




# BMJ Open Cross-sectional study to assess the healthcare professionals' knowledge, attitude and practices about probiotics use in Pakistan

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## ABSTRACT

**Objectives** The study aimed to assess the knowledge, attitude and practices (KAP) of HCPs regarding the use of probiotics in different health conditions and to identify various barriers that are associated with their use.

**Methods** A cross-sectional study was conducted on 405 HCPs by using a validated self-administered questionnaire for assessing their KAP towards probiotic use. The study data were analysed using descriptive statistics,  $\chi^2$  test and binary logistic regression (BLR).

**Results** Among the 405 participants, only 15.1% of HCPs had good knowledge, while 15.6% had acceptable practices and 89.1% had a positive attitude towards probiotics. The professional position of HCPs was significantly associated with knowledge ( $p=0.001$ ) and practice ( $p=0.001$ ). Among all the HCPs, the pharmacists showed a significant association with good knowledge ( $p=0.016$ ) and good practices ( $p=0.024$ ) by using BLR. The lack of knowledge about probiotics was a major barrier to the utilisation of probiotics.

**Conclusions** The poor knowledge and practices regarding the use of probiotics have been seen in the current study. While the participants showed a positive attitude towards the utilisation of probiotics. To transform HCPs' positive attitude to their practices and to create awareness regarding probiotic use focused training programmes should be initiated by professional health organisations.

## INTRODUCTION

Trillions of bacteria reside in the human gastrointestinal tract (GIT) and collectively they are called gut microbiota.<sup>1</sup> These microbes provide many benefits to the human body like regulation of the immune system, provision of energy, protection against pathogens and metabolism of lipids. Food products or supplements having such microorganisms can alter the composition of the microbial flora in GIT.<sup>2</sup>

The term 'probiotic' is a combination of 'pro' (Latin word) means 'for' and bios (Greek word) means 'life' and considered

## Strengths and limitations of this study

- We have reported for the very first time healthcare professionals (HCPs) knowledge, attitude, and practices (KAP) towards probiotic use in Southern Punjab, Pakistan.
- The sample size was inflated by 10% to minimise the errors in completing the questionnaire and to identify significant influencing factors of KAP among the HCPs.
- The response bias may be present in the current study due to the use of self-reporting data, which may affect the accuracy of the findings.
- As the current study was cross-sectional, so the causal relationship can not be established.
- The present study was conducted only in the HCPs of Southern Punjab (Multan), Pakistan and the results cannot be generalised to the HCPs working in the whole country.

as opposite to 'antibiotic', which was the first time used in the 1960s.<sup>3</sup> 'Live microorganism that, when administered in adequate amounts, confers a health benefit on the host' is the most accepted definition provided by WHO and the Food and Agriculture Organisation of the United Nations in regards to term probiotics.<sup>4 5</sup> *Bifidobacterium* and *Lactobacillus* genera are the most common microorganisms, which are mostly available in many probiotic products, while *Lactococcus*, *Streptococcus*, *Enterococcus*, *Propionibacterium* and *Saccharomyces* are less common.<sup>6</sup>

The change in human gut microbiota may cause many clinical complications like acute diarrhoea,<sup>7</sup> antibiotic-associated diarrhoea,<sup>8</sup> traveller's diarrhoea,<sup>9</sup> inflammatory bowel disease,<sup>10</sup> irritable bowel syndrome,<sup>11</sup> ulcerative colitis<sup>12</sup> and *Clostridium difficile* infection.<sup>13</sup> These complications can be treated



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**Table 1** Demographic and knowledge about probiotic drugs brand of healthcare professionals (N=405)

Variables		N (%)
Gender	Male	180 (44.4)
	Female	225 (55.6)
Age	≤25 years	215 (53.1)
	26–30 years	142 (35.1)
	≥31 years	48 (11.9)
Marital status	Single	302 (74.6)
	Married	103 (25.4)
Professional position	Physician	150 (37.0)
	Pharmacist	210 (51.9)
	Surgeon	45 (11.1)
Patient population	Paediatric	27 (6.7)
	Adult	258 (63.7)
	Geriatric	14 (3.5)
	Paediatric and adult	8 (2.0)
	Adult and geriatric	26 (6.4)
	Paediatric, adult and geriatric	72 (17.8)
Experience (year in practice)	≤4 years	326 (80.5)
	5–9 years	52 (12.8)
	10–14 years	14 (3.5)
	≥15 years	13 (3.2)
Knowledge about probiotic drugs brand*	Good knowledge	171 (42.2)
	Poor knowledge	234 (57.8)

\*Score range from 0 to 14. Poor knowledge (score of ≤7). Good knowledge (score of ≥8).

and prevented by the use of probiotics. Moreover, probiotics are also beneficial in the management of health conditions other than GIT like urinary tract<sup>14</sup> and respiratory tract infections,<sup>15</sup> allergies,<sup>16</sup> obesity,<sup>17</sup> stress<sup>18</sup> and cardiovascular disorders.<sup>19</sup>

Most of the previously published reports on probiotics were mainly focused on discovering their mechanism of action and possible health benefits. Unfortunately, there are only a few published studies on factors influencing the use of probiotics. It is known that the healthcare professionals' (HCPs) knowledge and attitude towards probiotics could affect their prescribing behaviour and the knowledge provided by them directly affects the consumption of probiotics by the patients. The evidence supporting the safe and effective use of probiotics is increasing with every passing day and it has been proved by different clinical trials.<sup>9 20–23</sup> However, less data are available about the usage and knowledge of healthcare workers (HCWs) regarding probiotics. The studies assessing knowledge, attitude and practices (KAP) of probiotics have been reported in different countries,<sup>24–28</sup> but to date, there is no published report on this topic that has assessed HCPs KAP towards probiotics in Pakistan.

The present study was designed to assess the KAP of HCPs regarding the use of probiotics and the various barriers that influence their prescribing in Pakistan.

## METHODS

### Study design

A descriptive, cross-sectional study was conducted using a self-administered questionnaire (SAQ) as a tool to assess the KAP of HCPs regarding probiotics use in Multan, Pakistan. A convenient sampling technique was used for the data collection from January 2020 to March 2020. The registered doctors (ie, general physician, paediatrician, gastroenterologist) and retail pharmacists working in the private and public sectors who were involved in the prescribing and sale of probiotics were included in the study. Only those participants were given the SAQ, who filled and signed the informed consent form. The incomplete responses were excluded from the final study results.

### Sample size

A sample size of 385 was calculated by using Raosoft, assuming a 95% CI, a response rate of 50%, Z of 1.96 and a margin of error of 5%. The calculated sample size was further 10% (N=38) increased to minimise any error that may occur while completing SAQ, making the final sample size of N=423 for this study.

### Questionnaire development

A close-ended questionnaire was developed and modified according to the need after conducting an extensive literature review.<sup>27 28</sup> To evaluate the clarity and utility of the questionnaire it was first circulated among the subject specialists (teaching pharmacists and physicians). The suggested changes from the subject specialists were then incorporated into the questionnaire. Afterward, to check the reliability and validity of the questionnaire, a pilot study was conducted on 30 participants. The Cronbach's alpha value of 0.846 showed that the questionnaire was reliable.

The final questionnaire was divided into two sections, section 1 comprised questions/information related to demographics and the second section contained questions related to probiotics (online supplemental table 1). The demographic section included information on gender, age, marital status, profession, patient population and experience (year in practice) of the participants. The probiotic portion of the questionnaire was further subdivided into five sections. These sections included questions regarding commercially available probiotic products, knowledge about probiotics, attitude towards probiotic use, practices regarding probiotic use and barriers to prescribe probiotics. The probiotic drug (brand) section comprised seven items in which participant rated their knowledge regarding commonly available probiotic brands in the market on a Likert scale (0=not at all, 1=somewhat, 2=very much). Second subsection

**Table 2** Difference in knowledge, attitude and practices of healthcare professionals about probiotics by demographic

Variables	Total N (%)	Knowledge*			Attitude†			Practice‡		
		Good	Poor	X <sup>2</sup> (p value)	Positive	Negative	X <sup>2</sup> (P)	Good	Poor	X <sup>2</sup> (p value)
Overall	405 (100%)	61 (15.1%)	344 (84.9%)	0.757 (0.384)	361 (89.1%)	44 (10.9%)	1.225 (0.268)	63 (15.6%)	342 (84.4%)	3.730 (0.053)
Gender										
Male	180 (44.4%)	24 (13.3%)	156 (86.7%)		157 (87.2%)	23 (12.8%)		21 (11.7%)	159 (88.3%)	
Female	225 (55.6%)	37 (16.4%)	188 (83.6%)		204 (90.7%)	21 (9.3%)		42 (18.7%)	183 (81.3%)	
Age				2.754 (0.252)			1.255 (0.534)			2.182 (0.336)
≤25 years	215 (53.1%)	38 (17.7%)	177 (82.3%)		191 (93.8%)	24 (11.2%)		36 (16.7%)	179 (83.3%)	
26–30 years	142 (35.1%)	16 (11.3%)	126 (88.7%)		125 (88.0%)	17 (12.0%)		23 (16.2%)	119 (83.8%)	
≥31 years	48 (11.9%)	7 (14.6%)	41 (85.4%)		45 (93.8%)	3 (6.3%)		4 (8.3%)	44 (91.7%)	
Marital status				0.027 (0.870)			0.440 (0.507)			0.104 (0.748)
Single	302 (74.6%)	46 (15.2%)	256 (84.8%)		271 (89.7%)	31 (10.3%)		48 (15.9%)	254 (84.1%)	
Married	103 (25.4%)	15 (%14.6)	88 (85.4%)		90 (87.4%)	13 (12.6%)		15 (14.6%)	88 (85.4%)	
Professional position				35.607 (<0.001)			0.256 (0.880)			39.741 (<0.001)
Physician	150 (37.0%)	5 (3.3%)	145 (96.7%)		134 (89.3%)	13 (10.7%)		3 (2.0%)	147 (98.0%)	
Pharmacist	210 (51.9%)	53 (25.2%)	157 (74.8%)		134 (88.6%)	24 (11.4%)		55 (26.2%)	155 (73.8%)	
Surgeon	45 (11.1%)	3 (3.7%)	42 (93.3%)		41 (91.1%)	4 (8.6%)		5 (11.1%)	40 (88.9%)	
Patient population				10.348 (0.066)			13.197 (0.022)			10.185 (0.070)
Paediatric	27 (6.7%)	5 (18.5%)	22 (81.5%)		23 (85.2%)	4 (14.8%)		5 (18.5%)	22 (81.5%)	
Adult	258 (63.7%)	42 (16.3%)	216 (83.7%)		228 (88.4%)	30 (11.6%)		42 (16.3%)	216 (83.7%)	
Geriatric	14 (3.5%)	5 (35.5%)	9 (64.3%)		11 (78.6%)	3 (21.4%)		4 (28.6%)	10 (71.4%)	
Paediatric and adult	8 (2.0%)	1 (12.5%)	7 (87.5%)		5 (62.5%)	3 (37.5%)		1 (12.5%)	7 (87.5%)	
Adult and geriatric	26 (6.4%)	4 (15.4%)	22 (84.6%)		24 (92.3%)	2 (7.7%)		7 (26.9%)	19 (73.1%)	
Paediatric, adult and geriatric	72 (17.8%)	4 (5.6%)	68 (94.4%)		70 (97.2%)	2 (2.8%)		4 (5.6%)	68 (94.4%)	
Experience (year in practice)				6.755 (0.080)			7.463 (0.059)			5.850 (0.119)
≤4 years	326 (80.5%)	49 (15.0%)	277 (85.0%)		290 (89.0%)	36 (11.0%)		54 (16.6%)	272 (83.4%)	
5–9 years	52 (12.8%)	6 (11.5%)	46 (88.5%)		50 (96.2%)	2 (3.8%)		3 (5.8%)	49 (94.2%)	

Continued

Variables	Total		Knowledge*		Attitude†		Practice‡		X <sup>2</sup> (p value)
	N (%)	N (%)	Good	Poor	Positive	Negative	Good	Poor	
10–14 years	14 (3.5%)	14 (3.5%)	1 (7.1%)	13 (92.9%)	10 (71.4%)	4 (28.6%)	4 (28.6%)	10 (71.4%)	
≥15 years	13 (3.2%)	13 (3.2%)	5 (38.5%)	8 (61.5%)	11 (84.6%)	2 (15.4%)	2 (15.4%)	11 (84.6%)	
Knowledge about probiotic drugs brands§					0.123 (0.726)				5.699 (0.017)
Good knowledge	171 (42.2%)	171 (42.2%)	27 (15.8%)	144 (84.2%)	168 (98.2%)	3 (1.8%)	18 (10.5%)	153 (89.5%)	
Poor knowledge	234 (57.8%)	234 (57.8%)	34 (14.5%)	200 (85.5%)	193 (82.5%)	41 (17.5%)	45 (19.2%)	189 (80.8%)	
									25.363 (<0.001)

P<0.05 was considered to indicate significance. Bold fonts show significant differences.

\*Score range from 0 to 27. Poor knowledge (score of ≤15), good knowledge (score of ≥16).

†Score range from 0 to 27. Negative attitude (score of ≤3), positive attitude (score of ≥4).

‡Score range from 0 to 25. A score of ≤ 14 was set for poor practice, ≥15 for good practice.

§Score ranges from 0 to 14. Poor knowledge (score of ≤7). Good knowledge (score of ≥8).

comprised knowledge about probiotics, where the first question was about the definition of probiotics. While second is composed of 13 different diseases or health conditions in which probiotics show promising benefits (assessed from literature review) and the participants rated their views on a Likert scale (0=not at all, 1=some-what, 2=very much). The third subsection is comprised of three items to assess HCPs' attitude about probiotics. The inverted score was used for a negative question. The total attitude score was 06, while participants having a score more than the mean of the total score (>03) were considered having a positive attitude. The fourth subsection was focused on assessing HCPs practices regarding prescribing probiotics in 13 different health conditions. The third and fourth subsections included a similar Likert scale as in previous portions. The Last segment of the questionnaire composed of the barriers related to the prescribing of probiotics. The scoring of the questionnaire has been described in online supplemental table 1.

### Data collection

The printed copies of the developed questionnaire were distributed among eligible HCPs along with informed consent and instruction for filling the questionnaire. Total 423 responses were collected out of 500 distributed questionnaires. The detail of the data collection process is provided in online supplemental figure 1.

### Statistical analysis

In the present study, the descriptive and inferential statistics were performed by using SPSS V.23.0 (IBM). In descriptive statistics, the frequencies and percentages were used to express the categorical variables. A  $\chi^2$  test was used to analyse the KAP between the study subgroups. The binary logistic regression (BLR) models were used to find the possible determinants for participant's positive attitude, good knowledge and practice regarding probiotics. The adjusted OR(AOR) and crude OR(COR) with a 95% CI were used to express the results of BLR. While the model was adjusted for gender, age, marital status, profession, patient population, experience (year in practice), and knowledge about probiotics brands of the participants In all tests, a p<0.05 was considered to be statistically significant.

### Patient and public involvement

There were no patients involved in the current study as the study participants were HCPs only.

## RESULTS

From the total 423 study participants, only 405 were included in the final analysis, as 18 questionnaires were incomplete. Most of the participants were, female 55.6% (n=225), aged less than 25 years 53.1% (n=215) and were single 74.6% (n=302). Around 51.9% (n=210) of the participants were pharmacists while 37.0% (n=150) were physicians with highest patient population as adults

**Table 3** Binary logistic regression for variables related to good knowledge of healthcare professionals

Variables		Variables associated with good knowledge					
		COR	95% CI	P value	AOR	95% CI	P value
Gender	Male	0.782	0.448 to 1.363	0.385	0.693	0.355 to 1.351	0.281
	Female*						
Age	≤25 years	1.257	0.524 to 3.016	0.608	0.702	0.203 to 2.432	0.577
	26–30 years	0.744	0.286 to 1.934	0.544	0.465	0.127 to 1.709	0.249
	≥31 years*						
Marital status	Single	1.054	0.561 to 1.981	0.870	1.210	0.535 to 2.736	0.647
	Married*						
Professional position	Physician	0.483	0.111 to 2.104	0.332	0.390	0.076 to 2.011	0.261
	Pharmacist	4.726	1.407 to 15.880	<b>0.012</b>	6.162	1.401 to 27.111	<b>0.016</b>
	Surgeon*						
Patient population	Paediatric	3.864	0.953 to 15.666	0.058	2.287	0.482 to 10.851	0.298
	Adult	3.306	1.144 to 9.552	<b>0.027</b>	2.090	0.642 to 6.806	0.221
	Geriatric	9.444	2.134 to 41.792	<b>0.003</b>	12.766	2.307 to 70.641	<b>0.004</b>
	Paediatric and adult	2.429	0.237 to 2.844	0.455	2.137	0.173 to 26.454	0.554
	Adult and geriatric	3.091	0.713 to 3.402	0.132	9.672	1.645 to 56.865	<b>0.012</b>
Experience (year in practice)	≤4 years	0.283	0.089 to 0.901	<b>0.033</b>	0.127	0.025 to 0.653	<b>0.013</b>
	5–9 years	0.209	0.051 to 0.850	<b>0.029</b>	0.107	0.017 to 0.666	<b>0.017</b>
	10–14 years	0.123	0.012 to 1.253	0.077	0.037	0.002 to 0.563	<b>0.018</b>
	≥15 years*						
Knowledge about probiotic drugs brand †	Good knowledge	1.103	0.637 to 1.909	0.726	0.953	0.500 to 1.819	0.885
	Poor knowledge*						

P<0.05 was considered to indicate significance. Bold fonts show significant differences.

\*Indicates a reference group in the logistic regression.

†Score range from 0 to 14. Poor knowledge (score of ≤7). Good knowledge (score of ≥8).

AOR, adjusted OR; COR, crude OR.

63.7% (n=258). The 80.5% (n=326) of the participants were having less than 4 years of professional experience. The 57.8% (n=234) of the participants had poor knowledge regarding the available probiotic products. The participants' demographic characteristics are presented in [table 1](#).

Among the participants, 15.1% (n=61) had good knowledge while 84.9% (n=344) had poor knowledge regarding the use of probiotics. The professional position of the respondent was significantly associated with knowledge ( $\chi^2=35.607$ ,  $p<0.001$ ). While the knowledge did not vary significantly between the gender, age, marital status, patient population and knowledge about different probiotics brands. The differences in KAP of HCPs regarding the use of probiotics can be seen in [table 2](#).

89.1% (n=361) of the participants had a positive attitude regarding probiotics, while only 10.9% (n=44) had a negative attitude. The difference in the attitude of

participants was significantly associated with the patient population ( $\chi^2=13.197$ ,  $p=0.022$ ) and knowledge about probiotic brands ( $\chi^2=25.363$ ,  $p<0.001$ ). The difference in attitude was not significantly associated with gender, age, marital status, professional position and experience.

The 15.6% (n=63) participants had good practices while 84.4% (n=342) had poor practices in prescribing probiotic products. The professional position ( $\chi^2=39.741$ ,  $p<0.001$ ) and the knowledge about the probiotic brands ( $\chi^2=5.699$ ,  $p=0.0017$ ) were significantly associated with the HCPs practices. The age, gender, marital status, patient population and experience did not show any significant association with the HCPs practice.

The BLR showed that in comparison to other HCPs, the pharmacists had higher odds regarding good knowledge about probiotics in both adjusted and unadjusted models (AOR=6.162, 95% CI 1.401 to 27.111,  $p=0.016$ ) and (COR=4.726, 95% CI 1.707 to 15.880,  $p=0.012$ )

**Table 4** Binary logistic regression for variables linked with the positive attitude of healthcare professionals

Variables		Variables associated with positive attitude					
		COR	95% CI	P value	AOR	95% CI	P value
Gender	Male	0.703	0.375 to 1.316	0.270	0.463	0.213 to 1.008	0.053
	Female*						
Age	≤25 years	0.531	0.153 to 1.840	0.318	0.125	0.011 to 1.406	0.092
	26–30 years	0.490	0.137 to 1.752	0.273	0.146	0.013 to 1.655	0.120
	≥31 years*						
Marital status	Single	1.263	0.633 to 2.518	0.508	2.648	0.993 to 7.064	0.052
	Married*						
Professional position	Physician	0.817	2.259 to 2.581	0.731	1.876	0.440 to 8.002	0.395
	Pharmacist	0.756	0.249 to 2.297	0.622	1.717	0.412 to 7.154	0.458
	Surgeon*						
Patient population	Paediatric	0.164	0.028 to 0.956	<b>0.044</b>	0.224	0.031 to 1.606	0.136
	Adult	0.217	0.051 to 0.931	<b>0.040</b>	0.334	0.071 to 1.575	0.166
	Geriatric	0.105	0.016 to 0.700	<b>0.20</b>	0.042	0.004 to 0.465	<b>0.010</b>
	Paediatric and adult	0.048	0.006 to 0.354	<b>0.003</b>	0.018	0.001 to 0.232	<b>0.002</b>
	Adult and geriatric	0.343	0.046 to 2.569	0.298	0.913	0.082 to 10.192	0.941
Experience (year in practice)	Paediatric, adult and geriatric*						
	≤4 years	1.465	0.312 to 6.873	0.629	2.867	0.387 to 21.214	0.302
	5–9 years	4.545	0.576 to 35.871	0.151	7.429	0.614 to 89.931	0.115
	10–14 years	0.455	0.068 to 3.043	0.416	0.216	0.011 to 4.433	0.320
≥15 years*							
Knowledge about probiotic drugs brand†	Good knowledge	11.896	3.618 to 39.118	<b>&lt;0.001</b>	34.396	7.282 to 162.456	<b>&lt;0.01</b>
	Poor knowledge*						

P<0.05 was considered to indicate significance. Bold values show significant differences.

\*Indicates a reference group in the logistic regression.

†Score range from 0 to 14. Poor knowledge (score of ≤7). Good knowledge (score of ≥8).

AOR, adjusted OR; COR, crude OR.

respectively. The groups with experience ≤4 and 5–9 years showed higher odds for good knowledge (COR=0.283, 95% CI 90.089 to 0.901, p=0.033), (AOR=0.127, 95% CI 0.025 to 0.653, p=0.013) and (COR=0.209, 95% CI 0.051 to 0.850, p=0.029), (AOR=0.107, 95% CI 0.017 to 0.666, p=0.017), respectively, in both adjusted and unadjusted BLR analysis (table 3).

The HCPs who were interacting with the population groups, 'geriatric' and 'geriatric and adults' showed significant association with positive attitude (COR 0.105, 95% CI 0.016 to 0.700, p=0.020), (AOR=0.042, 95% CI 0.004 to 0.465, p=0.010) and (COR=0.048, 95% CI 0.006 to 0.354), p=0.003), (AOR=0.018, 95% CI 0.001 to 0.232, p=0.002), respectively (table 4). The HCPs with good knowledge about probiotic brands showed higher odds for positive attitude in both unadjusted (COR 11.896, 95% CI 3.618

to 39.118, p<0.001) and adjusted (AOR=34.396, 95% CI 7.282 to 162.456), p<0.0001) models, respectively.

The results of BLR for good practice showed that the male HCPs showed higher odds for good practice (OR=0.442, 95% CI 0.216 to 0.905, p=0.025). The unadjusted and adjusted BLR models showed that the physicians and pharmacists were significantly associated with the good practice (COR=0.163, 95% CI 0.037 to 0.713), p=0.016), (AOR=0.142, 95% CI 0.025 to 0.810, p=0.028) and (COR=2.839, 95% CI 1.066 to 7.558, p=0.037), (AOR=6.040, 95% CI 1.272 to 28.668, p=0.024), respectively (table 5).

The lack of knowledge about the clinical use of probiotics (57%) was the most common reason among both doctors and pharmacists. The high cost of probiotics was the second common barrier (35.4%) for HCPs for not recommending probiotics to their patients (figure 1).

**Table 5** Binary logistic regression for variables related to good practice of healthcare professionals

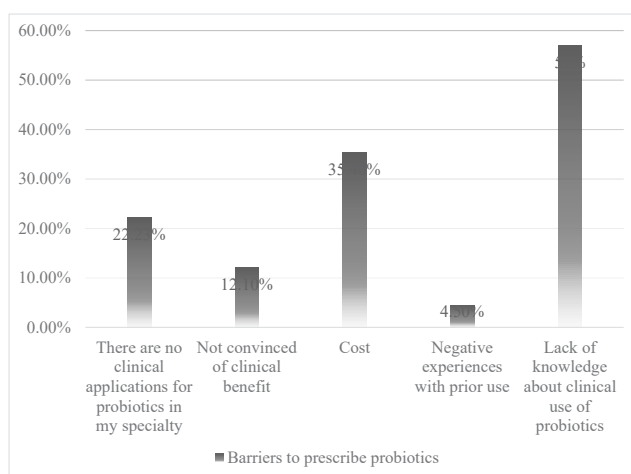
Variables		Variables associated with good practice					
		COR	95% CI	P	AOR	95% CI	P
Gender	Male	0.575	0.327 to 1.013	0.055	0.442	0.216 to 0.905	<b>0.025</b>
	Female*						
Age	≤25 years	2.212	0.748 to 6.543	0.151	20.008	0.458 to 8.792	0.355
	26–30 years	2.126	0.696 to 6.494	0.186	0.449	0.563 to 10.652	0.232
	≥31 years*						
Marital status	Single	1.109	0.591 to 2.078	0.748	0.998	0.431 to 2.314	0.997
	Married*						
Professional position	Physician	0.163	0.037 to 0.713	<b>0.016</b>	0.142	0.025 to 0.810	<b>0.028</b>
	Pharmacist	2.839	1.066 to 7.558	<b>0.037</b>	6.040	1.272 to 28.668	<b>0.024</b>
	Surgeon*						
Patient population	Paediatric	3.864	0.953 to 15.666	0.058	1.402	0.291 to 6.761	0.673
	Adult	3.306	1.144 to 9.552	<b>0.027</b>	1.215	0.371 to 3.984	0.748
	Geriatric	6.800	1.463 to 31.614	<b>0.014</b>	7.957	1.166 to 54.302	<b>0.034</b>
	Paediatric and adult	2.429	0.237 to 24.844	0.455	3.049	0.253 to 36.792	0.380
	Adult and geriatric	6.263	1.657 to 23.672	<b>0.007</b>	13.912	2.197 to 88.104	<b>0.005</b>
Experience (year in practice)	≤4 years	1.092	0.235 to 5.066	0.911	0.278	0.036 to 2.153	0.220
	5–9 years	0.337	0.050 to 2.263	0.263	0.070	0.006 to 0.765	<b>0.029</b>
	10–14 years	2.200	0.329 to 14.726	0.416	0.770	0.069 to 8.553	0.831
	≥15 years*						
Knowledge about probiotic drugs brand†	Good knowledge	0.494	0.275 to 0.888	<b>0.019</b>	0.372	0.185 to 0.747	<b>0.005</b>
	Poor knowledge*						

P<0.05 was considered to indicate significance. Bold values show significant differences.

\*Indicates a reference group in the logistic regression.

†Score range from 0 to 14. Poor knowledge (score of ≤7). Good knowledge (score of ≥8).

AOR, adjusted OR; COR, crude OR.



**Figure 1** The barriers to recommend probiotics reported by healthcare professionals.

## DISCUSSION

The present study was aimed at assessing the KAP of HCPs regarding the use of probiotics and the barriers that are encountered in their prescribing. The results showed that only a small percentage of HCPs (15.1%) had good knowledge regarding probiotic use, while the practising pharmacists were having better knowledge. These findings are not consistent with reports from Jordan (35.6%) and India (57.6%),<sup>25–29</sup> as the HCPs in these countries were having better knowledge regarding probiotics. Similarly, a study from Nigeria and an international study showed that the practitioners in these regions had better probiotics knowledge.<sup>24–30</sup> The differences seen in HCPs knowledge between our study and the previous reports may be because these countries have more developed probiotic industry and the HCPs are in more frequent contact with the probiotic product marketing professionals.<sup>31–32</sup>



Most HCPs (89.1%) had a positive attitude regarding the use of probiotics. This was consistent with studies conducted in Jordan, Nigeria, India and Europe.<sup>28 29 31 33 34</sup> The positive attitude of the HCPs towards probiotic use can be related to the fact that most of the probiotic products have been introduced recently in Pakistan and there are no reports of any adverse drug reactions associated with their use. Moreover, it was seen that the female HCPs had a more positive attitude (56.5 %) towards probiotic use as compared with males (43.5 %). This finding can be related to the perception that the females are generally more concerned about dietary approaches for the management of various ailments.<sup>25</sup>

In the current study, only 15.6% of HCPs had good practices regarding the use of probiotics in different health conditions, but the pharmacists were having better probiotic use practices than other professionals. This percentage is lower than the previous studies from Jordan (41.0%), Nigeria (25.8%) and international study (79.0%).<sup>24–26</sup> The less use of probiotic products in Pakistan can be attributed to the poor probiotics' knowledge of HCPs. Moreover, the biggest barrier related to the non-prescribing of probiotics reported by the HCPs was also a lack of knowledge and this is consistent with previously published studies.<sup>25 27 30 35</sup>

The higher probiotics knowledge among the HCPs will enhance their confidence to offer safe and effective treatment to the patients.<sup>35</sup> The results of this survey have highlighted the need for increasing HCPs' knowledge regarding the use of probiotics in Pakistan as most of them were having poor knowledge. To enhance the HCPs' knowledge, educational activities like continuing medical education programmes or focused training should be conducted by professional medical associations. The increase in HCP's knowledge regarding the use of probiotics will promote their safe and effective use in the population.

The present study was conducted among HCPs of Multan, Pakistan and the results cannot be generalised for the whole country. The influence of HCPs specialisation was not considered in this study, which can potentially influence their KAP regarding probiotics. Moreover, the knowledge section of the study questionnaire contained some indications that were not mentioned on the product label but were taken from the published literature. The response bias may be present in the current study due to the use of self-reporting data, which may affect the accuracy of the findings. As the current study was cross-sectional, so the causal relationship can not be established.

## CONCLUSION

The poor knowledge and practices regarding the use of probiotics have been seen in the current study. While the participants showed a positive attitude towards the utilisation of probiotics. To transform HCPs' positive attitude to their practices and to create awareness regarding

probiotic use focused training programmes should be initiated by professional health organisations. Lastly, probiotics should be included in the undergraduate curriculum of medical and pharmacy professions, so that future practitioners may have better knowledge and practices regarding the use of probiotics.

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