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Healthcare professionals' familiarity, perceptions, attitudes, and obstacles towards the use of prebiotics and probiotics

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ABSTRACT

Objective: This study aimed to investigate healthcare providers' (HCPs) knowledge and practice toward probiotics. Method: This cross-sectional study involved 294 randomly targeted pharmacists, physicians, and dentists in different health care settings (Mosul/Iraq) using an online questionnaire forum from April 2023 to July 2023. The questionnaire was divided into four main branches; demographic characteristics, familiarity, and experience, probiotic use perception and barriers against prescribing probiotics. Results: The majority (92.9%) of participants were aware of the definition of probiotics, over 77% were mindful of probiotics gastrointestinal health-effectiveness while 33.3% were aware of their dental usefulness. Around 26.8% indicated they would recommend probiotics to their patients, 4.0% refused to advise patients of using probiotics and 7.8% preferred to prescribe antibiotics over probiotics. The main reason of not prescribing probiotics was unfamiliarity with the availability of probiotics products (22.1%). The majority of HCPs (72.4%) showed their interest in broadening their knowledge about pre- and probiotics. Conclusion: This study showed that participants have insufficient knowledge to make them confident of prescribing probiotics. Tutoring HCPs regarding the use of probiotics is substantial to boost patients' wellbeing.

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INTRODUCTION

As it has been defined by the Food and Agriculture Organization (FAO) of the United Nations and World Health Organization, probiotics are "live microorganisms that, when administered in adequate amounts, confer a health benefit on the host"[1]. The general concept of using probiotics has been increasing recently owing to their health-beneficial effects. These effects involve alleviating a number of gastrointestinal problems such as lactose intolerance, traveler's diarrhea, gastritis, and enteritis[2]. Probiotics have also been shown effective in some oral health issues such as mal-odor, periodontitis, gingivitis, and dental caries[3]. In addition, probiotics have been investigated and demonstrated activity in a number of different diseases such as autoimmune diseases (allergy and type 2 diabetes mellitus) and chronic diseases such as chronic urogenital infections, skin infections, chronic liver diseases, over-weight, and hypercholesterinemia[4-11].

The global sales of probiotic products have been expected to grow by 48% (approximately from $2.7 billion in 2011 to $4 billion in 2016) and by 66% in 2020[12]. In spite of this global sale expansion, marketing of probiotics is poorly evaluated by the food and drug administration (FDA)[13]. Since healthcare providers (HCPs) have a substantial role in patients' health-education, their knowledge and attitudes regarding probiotics as therapy or co-therapy is vital. Additionally, exploring HCPs clinical practice trend of probiotics can aid in spotting the main obstacles preventing them from prescribing probiotics alongside prebiotics and help in addressing these barriers. HCPs knowledge, attitudes, and practice towards prescribing probiotics to their patients have been investigated in a number of studies all over the world[14-18]. However, no satisfactory data regarding HCPs of Iraq is available. Herein, the main aim of this survey-based study was to assess HCPs knowledge and attitudes toward probiotic use and to determine the potential barricades averting their clinical use in health settings.

METHODOLOGY

Participants and questionnaire

The study was a network sampling cross-sectional study directed to the HCPs in Mosul/Iraq, including pharmacists, physicians, and dentists working in academia, hospitals, private health sectors or even retirees who were working in the medical field. The study was conducted using an online questionnaire forum[19,20] from April 2023 to July 2023, starting with a pilot testing for content validity and rest-rest reliability (for memory and testing effect). The

questionnaire was delivered first to a small number of participants and adjusted gradually benefiting from the previous literature review and related investigations[21,22] to chive a reliability and content validity indices (CVI) of 0.7 for both. Basically, the questionnaire was divided into four main branches. The first one (demographic characteristics) was subdivided into further five questions about participants age, gender, profession, practice setting, and years in practice. Familiarity and experience was the second branch and this branch included questions regarding the participants' general knowledge and background about probiotics and prebiotics definition and effectiveness. The third and fourth branches were about probiotic use perception and barriers against prescribing probiotics from the participants' perspective. All questions were answered anonymously, and participants had the freedom to skip questions they did not want to answer. Ethical approval was obtained by the Ethical Approval Committee of the University of Mosul (EACUM) prior to performing the study, and all participants signed an online informed consent.

Statistical analysis

Microsoft Excel (2010) was used to tabulate the data. Percentage (%) and mean were used to express the result for categorical variables and continuous variables, respectively. Data analysis was performed using Jeffrey's Amazing Statistics Program (JASP) version 0.18.3. Chi-square test and fisher exact test were used to express statistical significance and a p value of <0.05 was considered significant.

RESULTS and DISCUSSION

Demographic characteristics

Table 1 demonstrates the demographic characteristics of the study sample. The total number of distributed surveys was 294 (considering an error rate of 5% and a confidence level of 95%), however different numbers of responses were obtained for individual questions (20% of non-respondents was taken into account). The maximum number of participants were in the age range of 24-34 years (53.4%) followed by participants of the age group 35-45 years (34.6%) while only 35 (12.0%) participants were aged>45 years. The majority of study sample was females (68.4%). Pharmacists were the main contributors to the study (62.8%) while physicians and dentist accounted for 22.8% and 14.5% of the participants, respectively. One hundred fifty-nine (55.8%) participants were hospital-based health-care providers, 81 (28.4%) were academics, 41 (14.4%) worked in private sector and only 4 (1.4%) were retirees. Considering the duration that was spent by the contributors in the medical field, 108 (37.9%) were newly graduated with an experience duration between 1-5 years. Around 20% of the participants had 6-10 and 11-15 year-experience in practice

and 13.7% had been in practice for more than 20 years.

This is a survey-based study aimed to assess the Iraqi HCPs knowledge towards the use of probiotics and the main obstacles stand against their prescription in Mosul city. Considering the study limitation, we experienced the inadequate number of HCPs who actively participated and that the study was run in one city which may affect its generalizability. Similarly, researchers who conducted an international survey study in 2019 faced the same issue[19] and justified this outcome by the poor probiotics' knowledge of some HCPs or that the questioning style of the survey did not get much agreement by some of the participants causing them to be uncomfortable to fulfill the survey entirely. Male to female ratio was unequal (1:2) which additionally contributed to the inability to statistically evaluate the finding[19]. The higher percentage of female participation may be attributed to their general interest in dietary and nutritional supplementation.

Table 1. Demographic features of study population

Characteristics	N (%)
Age range (mean, range)	
24-34	156 (53.4)
35-45	101 (34.6)
>45	35 (12.0)
Gender	
Male	93 (31.6)
Female	201 (68.4)
Profession	
Pharmacist	182 (62.8)
Physician	66 (22.8)
Dentist	42 (14.5)
Practice Setting	
Academic	81 (28.4)
Hospital	159 (55.8)
Private sector	41 (14.4)
Retired	4 (1.4)
Duration in Practice (year)	
1-5	108 (37.9)
6-10	55 (19.3)
11-15	59 (20.7)
16-20	24 (8.4)
>20	39 (13.7)

Familiarity and experiences

By assessing the participants' general knowledge and background information (Table 2), the majority (92.9%) rated themselves as being acquainted with the definition of the probiotics (160 pharmacists, 40 physicians and 21 dentists; p value=0.0001). The highest percentage (84.4%) of the study subjects were aware that probiotics are consumed as supplements or probiotics-fortified food products (156 pharmacists, 18 physicians, and 15 dentists; p value=0.0001), while around 8% of them did not know that. A minority of the participants (n=13, 5.9% and n=32, 15.0%) were unmindful that probiotics have proven clinical health beneficial effects on diarrhea and inflammatory bowel diseases, respectively while most of them (n=200, 91.3%, and n=165, 77.5%) admitted their knowledge of such effectiveness (168 pharmacists, 28 physicians, and 4 dentists; p value=0.0001). Despite that, only 33.3% of the study population were familiar with the dental application of probiotics, however, more than half of them were not (24 pharmacists, 19 physicians, and 23 dentists; p value=0.268). Around 61% assumed that there are no high risks associated with the clinical use of probiotics for the patients (83 pharmacists, 15 physicians, and 21 dentists; p value=0.00001). Considering prebiotics, 69.4% of the participants were aware of the definition of prebiotics (76 pharmacists, 41 physicians, and 10 dentists; p value=0.00001) and 35.8% were confused between pre- and probiotics definition (10 pharmacists, 32 physicians, and 22 dentists; p value=0.00029).

Though the majority of the participants rated themselves as familiar with the gastrointestinal effect of probiotics, more than half of them were unaware of the dental effectiveness of the probiotics. In a recent study, the majority of the participated dentists was found to be aware of the general probiotic term but when it comes to the in-depth knowledge of the dosing and uses they were found to be less knowledgeable[23]. This lack of confidence in prescribing probiotics to oral/dental health issues might be due to the fact that most studies approved the clinical effectiveness of probiotics for gastrointestinal problems while assessment of their use for dental problems is still in its infancy.

Table 2. Questions assessing participants' probiotics knowledge and background information

Questions	Total number of responses	N (%)	Pharmacist	Physician	Dentist	P value
Probiotics are live microorganisms that provide a health benefit when taken in adequate amounts	238					
True		221 (92.9)	160	40	21	0.0001*
False		9 (3.8)	1	4	4	
Do not know		8 (3.4)	1	3	4	
Probiotics are consumed as supplements or in probiotic-fortified foods	224					
True		189 (84.4)	156	18	15	0.0001*
False		18 (8.0)	3	7	8	
Do not know		17 (7.6)	1	8	8	
Some probiotic products have clinically proven beneficial effects on diarrhea	219					
True		200 (91.3)	168	28	4	0.0001*
False		6 (2.7)	2	1	3	
Do not know		13 (5.9)	2	6	5	
Some probiotic products are effective for inflammatory bowel disease and irritable bowel syndrome	213					
True		165 (77.5)	160	4	1	0.0001*
False		16 (7.5)	3	5	8	
Do not know		32 (15.0)	7	10	15	
Probiotics along with prebiotics could be useful for periodontal diseases and oral malodor	198					
True		66 (33.3)	24	19	23	0.268
False		30 (15.2)	8	15	7	
Do not know		102 (51.5)	35	30	37	
There are high risks associated with the clinical use of probiotics for most patients	194					
True		30 (15.5)	8	11	11	0.00001*
False		119 (61.3)	83	15	21	
Do not know		45 (23.2)	12	9	24	
Prebiotics are food that you eat that can help the good bacteria in your body	183					
True		127 (69.4)	76	41	10	0.00001*
False		28 (15.3)	5	7	16	
Do not know		28 (15.3)	2	13	13	

Prebiotics are live bacteria that are helpful to your health when you eat them	179					
True		64 (35.8)	10	32	22	0.00029*
False		76 (42.5)	34	18	24	
Do not know		39 (21.8)	6	16	17	
Prebiotics are harmful synthetic chemicals	176					
True		9 (5.1)	1	3	5	0.00001*
False		136 (77.3)	118	6	12	
Do not know		31 (17.6)	1	14	16	
Prebiotics are natural antibiotics	174					
True		50 (28.7)	12	17	21	0.00001*
False		72 (41.4)	53	8	11	
Do not know		52 (29.9)	7	23	22	

Percentage (%): Indicates the percentage of each answer of the total answer obtained for each question.
*: The result is significant at $p<0.05$ using Chi-square test (to compare the answers in-between professions: pharmacist, physician and dentist.

Probiotics uses perception and barriers against prescribing probiotics

When participants were asked about their willingness of prescribing probiotics to their patients, 26.8% indicated they would recommend probiotics to their patients (14 pharmacists, 13 physicians, and 13 dentists; p value=0.99) and that 9.2% have no concerns of such use (p value=0.73 in-between professions). However, 4.0% refused to advise their patients of using probiotics (2 pharmacists, 2 physicians, and 2 dentists; p value=0.99) and 7.8% preferred to prescribe antibiotics over probiotics in conditions treated by the two agents (2 pharmacists, 4 physicians, and 5 dentists; p value=0.56). Regarding prescribing prebiotics, 23.1% didn't mind to prescribe prebiotics to the patients along with probiotics.

The majority of survey participants (72.4%) showed their interest in broadening their knowledge about pre- and probiotics (45 pharmacists, 28 physicians, and 32 dentists; p value=0.52) and 55.9% indicated they would benefit from related workshops (40 pharmacists, 18 physicians, and 22 dentists; p value=0.59). Data are shown in Table 3.

Of the total participants in the current study, more than 90% defined probiotics correctly. In accordance, a previous study conducted in the United State got a near percentage (86.7%)[24], while a lower percentage (65.6%) was reported by Otuto et al.[25] among the HCPs. On the other hand, we found that only 69.4%

of the HCPs defined prebiotics properly. Although that probiotic agents have a beneficial impact on the body health, still there is a need to increase HCPs knowledge about prebiotics.

From the respondents' point of view, when they were asked about the main barriers that stand against probiotic uses, 13.7% justified it to the high cost of the commercial products (24 pharmacists, 15 physicians, and 15 dentists; p value=0.73), 13.0% attributed it to the lack of sufficient data on probiotics' safety (pharmacists, 13 physicians, and 16 dentists) and 12.7% doubted the quality of the available probiotic products (25 pharmacists, 9 physicians, and 16 dentists). The relatively high percentage (22.1%: 15 pharmacists, 33 physicians, and 39 dentists) claimed that the lack of information regarding the availability of probiotic products made them unaware of such medication. Of all respondents, the excuse of 64 participants (16.3%: 9 pharmacists, 24 physicians, and 31 dentists) for not prescribing probiotics was the limited or the non-availability of clinically proven probiotic products and 10.9% blamed themselves for knowing little or nothing about probiotics (10 pharmacists, 17 physicians, and 16 dentists).

When participants were questioned about their attitude of prescribing probiotics to their patients, 26.8% answered positively. In Canada, it has been reported that around 60% of community pharmacists had already recommended probiotics for patients of different ailments[26]. Similarly, but opposite to our finding, prescribing probiotics in UK and India has attained a wider acceptance than in other parts of the world[27-29]. Practically, the relatively low rate of probiotic use that was concluded in our study may be attributed, in part, to the lack of information of the available products in the market as it was justified by the participants (22.1%). Similarly, around 70% of HCPs participated in a survey conducted in more than eight of the Middle Eastern countries (Jordan, Lebanon, Palestine, Syria, Iraq, Egypt, the Gulf, and Morocco) in 2023 stated that "lack of information regarding available probiotics products" was the main barrier to probiotic prescription or use[14]. Here, we can suggest that more efforts should be made by the pharmacists who work as medical representatives to expand the HCPs awareness of these products. Jordanian HCPs were also reported to have the same probiotics marketing issue[20]. Moreover, the same study found that participants insufficient knowledge about probiotics was one of the barriers against using them which comes in accordance with our study. Academic specialists can introduce the concept of pro- and prebiotics to the undergraduate's syllabus and HCPs can benefit from related workshops. Cost is another barrier that was claimed by 13.7% of the participants to stand against

their willingness to prescribe probiotics. Locally produced probiotic products could be a good solution to overcome the importation expenses of probiotics products. A high percentage of the participants showed negative attitudes when it comes to preferring probiotics over traditional antibiotics. This point needs to get much attention since using probiotics as alternative or complementary therapy to antibiotics in certain infectious diseases has been reported to be as effective as antibiotics in addition to reducing the cost implied[30-34]. The study declared a shortage in the general knowledge and in practicing the use of probiotics by HCPs in Mosul/Iraq. The majority of participants showed their intention to learn more about probiotics; academic teachers and medical representatives may play a role in widening the awareness of the general population and HCPs in this regard. However, the small sample size of the current study limits the possibility of generalizing these findings and future studies with a large sample size is essential to make a conclusive statement.

Table 3. Questions assessing participants' probiotics use perception and reasons preventing their use

Questions	Number of responses	N (%)	Pharmacist	Physician	Dentist	P value
Do you believe probiotics are beneficial for health?	164					
Not at all		11 (6.7)	2	4	5	0.0017*[a]
A little		11 (6.7)	1	5	5	
Somewhat		48 (29.3)	7	21	20	
Quite a bit		41 (25.0)	5	16	20	
Very much		53 (32.3)	25	18	10	
If supported by peer-reviewed literature, would you be willing to recommend probiotics to your patients?	149					
Not at all		6 (4.0)	2	2	2	0.99[a]
A little		26 (17.4)	8	9	9	
Somewhat		44 (29.5)	15	14	15	
Quite a bit		33 (22.1)	12	10	11	
Very much		40 (26.8)	14	13	13	
Do you believe prebiotics are beneficial for health?	149					

Not at all		9 (6.0)	1	4	4	0.96[a]
A little		21 (14.1)	8	7	6	
Somewhat		38 (25.5)	12	15	11	
Quite a bit		41 (27.5)	13	15	13	
Very much		40 (26.8)	13	14	13	
Do you think that prebiotics are harmful to the health?	148					
Not at all		87 (58.8)	56	19	12	0.99[b]
A little		40 (27.0)	10	15	15	
Somewhat		17 (11.5)	5	6	6	
Quite a bit		4 (2.7)	1	2	1	
Very much		0 (0.0)	0	0	0	
If supported by peer-reviewed literature, would you be willing to recommend prebiotics to your patients?	147					
Not at all		14 (9.5)	4	5	5	0.98[a]
A little		28 (19.0)	8	9	11	
Somewhat		38 (25.9)	14	12	12	
Quite a bit		33 (22.4)	11	13	9	
Very much		34 (23.1)	12	12	10	
I am interested in learning more about pre- & probiotics	145					
Not at all		4 (2.8)	1	2	1	0.52[a]
A little		12 (8.3)	2	5	5	
Somewhat		11 (7.6)	3	5	3	
Quite a bit		13 (9.0)	7	2	4	
Very much		105 (72.4)	45	28	32	
I would benefit from education or workshops related to the uses o pre- & probiotics	143					
Not at all		4 (2.8)	1	1	2	0.59[a]
A little		17 (11.9)	5	7	5	
Somewhat		16 (11.2)	6	5	5	
Quite a bit		26 (18.2)	8	8	10	
Very much		80 (55.9)	40	18	22	
I accept using pre- & probiotics in the management of medical conditions	142					

Not at all		5 (3.5)	1	3	1	
A little		15 (10.6)	5	5	5	
Somewhat		35 (24.6)	12	11	12	0.79[a]
Quite a bit		38 (26.8)	17	11	10	
Very much		49 (34.5)	20	19	10	
I recommend pre- & probiotics without any concerns	141					
Not at all		42 (29.8)	16	12	14	
A little		40 (28.4)	16	8	16	
Somewhat		30 (21.3)	7	12	11	0.73[a]
Quite a bit		16 (11.3)	6	5	5	
Very much		13 (9.2)	3	4	6	
I prefer prescribing antibiotics more than probiotics in conditions which could be treated by both antibiotics and probiotics	141					
Not at all		48 (34.0)	20	10	18	
A little		31 (22.0)	7	13	11	
Somewhat		32 (22.7)	11	10	11	0.56[a]
Quite a bit		19 (13.5)	4	7	8	
Very much		11 (7.8)	2	4	5	
From your point of view, what are the most important barriers against probiotic use? (Please select all that apply)	393					
I have little or no idea about probiotics		43 (10.9)	10	17	16	
Lack of information regarding available probiotic products		87 (22.1)	15	33	39	
Limited or non-availability of clinically proven probiotic products		64 (16.3)	9	24	31	
Clinical use of probiotics is controversial		44 (11.2)	11	16	17	0.73[a]
I do not trust the quality of the available probiotic products		50 (12.7)	25	9	16	
There is limited data on the safety of probiotics		51 (13.0)	22	13	16	
The high cost of the available probiotic products		54 (13.7)	24	15	15	

Percentage (%): Indicates the percentage of each answer of the total answer obtained for each question.

*: The result is significant at $p<0.05$ using a: Chi-square test and b: Fischers exact test (to compare the answers in-between professions: pharmacist, physician, and dentist.

STATEMENT OF ETHICS

Ethical approval was obtained via the Ethical Approval Committee of the University of Mosul (ID: 22RCM002).

CONFLICT OF INTEREST STATEMENT

The authors declared no conflict of interest.

AUTHOR CONTRIBUTIONS

Zahraa Amer Hashim: design and planning, data analysis and writing; Radhwan Nidal Al-ZIDAN: questionnaire design and data collection, Marwa H. Mohammed: editing, Hiba Radhwan Tawfeeq: proof reading.

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