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A cross sectional survey to assess healthcare professionals' attitudes to and understanding of probiotics☆

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SUMMARY

Background and aims: Consumers' belief in the benefits of probiotics is influenced by information they receive from healthcare professionals (HCPs). HCPs therefore need to be aware of the current evidence base in order to advise consumers appropriately. This survey aimed to establish HCP attitudes towards, and understanding of, the use of probiotics in healthcare.

Methods: An online, cross-sectional survey was distributed to dietitians, paediatricians and General Practitioners (GPs) through three medical/health professional bodies: the British Dietetic Association (BDA), the European Society for Primary Care in Gastroenterology (ESPCG) and the European Paediatric Association (EPA). Paper copies of the survey were distributed at relevant medical congresses.

Results: There were 1360 respondents representing all three groups of HCPs. The majority of respondents (86.3%, n = 1068) agreed that probiotics have a place in clinical medicine and were likely to recommend them (72.1%, n = 882), yet only 55.7% (n = 230) of dietitians were familiar with the World Health Organisation (WHO) definition of a probiotic. There was a positive, however, weak correlation between a high level of training and the likelihood of a respondent recommending a probiotic ($r = 0.24$, $p < 0.005$). Inadequate knowledge appeared to be a limiting factor in patients receiving evidence-based information and appropriate recommendations. The more concerns an HCP had, the less likely they were to recommend a probiotic regularly ($p < 0.005$). The majority (91%, n = 1099) of respondents cited a need for more education.

Conclusions: HCPs recognise that probiotics have a place in clinical medicine and would recommend them if they had more information to support informed decision-making within patient care.

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1. Introduction

Probiotics are defined as “live micro-organisms that, when ingested in adequate amounts, confer a health benefit on the host” [1,2].

The vital role of gut microbiota in health and disease is now well established and a number of high-quality meta-analyses confirm the role of probiotics in various disease areas and therapeutic indications such as infectious diarrhoea, antibiotic-associated diarrhoea (AAD), gut transit, Irritable Bowel Syndrome (IBS), abdominal pain and bloating, ulcerative colitis and necrotizing enterocolitis. However, results have not been positive in all areas studied with evidence showing probiotics are not effective in acute pancreatitis or Crohn's disease [2–7]. Probiotics are generally well tolerated by patients of all ages, although, caution is advised in immunologically vulnerable patients [7].

Interest by researchers in the field of probiotics is increasing rapidly and many HCPs are using probiotics regularly in their clinical practice [2,8], yet, little is known about HCPs' knowledge of and behaviours around probiotic use. Given the important benefits of probiotics, these areas require further investigation.

It has been suggested that alterations in living conditions aimed at improving hygiene are causing changes in factors that affect the establishment of intestinal microbiota [9]. Furthermore, the use of antibiotics, particularly in children, impacts upon the microbial

☆ The term *Healthcare professional(s)* is abbreviated to *HCP(s)* throughout the article.

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balance within the gastrointestinal tract, frequently resulting in AAD [10]. Probiotics may prevent AAD through replenishment of the gut microflora [10].

Patients' and consumers' faith in the benefits of probiotics may be influenced by their existing beliefs, as well as the information they receive from recognised HCPs. The attitude of HCPs towards commercially available probiotics has been shown to determine how credible probiotics are perceived by patients and consumers [11,12].

Many patients are interested in the use of probiotics to alleviate a variety of gastrointestinal symptoms [13]. However, patients do not commonly disclose their probiotic use to their physician, therefore, healthcare providers may need to take the initiative to discuss probiotic supplementation with their patients [14]. A conversation of this type enables the HCP to identify whether the patient is using probiotics correctly and to consider whether the sources of probiotics being used could be potentially beneficial or harmful to the patient [15,16]. Nevertheless, the HCP should be knowledgeable about probiotics to be able to offer appropriate, professional advice.

Despite HCPs being the gateway to reliable information about probiotics, and patients being dependent on them to make informed decisions [2], it has been suggested that HCPs do not consider their understanding of probiotics very highly [16]. HCPs tend to inconsistently recommend probiotics, and often leave the choice of strain to the patient [17]. There is a need for increased awareness by HCPs of their role in helping to improve the general public's understanding and appropriate use of probiotics [3,18].

The aim of this survey was to investigate HCPs' attitudes towards, and understanding of, probiotics. The HCPs surveyed included dietitians, paediatricians and General Practitioners (GPs). The objectives of the survey were to establish and compare the attitudes towards probiotics between professions; establish and compare the current level of knowledge amongst these HCPs; to investigate how often HCPs refer to the evidence-base behind probiotics; and to explore the concerns and barriers HCPs have in recommending probiotics.

2. Materials and methods

2.1. Questionnaire development

A 30-question, cross-sectional, online questionnaire was designed in DanSurvey, a licenced product of LimeSurvey (Symfony, England), and developed using web-based guidelines [19] including examples of questions from a previously performed probiotic survey [20]. The questionnaire was based predominantly on multiple-choice questions with an open field to clarify the answer where required, and it was divided into three sections: 'About you' (6 questions), 'Probiotics' (21 questions) and 'How to get information to you' (3 questions) (Supplementary Appendix 1). A pilot study was performed to obtain feedback on the questionnaire structure and questions. Respondents in the pilot were asked to record the time it took to complete the survey, which was 10–15 min. It was decided to cap the questionnaire at 30 questions to stay within the timeframe of 30 min.

2.1.1. Anonymity and ethics

The survey was anonymous, with no personal or identifiable data being collected. A participant information sheet was provided. Consent was assumed if the survey was completed.

Ethical approval was granted, the names of the institutions were removed for blind, peer review.

2.1.2. Participants

In December 2015, the questionnaire was sent electronically to 27,287 members of three medical/health professional bodies: the British Dietetic Association (BDA), the European Society for Primary Care in Gastroenterology (ESPCG) and the European Paediatric Association (EPA), and paper copies of the questionnaire were distributed at relevant medical congresses during registration. Questionnaire completion was entirely optional.

2.1.3. Data analysis

Pearson's Chi-square test was applied to establish correlations within the data, which was inputted into SPSS (Version 23. 2015, IBM, USA). Frequency data was observed to check for outliers and data that could not be correct. Data were described using univariate analysis. Chi-squared tests were used to compare responses between the three groups of HCPs (dietitians, GPs with special interest in gastroenterology and paediatricians) and a significance level of $p \leq 0.05$ was used. If respondents did not fit into any of the specified categories, they were classified as 'Other'. Descriptive statistics were used to describe the different groups of HCPs, their attitudes, knowledge, how they value current information and their knowledge gaps. Differences between the groups were examined. Significance was considered at the 5% level ($p \leq 0.05$). Numbers and percentages refer to the number who responded to that particular question. Not every respondent answered every question, therefore, pairwise deletion was undertaken.

3. Results

The response rate for the electronic questionnaire was 4.98%. The total number of attendees at the congresses was unknown so a response rate could not be calculated. It is also possible that some people received the questionnaire online and also attended one of the congresses. Table 1 summarises response rates and HCP characteristics.

A total of 27,287 questionnaires were distributed and 1360 responses recorded. The highest absolute number of respondents (62.2%, n = 846) was from paediatricians. Overall, most of the respondents worked in paediatrics (63%, n = 857) and were hospital based (45%, n = 611). Dietitians mainly worked in hospitals (16.5%, n = 224), or the community (14.6%, n = 199) with main areas of expertise in nutritional support (16%, n = 217) and gastroenterology (9.6%, n = 131).

Table 2 describes reported attitudes of HCPs to nutritional advice and the use of probiotics, 90.2% (n = 1112) of respondents agreed that nutritional advice plays an important role in clinical practice.

There was a high level of agreement on this across the professions: dietitians 83.2% (n = 298), paediatricians 93.5% (n = 753), and GPs 77.4% (n = 24). Of the respondents, 86.3%, (n = 1068) agreed that probiotics have a place in clinical practice, and there was again a high level of agreement across the different professions: dietitians 78.2% (n = 279), paediatricians 89.8% (n = 727), and GPs 83.9% (n = 26). Of the HCPs who agreed probiotics have a place in clinical medicine, 79% (n = 847) recommended probiotics several times a month or more. The majority of respondents (71.1%, n = 886) believed that probiotics were an evidence-based intervention for health and there was more agreement among paediatricians (76.4%, n = 618) and GPs (71%, n = 22) than dietitians (62.5%, n = 223). Although many HCPs were likely to suggest a probiotic food or drink (72.1%, n = 882), paediatricians (79.7%, n = 641) and GPs (74.2%, n = 23) were more likely to do so than dietitians (55.3%, n = 194).

HCPs were most likely to recommend probiotics for children with irregular bowel movements and diarrhoea (51.8%, n = 705).

Table 1
Respondent characteristics.

	Dietitian N (%)	Paediatrician N (%)	GP N (%)	Other N (%)	Did not declare N (%)	Total N (% of respondents)
Total	**426 (31.3%)**	**846 (62.2%)**	**36 (2.6%)**	**21 (1.5%)**	**31 (2.3%)**	**1360 (100%)**
Country:						
United Kingdom	409 (96)	10 (1.1)	5 (2)	1 (0.2)	1 (0.2)	426 (31.2)
Russia	2 (0.5)	342 (40.4)	2 (0.5)	2 (0.5)	4 (1.2)	352 (25.6)
Italy	2 (0.9)	201 (23.7)	7 (3.2)	7 (3.2)	10 (4.6)	227 (16)
Turkey	0	223 (26.3)	0	0	1 (0.5)	224 (16.5)
Other country	13 (3)	66 (7.8)	22 (24)	11 (8.5)	15 (10.6)	127 (10.37)
Did not declare	0	4 (0.4)	0	0	0	4 (0.4)
Gender:						
Female	388 (91)	585 (69)	15 (41.8)	14 (66.7)	16 (51.6)	1018 (74.9)
Male	24 (5.7)	240 (28.5)	20 (55.4)	7 (33.3)	13 (41.9)	304 (2.2)
Prefer not to say	14 (3.3)	21 (2.5)	1 (2.8)	0	0	38 (2.7)
When graduated:						
last 5 years	158 (37)	330 (39.1)	6 (16.7)	8 (38.1)	6 (19.4)	508 (37.4)
5–15 years ago	118 (27.7)	197 (23.3)	5 (13.9)	5 (23.8)	12 (38.7)	338 (24.9)
>15 years ago	150 (35.2)	316 (37.4)	24 (66.7)	8 (38.1)	13 (41.9)	512 (37.6)
Did not declare	0	1 (0.4)	1 (2.7)	0	0	1 (0.1)
Area work in?						
Paediatrics	87 (10.5)	732 (89)	5 (0.6)	11 (1.3)	22 (2.6)	857[a]
Hospital	224 (38)	356 (60)	9 (1.5)	12 (1.8)	10 (1.6)	611[a]
Community	199 (66)	88 (29)	15 (5)	4 (1.3)	3 (1.0)	309[a]
Adults	174 (96)	17 (8.5)	8 (4)	3 (1.5)	2 (1.0)	204[a]
General	57 (59)	18 (18.5)	22 (22.5)	3 (3.0)	1 (1.0)	101[a]
Care of the Elderly	60 (87)	3 (4.3)	6 (8.7)	0	0	69[a]
Maternity	14 (24)	43 (74)	1 (1.7)	0	0	58[a]
Area of expertise[b]						
Paediatrics	69 (8.9)	702 (90.7)	3 (0.4)	12 (1.5)	24 (3)	810[a]
Nutritional support	217 (70)	88 (28.6)	3 (1)	1 (0.3)	1 (0.3)	310[a]
Gastroenterology	131 (50)	103 (40)	26 (10)	2 (0.7)	6 (1.9)	268[a]
Allergy and Immunology	48 (28)	120 (70.2)	2 (1.8)	6 (3.30)	4 (2.2)	180[a]
Diabetes	87 (65)	42 (31)	5 (4)	0	1 (0.7)	135[a]
Parenteral and enteral nutrition	95 (73)	34 (26)	1 (1)	0	1 (0.8)	131[a]
Education and research	42 (41.6)	45 (44.6)	7 (6.9)	5 (5)	2 (2)	101[a]

[a] Number of ticked options.
[b] Areas of expertise with more than 100 respondents.

Table 2
HCP attitudes towards nutritional advice and probiotics.

Response rates, N (%)		Dietitian N (%)	Paediatrician N (%)	GP N (%)	Other N (%)	Did not declare N (%)	Total N (%)
Nutritional advice plays an important role in my clinical practice	Disagree	57 (15.9)	34 (4.2)	3 (9.7)	0 (0)	1 (4.8)	95 (7.7)
	Neutral	3 (0.8)	18 (2.2)	4 (12.9)	1 (5.6)	0 (0)	26 (2.1)
	Agree	298 (83.2)	753 (93.5)	24 (77.4)	17 (94.4)	20 (95.2)	1112 (90.2)
Probiotics have a place in clinical medicine	Disagree	14 (3.9)	47 (5.8)	5 (16.1)	0 (0)	0 (0)	66 (5.3)
	Neutral	64 (17.9)	36 (4.4)	0 (0)	1 (5.6)	2 (9.5)	103 (8.3)
	Agree	279 (78.2)	727 (89.8)	26 (83.9)	17 (94.4)	19 (90.5)	1068 (86.3)
Probiotics are an evidence based intervention for health	Disagree	34 (9.5)	38 (4.7)	3 (9.7)	0 (0)	2 (9.5)	77 (6.2)
	Neutral	100 (28.0)	153 (18.9)	6 (19.4)	8 (47.1)	5 (23.8)	272 (22.0)
	Agree	223 (62.5)	618 (76.4)	22 (71.0)	9 (52.9)	14 (66.7)	886 (71.7)
How likely are you to suggest a probiotic food or drink?	Unlikely	98 (27.9)	103 (12.8)	7 (22.6)	4 (23.5)	5 (23.8)	217 (17.7)
	Don't know	59 (16.8)	60 (7.5)	1 (3.2)	2 (11.8)	3 (14.3)	125 (10.2)
	Likely	194 (55.3)	641 (79.7)	23 (74.2)	11 (64.7)	13 (61.9)	882 (72.1)

Pertaining to diarrhoea in young children, 73.8% (n = 624) of paediatricians, as opposed to 14.1% (n = 60) of dietitians, and 47% (n = 17) of GPs, would recommend a probiotic. Among the dietitians, 48.4% (n = 206) would recommend a probiotic for bloating and 58.5% (n = 249) for IBS, across the general population. For allergies in the general population, 42% (n = 355) of paediatricians as opposed to 7.7% (n = 33) of dietitians and 11% (n = 4) of GPs would recommend a probiotic.

Fig. 1 provides an overview of HCP knowledge of probiotics.

The majority of paediatricians (76.3%, n = 482) and GPs (70.0%, n = 21) were familiar with the WHO definition of a probiotic, compared to 55.7% (n = 230) of dietitians. The majority of dietitians (67.8%, n = 280) and GPs (70%, n = 21) correctly agreed that not all yogurts have proven clinical evidence of health benefits, while less than half (44.5%, n = 281) of paediatricians agreed with the statement. A similar and slightly higher proportion of dietitians (40.4%, n = 167) and paediatricians (40.7%, n = 257) compared to GPs (33.3%, n = 10) agreed that probiotic yogurts contain additional bacteria with proven health benefits. The majority of respondents agreed that probiotics and live active cultures are not the same (n = 945, 91.6%). Few respondents (n = 158, 20.5%) agreed with the statement that all yogurts contain bacteria. Dietitians (50%, n = 216) agreed that probiotics should be taken daily for efficacy, whereas 24.9% (n = 211) paediatricians and 36.1% (n = 13) GPs agreed with this statement.

Less than a third of dietitians (31.7%, n = 131), paediatricians (28.3%, n = 179) and GPs (16.7%, n = 5) agreed that a probiotic

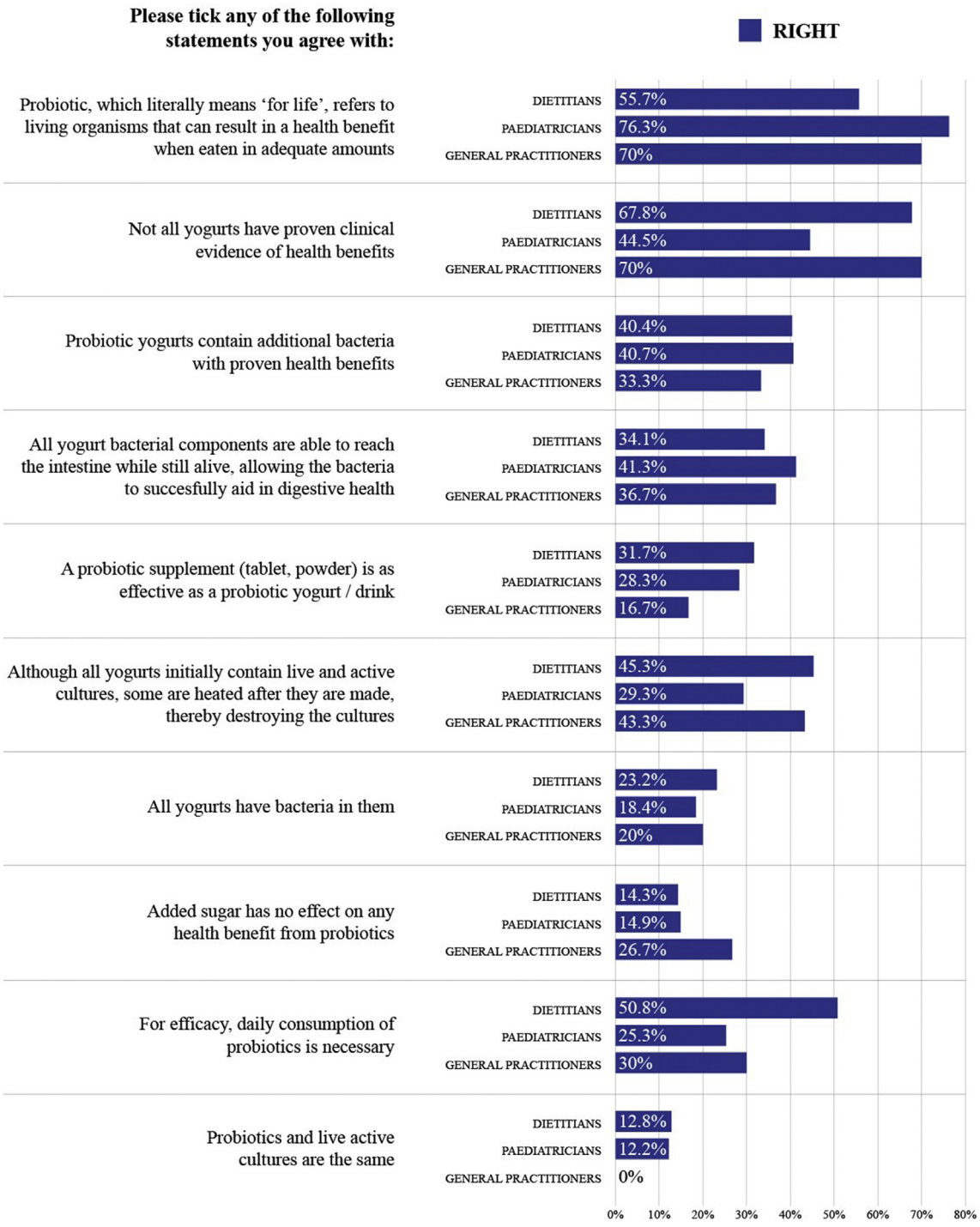

Fig. 1. HCP probiotic knowledge: Percentage of HCPs in agreement with each statement.

supplement (tablet or powder) would be as effective as a probiotic yogurt or drink. This is supported by the particular strains that HCPs are likely to recommend (Fig. 2) and the types of probiotic products that HCPs reported they prefer to recommend: 16.7% (n = 69), 58% (n = 370) and 13% (n = 4) of dietitians, paediatricians and GPs respectively prefer to recommend a probiotic powder; 23% (n = 95), 32% (n = 203) and 26.7% (n = 8) prefer to recommend a probiotic tablet, 43.0% (n = 204), 34% (n = 219) and 27% (n = 20) prefer to recommend a probiotic yogurt and 50% (n = 207), 14.6% (n = 32) and 43% (n = 13) prefer to recommend a probiotic fermented milk.

In addition, the results of the survey indicate that the majority of HCPs (81.5%, n = 957) agreed that the efficacy of probiotics is supported by evidence demonstrating their role in balancing the intestinal flora and enhancing its functionality. Overall, 67.6% (n = 803) of HCPs agreed with the evidence supporting the use of probiotics in AAD, with the majority of paediatricians accepting the evidence behind the treatment of AAD (71.1%, n = 553). Although, 40% (n = 313) of paediatricians believed that probiotics alleviated thrush (oral or vaginal not specified), a substantial proportion of HCPs overall neither agreed nor disagreed with the statements that probiotics alleviate thrush (43.8%, n = 512), psoriasis (59.4%,

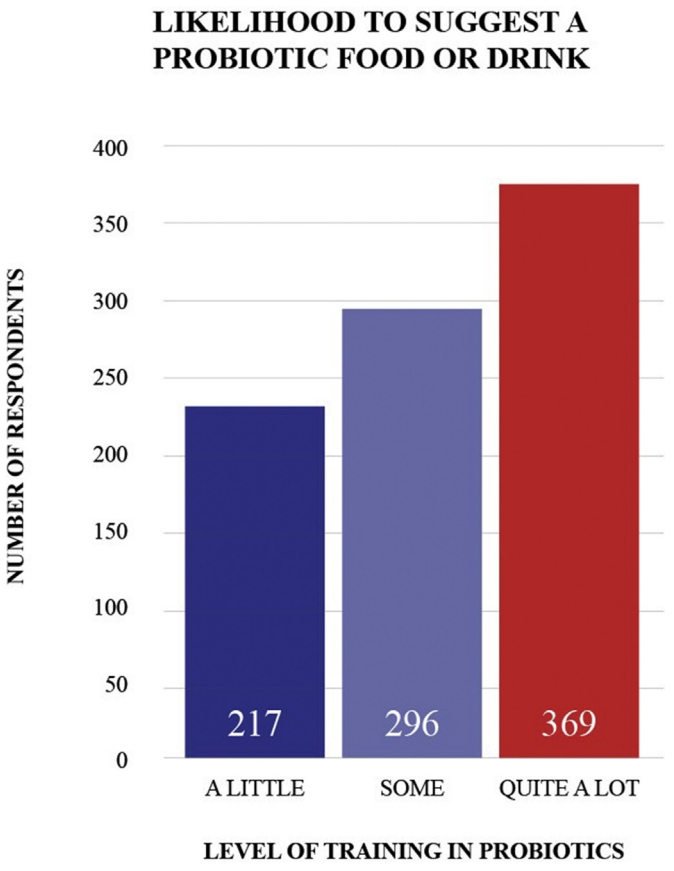

Fig. 2. The level of training in probiotics cross-tabulated with the likelihood of an HCP to recommend a probiotic.

n = 696), improve infection control (45.6%, n-538) or reduce the risk of a common cold (44.8%, n = 520).

When comparing the three professional groups, dietitians had the least training in probiotics with 91.9% (n = 1250) describing their training in probiotics as 'some/a little'. When questioned whether there is a need for additional HCP education in probiotics, 91% (n = 1120) of the respondents answered positively. Whilst weak, there was a significant, positive correlation between high levels of training and the likelihood of an HCP recommending a probiotic ($r = 0.241$, $p < 0.005$).

Frequency of probiotic recommendation was correlated to whether HCPs had concerns regarding probiotic use; overall, 8.4% (n = 114) of HCPs with concerns versus 24.3% (n = 330) of HCPs with no concerns, were likely to recommend probiotics daily. A Chi-squared test confirms that the level of concern has a significant impact on recommendation habits; the more concerns an HCP has, the less likely they are to recommend a probiotic regularly ($p < 0.005$).

Dietitians relayed a significantly higher level of concern, with 53% (n = 182) answering yes to 'do you have a concern' ($p < 0.005$). Paediatricians 17.7% (n = 142) and GPs 29% (n = 9) responded affirmatively. The most frequently cited concerns for dietitians were around the use of probiotics within immunosuppressed patients (28%, n = 19), their own lack of education (28%, n = 19), evidence and efficacy (26%, n = 18) and cost (11%, n = 7) (figures are the percentage of the concerns raised by dietitians).

Paediatricians agreed that caution needs to be exercised with immunosuppressed patients (16%, n = 8) and raised concern about an allergic reaction (8.6%, n = 13) to the chosen probiotics. There was a low level of concern amongst paediatricians regarding use in neonates (2%, n = 3); including the therapeutic indications of probiotics (2%, n = 3); resistance to probiotics (2%, n = 3); dysbiosis or imbalance of gut microbiota (2%, n = 3), level of evidence-base (1%, n = 1); overgrowth of gut microbiota (1%, n = 1) and emotional impact (1%, n = 1). General Practitioners cited efficacy as their leading concern (37.5%, n = 4) followed by cost (12.5%, n = 1), evidence (12.5%, n = 1) and use in immunosuppressed patients (12.5%, n = 1).

Specific examples of concerns respondents raised within the free text sections included:

> *"Evidence for their use remains low and there are many probiotics on the market, but many do not have any scientific evidence demonstrating effectiveness of the specific product"*

> *"As I don't fully understand them, and am not convinced the evidence is there to fully support their use, I would be cautious/concerned about using them without convincing myself of their usefulness"*

> *"Cost for patients, difficulty in (patient) making an informed decision as most information is published by companies which produce the products, studies on one product/strain of bacteria are not necessarily transferable to other products"*

4. Discussion

The role of the gut microbiota in health and disease alongside the utility of probiotics in multiple therapeutic areas, described in several recent meta-analyses, is reflected in the results of this survey (2, 4–6).

Good quality, patient-orientated evidence shows probiotics reduce the risk of AAD and increase remission rates in adult ulcerative colitis [7]. This survey reports that the majority of respondents agreed that probiotics have a place in clinical practice (86.3%, n = 1068) and the majority were likely to recommend a probiotic food or drink (72.1%, n = 882). Although the author notes that there may have been significant response bias favouring HCPs with an interest in probiotics. However, the proportion of dietitians recommending a probiotic reported in this survey (55.3%, n = 194) is lower than recorded in a previously published UK survey where 91.2% of dietitians were likely to recommend a probiotic [11]. Although the dietitian respondents in this survey believed probiotics have a place in clinical practice, only 55.3% (n = 194) reported that they were likely to recommend one, leaving a substantial proportion (44.7%, n = 157) not likely to recommend a probiotic. The majority of respondents believe probiotics have a place in clinical medicine, consequently, the concerns they have about recommending probiotics may highlight a lack of confidence between an intent to recommend and actual clinical practice. A lack of confidence may originate from a lack of education about probiotics.

The results of this survey also suggest that, despite the majority of respondents agreeing that probiotics having a place in clinical practice, there is variation between the different professions with regards to the degree to which probiotics are believed to be evidence-based interventions for health. A lower proportion of dietitians compared to paediatricians and GPs agreed with this statement. Furthermore, dietitians rated their knowledge of probiotics lower than paediatricians and GPs. Although widely publicised, dietitians had a lower level of awareness of the WHO definition of a probiotic than paediatricians and GPs. The majority of dietitians (67%, n = 280) rightly agreed that not all yogurts have proven clinical evidence of health benefits, however, only 23.2% (n = 99) believed that all yogurts contain bacteria, thereby leaving 76.8% (n = 327) incorrectly claiming that only certain yoghurts

contain bacteria. This indicates a lack of consensus among HCPs and substantiates the need for additional education about probiotics.

The results of this survey indicate that paediatricians are more likely to suggest probiotics for children with gastrointestinal issues and allergies, while dietitians are more likely to recommend probiotics to adults for bloating, and to the general population for IBS. This aligns with the probiotic guidance developed by the European Society for Primary Care Gastroenterology (ESPCG), as reported in a systematic review of probiotics in the management of lower gastrointestinal symptoms in clinical practice, where the evidence for probiotics in IBS was rated highly [8]. The results of this survey suggest that paediatricians appear to be more confident in their knowledge of probiotics and their ability to recommend a specific product.

This study has limitations which should be considered. The response rate for the survey was very low and the results may not therefore be representative of each of the three professions. There may have been overlap between those who completed the online survey and those who completed a survey at the conference although this is unlikely. It cannot be assumed that the results are generalizable to other HCPs who did not respond. Although the survey was piloted, it is possible that some questions were not clear which may impact on respondents' responses.

Patients are likely to benefit from an increase in knowledge levels of probiotics amongst relevant groups of HCPs. Increased knowledge should instil confidence in HCPs to offer the patient the most effective treatment option [9]. Education about the field of gut microbiota and probiotics should be provided to HCPs [2] at a level that is appropriate for their clinical application, using an evidence-based approach, to counteract a lack of confidence due to a lack of knowledge [9,21]. The need for education is confirmed by the results of this survey, where HCPs who rate their knowledge as high, are more likely to recommend a probiotic. Resources need to be produced, and promoted to professional groups such as dietitians, paediatricians and GPs to allow patients to benefit from the treatments options available via probiotics.

Statement of authorship

Zelda Wilson designed the questionnaire, performed the analysis, wrote the draft manuscript and approved the final version for submission for publication. Kirsten Whitehead contributed significantly to this project in the design of the survey, preparing the ethics application, the analysis and in commenting in detail on the manuscript.

Conflict of interest

The lead author is an employee of Groupe Danone, 17, Boulevard Haussmann, Paris 75009.

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This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Transparency declaration

The lead author affirms that this manuscript is an honest, accurate, and transparent account of the study being reported. The reporting of this work is compliant with STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines. The lead author affirms that no important aspects of the study have been omitted and that any discrepancies from the study as planned have been explained.

CRediT authorship contribution statement

Zelda Wilson: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data curation, Writing - original draft, Writing - review & editing, Visualization, Project administration. **Kirsten Whitehead:** Supervision.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.clnesp.2019.08.004.

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