice,” *Aust. Health Rev.*, vol. 41, no. 4, pp. 378–383, Aug. 2017, doi: 10.1071/AH16080.
- [29] S. Satibi, E. H. Daulay, G. A. Oviani, K. Erlianti, A. Fudholi, and D. A. Puspadari, “Performance analysis of pharmacist and influencing factors in the era of national health insurance at Puskesmas,” *J. Manag. Pharm. Pract.*, vol. 8, no. 1, p. 32, 2018.