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## ORIGINAL ARTICLE

# Probiotic use in clinical practice: Results of a national survey of gastroenterologists and nutritionists<sup>☆</sup>



L.R. Valdovinos-García<sup>a</sup>, A.T. Abreu<sup>b</sup>, M.A. Valdovinos-Díaz<sup>a,\*</sup>

<sup>a</sup> Departamento de Gastroenterología, Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán, SSA, Mexico City, Mexico

<sup>b</sup> Unidad de Medicina de Atención Ambulatoria Villa Coapa, Hospital General Regional N.º 2, Instituto Mexicano del Seguro Social, Mexico City, Mexico

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### KEYWORDS

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### Abstract

**Introduction and aims:** Probiotics are effective in gastrointestinal disease management. In Mexico, there are no studies on the use and prescription of probiotics by healthcare professionals. Our aim was to evaluate probiotic use and prescription on the part of gastroenterologists and nutritionists.

**Materials and methods:** An online survey questionnaire was sent to members of the *Asociación Mexicana de Gastroenterología* (n = 1042), the *Asociación Mexicana de Nutriología* (n = 220), and healthcare professionals registered at the Fourth International Symposium: Intestinal Microbiota (n = 1328).

**Results:** Response was 34% (997 questionnaires answered) and 570 (64%) of the respondents were women. Mean participant age was 36.2 years (range 18–83). Thirty-six percent of the participants were gastroenterologists, 46% were nutritionists, and 18% were chemists and microbiologists. Seventy-one percent of the respondents knew the Food and Agriculture Organization (FAO) definition of probiotics and recommended them «always» (64.9%), «rarely» (31.7%), and «never» (3.6%). Gastroenterologists indicated probiotics for the treatment of disease (56.5%) and nutritionists for health maintenance (39%). Ninety-seven percent of the gastroenterologists and 98% of the nutritionists evaluated probiotics as effective in gastrointestinal symptom management and considered them safe. The majority of the respondents did not know which probiotic strain was contained in the commercial probiotic product.

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\* Corresponding author. Vasco de Quiroga 15, Colonia Sección 16, Del. Tlalpan, Mexico City CP 14000, Departamento de Gastroenterología, Tel.: +54870900, extension 2706-2710

E-mail address: [miguelvaldovinosd@gmail.com](mailto:miguelvaldovinosd@gmail.com) (M.A. Valdovinos-Díaz).

**PALABRAS CLAVE**

Probióticos;  
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probióticos;  
Encuesta

**Conclusions:** The survey results showed that the participating gastroenterologists and nutritionists understood the concept of probiotics, recommended them frequently, and considered them safe. The gastroenterologists prescribed probiotics as therapeutic agents and the nutritionists to maintain health. There was a lack of knowledge about the microbial composition of the products containing probiotics available in Mexico.

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## Uso de probióticos en la práctica clínica: resultados de una encuesta nacional a gastroenterólogos y nutriólogos

### Resumen

**Introducción y objetivo:** Los probióticos son efectivos en el manejo de enfermedades gastrointestinales. En México, no hay estudios sobre usos y prescripción de los probióticos por los profesionales de la salud. Nuestro objetivo fue evaluar el uso y prescripción de probióticos por gastroenterólogos y nutriólogos.

**Material y métodos:** Una encuesta electrónica fue enviada a los miembros de la Asociación Mexicana de Gastroenterología (n = 1,042) y a la Asociación Mexicana de Nutriología (n = 220) y a los registrados en el IV Simposio Internacional: Microbiota Intestinal (n = 1,328).

**Resultados:** La respuesta fue del 34% (997 encuestas contestadas), 570 eran mujeres (64%), la edad promedio fue de 36.2 años (rango 18-83), el 36% fueron gastroenterólogos, el 46% nutriólogos y el 18% químicos y microbiólogos. El 71% conoce la definición de la Organización de las Naciones Unidas para la Agricultura y la Alimentación (FAO) de probióticos. Un 64.9% los recomienda siempre, un 31.7% rara vez y nunca un 3.6%. La indicación de probióticos por los gastroenterólogos fue el tratamiento de enfermedades (56.5%) y por los nutriólogos el mantenimiento de la salud (39%). El 97% de los gastroenterólogos y el 98% de los nutriólogos evaluaron a los probióticos como efectivos para el manejo de síntomas digestivos. El 97% de los gastroenterólogos y el 98% de los nutriólogos consideraron que los probióticos son seguros. No hubo relación entre los productos comerciales con probióticos y las cepas recomendadas.

**Conclusiones:** Los gastroenterólogos y nutriólogos conocen el concepto de probióticos, los recomiendan frecuentemente y consideran que son seguros. Los gastroenterólogos prescriben los probióticos como agentes terapéuticos y los nutriólogos para conservar la salud. Existe un desconocimiento de la composición microbiana de los productos con probióticos disponibles en México.

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## Introduction and aims

Probiotics are live microorganisms that, when administered in adequate amounts, confer a health benefit on the host.<sup>1</sup> Scientific interest in probiotics has been increasing significantly since the beginning of the twenty-first century, due in part to the recent knowledge about the gut microbiota and its role in health and disease, but also due to the growth of the consumption and sales of probiotics. Today, probiotics are available as functional foods or supplements and as medications. The wide variety of commercial products with different presentations (capsules, tablets, envelopes, vials, foods, supplements, milk formulas, etc.) with varying doses and microbial compositions make the choice of a probiotic difficult in clinical practice.<sup>2</sup>

There are numerous clinical trials, meta-analyses, and systematic reviews that show the beneficial effect of probiotic use in gastrointestinal diseases.<sup>3,4</sup> That scientific evidence supports the use of probiotics in the treatment of acute infectious diarrhea,<sup>5</sup> in the prevention of antibiotic-associated diarrhea,<sup>6</sup> in *Clostridium difficile* infection,<sup>7</sup> in *Helicobacter pylori* eradication therapy,<sup>8-10</sup> in the management of irritable bowel syndrome,<sup>11</sup> ulcerative colitis,<sup>12</sup> pouchitis,<sup>13</sup> and in occult and overt hepatic encephalopathy.<sup>14</sup> Other indications for probiotic use in gastroenterology, whose evidence is limited and requires further study, are infantile colic,<sup>15</sup> diverticular disease of the colon,<sup>16</sup> chronic functional constipation,<sup>17</sup> radiation enteritis,<sup>18</sup> necrotizing enterocolitis,<sup>19</sup> gastrointestinal cancer, and fatty liver disease.<sup>20</sup> Different guidelines and consensus have been published on the use of probiotics in gastroenterology.

There are no studies in Mexico on the pattern of prescription and the clinical use of probiotics by gastroenterologists and specialists in clinical nutrition.

The aim of the present study was to investigate which probiotics are the most widely used, as well as finding out the indications for and recommendations of probiotics by Mexican gastroenterologists and nutritionists.

## Subjects and methods

### Subjects

An anonymous online survey was conducted on gastroenterologists that are members of the *Asociación Mexicana de Gastroenterología*, nutritionists that belong to the *Asociación Mexicana de Nutriología A.C.*, and individuals who attended the Fourth International Symposium: "Gut Microbiota" held in Mexico City on May 29 and 30, 2015. Gastroenterologists and nutritionists with active clinical practices, either in the private or public sector, that voluntarily agreed to answer the anonymous questionnaire, with no remuneration, were included in the study. Students or interns and physicians with no clinical practice were excluded.

### Sample size

For the gastroenterologist group, data were taken from the General Administration of Healthcare Information and the 2011 Human Resources statistics (*SS/DGIS SINAI* [Spanish acronym], 2011), which reported the existence of 476 gastroenterologists and 17,134 general surgeons in Mexico, together totaling 17,610 physicians. For that finite population, the sample size for estimating a proportion was calculated, utilizing a 95% confidence interval, a 5% margin of error, and a worst-case-scenario heterogeneity of 50%, resulting in a sample size of 376 for the gastroenterologist group. For the nutritionist group, the datum was taken from the National Institute of Statistics and Geography (*INEGI*, Spanish acronym) and the 2012 National Job and Employment Survey (*ENOE*, Spanish acronym) that reported the existence of 2.4 nutritionists per 1,000 inhabitants. With the registration of 120.8 million inhabitants in Mexico in 2012, the number of nutritionists was calculated as 338,240 (*INEGI/ENOE* 2012). For that finite population, the sample size for estimating a proportion was calculated, utilizing a 95% confidence interval, a 5% margin of error, and a worst-case-scenario heterogeneity of 50%, resulting in a sample size of 384 for the nutritionist group.

### Survey

The questionnaire was formulated using the "SurveyMonkey" online instrument that included 20 questions: 3 matrix questions and 17 multiple choice questions (Appendix 1). The demographic data of age, sex, professional activity, educational level, type of clinical practice, and years of clinical practice experience were included. The pattern of probiotic recommendation was studied according to recommendation frequency,

prescription justification, indications, recommended strains, most widely prescribed commercial products, most important probiotic characteristic for its recommendation, probiotic safety perception, and personal probiotic use.

### Statistical analysis

Results were expressed in mean, median, standard deviation, and interquartile ranges, depending on the type of variable. The chi-square test and Student's t test were used for the statistical analysis, depending on the data to be analyzed. Calculations were made using the Stata version 14.1 statistics package.

The present study was exempt from review by the Ethics Committee.

## Results

There were 997 (34.49%) responses to the 2,590 invitations sent requesting participation in the survey. A total of 382 gastroenterologists, 453 nutritionists, and 162 nurses, microbiologists, chemists, and others answered the questionnaire. Of the participants, 300 (30.09%) had no clinical activity or practice related to gastroenterology or nutrition, and so were excluded from the remaining questions of interest for the present study. The final sample consisted of 697 surveyed participants, of which 357 (51.21%) were gastroenterologists and 340 (48.78%) were nutritionists. The demographic data of the participants included in the study are shown in Table 1.

A total of 211 (64.92%) gastroenterologists and 245 (76.08%) nutritionists ( $p=0.002$ ) knew the definition of probiotics, according to the United Nations Food and Agriculture Organization (FAO). Figure 1 shows the distribution of the frequency with which the survey participants recommended the use of probiotics.

The majority of gastroenterologists (56.5%) and only 35.5% of the nutritionists recommended probiotic use because they considered them effective in the treatment of diseases. The majority of the nutritionists (39%) and only 21.5% of gastroenterologists considered probiotics necessary for maintaining a good state of health.

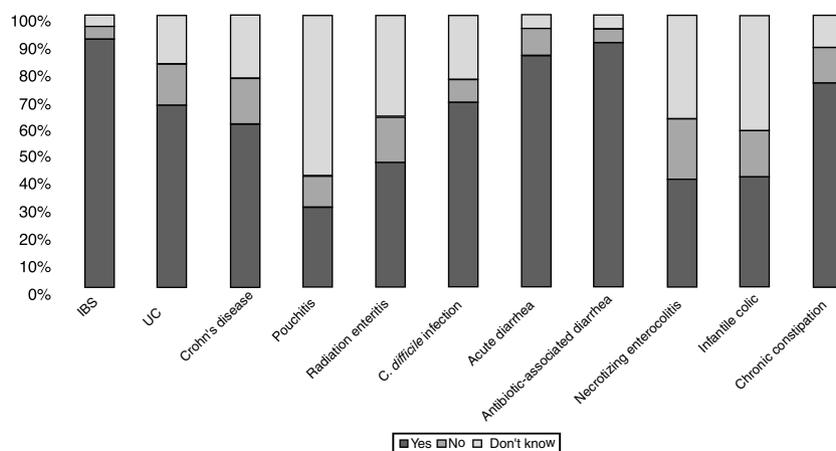
More than 97% of the those surveyed were completely or partially in agreement with the use of probiotics to manage symptoms and gastrointestinal diseases (fig. 2). More than 80% of the survey participants of both groups considered probiotics useful for treating irritable bowel syndrome, acute diarrhea, and antibiotic-associated diarrhea. They did not consider them useful in the treatment of ulcerative colitis, Crohn's disease, pouchitis, radiation enteritis, necrotizing enterocolitis, or infantile colic. The majority of gastroenterologists recommended probiotics for the treatment of pseudomembranous colitis due to *Clostridium difficile* infection and only 52.04% of the nutritionists considered probiotics useful in that pathology. A total of 83.49% of the nutritionists and 65.01% of the gastroenterologists recommended probiotics for the treatment of chronic constipation.

**Table 1** Demographic characteristics of the subjects surveyed.

Characteristic n (%)	Gastroenterologists n = 357	Nutritionists n = 340	p
Men	243 (81.54)	55 (16.46)	0.000
Women	114 (28.57)	285 (71.43)	0.000
Age in years (SD)	47.66 (14.93)	29.98 (8.98)	0.000
Specialty	260 (89.35)	31 (10.65)	0.000
Master's degree	49 (44.14)	62 (55.86)	0.140
Doctoral degree	12 (57.14)	9 (42.86)	0.581
Post-doctoral degree	2 (100)	0 (0)	0.500
None	34 (12.50)	238 (87.50)	0.000
Private practice	128 (46.55)	147 (53.45)	0.046
Institutional practice	66 (46.48)	76 (53.52)	0.205
Both practices	163 (58.21)	117 (41.79)	0.002
Pediatrics practice	31 (93.24)	2 (6.06)	0.000
Adult practice	264 (66.17)	135 (33.83)	0.000
Pediatrics and adult practice	62 (23.40)	203 (76.60)	0.000



**Figure 1** Frequency of recommendations of probiotics by gastroenterologists and nutritionists.



**Figure 2** Awareness of the evidence that supports the use of probiotics in the different gastrointestinal diseases.

The most important characteristics considered by the gastroenterologists and nutritionists for prescribing a probiotic are shown in Table 2. The strain tested in a clinical study for the symptom or specific disease was the most

important characteristic for prescribing a probiotic for 141 (44.33%) gastroenterologists and 106 (34.30%) nutritionists, with a significant difference between the groups ( $p = 0.010$ ).

**Table 2** Most important characteristic for the prescription of probiotics.

	Gastroenterologists n = 318 (%)	Nutritionists n = 309 (%)	p
Product cost and presentation	25 (7.86)	27 (8.73)	0.691
Contains a greater variety of strains and number of live microorganisms	53 (16.66)	67 (21.68)	0.110
Contains the specific strain tested in the clinical study for the symptom or specific disease	141 (44.33)	106 (34.30)	0.010
Quality control and ethics of the production industry or manufacturer	46 (14.46)	30 (9.70)	0.037
Wide availability and accessible price of the product	50 (15.72)	74 (23.94)	0.010
Others	3 (0.97)	5 (1.61)	0.499

**Table 3** Knowledge on the part of gastroenterologists as to the probiotic strain contained in the commercial product.

Commercial product	Knowledge of the strain and the commercial product (%)	Knowledge of the commercial product but not the strain (%)	No knowledge of the strain or the commercial product (%)
Yakult	67.65	30.51	1.84
Floratil	65.02	28.98	6.01
Enterogermina	52.63	39.47	7.89
Lactipan	47.08	45.99	6.93
Gastro Protect	49.22	45.35	5.43
Lacteol Fort	46.99	43.98	9.02
Lacteol Cron	40.89	44.61	14.50
Zir Fos	40.23	42.91	16.86
Probio HP	39.02	47.35	13.64
Glutapak R	38.76	38.37	22.87
Activia	37.89	60.94	1.17
Sinuberase	35.77	54.62	9.62
Liolactil	36.47	48.63	14.90
Neoflor	34.11	49.22	16.67
Biogaia	32.26	45.97	21.77
Senex 3	31.17	49.39	19.43
Rebiot E	17.31	71.54	11.15

More than 97% of those surveyed, from both groups, were in complete or partial agreement that probiotics were safe and did not present a health risk.

The main reason the surveyed participants did not recommend probiotics was cost for 19.7% of the gastroenterologists and 27.6% of the nutritionists, with a significant difference between the groups. Probiotics were not recommended by 18.8% of gastroenterologists because they considered there was not enough scientific evidence to support their use and by 7% because they were unaware of the scientific evidence on probiotic use (Table 3). A total of 147 (50.34%) gastroenterologists and 213 (66.14%) nutritionists stated that they personally consumed probiotics.

Tables 3 and 4 show the commercial probiotic products most recommended by the gastroenterologists and nutritionists, respectively. In addition, the percentage of surveyed participants that had knowledge of the probiotic strain contained in the recommended product were shown, as well as the percentage of surveyed participants that knew the commercial product but not the probiotic strain it contained, and the percentage of participants that knew neither the probiotic strain nor the commercial product. When the

matrix question of the name of the commercial product and the matrix question of the probiotic strain were matched, no commercial product reached more than 80% of knowledge of the probiotic strain it contained.

## Discussion and conclusions

In our study, we found that the majority of the gastroenterologists and nutritionists surveyed recommend the use of probiotics. The gastroenterologists consider probiotics useful in the treatment of gastrointestinal diseases and the nutritionists use them to prevent disease or maintain a good state of health. The results also showed that more than half of the participants surveyed consumed probiotics themselves. Those data suggest that the concept that probiotics are beneficial in relation to states of health and disease has spread among healthcare professionals. That could be due to an increase in the marketing and sales of probiotics worldwide and to a significant increase in the scientific evidence that supports the use of probiotics under conditions of health and disease.<sup>1,2</sup> However, our results clearly show

**Table 4** Knowledge on the part of nutritionists as to the probiotic strain contained in the commercial product.

Commercial product	Knowledge of the strain and the commercial product (%)	Knowledge of the commercial product but not the strain (%)	No knowledge of the strain or the commercial product (%)
Yakult	73.87	23.69	2.44
Gastro Protect	61.23	32.61	6.16
Glutapak R	45.08	30.68	24.24
Activia	24.05	74.43	1.53
Sinuberase	24.60	58.73	16.67
Floratil	22.40	39.60	38.00
Probio HP	20.93	39.92	39.15
Lactipan	19.70	47.35	32.95
Enterogermina	19.61	44.71	35.69
Biogaia	15.89	42.64	41.47
Senex 3	15.63	48.44	35.94
Lacteol Cron	15.54	34.26	50.20
Lacteol Fort	14.51	43.92	41.57
Liolactil	13.83	45.45	40.71
Zir Fos	13.15	39.04	47.81
Neoflor	10.55	34.38	55.08
Rebiot E	10.42	54.05	35.52

that both the gastroenterologists and nutritionists recommend commercial products with probiotics without taking the concept of strain specificity and clinical indication into account. In over 80% of the products recommended, the gastroenterologists and nutritionists did not know the probiotic strain it contained. That undesirable prescription pattern could cause therapeutic failure with probiotics.

In the present study, we found that the majority of the survey participants recommended the use of probiotics in infectious diarrhea and antibiotic-associated diarrhea. That result concurs with different controlled clinical trials and meta-analyses that have shown that probiotics are effective in those two conditions, with very good quality of evidence.<sup>5,6</sup> Studies on the use of probiotics for treating *C. difficile* infection have demonstrated that some probiotic strains help prevent the infection, but do not cure it.<sup>21,22</sup> Half of the gastroenterologists surveyed recommended probiotics in cases of said infection. With respect to irritable bowel syndrome and chronic constipation, probiotics have shown a beneficial effect, but the scientific evidence in those disorders is of moderate-to-low quality.<sup>23–25</sup> The majority of the participants surveyed recommended the use of probiotics in irritable bowel syndrome and chronic constipation. In contrast, the gastroenterologists and nutritionists did not prescribe probiotics in ulcerative colitis, Crohn's disease, diverticulosis, radiation enteritis, or infantile colic. Those findings suggest that there is a partial lack of knowledge in the gastroenterology and nutrition communities about the scientific evidence and clinical guidelines published on the use of probiotics in different gastrointestinal conditions.

Regarding the safety of probiotics, almost all the participants surveyed considered probiotics to be safe. Even though the literature contains reports of a very limited number of cases of bacteremia due to *Lactobacilli*, and fungemia due to yeasts, in patients with central vein catheters or that are immunosuppressed, in general, probiotics are

recognized to be a safe therapeutic tool, with no major adverse events.<sup>26</sup>

One of the limitations of our study was the low response rate to the online survey (30%), which did not allow us to generalize the conclusions to the entire population of gastroenterologists and nutritionists in Mexico. Another was the fact that the questionnaire was not internally and externally validated. Nevertheless, a considerable number of gastroenterologists and nutritionists were surveyed, and an attempt was made to include the most relevant items in the questionnaire to become aware of the probiotic prescription pattern.

We conclude that gastroenterologists and nutritionists in Mexico understand the concept of probiotics and the majority consider them to be beneficial under conditions of health and disease. However, there is a partial lack of knowledge of the scientific evidence and clinical guidelines on the efficacy of probiotics in digestive disorders. Products with probiotics are recommended without knowing the probiotic strains they contain. Programs of continuous medical education and diffusion of the clinical guidelines are required for the appropriate use of probiotics in Mexico.

## Ethical disclosures

**Protection of human and animal subjects.** The authors declare that no experiments were performed on humans or animals for this study.

**Confidentiality of data.** The authors declare that they have followed the protocols of their work center on the publication of patient data.

**Right to privacy and informed consent.** The authors declare that no patient data appear in this article.

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## Conflict of interest

Miguel A. Valdovinos Díaz is a Member of the Advisory Board of Biocodex, Sanofi, Menarini, Mayoly-Spindler, and Takeda. He is a Speaker for Takeda, Ferrer, Sanofi, Menarini, Mayoly-Spindler, Columbia, Biocodex, and Carnot.

Ana Teresa Abreu y Abreu is a Member of the Advisory Board of the Sanofi, Takeda, and Mayoly-Spindler laboratories. She is a Speaker for Takeda, Sanofi, Mayoly-Spindler, Alfa Wassermann, Carnot, and Biocodex.

Luis Raúl Valdovinos García declares that he has no conflict of interest.

## Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at [doi:10.1016/j.rgm.2018.10.001](https://doi.org/10.1016/j.rgm.2018.10.001).

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