

Research Article



Difficulties experienced by endodontics researchers in conducting studies and writing papers

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Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Author Contributions

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ABSTRACT

Objectives: The study investigated the difficulties experienced by endodontics researchers around the world in conducting studies and writing papers.

Materials and Methods: A survey consisting of 18 questions on the difficulties experienced by endodontics researchers in performing studies and writing papers was e-mailed to academics in the field of endodontics working at 202 universities. The independent risk factors were analyzed using binary logistic regression at a significance level of 0.05.

Results: A total of 581 individuals (10.7%) agreed to participate in the study. Almost half the participants (48.2%) reported that they had received some type of training in conducting studies and writing papers. In response to the question, “Do you get help from a statistician to perform the statistical analyses of your studies?,” 77.1% answered “yes.” Around 40% of the participants stated that the need to obtain ethical approval negatively affected their desire to conduct studies. The participants’ regions had no effect on the reported difficulties associated with writing papers in English or conducting statistical analyses ($p > 0.05$). Most participants (81.8%) reported difficulties in writing the Discussion section, regardless of their region, academic degrees, or years of experience.

Conclusions: The participants stated they experienced difficulties in many areas, such as conducting statistical analyses, finding new ideas, and writing in English. Engaging in a detailed examination of ethics committee rules, expanding biostatistics education, increasing the number of institutions providing research funding, and increasing the number of endodontics journals can increase the enthusiasm of endodontics researchers to publish papers.




Keywords: Article writing; Biostatistics; Endodontics journals; Endodontics materials; Methodological design

INTRODUCTION

Dentistry is one of the most important fields of health sciences; therefore, it must be based on solid scientific evidence [1,2]. Scientific evidence is slowly structured from research that is formally described in scientific articles. Determining a subject of interest and research question is the first step in this process. Subsequently, all the clinical or laboratory phases

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must be correctly implemented to reach reliable results that will be shared with the scientific community [3-7].

The complexity of dental procedures and the multiple factors associated with their results make dental research a significant challenge [8]. For a scientific finding to contribute substantially to the establishment of scientific evidence, it must have been obtained through research with a well-outlined methodological design, and its results must have been correctly analyzed statistically. Then, the scientific findings must be formally communicated via an impartial and properly written paper [9].

English is considered the “universal language,” and therefore, it is the language of choice in several fields, including science. Currently, 98% of scientific publications are written in English, especially in the areas of natural and basic sciences, establishing English as the “lingua franca” of science [10]. This creates a disadvantage for scientists who have learned English as a foreign language because they must publish complex texts in a foreign language to advance their careers. According to Ramírez-Castañeda [11], English proficiency and socioeconomic level influence scientific success, access to knowledge, and expatriation, among other things.

The importance of ethics for research studies is well established and guided by the principles enshrined in the Declaration of Helsinki [12]. Ethics associated with research in different areas are a subject of great interest. For this reason, the existence of an ethics committee at universities or other educational institutions is essential. The task of an institutional research ethics committee is to ensure respect towards all those who participate in research, defending their interests in terms of integrity, autonomy, and dignity; acknowledging their vulnerability; and ensuring that research upholds ethical standards [13].

Another major challenge related to research is data analysis and the interpretation of results [14]. For this, it is necessary to master statistics, a form of mathematical analysis that uses quantified models, representations and synopses for a given set of experimental or real-life data. Statistics studies methodologies to gather, review, analyze, and draw conclusions from data. In the health sciences, the accuracy and relevance of statistical analysis is a critical element of scientific reports, and statistical analyses can influence the research conclusions and clinicians’ decision-making [15].

Worldwide surveys have analyzed clinicians’ preferences related to access cavity design, cleaning and shaping practices, antibiotics usage, and radiographic imaging [16-19]. However, materials and techniques are only created and developed through scientific scrutiny. Thus, this study sought to evaluate the difficulties experienced by endodontics researchers around the world in conducting studies and writing papers.

MATERIALS AND METHODS

The study protocol was approved by the Bezmialem Vakif University Ethics Committee (no. E-54022451-050.01.04-6353). Initially, a pilot study including a professor with doctor of dental surgery (DDS) and doctor of philosophy (PhD) academic degrees, an associate professor with DDS and PhD degrees, 2 assistant professors with DDS degrees, and a specialist endodontist with a DDS degree was performed to validate participants’ level of

understanding. A power analysis was conducted with the G*Power 3.1.2 program (University of Duesseldorf, Duesseldorf, Germany) to determine the sample size. An alpha level of 0.05 and a power of 0.80 were assumed when 1-sided tests were used to establish the significance of correlations. The results showed that 512 respondents were required. The questionnaire was e-mailed to 5,395 academics in the field of endodontics working at 202 different universities in 6 regions in the world. The survey was sent with a cover letter that informed the participants about the objectives of the study and provided a weblink to the survey in Google Forms (Alphabet Inc., Google LLC, Mountain View, CA, USA). The survey had 2 parts. The first part gathered information on baseline parameters, such as gender, years of experience, and academic titles and degrees, whereas the second part of the questionnaire comprised questions on difficulties in conducting research and writing papers. The questions and structure of the survey were created according to suggestions of Tsang *et al.* [20]. The questions in the survey included multiple-choice answers or checkboxes, and were written in English (Figure 1). The participants were not asked to provide personal data.

Frequencies and percentages were calculated to provide an overview of the responses. The effects of participants' region, years of experience, and academic degrees on responses to questions about using language, conducting statistical analysis, choosing a journal, obtaining ethical approval, and expense or lack of availability of materials were investigated. The independent risk factors were analyzed using binary logistic regression. All the completed questionnaires were included in the analysis. SPSS version 22 (IBM Corp., Armonk, NY, USA) was used for all statistical analyses, and a *p* value < 0.05 was considered to indicate statistical significance.

<p>Gender: A. Female B. Male</p> <p>Region: A. Asia Pacific B. Central and South America C. Europe D. Middle East and Africa E. North America</p> <p>Years of professional experience: A. ≤ 10 B. 11-20 C. 21-30 D. ≥ 31</p> <p>Your academic title: A. Specialist Endodontist B. Assistant Professor C. Associate Professor D. Professor</p> <p>Your academic degree (Select all that apply): A. DDS B. DMD C. MSc D. MSD E. PhD F. Other</p>	<p>Have you received any education on producing studies or writing articles? A. Yes B. No</p> <p>How many articles have you published in SCI or SCI Expanded indexed journals in the last 5 years? A. ≤ 3 B. 4-7 C. 7-10 D. ≥ 11</p> <p>Do you have difficulty developing new ideas for a study? A. Yes B. No C. Sometimes</p> <p>Do you have difficulty using language when writing articles? A. Yes B. No C. Sometimes</p> <p>Do you use any language editing services when writing articles? A. Yes B. No C. Sometimes</p>	<p>Does the necessity of obtaining ethical approval negatively affect your desire to produce a study? A. Yes B. No C. Sometimes</p> <p>Do you have difficulty conducting statistical analyses for a study? A. Yes B. No C. Sometimes</p> <p>Do you get help from a statistician to perform the statistical analyses for your studies? A. Yes B. No C. Sometimes</p> <p>Do you ever postpone a study because of the cost or unavailability of the materials used in your studies? A. Yes B. No C. Sometimes</p> <p>Do you have difficulty choosing a journal that is a good fit for your article? A. Yes B. No C. Sometimes</p>	<p>Do you think there are enough journals in the SCI and SCI Expanded indexes publishing in the field of endodontics? A. Yes B. No</p> <p>Which part of the article do you have the most difficulty writing? (Select all that apply) A. Abstract B. Introduction C. Material and method D. Results E. Discussion F. Conclusion G. Cover letter</p> <p>In which of the following areas do you encounter difficulties when planning a study or writing an article? (Select all that apply) A. Finding new ideas B. Using language effectively C. Obtaining ethical approval D. Conducting statistical analyses E. Expensive or unavailable materials F. Insufficient number of journals G. Limited time</p>
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Figure 1. Survey questions.

RESULTS

A total of 581 individuals (10.7%) agreed to participate in the study and completed the questionnaires. Forty-one respondents who partially completed the questionnaire were excluded from the study. Of the participants, 266 (45.8%) were men, while 315 (54.2%) were women. Participants' demographic data are shown in **Table 1**. Female participants more frequently reported difficulty writing in English than male participants (odds ratio [OR], 2.303; 95% confidence interval [CI], 1.474–3.598; $p < 0.001$). Gender had no effect on difficulty in choosing a journal to submit a paper (OR, 1.605; CI, 0.969–2.658; $p = 0.066$). Female participants were more likely to report difficulty in conducting statistical analyses than male participants (OR, 2.299; CI, 1.459–3.623; $p < 0.001$).

Most of the participants with 21–30 years of experience had published 4–7 papers in journals, while almost half of all participants (46.5%) had published 0–3 papers in SCI or SCI Expanded journals in the last 5 years. The fact that more than half of the participants had less than 20 years of experience (62.9%) and the number of published articles was directly proportional to years of experience could explain this result. The answers about developing new ideas for research, obtaining ethical approval, conducting statistical analysis, and whether any language editing service was used when writing articles are shown in **Figure 2**. Eighty-six percent of the participants had postponed a study because of the costs or unavailability of materials. More than 60% of the participants responded that only a few journals in SCI and SCI Expanded were highly interested in publishing papers in the field of endodontics (**Figure 3**). In response to the question “Do you get help from a statistician to perform the statistical analyses of your studies?,” 77.1% answered “yes.” Around 40% of the participants stated that the need to

Table 1. General characteristics of the participants

Variables	Values
Sex	
Male	266 (45.8)
Female	315 (54.2)
Region	
Asia-Pacific	122 (21)
Central and South America	108 (18.6)
Europe	147 (25.3)
Middle East and Africa	142 (24.4)
North America	62 (10.7)
Years of professional experience	
0–10	138 (23.8)
10–20	227 (39.1)
20–30	177 (20.1)
> 30	99 (17)
Academic title	
Specialist	78 (13.4)
Assistant Professor	165 (28.4)
Associate Professor	140 (24.1)
Professor	185 (31.8)
Other	13 (2.2)
Academic degree	
Doctor of Dental Surgery (DDS)	281 (48.4)
Doctor of Dental Medicine (DMD)	73 (12.6)
Doctor of Philosophy in Dentistry (PhD)	288 (49.6)
Master of Medical Science (MMSc)	99 (17)
Master of Science in Dentistry (MSD)	85 (14.6)
Other	30 (5.2)

Values are presented as number (%).

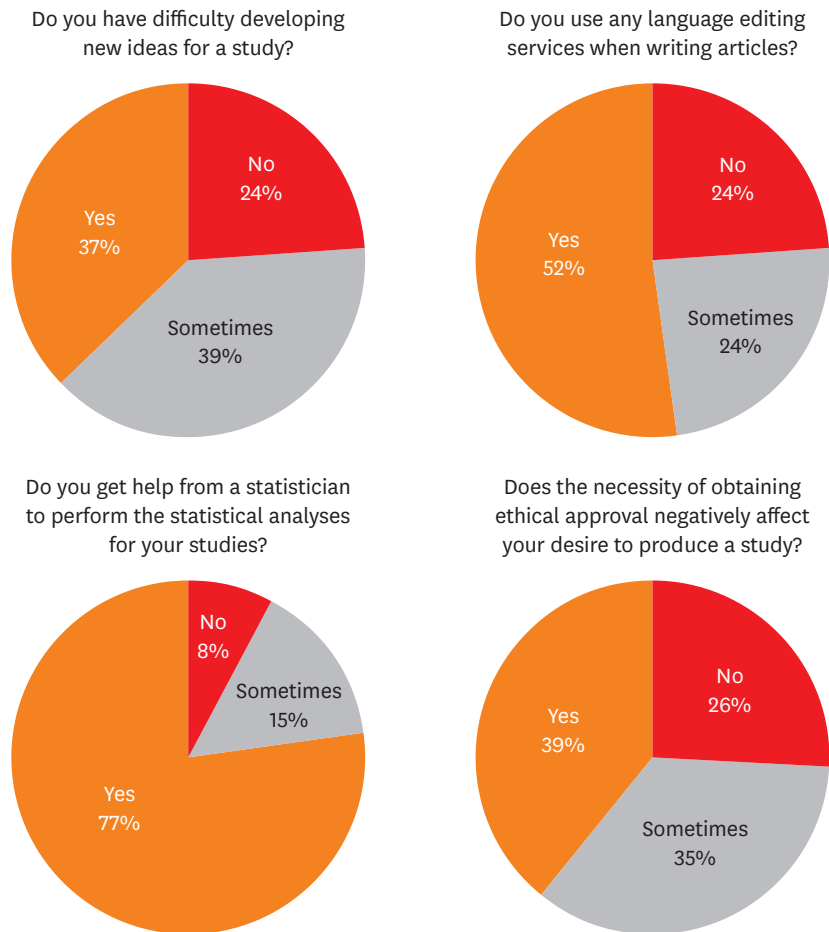


Figure 2. Responses of all participants on developing new ideas for a study, obtaining ethical approval, and conducting statistical analyses, as well as whether they used any language editing services when writing an article.

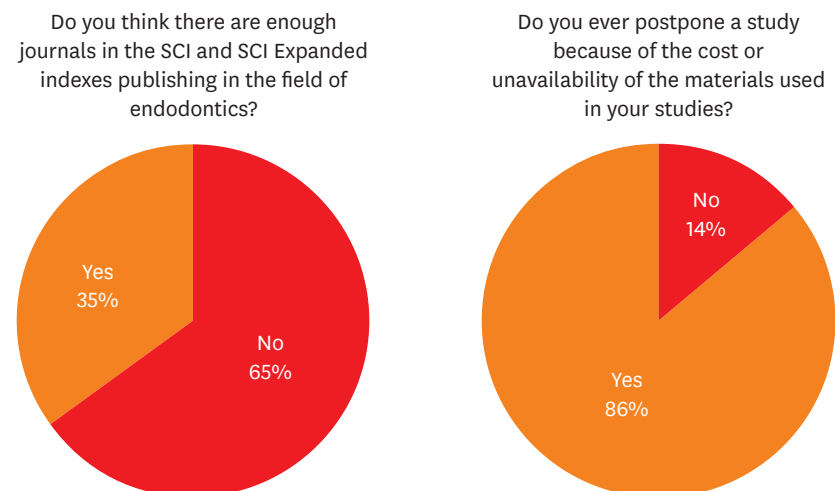


Figure 3. Responses of the participants regarding whether they had postponed a study because of the cost or lack of availability of the materials used in their studies and whether there are enough journals in the field of endodontics in the Science Citation Index (SCI) and SCI Expanded.

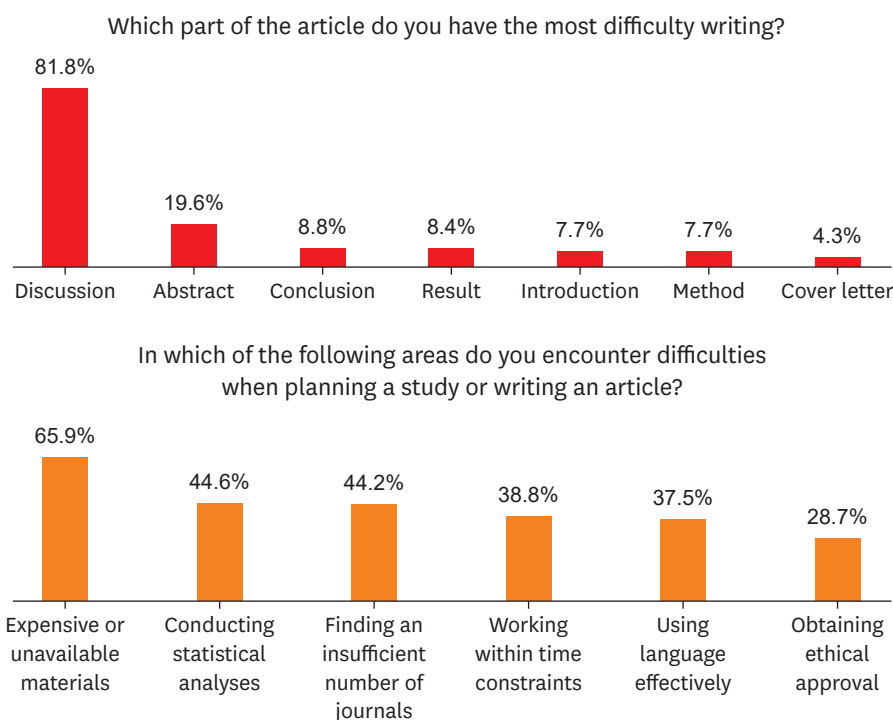


Figure 4. Participants' responses regarding the most difficult part of writing an article and the most difficult situations when writing an article.

obtain ethical approval negatively affected their desire to produce studies. All the difficulties described by the participants are shown in **Figure 4**.

The location of the participants had no effect on whether they experienced difficulty conducting statistical analyses ($p > 0.05$). When North America was considered as the reference region for difficulty finding a suitable journal to submit papers, participants from other regions were more likely to report difficulty ($p < 0.001$; **Table 2**). In the Asia-Pacific region, the need to obtain ethical approval negatively affected researchers' desire to conduct studies. This difference was statistically significant when compared with other regions (OR, 12.83; 95% CI, 5.313–30.983; $p < 0.001$).

When writing in English, less experienced researchers (0–20 years of work) were more likely to report difficulty than more experienced researchers (21 years or more of work; $p < 0.05$). No significant difference was observed when comparing the participants with 21–30 and with 31 years or more of experience (OR, 1.264; 95% CI, 0.652–2.451; $p = 0.488$). Researchers with a doctor of dental medicine (DMD), DDS, or PhD degree were less likely to report difficulty in conducting statistical analyses than those with a master of science in dentistry (MSD) degree ($p < 0.05$). No significant difference was observed between participants with master of science (MS or MSc) and MSD degrees ($p = 0.211$; **Table 3**). Factors associated with postponing a study because of costs or lack of availability of materials, as determined via logistic regression analysis, are shown in **Table 4**.

In the last 5 years, most of the participants with 21–30 years of experience had published 4–7 papers in SCI or SCI Expanded journals, whereas participants from other groups (in terms of experience) had published 0–3 articles in the same period ($p = 0.001$). Among researchers

Table 2. Factors associated with difficulty using language while writing an article and choosing a journal that matches an article among the participants, according to logistic regression analysis ($p < 0.05$)

Variables	OR (95% CI)	<i>p</i> value
Difficulty using language while writing an article		
Sex		
Female	2.303 (1.474–3.598)	< 0.001
Male	Reference	
Region		
Asia-Pacific	0.906 (0.381–2.158)	0.824
Central and South America	1.693 (0.677–4.233)	0.260
Europe	1.528 (0.591–3.953)	0.382
Middle East and Africa	0.565 (0.24–1.329)	0.191
North America	Reference	
Years of professional experience		
0–10	2.974 (1.433–6.175)	0.003
11–20	2.369 (1.275–4.403)	0.006
21–30	1.264 (0.652–2.451)	0.488
≥ 31	Reference	
Academic degree		
DMD	11.138 (2.847–43.57)	0.001
DDS	2.391 (1.097–5.21)	0.028
PhD	3.029 (1.59–5.773)	0.001
MSc	1.921 (0.846–4.363)	0.119
MSD	Reference	
Difficulty choosing a journal that matches an article		
Sex		
Female	1.605 (0.969–2.658)	0.066
Male	Reference	
Region		
Asia-Pacific	9.287 (3.724–23.163)	< 0.001
Central and South America	11.201 (4.198–29.889)	< 0.001
Europe	4.491 (1.882–10.715)	0.001
Middle East and Africa	6.585 (2.733–15.864)	< 0.001
North America	Reference	
Years of professional experience		
0–10	3.786 (1.613–8.885)	0.002
11–20	1.66 (0.845–3.259)	0.141
21–30	3.237 (1.434–7.306)	0.005
≥ 31	Reference	
Academic degree		
DMD	0.89 (0.204–3.875)	0.877
DDS	0.942 (0.266–3.337)	0.926
PhD	0.415 (0.141–1.223)	0.111
MSc	0.238 (0.071–0.798)	0.020
MSD	Reference	

The data in the table were calculated based on the “reference” groups.
OR, odds ratio; CI, confidence interval.

who reported difficulty writing papers in English, 87.5% had 0–20 years of experience ($p = 0.001$). Among researchers with 31 years or more of experience, 35.3% did not use a language editing service ($p = 0.001$). The frequencies and percentages of the other responses according to gender are shown in **Table 5**.

No statistically significant relationship was observed between researchers' academic titles and their answers to the following questions: “Do you think there are enough journals in the SCI and SCI Expanded publishing in the field of endodontics?” ($p = 0.172$) and “Do you have difficulty choosing a journal that is a good fit for your article?” ($p = 0.061$). Considering assistant professors and specialists in endodontics, 52% and 47%, respectively, emphasized that the need to obtain ethical approval negatively affected their desire to conduct research.

Table 3. Factors associated with difficulty conducting statistical analyses and the requirement of obtaining ethical approval among the participants, according to logistic regression analysis ($p < 0.05$)

Variables	OR (95% CI)	<i>p</i> value
Difficulty conducting statistical analyses		
Sex		
Female	2.299 (1.459–3.623)	< 0.001
Male	Reference	
Region		
Asia-Pacific	1.73 (0.693–4.317)	0.240
Central and South America	1.28 (0.526–3.116)	0.586
Europe	1.437 (0.586–3.523)	0.429
Middle East and Africa	1.36 (0.562–3.288)	0.495
North America	Reference	
Years of professional experience		
0–10	1.13 (0.5–2.55)	0.769
11–20	0.765 (0.382–1.531)	0.450
21–30	0.432 (0.211–0.885)	0.022
≥ 31	Reference	
Academic degree		
DMD	0.118 (0.028–0.499)	0.004
DDS	0.211 (0.058–0.771)	0.019
PhD	0.189 (0.056–0.632)	0.007
MS or MSc	0.411 (0.102–1.658)	0.211
MSD	Reference	
Difficulty with the requirement of obtaining ethical approval		
Sex		
Female	2.825 (1.834–4.352)	< 0.001
Male	Reference	
Region		
Asia-Pacific	12.83 (5.313–30.983)	< 0.001
Central and South America	8.013 (3.522–18.231)	< 0.001
Europe	5.453 (2.423–12.274)	< 0.001
Middle East and Africa	7.627 (3.36–17.312)	< 0.001
North America	Reference	
Years of professional experience		
0–10	1.859 (0.901–3.839)	0.094
11–20	1.034 (0.557–1.921)	0.915
21–30	0.594 (0.311–1.137)	0.116
≥ 31	Reference	
Academic degree		
DMD	1.524 (0.544–4.268)	0.423
DDS	1.691 (0.75–3.812)	0.205
PhD	1.364 (0.703–2.647)	0.359
MS or MSc	5.049 (1.846–13.813)	0.002
MSD	Reference	

The data in the table were calculated based on the “reference” groups.
OR, odds ratio; CI, confidence interval.

Approximately 40% of associate professors and professors responded to this question by selecting the answer “sometimes” ($p = 0.001$). Of the 132 who responded “no” to the question “Do you have difficulty using language when writing articles?,” 37.9% were professors.

DISCUSSION

In all medical areas, the predictability of an intervention can only be increased through scientific development. For this, well-designed research and well-written papers are invariably needed. Technical endodontic preferences have already been investigated in several

Table 4. Factors associated with postponing a study because of the cost or unavailability of materials according to logistic regression analysis ($p < 0.05$)

Variables	OR (95% CI)	<i>p</i> value
Sex		
Female	1.996 (1.168–3.412)	0.011
Male	Reference	
Region		
Asia-Pacific	1.495 (0.553–4.044)	0.428
Central and South America	1.282 (0.494–3.331)	0.610
Europe	1.161 (0.432–3.12)	0.768
Middle East and Africa	2.853 (1.01–8.058)	0.048
North America	Reference	
Years of professional experience		
0–10	10.259 (3.595–29.27)	< 0.001
11–20	2.95 (1.447–6.013)	0.003
21–30	1.625 (0.77–3.43)	0.203
≥ 31	Reference	
Academic degree		
DMD	0.914 (0.232–3.605)	0.897
DDS	0.203 (0.066–0.623)	0.005
PhD	0.664 (0.235–1.871)	0.438
MS or MSc	1.627 (0.411–6.433)	0.488
MSD	Reference	

OR, odds ratio; CI, confidence interval.

Table 5. Frequencies and percentages of all participants' answers to other questions according to gender (n : sample size, $p < 0.05$)

Questions	Answers	Male	Female	<i>p</i> value
Have you received any education on producing studies or writing articles?	No	126 (41.9)	175 (58.1)	0.049
	Yes	140 (50)	140 (50)	
How many articles have you published in SCI or SCI Expanded indexed journals in the last 5 years?	0–3	100 (37)	170 (63)	0.001
	4–7	47 (32.2)	99 (67.8)	
	7–10	28 (56)	22 (44)	
	10+	91 (79.1)	24 (20.9)	
Do you have difficulty using language when writing articles?	No	82 (62.1)	50 (37.9)	0.001
	Sometimes	103 (47.2)	115 (52.8)	
	Yes	81 (35.1)	150 (64.9)	
Do you have difficulty conducting statistical analyses for a study?	No	78 (65.5)	41 (34.5)	0.001
	Sometimes	94 (50)	94 (50)	
	Yes	94 (34.3)	180 (65.7)	

Values are presented as number (%).

global surveys [16,17,19]; however, to date, no study has evaluated researchers' difficulties in performing studies and writing papers in endodontics. This was the aim of this paper, wherein a multiple-choice questionnaire was completed by professionals around the world.

The first step in conducting a relevant study depends on determining a subject of interest and a research question [4]. Although 48.2% of the participants stated that they received some training in conducting research and writing papers, only 24% did not have difficulties in developing new ideas for a study. Designing studies and finding new ideas could be challenging for many researchers, even if they have received specific training for this.

Portuguese and Spanish are the predominant languages in Central and South America [21], whereas the most widely spoken language in North America is English [22]. Although many languages are used in each region, the participants' regions had no effect on the experience of difficulty in writing in English ($p > 0.05$; **Table 3**). Most scientific publications (98%) are written in English [10]. The English writing process can take a long time for non-native

English-speaking scientists; furthermore, 21% of these researchers reported that their anxiety jumped when they needed to report their scientific findings by writing papers in English [23]. In our results, 77% of the researchers also emphasized the difficulty of writing in English. In addition, half of the participants stated that they always used professional language editing services, while 24% stated that they used these services sometimes because they thought that doing so might increase the likelihood of the manuscript being accepted.

The medical and dental literature is replete with papers stressing the incorrect use of statistics and/or data misinterpretation [24,25]. It was recently reported (among other statistically related problems) that, in endodontics, 41% of 209 published papers used the wrong statistical approaches, and 19% of the conclusions would change after performing correct mathematical procedures [24]. However, Lucena *et al.* [24] only investigated the potential errors and misuse of statistics in studies on leakage in endodontics. The fact that studies on leakage in endodontics are methodologically controversial and the articles are no longer published in major journals may have influenced these results.

Even if the statistical analysis of a study is correctly performed, researchers may have doubts and/or interpret the results incorrectly, compromising the Discussion section and the reliability of the research [26]. According to a previous study, 51.5% of 307 articles published in 10 dental journals between 1995 and 2009 contained at least 1 statistical error [27]. The misuse of statistics in data analysis may lead to erroneous conclusions. Therefore, researchers have supported the inclusion of statistical experts on journals' editorial boards [24]. In the present study, 80% of the participants reported difficulties in conducting statistical analyses of their data. In the meantime, 77% reported that they always sought help from a statistician to perform this work. However, researchers with 21 years or more of experience and those with DMD, DDS, and PhD degrees did not report significant difficulties in conducting statistical analyses in their studies. Instead, less experienced researchers (0–20 years of experience) and those with lower academic degrees (MSc and MSD) were more likely to report difficulties in this domain than the researchers from other groups ($p < 0.05$). A possible explanation for this result is that, in most countries, MSc and MSD degree education is shorter than that for a PhD, and consequently, less statistical analysis training may be given. It is also unsurprising that participants with more professional experience reported having less difficulty with statistical analyses. Increasing the statistical training period in endodontics training could improve researchers' ability to perform correct data analysis and interpretation.

Ethical approval procedures are generally seen as an obstacle to be overcome and probably overshadow the full consideration of process ethics, ethical debates, and dilemmas that arise throughout research practice [28]. Variations in the process and extended time needed to obtain ethical approval for observational studies hamper the inclusion of patients [29]. The process of obtaining ethical approval for low-risk, non-interventional, observational studies varies enormously across European countries [30]. It is presumed that there is more delay in approval for studies with a higher potential of harm for patients [29,31]. In the present study, compared with the participants in North America, the participants in the Asia-Pacific region showed a 13 times greater effect of the requirement for obtaining ethical approval on the desire to conduct research ($p < 0.001$). There could be different ethical approval procedures in the Asia-Pacific countries. In addition, according to these data, the participants in North America may not have had difficulties since the ethical committee rules in their region may have been declared more clearly than in the Asia-Pacific region.

Although the participants' regions showed no statistically significant associations with difficulties in writing papers in English or conducting statistical analyses ($p > 0.05$), there was an association between regions and the choice of an appropriate journal in which to potentially publish papers ($p < 0.001$). Compared with the participants in North America, those in Central and South America were 11 times more likely to report difficulty in choosing a suitable journal, while those from Europe were 5 times more likely to report difficulty. The fact that the 2 most traditional journals in the field of endodontics are from Europe (*International Endodontic Journal*) and North America (*Journal of Endodontics*) could explain this result. Moreover, 65% of the participants agreed that there are not enough SCI and SCI Expanded journals in the field of endodontics. Statistically significant relationships were not observed between researchers' academic titles and their responses to the questions regarding whether there are sufficient numbers of endodontics journals in the SCI and SCI Expanded and whether they could select a suitable journal ($p > 0.05$). It is not surprising that endodontics researchers had difficulty choosing a journal that matched their article if they thought there were insufficient journals.

The uncertainty of research support for researchers and the academic and clinical demands faced by faculty may jeopardize the future of dentistry research [32]. More financial resources are needed for researchers to be able to plan and conduct relevant studies. Having diverse sources of research funding has been recommended as beneficial in times of funding uncertainty [32]. In the results of the current survey, 86% of the respondents stated that they had been forced to postpone studies because of a lack of financial resources or unavailability of the needed materials. The problems experienced with the distribution of materials to different countries by manufacturers and exchange rate differences between countries may prevent researchers from accessing materials.

Issues facing women in academia are multiple and complex [33]. Consistent evidence has shown that men publish more than women in Europe, the United States (US), and other countries [34]. Women dental researchers have been found to be significantly underrepresented in the editorial boards of dental journals as well as in the position of editor-in-chief [35]. In addition, an extensive survey of almost 1,000 US physician mothers emphasized that paternal discrimination in their US academic institutions affected their medical training and practice [36]. In the present study, compared with male researchers, women reported almost twice the level of difficulty in writing articles. Although this study did not directly focus on gender bias in academia, the need for female academics to balance childcare, housework, and academic expectations may be the reason for their difficulties. In addition, the risk of postponing studies because of the costs or unavailability of materials was approximately twice as high among women in comparison to men (**Table 4**). Garcia *et al.* found that about two-thirds of research project grant applicants in the dentistry field were men [37]. This may be because male researchers are more likely to have access to expensive materials as they apply for research project grants than female researchers are.

The Discussion section of a paper must explain the meaning of the results and the paper's contributions to the specific area [38]. In this study, most participants (81.8%) expressed difficulties in writing the Discussion section, regardless of the region, academic degree, or years of experience. In addition, 19.6% of the participants reported some difficulty in writing the abstract. The abstract could be the only part of the article that readers read closely. It must be the most highly polished part of the paper [39]. Therefore, participants may feel pressured when writing the abstract.

The main limitation of the current study is that only 10.7% of the sent questionnaires were answered. This response rate may have several explanations: Invitees may not have checked their e-mail, or they may not have had time to respond; moreover, some of the emails might not have been received because of spam filters or inactive usage. A limitation is that a Likert scale was not used in this study, given that it is a common way to elicit feedback on how strongly people feel about a topic. If it had been used in this study, it would have been easier for participants to answer the questions. Another limitation is that participants' responses were analyzed by region, not country; evaluating their responses by country would have enabled us to obtain more detailed and distinctive results. Future research may focus on classifying the difficulties experienced by endodontic researchers in more detail.

CONCLUSIONS

This study sought to evaluate the difficulties experienced by endodontics researchers around the world in performing studies and writing papers. The participants mainly expressed difficulties in conducting statistical analyses, finding new ideas, and writing in English. A detailed examination of ethics committee rules, expanding biostatistics training in undergraduate and postgraduate education, increasing the number of institutions or universities providing research funding, increasing the number of endodontics journals in SCI or SCI Expanded, and training researchers to write in English effectively can increase the enthusiasm of endodontics researchers.

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