A CRITICAL REVIEW OF GENDER EQUALITY IN DENTAL SCIENCE: HOW TO WALK THE TALK

EQUIDADE DE GÊNERO NA CIÊNCIA ODONTOLÓGICA: COMO COLOCAR PALAVRAS EM AÇÃO, UMA REVISÃO CRÍTICA

UNA REVISIÓN CRÍTICA DE LA IGUALDAD DE GÉNERO EN LA CIENCIA DENTAL: CÓMO HACER LO QUE HABLAMOS

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Abstract

Gender equality has become a concern and a topic of interest in science. Thus, this critical review aimed to analyze evidence of the gender gap in Brazilian Dental Science, to discuss challenges, and to suggest evidence-based recommendations. Peer-reviewed publications were assessed, and data were obtained from Instituto Brasileiro de Geografia e Estatística and two scientific agencies, Coordenação de Aperfeiçoamento de Pessoal de Nível Superior and Conselho Nacional de Desenvolvimento Científico

e Tecnológico. In Brazil, women are the majority among all registered dentists (61%), dental specialists (56.2%) and researchers (55.4%). Despite this great progress in female participation in Dental Science, prevailing structural sexism, gender stereotypes, bias, discriminatory behavior, and lack of a welcoming environment may be responsible for some current gender gap. For instance, there is limited representation of women in leadership positions in different domains, from paper authorship to conference speaking and research funding. Available data highlight the need for action to promote diversity and equal opportunities for all to succeed in Dental Science.

Keywords: Dentistry; Gender inequality; Review; Science; Sexism.

Resumo

A igualdade de gênero se tornou uma preocupação e um tema relevante no campo científico. Assim, esta revisão crítica teve como objetivo analisar evidências sobre iniquidades de gênero na ciência odontológica brasileira, discutir desafios e sugerir recomendações baseadas em evidências. Publicações revisadas por pares foram consultadas, além de dados do Instituto Brasileiro de Geografia e Estatística e órgãos científicos, como Coordenação de Aperfeiçoamento de Pessoal de Nível Superior e Conselho Nacional de Desenvolvimento Científico e Tecnológico. No Brasil, dados apontam que as mulheres são a maioria entre os cirurgiões-dentistas cadastrados (61%), especialistas (56,2%) e pesquisadores (55,4%). Apesar do progresso na participação feminina na ciência odontológica, a presença de sexismo estrutural, estereótipos de gênero, viés, comportamentos discriminatórios e ausência de um ambiente acolhedor podem ser responsáveis pela iniquidade de gênero vigente. Por exemplo, há representação limitada das mulheres em posições de liderança em diferentes domínios, desde publicações científicas até palestrantes convidados em eventos e obtenção de financiamento para pesquisa. Os dados disponíveis ressaltam a necessidade de ações para promover diversidade e, a partir de uma perspectiva de equidade, oferecer oportunidades para que todos possam ser bem sucedidos na ciência odontológica.

Palavras-chave: Ciência; Iniquidade de gênero; Odontologia; Revisão; Sexismo.

Resumen

La igualdad de género se ha convertido en una preocupación y un tema de interés en la Ciencia. Por lo tanto, esta revisión crítica tuvo como objetivo analizar la evidencia de la brecha de género en la ciencia dental brasileña, discutir desafíos y sugerir recomendaciones basadas en evidencia. Se revisaron publicaciones revisadas por pares y se obtuvieron datos del Instituto Brasileiro de Geografía e Estatística y agencias científicas, como la Coordenação de Aperfeiçoamento de Pessoal de Nível Superior y el Conselho Nacional de Desenvolvimento Científico e Tecnológico. En Brasil, las mujeres son la mayoría entre odontólogos registrados (61%), especialistas dentales (56,2%) e investigadores (55,4%). A pesar de este gran avance en la participación femenina en la ciencia dental, el sexismo estructural predominante, los estereotipos de género, los sesgos, el comportamiento discriminatorio y la falta de un entorno acogedor pueden ser los responsables de la brecha de género actual. Por ejemplo, hay una representación limitada de mujeres en puestos de liderazgo en diferentes dominios, desde publicaciones científicas hasta oradores de conferencias y financiamiento para investigación. Los datos disponibles destacan la necesidad de actuar para promover la diversidad y la igualdad de oportunidades para que todos puedan tener éxito en la ciencia dental.

Palabras clave: Ciencia; Inequidad de Género; Odontología; Revisión; Sexismo.

1 Introduction

In science, diversity can be considered the driving force of innovation and creativity, through the collaboration of individuals with different perspectives, ideas, and experiences (Lee; Pollitzer, 2016). A diverse workforce incorporates different social contexts and broadens understanding of the relevance of science itself (Allagnat *et al*., 2017). An essential aspect of diversity is gender, a dynamic and non-binary construct culturally defined and understood by society as a social role – a set of norms that dictate behaviors considered desirable or appropriate for an individual according to biological or perceived sex (Springer; Hankivsky; Bates, 2012). Despite this definition, scientific literature often refers to gender as a binary variable, dichotomized into female and male (Money; Hampson; Hampson, 1955; Shamseer *et al*., 2021).

From a historical perspective, the second half of the 20th century was marked by women's liberation movements, as well as the struggle for equal rights between men and women allied with greater need for human resources in the workforce and in the scientific field. This scenario allowed for a turning point for women, who gained increased access to scientific education in historically male careers (Quintão; Barreto; Menezes, 2021). Over the years, gender equality has become a concern and a topic of interest in science. Women have made remarkable contributions as researchers and strive to overcome professional and social barriers to advance in academic careers on a daily basis (Allagnat *et al*., 2017; Ioannidou *et al*., 2019). Nowadays, women perform activities in most professional areas; however, they tend to occupy intermediate positions, while executive and managerial positions are still largely reserved for men (Quintão; Barreto; Menezes, 2021).

International organizations recognize the need for equal participation of researchers in Science, Technology, Engineering, and Mathematics (STEM), and aim to promote innovation through diversity and gender equality (Allagnat *et al*., 2017; Ioannidou *et al*., 2019). The United Nations Sustainable Development Goal 5 aims to “achieve gender equality and empower all women and girls”. It requires implementing measures to ensure women's participation in the workforce and providing equal opportunities and representation in leadership positions (UN, 2016; Allagnat *et al*., 2017). Still, women face challenges to achieve full and effective inclusion at all stages of their careers, as illustrated by the “leaky pipeline” metaphor, which unfortunately represents a real fact: the number of women decreases as they move up the career ladder (Pell, 1996). Studies have indicated this may be a result of disadvantage, hostile environment, and

bias, rather than a result of a lack of qualified professionals (Monroe; Chiu, 2010; Witteman *et al*., 2019; Casad *et al*., 2021).

Given this scenario, it is necessary to analyze evidence of the gender gap in science and to go beyond: how to walk the talk? Thus, this critical review presents three main goals. At first, the current state of the gender gap in Brazil and Dental Science is reviewed, highlighting advances and persistent inequalities. Secondly, the paper discusses challenges and mechanisms that may help explain the observed asymmetries.

Data were obtained from peer-reviewed publications, and from the *Instituto Brasileiro de Geografia e Estatística* (IBGE) and two scientific agencies: *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* (CAPES) and *Conselho Nacional de Desenvolvimento Científico e Tecnológico* (CNPq). Data from different countries were also collected to allow a more comprehensive understanding of the challenges faced in Brazil. Although gender is not a binary variable, the terms male/female had to be used, as they had been previously adopted in the studies included in this critical review.

2 Brazilian women: education and workforce

According to IBGE, Brazil has approximately 214 million people, among which about 51% are women (IBGE, 2022). Access to Higher Education is restricted, as only 17.4% of the population over 25 years finish higher education (IBGE, 2021a). In Brazil, among individuals aged 25–34 years, 25.1% of women finish higher education, against 18.3% of men. However, a Brazilian woman aged between 18 to 24 is more likely to be in higher education or having already finished it, when compared with men in the same age group (IBGE, 2021a).

Women represent 46.8% of professors at higher education institutions in Brazil (IBGE, 2021a). In 2019, the participation of women in leadership positions both in the public sector – for example, directors of government agencies – and in the private sector was 37.4%, indicating that Brazilian women are underrepresented in leadership positions that may have greater pay and responsibilities (IBGE, 2021a). In 2019, Brazilian women received 77.7% of the income of men. Inequality in income from work was greater in leadership positions, such as directors and professionals in the scientific field, groups in which women received, respectively, 61.9% and 63.6% of men's income. Differences in were observed among Brazilian regions. In the Southeast and South regions, women earn salaries about 70.0% less than men's salaries. In the

North and Northeast, income for both sexes are lower than other regions overall, as well as the gender pay gap, which is respectively, 92.6% and 86.5% (IBGE, 2021a).

The participation of women in the workforce is substantially smaller (41.2%) than that of men (61.4%) and women with high education are 3.3 times more likely to be in the job market than women with less or without schooling. Among men, this same metric reaches 1.7 times. Women may find it difficult to get a job and to remain employed, especially without the support of specific public policies. They are responsible for almost twice the housework and daily family care and therefore face obstacles to be employed in full time and better paid jobs. In 2020, a total of 4.9 million Brazilian people were formally enrolled in domestic service jobs, an activity mostly performed by women, with 4.5 million of them (IBGE, 2021b).

In 2006, The World Economic Forum first introduced The Global Gender Gap Index, a metric that assesses progress towards gender equality, comparing countries' gender gaps across four dimensions: economic opportunities, education, health, and political leadership. Among 156 countries, Brazil occupies the 93rd position, below other Latin American countries, such as Argentina, Uruguay, Paraguay and Venezuela (World Economic Forum, 2021).

3 Methods

3.1 Publications

For this critical review, potentially relevant terms were identified using controlled vocabularies (DeCS/MeSH terms) and by reading relevant indexed articles (free terms). The search for papers was carried out in the PubMed database, using the MeSH terms 'Dentistry', 'Sexism', 'Implicit bias', 'Gender equity', published up to June 2022, with no language restrictions. Grey literature was searched through the Google Scholar and the OpenGrey database. No filters or date restrictions were applied. To ensure literature saturation, reference lists of the included studies were checked, and experts were contacted requesting ongoing or unpublished studies in this research field.

3.2 Institutional data

Data were obtained from IBGE and two funding Brazilian agencies CAPES and CNPq.

4 Women participation in Brazilian Dentistry

Women were fewer in Brazilian dental schools until the 1980s, when the feminization of the profession began (Quintão; Barreto; Menezes, 2021). According to the Federal Council of Dentistry (CFO), a total of 375.060 dentists are registered in 2022, and 61% are women (CFO, 2022; Tiwari *et al*., 2019) (Figure 1). Among the 127.552 registered dental specialists, 56.2% are women, most commonly in Pediatric Dentistry and in Special Care Dentistry. In Implantology, Oral and Maxillofacial Surgery and Traumatology, Oral and Maxillofacial Prosthesis, and Sports Dentistry men are most of registered specialists (CFO, 2022) (Figure 2).

A report by Gender in the Global Research Landscape showed that, over the past 20 years, women's participation rates in research have varied across different countries. An increase in women researchers from 1996 to 2015 has been reported, ranging from 26% in Japan to 55% in Brazil. Between 2011 and 2015, there were 12.755 Brazilian dental researchers, of which 55.4% were women (Allagnat *et al*., 2017) (Figure 1).

Statistics released by Scimago Journal & Country Rank reveal that Brazil stands out in scientific production in the field of Dentistry, ranking second among 173 countries (Scimago Journal & Country Rank, 2022). However, there seems to be no national gender equity policy. State financed and distributed dental research scholarships benefit more men than women (Figure 1). A bibliometric study ranked an Orthodontics journal published in Brazil between 2010 and 2020, and identified that women authorship was underrepresented, reaching only 39.5% of the total number of authors. Although most Brazilian postgraduate dental courses are coordinated by women (63.64%), they are underrepresented in leadership roles in professional dental associations (Quintão; Barreto; Menezes, 2021).

5 Unmet challenges

Female representation in Dentistry and Dental Science has shown a progressive increase over the last decades. While in Brazil women are the majority among registered dentists, they are also the largest share among graduates from Dental Schools in the United States and in some of the most populous European countries, namely Germany, United Kingdom, and France (Tiwari *et al*., 2019; Istrate *et al*., 2021).

Still, gender inequalities in Dentistry remain pervasive, even in countries with increased women participation in the dental workforce, such as Brazil (Feldman, 2015). Limited female representation has been found in academic Dentistry, and it may negatively impact

career progression (Bompolaki; Pokala; Koka, 2021; Koka *et al*., 2021; Martorell *et al*., 2021). The main challenges faced by women in Dental Science and the ways to address them can be assessed in three broad categories: gender stereotype and implicit bias, academic environment, and social capital (Witteman *et al*., 2019; Casad *et al*., 2021; Gruber *et al*., 2021) (Figure 3).

5.1 Gender stereotype and implicit bias

Traditional gender roles have indicated the "preferable" occupation of individuals: while women are recognized for their supposed warmth and good as caregivers, men are regarded for their ambition and potential as good breadwinners (Gruber *et al*., 2021). There is evidence that gender-role stereotypes are established early in life, as seen in one study in which six-year-old girls were found to be less likely than boys to recognize their intellectual ability (Bian; Leslie; Cimpian, 2017). Such stereotypes may lead to sexist thought and behavior, calling into question the ability of women to succeed in academic careers. The association of men as brilliant and intellectually able has been acknowledged as a possible source of bias across different domains in science, resulting that they are chosen as leaders of institutions, recognized by their work and prized with awards (Gruber *et al*., 2021).

Socially constructed beliefs have been shown to influence behavior, judgments, decisions, and usually occur without the awareness of the individual (Greenwald; Banaji, 1995). This unconscious judgment has been referred to as "implicit bias", in recognition of its partiality and unfair evaluation of stereotyped individuals such as women, ethnic and sexual minorities. Implicit bias has been increasingly recognized as one of the possible causes of gender inequality in science. It must be noted that "structural sexism" has been used to describe gender inequalities observed in a system, giving rise to unequal distribution of power and resources (Homan, 2019). Sexism and structural sexism have been pointed out as possible causes of the gender gap in science and in the organization of ecosystems (systemic bias), by enabling implicit bias and negative stereotypes (Witteman *et al*., 2019; Calaza *et al*., 2021).

5.1.1. Career progression

In the last decades, research in STEM has increasingly sought to better understand the mechanisms leading to pervasive gender inequalities (Moss-Racusin *et al.,* 2012; Dworkin *et al*., 2020). In an experimental study which assessed the role of implicit gender bias among faculty participants in students' selection, all faculty, men and women, rated male student

candidates as more competent and deserving of a job and of higher salary (Moss-Racusin *et al.,* 2012).

Among 3862 papers in Dentistry, published between 2006 and 2016, there were fewer women than men as first or last authors. Despite the overtime increase in female authorship, which totaled 61% in the study period, women were first or last authors of respectively 37.2% and 22.6% of the papers, which showed a persistent gender gap in dental publications in the evaluated time frame (Sartori *et al*., 2021).

The potential negative effects of gender inequalities in citations have picked the interest of researchers (Larivière *et al*., 2013; Dworkin *et al*., 2020). A study in neuroscience aimed to go beyond the assessment of the gender gap itself. It looked into the possible causes for the observed inequalities in citation count, by evaluating the effect of author's gender on gender parity of the references included in 61.416 papers. Findings from this study showed that male authors were less inclined to cite work lead by women, as first of last authors. They were also being largely responsible for the under citation of female-led papers. Data from these studies highlight that citation counts might be biased to an extent and call for the need for conscious citation practices in academia (Dworkin *et al*., 2020).

In academic career, the acquisition of research grants is of crucial importance. In project evaluations, the gender of the candidate may influence more than the quality of the submitted material (Witteman *et al*., 2019). This disadvantage and lack of recognition may lead to serious consequences. In Brazil, in 2015, when half of dental researchers were female, CNPq granted more fellowships to men (62.8%) than women (37.2%) (Tiwari *et al*., 2019), as shown in Figure 2.

There is evidence that women are negatively assessed in postgraduate school selection process (Franco *et al*., 2021) and receive less recognition and funding for scientific research (CNPQ, 2022). Women are also underrepresented as leaders in different scientific domains: they are invited to speak at conferences less often than their male colleagues (MartorelL *et al*., 2021), and they are less represented as editors in scientific publishing (Bennie; Koka, 2021) and as deans of dental Schools (Bompolaki; Pokala; Koka, 2021). This gender imbalance in leadership may delay efforts to dismantle systems of oppression, causing the loss of valuable opportunities to raise awareness of the scientific community. It also generates a lack of role models, mentors and inspirations for the younger scientists (Koka *et al*., 2021).

5.1.2 Lifestyle roles and career practices

There is concern that traditional gender roles and structural sexism might influence some of the gender inequalities observed in science (Gruber *et al*., 2021). A conceptual model of structural sexism highlights three different domains, from macro to micro-level, involving: 1) institutions, in the norms of culture; 2) interactions, that is, influencing behavior of individuals; and 3) individual level, with our own gender ideology (Homan, 2019). These complex systemic factors might influence the choice of certain jobs and occupations (Gruber *et al*., 2021), considered as more or less favorable and culturally acceptable for men and women (Lester, 2008). This may explain in part the distribution of dental specialists in Brazil among subareas. While in Paediatric Dentistry women represent 89.9% of all registered specialists, in traditionally male-dominated fields, such as Maxillofacial Surgery, the participation of women is 24.5% (Figure 2).

In addition, there is evidence that traditional feminine gender traits of caretaking and being compassionate have led to the belief that women are supposed to carry out specific services to their departments that, although relevant and necessary, often go unnoticed and may not be well rewarded. For example, it has been reported that female faculty were expected to "mom" students, providing emotional comfort, and performing administrative roles with low visibility, status and recognition, such as management of social events, committee work, and even act as unofficial secretary for their department, in addition to the constant need to prove their worth and credibility. It is possible that such service may be related in part to their lower productivity and number of publications (Lester, 2008; Gruber *et al*., 2021).

There is also concern about the impact of caregiving responsibilities on academic parents and its influence on their productivity. Parents may have less time available for research (Gruber *et al*., 2021), especially mothers, as females carry the long-sanding caregiver stereotype. This burden has been highlighted in one study that assessed the impact of gender, race, and parenthood on researchers' productivity during the COVID-19 pandemic when schools and universities had to shift to online classes (Staniscuaski *et al*., 2021). Academic mothers and black women reported a high impact on their productivity during this time, while their male colleagues reported the lowest impact (Staniscuaski *et al*., 2021).

Women in academia face different challenges throughout their life course (Gruber *et al*., 2021; Nordling, 2022). As postdocs and early career researchers, women in their third decade of life may be responsible for young children and might wish to become mothers.

Although men are not affected by this problem in the same way, there is often a lack of support for them that would aid in the transformation of current systemic and cultural norms, such as having rights to paid paternity leave (Gruber *et al*., 2021; Shannon *et al*., 2019).

On the other hand, senior scientists may face menopause, as consequence of low reproductive hormones, in a time in their career scientists usually face different responsibilities, such as leadership roles in their respective areas. Women are not the only ones who may suffer with menopause, which can affect transgender and non-binary individuals. However, menopause is commonly overlooked, along with its physical and mental burden. There is need for more studies in such topics in the field of healthcare and Dentistry with open discussion and dialogue, as these challenges must not be overlooked, considering the possibility of losing experienced and talented professionals (Norling, 2022).

5.1.3 Intersectionality

Intersectional feminism considers the cumulative and unique impact of different social identities in one's experience of discrimination. Initially used in reference for the multidimensional experiences of black women (Crenshaw, 1989), nowadays it recognizes the intersections of gender, race, sexual orientation, socioeconomic status, among others (Springer; Hankivsky; Bates, 2012). Through intersectionality lens, it has become clear that challenges for researchers in science involve more than one's gender. Among researchers identified as women or people of color, 72% reported ethnicity-related problems (Kameny *et al*., 2014). A bibliometric analysis of studies authored by American authors found underrepresentation of both black and Latin individuals (Kozlowski *et al.,* 2019). In Dentistry, one study assessed leadership gender and ethnic distribution among presidents of prestigious associations and results showed a dearth of diversity and persisting inequalities; in the U.S., the role of president of fifty percent of specialty organizations had never been occupied by a person of color (Koka *et al*., 2021).

Studies of inequalities in Dental Science using an intersectional framework are limited. There is need for more research to understand and promote diversity and inclusion in the dental workforce, from publications to citations and other roles of leadership and influence, across different social identities. For instance, the lesbian, gay, bisexual, transgender, queer, intersex, asexual + (LGBTQIA+) community has gained more visibility for the systemic inequalities they face in STEM (Cech; Waidzunas, 2021) and also in studies of dental education (Brondani; Peterson, 2011; Feng *et al*., 2017; Vieira, 2019). However, evidence is still scarce and there is

need for more studies across disciplines to document the unique experiences of the LGBTQIA+ community.

5.2. Academic environment

In order to attract, allow for continuity and success of female and researchers of minority groups, a safe and pleasant workplace climate is necessary (Nasem, 2018). Efforts to include female participation in science have increasingly acknowledged the need to address the academic environment, which has been recognized for its potential to be chilly at times (Nasem, 2018; Casad *et al*., 2021).

Inspired by #metoo and social movements against sexual harassment, the National Academies of Sciences, Engineering and Medicine carried out a study on the subject in 2018, in recognition that efforts to close the gender gap in science would be incomplete if such discrimination was left unaddressed (Nasem, 2018). In Dentistry, a multicenter study sought to assess dental student's opinions on gender bias and sexual harassment in 4 countries, Brazil, Bulgaria, India, and the U.S. Among Brazilian students, 1 in every 5 reported to have been at least "somewhat" verbally harassed in the past, the highest rate among the included countries. It must be noted that 46% of the students would not feel comfortable in reporting situations of sexual harassment (Ivanoff *et al*., 2018).

Another form of harassment that has been previously reported is bullying (Gruber *et al*., 2021). However, there is still limited evidence of the topic and more studies are needed to clarify the prevalence and associated factors with discrimination actions in science and also in academic Dentistry, to inform organizational policies and design interventions as needed.

5.2.1 Stereotype threat

In the study of gender inequality in science, emerging evidence has highlighted the role of academic climate and its impact on female scientists' sense of belonging and productivity (Casad; Petzel; Ingalls, 2019; Casad *et al*., 2021; Calaza *et al*., 2021). This may include the feel of identification and sense of belonging to an ambient based on different clues, from physical characteristics and decoration of a given space that may reinforce existing stereotypes (Cheryan *et al*., 2009); absence of inclusive language in the workplace (Perales *et al*., 2022); underrepresentation of women in a department or institution and experience or knowledge of harassment of any kind (Casad; Petzel; Ingalls, 2019).

Such organizational clues, whether they are subtle of not, might lead stereotyped groups to develop awareness of social stigma and feel threatened when faced with the possibility of discrimination, which is known as stereotype threat (Casad; Petzel; Ingalls, 2019; Casad *et al*., 2021; Calaza *et al*., 2021). This condition has been recognized as highly relevant, with the potential to negatively impact the performance, productivity, academic involvement, and self-esteem of vulnerable groups, such as women in male dominated fields, but especially women with intersecting race identities (Casad; Petzel; Ingalls, 2019). Stereotype threat has been documented in the field of psychology and there is need for further research to understand its relevance for the gender gap in Dentistry. Future studies on this topic would provide valuable insight in the understanding of persisting inequalities using an intersectional framework.

5.3 Social capital, fewer connections, mentoring, and networking opportunities

According to Pierre Bourdieu, social capital can be defined as "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition" (Bordieu, 1986, p. 21). The possibility that female researchers may have less access to influential networking and fewer mentoring opportunities in comparison to their male peers has been previously documented (Moss-Racusin *et al.,* 2012; Casad *et al*., 2021). This is a matter of concern, as career advancement may rely greatly on mentorship (Gruber *et al*., 2021), especially if individuals have access to a diverse "mentoring network", with multiple mentors who may provide advice and support, from career aspects to technical or administrative tasks. Professionals at early stages of their careers may benefit greatly from social capital, that is, social resources and connections (Seibert; Kraimer; Liden, 2001), especially minority groups (Gruber *et al*., 2021).

6 Possible solutions

In Dental Science, it is evident that some gender gaps are persistent and there is need to further assess different topics, such as intersectionality, bullying, stereotype threat and the extent to which networking might influence career progression in the field. Current social indicators in Brazil, including female access to education and participation in the workforce, present a clear view of structural sexism and systemic challenges women face to succeed. The gender inequality observed in Brazilian Dental Science is a consequence of long-standing social and power asymmetries observed in the general population (IBGE, 2020). On the other hand,

the high percentage of female participation in Brazilian Dentistry and Dental Science presents unique opportunities to raise awareness and act towards meaningful change.

So far, there has been much talk of challenges, but what about action? How can we better walk the talk? In this way, the first step to address gender inequalities in Dentistry involves the assessment of how, why, and where it happens, so that goals and strategic actions can be better designed and implemented to level the playing field. Future studies should address the gender gap in Dental Science, its determinants, and how to address them. Evidence obtained from qualitative and quantitative studies, including longitudinal data, meta-research, bibliometric analysis, and mixed-methods studies, would provide valuable information for stakeholders at all levels.

In addition, there is need for tracking progress and making diversity data open and easily available (Khan *et al.,* 2019). In this way, current data and intervention strategies might be closely followed and evaluated. There is need for accountability – institutions should be held responsible for diversity (Khan *et al.,* 2019). One way to do this would be to include faculty and student diversity as a measure of quality in the evaluation of the postgraduate programs in Dentistry carried out by CAPES every four years (CAPES, 2022). One starting point might be to evaluate whether the programs themselves include diversity as part of their self-evaluation process, which was established by CAPES in 2018 (CAPES, 2019).

Although there is still a lot to discover, evidence highlights the need for purposeful and intentional effort. In this section, recommendations and possible solutions will be presented based on the existing literature and documented experience, grouped according to the challenges previously listed.

6.1 Gender stereotype and implicit bias

In female researchers' career in academia, difficulties in progression may arise that are related to gender inequalities in publication metrics (Davies *et al*., 2021). It may represent a superficial representation of scientists' contribution and impact (Davies *et al*., 2021). Systemic change towards a more inclusive view that rewards networking, community engagement, communication, collaboration, among others (Davies *et al*., 2021) might lessen the impact of discriminatory behavior that perpetuate gender disadvantage (Khan *et al.,* 2019).

In addition, there is need to offer equitable support for women in different life course stages. It may include but is not limited to: paid maternity and paternity leave, (Shannon *et al*., 2019), access to lactation facilities (Henry-Moss *et al*., 2019), and raising awareness and

offering support for people undergoing menopause (Nordling, 2022). In Brazil, CNPq provided researchers the opportunity to include maternity leave in their curriculum vitae, named Plataforma Lattes[1] (CNPq, 2021). As an example of a good initiative we can mention the Graduate Program in Dentistry at the Universidade Federal of Minas Gerais (UFMG), which every four years faculty members are evaluated and need to fulfill pre-requisites to be eligible to be a part of the program as advisors (UFMG, 2022b). In an innovative effort to provide support for academic mothers who were on maternity leave, there is an extended time frame of five years (UFMG, 2022b).

Implicit bias and strategies to address it in academia have been the focus of studies (Kang; Kaplan, 2019; Régner *et al*., 2019). One strategy that is commonly recommended is implicit bias training in organizations (Sherman *et al.,* 2019; Franco *et al*., 2021). Attempts to control implicit bias from an individual perspective might be challenging, as it might prove to be difficult to control how people think and behave (Kang; Kaplan, 2019) and it might not lead to long-lasting effects (Pritlove *et al*., 2019). However, findings from a real-life study show that action of committees and people who hold decision-making are more likely to be discriminatory in nature if they do not acknowledge that biases are a problem that need to be addressed. Educational efforts to raise awareness of systemic, implicit bias, and its consequences on career progression of commonly stereotyped groups would be a good starting point (Régner *et al*., 2019). It has also been recommended that peer review at different levels, including scientific publishing and funding, should be blind for candidates' gender and race (Khan *et al*., 2019).

Individual interventions should also be accompanied by structural and organizational change within environments that advocate for progress and inclusion (Kang; Kaplan, 2019; Pritlove *et al*., 2019), such as diversity in committees, faculty and student recruitment, and no tolerance for discriminatory behavior of any kind (Khan *et al*., 2019). Prevailing gender roles and institutional norms might shift towards a more diverse approach as more people use intersectionality lens and believe in and advocate for diversity. In addition, holding individuals accountable for change has been pointed out as a good option, for example in offering mentorship and support for underrepresented groups (Kang; Kaplan, 2019).

Leadership against gender inequality in Dental Science must be addressed. There is need to highlight the work of inspiring and pioneering women, who will act as role models and whose success will undoubtedly inspire generations to come (Koka *et al*., 2021). One interesting

[1] Available at: https://lattes.cnpq.br. Accessed at: 02 dez. 2025.

initiative has been designed in Australia to engage influential men who occupy leadership roles and are able to promote and advocate for meaningful change. The program is called Male Champions of Change (Latimer *et al*., 2019). The proposed allyship with those in position of power and influence is of utmost importance to act against prevailing systems of oppression and promote accountability (Latimer *et al*., 2019).

6.2 Academic environment

In academia, there is need for more research and raise awareness of students and faculty members on bullying and harassment, with no tolerance. Efforts to increase participation of women and diversity, diffuse power structures and address any kind of harassment are strongly recommended (Nasem, 2018).

A related topic of concern is stereotype threat, which may develop once typically stereotyped groups became aware of clues of discriminatory behavior, including harassment, excessive homogeneity of departments, and lack of inclusive language (Casad; Petzel; Ingalls, 2019; Casad *et al*., 2021; Calaza *et al*., 2021). The use of one's preferred name and pronouns aims for inclusion and to foster welcoming workplace climate. At UFMG, all students, faculty member and employees have had a right to formally use their preferred names since 2015, while researchers have been able to add it to their CNPq Lattes curriculum platform since 2018 (UFMG, 2022a).

6.3 Social capital

The role of social capital and mentorship as a determinant of career success has been previously approached (Seibert; Kraimer; Liden, 2001). Studies have sought to understand how social capital might influence career progression and success of female researchers (Casad *et al*., 2021; Schröder; Lutter; Habicht, 2021) and its mechanisms.

Social resources, mentorship and connections matter for career success and progression (Seibert; Kraimer; Liden, 2001), which is also true in scientific careers (Gruber *et al*., 2021). Accessibility to mentorship and "mentoring network" can greatly benefit female researchers. Even though mentorship is widely recognized as a determinant of success, it is still poorly adopted (Davies *et al*., 2021). Mentorship skills and experience of mentors must be rewarded in the scientific community in recognition of their great contribution and impact (Davies *et al*., 2021).

7 Conclusions

In the last decades, there has been great progress in female participation in Brazilian Dentistry, with most registered dentists, dental specialists, and researchers being female. However, this review presents evidence that persistent gender gaps, such as limited participation among leadership positions across different domains, may limit and negatively impact career progression. The lack of diversity in science not only limits its quality, innovation, and diversity, but it is also a matter of social justice, scientific integrity, and effective representation of the society it serves. There is need for more research to better understand how previously mechanisms may be responsible for the current reality. Available data highlights the need for action to promote diversity and equal opportunities for all to succeed in Dental Science.

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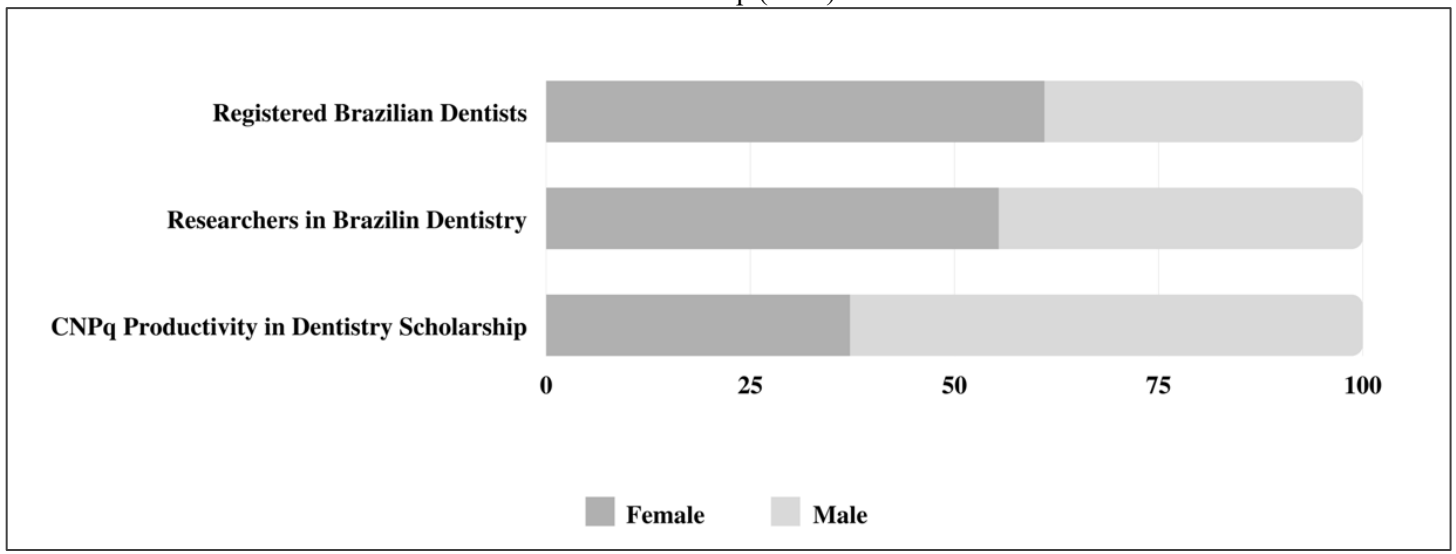
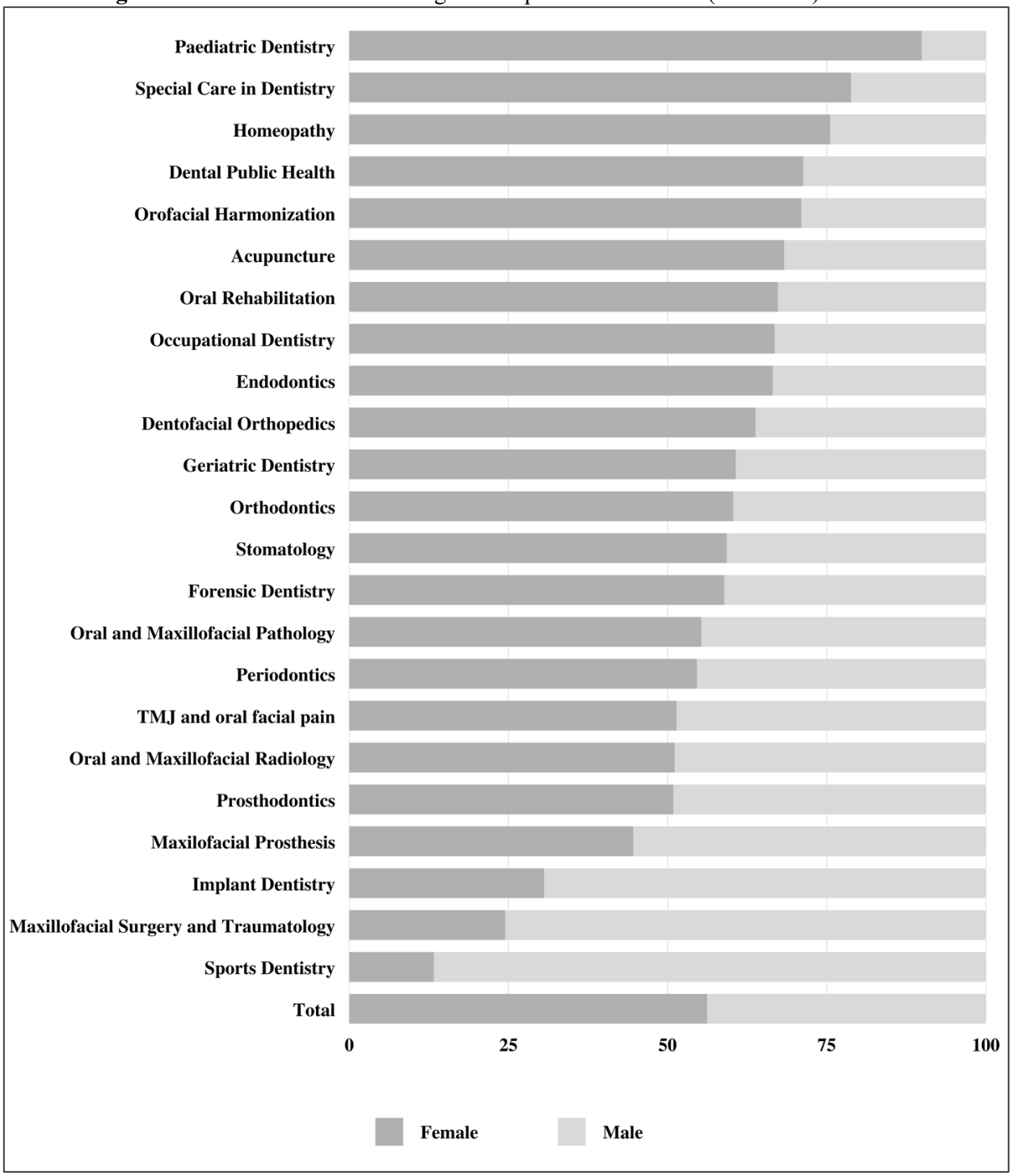
Figures and figure legends

Figure 1 - Gender distribution of registered Brazilian dentists (June 2022), researchers in Brazilian Dentistry (2011-2015) and CNPq Productivity in Dentistry Scholarship (2022).



Source: Tiwari *et al*. (2019); CFO (2022); CNPQ (2022).

Figure 2 - Gender distribution of registered specialists in Brazil (June 2022).



Source: CFO (2022)[2].

[2] Data organized in descending order, from the highest to the lowest female participation in registered specialties

Figure 3 – Distribution of the different domains of challenges female researchers in STEM may face, examples and possible solutions.

Causes		Examples	Possible solutions and recommendations
Gender stereotype and implicit bias	Career progression	Inequalities in researcher assessment, publications, citations, funding, inequalities in leadership positions	Implicit bias training, educating committees, promoting inclusive metrics in evaluations, blind peer review in different domains, including scientific publishin, highlight female researches' success, partner with male leaders and influential men
	Lifestyle roles and career practices	Choice of certain jobs and occupations, women in academia being expected to adhere to gender roles, life course challenges	Advocate towards change in institutional norms, promote diversity, offer equitable support throughout the lifecourse
	Intersectionality	The multidimensional experience of individuals with cumulative social identities (gender, race, sexual orientation, others)	Advocate for intersectional diversity, diversity in selection committees, advertise diversity in student and faculty recruitment, no torelance for discriminatory thought and action
Academic environment	Harassment	Sexual harassment, bullying	Raise awareness, educate students and faculty members, zero tolerance for harassment, increase diversity in the workplace, research
	Hostile climate	Stereotype threat	Use of inclusive language, advertise diversity, use of one's preferred name and pronouns, avoid geeky decoration, increase participation of female researchers and minory groups
Social capital	Networking and mentorship	Restrict access and availability	Mentor women and minority researchers, value mentorship skills and reward faculty members for their mentoring experience, offer support for networking opportunities, access to "mentoring network"

Source: Adapted from Lester (2008); Casad *et al*. (2021); Gruber *et al*. (2021).