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
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.

| Gender: | Have you received any education on producing studies or writing articles? | Does the necessity of obtaining ethical approval negatively affect your desire to produce a study? | Do you think there are enough journals in the SCI and SCI Expanded indexes publishing in the field of endodontics? |
|---------|---------------------------------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| A. Female | A. Yes | A. Yes | A. Yes |
| B. Male  | B. No | B. No | B. No |

| Region: | How many articles have you published in SCI or SCI Expanded indexed journals in the last 5 years? |
|---------|------------------------------------------------------------------------------------------------|
| A. Asia Pacific | A. ≤ 3 |
| B. Central and South America | B. 4-7 |
| C. Europe | C. 7-10 |
| D. Middle East and Africa | D. ≥11 |
| E. North America | |

| Years of professional experience: | Do you have difficulty developing new ideas for a study? | Do you have difficulty conducting statistical analyses for a study? |
|---------------------------------|-------------------------------------------------|------------------------------------------------------------------|
| A. ≤ 10                        | A. Yes                                         | A. Yes                                           |
| B. 11-20                       | B. No                                          | B. No                                            |
| C. 21-30                       | C. Sometimes                                   | C. Sometimes                                      |

| Your academic title: | Do you have difficulty using language when writing articles? | Do you ever postpone a study because of the cost or unavailability of the materials used in your studies? |
|---------------------|----------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| A. Specialist Endodontist | A. Yes                                    | A. Yes                                           |
| B. Assistant Professor  | B. No                                     | B. No                                            |
| C. Associate Professor | C. Sometimes                              | C. Sometimes                                      |

| Your academic degree (Select all that apply): | Do you use any language editing services when writing articles? | Do you have difficulty choosing a journal that is a good fit for your article? |
|-----------------------------------------------|----------------------------------------------------------------|--------------------------------------------------------------------------------|
| A. DDS                                        | A. Yes                                                  | A. Yes                                           |
| B. DMD                                        | B. No                                                   | B. No                                            |
| C. MSc                                        | C. Sometimes                                            | C. Sometimes                                      |

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                               | 78 (13.4)       |
| Specialist                                   | 165 (28.4)      |
| Assistant Professor                          | 140 (24.1)      |
| Associate Professor                          | 185 (31.8)      |
| Professor                                    | 13 (2.2)        |
| Academic degree                              | 281 (48.4)      |
| Doctor of Dental Surgery (DDS)               | 73 (12.6)       |
| Doctor of Dental Medicine (DMD)              | 288 (49.8)      |
| Doctor of Philosophy in Dentistry (PhD)      | 99 (17)         |
| Master of Medical Science (MMSc)             | 85 (14.6)       |
| Master of Science in Dentistry (MSD)         | 30 (5.2)        |

Values are presented as number (%).
Difficulties experienced by endodontics researchers

Do you have difficulty developing new ideas for a study?
- Yes: 37%
- Sometimes: 39%
- No: 24%

Do you use any language editing services when writing articles?
- Yes: 52%
- Sometimes: 24%
- No: 24%

Do you get help from a statistician to perform the statistical analyses for your studies?
- Yes: 77%
- Sometimes: 15%
- No: 8%

Does the necessity of obtaining ethical approval negatively affect your desire to produce a study?
- Yes: 39%
- Sometimes: 35%
- No: 26%

Do you think there are enough journals in the SCI and SCI Expanded indexes publishing in the field of endodontics?
- Yes: 35%
- No: 65%

Do you ever postpone a study because of the cost or unavailability of the materials used in your studies?
- Yes: 14%
- No: 86%

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.
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 ($p = 0.001$).
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 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) | p 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                                    | 3.009 (1.290–7.773) | 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.
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

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**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)     | p 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 (0.562–2.888) | 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 (3.16–17.312) | < 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 (0.544–4.288) | 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.
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

| Questions                                                                 | Answers | Male | Female | p value |
|--------------------------------------------------------------------------|---------|------|--------|---------|
| Have you received any education on producing studies or writing articles? | No      | 126  | 175    | 0.049   |
|                                                                          | Yes     | 140  | 140    |         |
| How many articles have you published in SCI or SCI Expanded indexed journals in the last 5 years? | 0–3     | 100  | 170    | 0.001   |
|                                                                          | 4–7     | 47   | 99     |         |
|                                                                          | 7–10    | 28   | 22     |         |
|                                                                          | 10+     | 91   | 24     |         |
| Do you have difficulty using language when writing articles?             | No      | 82   | 50     | 0.001   |
|                                                                          | Sometimes | 103  | 115    |         |
|                                                                          | Yes     | 81   | 150    |         |
| Do you have difficulty conducting statistical analyses for a study?      | No      | 78   | 41     | 0.001   |
|                                                                          | Sometimes | 94   | 94     |         |
|                                                                          | Yes     | 94   | 180    |         |

Values are presented as number (%).
Difficulties experienced by endodontics researchers

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, 80% 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 endodontics 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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REFERENCES

1. Chiappelli F, Prolo P, Newman M, Cruz M, Sunga E, Concepcion E, Edgerton M. Evidence-based practice in dentistry: benefit or hindrance. J Dent Res 2003;82:6-7. PUBMED | CROSSREF
2. Sellars S. How evidence-based is dentistry anyway? From evidence-based dentistry to evidence-based practice. Br Dent J 2020;229:12-14. PUBMED | CROSSREF
3. Kotz D, Cals JW. Effective writing and publishing scientific papers, part IV: methods. J Clin Epidemiol 2013;66:817. PUBMED | CROSSREF
4. Kotz D, Cals JW. Effective writing and publishing scientific papers - Part I: how to get started. J Clin Epidemiol 2013;66:397. PUBMED | CROSSREF
5. Cals JW, Kotz D. Effective writing and publishing scientific papers, part VI: discussion. J Clin Epidemiol 2013;66:1064. PUBMED | CROSSREF
6. Cals JW, Kotz D. Effective writing and publishing scientific papers, part X: choice of journal. J Clin Epidemiol 2014;67:3. PUBMED | CROSSREF
7. Kotz D, Cals JW. Effective writing and publishing scientific papers, part XII: responding to reviewers. J Clin Epidemiol 2014;67:243. PUBMED | CROSSREF
8. Neuppmann Feres MF, Roscoe MG, Job SA, Mamani JB, Canto GL, Flores-Mir C. Barriers involved in the application of evidence-based dentistry principles: a systematic review. J Am Dent Assoc 2020;151:16-25.e16.
9. El-Serag HB. Writing and publishing scientific papers. Gastroenterology 2012;142:197-200.
10. Wajsberg J. Michael D. Gordin. Scientific babel: how science was done before and after global English. Chicago: University of Chicago Press, 2015. 424 pp. $30.00 (cloth). ISBN-13: 9780226000299. J Hist Behav Sci 2016;52:315-317.
11. Ramírez-Castañeda V. Disadvantages in preparing and publishing scientific papers caused by the dominance of the English language in science: The case of Colombian researchers in biological sciences. PLoS One 2020;15:e0238372.
12. World Medical Association. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. JAMA 2013;310:2191-2194.
13. Gelbier S, Wright D, Bishop M. Ethics and dentistry: I. The meaning of ethics. Dent Update 2001;28:468-473.
14. Kotz D, Cals JW, Tugwell P, Knoettnersus JA. Introducing a new series on effective writing and publishing of scientific papers. J Clin Epidemiol 2013;66:359-60.
15. Kritikadatta J, Valarmathi S. Research methodology in dentistry: Part II - The relevance of statistics in research. J Conserv Dent 2012;15:206-213.
16. Tsotsis P, Dunlap C, Scott R, Arias A, Peters OA. A survey of current trends in root canal treatment: access cavity design and cleaning and shaping practices. Aust Endod J 2021;47:27-33.
17. Dutner J, Mines P, Anderson A. Irrigation trends among American Association of Endodontists members: a web-based survey. J Endod 2012;38:37-40.
18. Deniz-Sungur D, Aksel H, Karaismailoglu E, Sayin TC. The prescribing of antibiotics for endodontic infections by dentists in Turkey: a comprehensive survey. Int Endod J 2020;53:1715-1727.
19. Setzer FC, Hinckley N, Kohli MR, Karabucak B. A survey of cone-beam computed tomographic use among endodontic practitioners in the United States. J Endod 2017;43:699-704.
20. Tsang S, Royse CF, Terkawi AS. Guidelines for developing, translating, and validating a questionnaire in perioperative and pain medicine. Saudi J Anaesth 2017;11 Suppl 1:S80-S89.
21. van de Kerke S, Muysken P. The Andean matrix. In: Muysken PC, O'Connor LM, editors. The native languages of South America. Cambridge: Cambridge University Press; 2014. p126-151.
22. Kinkade MD. The languages of native North America: the languages of native North America. J Linguist Anthropol 2000;10:297-298.
23. Hanauer DI, Englander K. Quantifying the burden of writing research articles in a second language: data from Mexican scientists. Writ Commun 2011;28:403-416.
24. Lucena C, Lopez JM, Pulgar R, Abalos C, Valderrama MJ. Potential errors and misuse of statistics in studies on leakage in endodontics. Int Endod J 2013;46:323-331.
25. Polychronopoulou A, Pandis N, Eliades T. Appropriateness of reporting statistical results in orthodontics: the dominance of P values over confidence intervals. Eur J Orthod 2011;33:22-25.
26. Souza E. Research that matters: setting guidelines for the use and reporting of statistics. Int Endod J 2014;47:115-419.
27. Kim JS, Kim DK, Hong SJ. Assessment of errors and misused statistics in dental research. Int Dent J 2011;61:163-167.
28. Tracy SJ. Qualitative quality: eight “big-tent” criteria for excellent qualitative research. Qual Inq 2010;16:837-851.
29. Buck K, Nolte L, Kelly H, Detering K, Sinclair C, White BP, Sellars M. Challenges in obtaining research ethics and governance approvals for an Australian national intersector, multisite audit study. Aust Health Rev 2017;44:799-805.
30. de Lange DW, Guidet B, Andersen FH, Artigas A, Bertolini G, Moreno R, Christensen S, Cecconi M, Agyvald-Ohman C, Gradisek P, Jung C, Marsh BJ, Oeyen S, Bollen Pinto B, Szczeklik W, Watson X, Zafeiridis T, Flaatten H. Huge variation in obtaining ethical permission for a non-interventional observational study in Europe. BMC Med Ethics 2019;20:39.
31. Barnett AG, Campbell MJ, Shield C, Farrington A, Hall L, Page K, Gardner A, Mitchell BG, Graves N. The high costs of getting ethical and site-specific approvals for multi-centre research. Res Integr Peer Rev 2016;1:16.
32. D’Souza RN, Colombo JS. How research training will shape the future of dental, oral, and craniofacial research. J Dent Educ 2017;81:eS73-eS82.
33. National Academy of Sciences (US), National Academy of Engineering (US), Institute of Medicine (US) Committee on Maximizing the Potential of Women in Academic Science and Engineering. Beyond bias and barriers: fulfilling the potential of women in academic science and engineering. Washington, D.C.: National Academies Press; 2017. p1-317.
34. Aiston S, Jung J. Women academic and research productivity: an international comparison. Gend Educ 2015;27:205-220.
35. Ioannidou E, D’Souza RN, Macdougall MJ. Gender equity in dental academics: gains and unmet challenges. J Dent Res 2014;93:5-7.
36. Halley MC, Rustagi AS, Torres JS, Linos E, Plaut V, Mangurian C, Choo E, Linos E. Physician mothers’ experience of workplace discrimination: a qualitative analysis. BMJ 2018;363:k4926.
37. Garcia MN, Tiano JP, Contreras O, Hildebolt CF, Horsford J, Stewart D. Trends in academic dentistry and oral health research funding by gender. JDR Clin Trans Res 2020;5:176-184.
38. Annesley TM. The discussion section: your closing argument. Clin Chem 2010;56:1671-1674.
39. Ickes MJ, Gambescia SE. Abstract art: how to write competitive conference and journal abstracts. Health Promot Pract 2011;12:493-496.