Structural barriers drive gender inequality across academic careers in Brazilian ecology

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ABSTRACT

Although women often outnumber men in the early stages of academic careers in ecology, they remain significantly underrepresented in senior positions. In Brazil, women comprise the majority of graduate students in ecological sciences but hold fewer senior academic roles, receive less research funding, and face greater obstacles to visibility and recognition. To understand the factors contributing to this disparity, we conducted a nationwide survey with 283 Brazilian ecologists, analysing gender-based differences across career stages. Using descriptive statistics, chi-squared tests, and correspondence analysis (ANACOR), we examined experiences related to gender identity, parenthood, workplace dynamics, and scientific productivity. Our findings reveal persistent structural inequalities: women, particularly in early-career stages, reported more frequent experiences of gender discrimination and sexual harassment, limited access to leadership roles, lower publication rates, and heightened concerns about personal safety during fieldwork. Women more commonly cited personal and professional constraints as factors influencing their academic permanence. Overall, both men and women identified a lack of funding as the primary barrier to scientific productivity. These results underscore the intersectional barriers to gender equity in ecology and emphasise the urgency of structural, evidence-based reforms to build more inclusive academic environments.

Keywords: Brazilian ecology science; Ecology careers; Gender inequality; Lack of funding; and Structural barriers.

INTRODUCTION

In the ecological sciences, although women are overrepresented at the undergraduate level, their representation decreases as they progress in their careers, with only one-third of women holding university professor positions in the field [1,2]. Recent data on ecology researchers in Brazil indicate that women represent the majority at the master's and PhD levels, with an average of 55.7% [3]. However, their representation drops significantly at the whole professor level, where men hold twice as many positions [3]. Furthermore, only 20% of female faculty have been awarded grants to conduct their research [3]. This gender gap extends beyond academic positions: women in faculty positions have lower publication rates, receive less funding, and are less frequently invited to speak at conferences [4,5]. Although several countries have implemented initiatives to reduce gender inequality in academia, progress has been slow [6,7].

Many are the challenges that lead to this gender inequality. For instance, the lack of role models in early education contributes to the drop in female students during undergraduate studies [8,9]. At the graduate level, factors such as motherhood and implicit bias hinder women's advancement toward full professor positions [12–14]. Those factors are compounded by gender discrimination and sexual harassment throughout the professional and academic trajectory [10,11]. In Brazil, the discussion of gender is still in its early stages, and data-driven studies exploring the specific challenges and realities faced by women in developing countries remain scarce. A critical question remaining is: what factors contribute to women's underrepresentation between the PhD stage and full professorship, and what challenges they face in securing funding and grants for their research?

Beyond quantitative data on the current inequality scenario in academia, understanding the challenges and barriers faced at each career stage can inform strategies tailored to different minority groups, as well as contribute to the development of data-driven policies that increase

diversity in ecological sciences. In this study, we developed an extensive questionnaire to gather the personal and professional experiences, and perceptions of Brazilian researchers, aiming to better understand the key factors contributing to the low gender diversity among faculty members at universities and research institutions. Our focus is primarily on gender-related barriers that may hinder career progression in academia at two stages: early and senior, with the aim of fostering a more inclusive and representative ecological science in the Global South.

METHODS

Data collection

To identify barriers at different career stages in Brazilian ecology, we collected both qualitative and quantitative data through an online survey disseminated over a four-month period. This survey was made available via the Instagram account of the 'Women in Ecology' project <https://www.instagram.com/mulheres_na_ecologia/>, which promotes the work of women ecologists in Brazil, and through an email list compiled from postgraduate programs and faculty contacts in ecology and conservation across the country. Additionally, we also shared the survey with Brazilian institutes and organisations focused on ecological research.

The survey comprised 48 questions organised into seven sections: (1) personal information and demographics, (2) education and income, (3) work environment, (4) mentorship, (5) productivity, (6) parenthood, and (7) academic career satisfaction (see the complete questionnaire in Supplementary Information, SI). Our study was approved by the Human Research Ethics Committee of the Federal University of Bahia (CEpEE/UFBA) under the Certificate of Presentation for Ethical Assessment (CAAE) 69100023.3.0000.5531.

We received 399 responses, which were filtered based on gender self-identification - respondents who self-identified as "women" (W) and those who self-identified as "men" (M). We adopted a binary classification due to the low participation of respondents from other

gender identities. We also filtered responses by country, retaining only those from ecologists with professional experience in Brazil and working in an academic career. Our final dataset included 69 responses from men and 215 from women, totalling 283. We considered two career stages: early-career (junior) and senior-career (senior) ecologists. We defined early-career ecologists as those currently pursuing a master's or PhD degree and/or having between one and five years of experience in their current position, and senior-career ecologists as those with over six years of experience in their current position and/or aged 40 years or older. These categories were established to account for differences in career stage experiences, which may influence perceptions of the challenges faced.

Statistical analysis

To assess the significance of differences between groups, we computed frequencies and means, along with their standard deviations, for discrete and continuous variables, respectively. When appropriate, we used chi-squared (χ^2) tests, employing Monte Carlo p-value simulation[15], to compare categorical data. Statistical significance was set at $p\text{-}value < 0.05$.

To explore associations between gender identity, supervisor's gender, gender discrimination, sexual harassment, and career stages, we performed a correspondence analysis (ANACOR), a method particularly suitable for analysing categorical data[16]. The statistical analysis was based on respondents' answers to a set of binary variables representing the presence or absence of specific gender-based discriminatory experiences (e.g., gender discrimination, leadership bias, and gender-based jokes), mentorship, as well as metadata on gender identity and career stage. The first two dimensions, which accounted for the greatest significant proportion of variance, were retained for interpretation.

For all statistical analyses, responses categorised as '*did not answer*' and '*not applicable*' were excluded, as they did not contribute to the intended analyses and could

potentially bias the results. The raw data and code used for data processing and analysis are available on Zenodo at (link will be added). All analyses were performed using R version 4.3.2 [17].

RESULTS

Participants ranged in age from 20 to 39 years. The majority self-identified as white, with only 17.7% of men and 21% of women identifying as brown or black, and 1.5% of men and 2.3% of women of men identifying as Asian (SI, Fig. S1). Male respondents were almost evenly split between senior (54%) and early-career (46%) stages, whereas most female respondents were in the early-career stage (64%). Overall, 50.7% of respondents had relocated from their state of birth (SI, Fig. S2 and S3). Significant gender differences were found in the reasons for relocation (χ^2 = 16,13, *p-value* = 0.04) (Table 1). Among early-career researchers, the most commonly cited reasons were preference for a postgraduate program (M = 25% and W = 33%), research focus (M = 9% and W = 17%), and better quality of life (M = 16% and W = 12%). For senior career respondents, the primary reasons included better quality of life (M = 25% and W = 23%) and securing temporary or permanent contracts (M = 19% and W = 19%)(SI, Table S1 and S2, Fig. S4). Gender-specific differences also emerged: 15% of women reallocated due to their partner's move, compared to 0% of men, while 25% of men reallocated for research-related reasons, compared to 12% of women (Table 1). In terms of consequences, most respondents reported no significant adverse impact from relocation. However, 19% of senior men reported experiencing career-related problems when moving with a partner, compared to only 5% of women (SI, Table S1).

Career choices influenced parenthood decisions differently across genders (Fig. 1). More than half of the respondents (M = 56%, W = 67%) reported not having children. However, the reasons for this decision varied significantly by gender: 36% of men indicated career-related concerns compared to 65% of women (χ^2 = 17.92, *p-value* < 0.001) (Table 1). There

were also gender differences in perceptions of how maternity leave impacts women's careers ($\chi^2 = 5.68$, *p-value* < 0.02) (Table 1). While most men (60%) and women (76%) acknowledged a negative impact, 40% of men did not perceive maternity leave as prejudicial (Fig. 1).

Questions regarding the workplace environment revealed significant gender-based differences in perceptions of gender representation, professional preferences, gender discrimination, and harassment. Regarding team composition preferences, most men (81%) and women (55%) expressed no preference, although a notable proportion of women (43%) preferred mainly working with other women ($\chi^2 = 15.22$, *p-value* < 0.001). This difference narrowed in perceptions of workplace support: both men and women primarily reported receiving support from people of both genders (M = 62%, W = 43%). However, women were more likely to report receiving support exclusively from other women (M = 3%, W = 18%) ($\chi^2 = 29.22$, *p-value* < 0.001) (Table 1). When asked about gender representation in their institutions, both men (32%) and women (35%) reported that men outnumbered women in their departments (Table 1). However, men were more likely to believe there was no gender disparity in hiring or leadership selection (M = 58% and 29%, respectively; W = 31% and 10%). Conversely, most women perceived that men were more often hired or promoted (M = 18% and W = 45%; $\chi^2 = 29.22$, *p-value* < 0.001) and more frequently selected for leadership roles (M = 10% and W = 22%; $\chi^2 = 27.45$, *p-value* < 0.001) (Table 1).

Reports of gender-based workplace discrimination were significantly more common among women. Respondents evaluated scenarios involving common forms of discrimination, such as receiving credit for work, award/promotions gaps, grant disparities, undermined authority, exclusion from fieldwork, devaluing of opinions, pregnancy-related bias, and gender-based jokes (Fig. 2). Women consistently reported higher frequencies of these experiences compared to men ($\chi^2 = 158.97$, *p-value* < 0.001; Table 1). Most men (54%) reported no experiences of gender discrimination and were excluded from this part of the

analysis (n = 34). Among women, the most frequently cited experiences included being targeted by gender-based jokes or embarrassing situations (20%) and being perceived as aggressive or unpleasant when asserting authority (16%). Other recurring experiences included men receiving credit for their work, pregnancy-related discrimination, and devaluation of their opinions (Fig. 2, Table 1).

Sexual harassment reports also revealed substantial gender disparities. While 34% of women reported having experienced sexual harassment during their careers, only 7% of male respondents reported the same ($\chi^2 = 17.55$, *p-value* < 0.001; Table 1, Fig.4a). Most incidents were not reported (M = 60% and W = 50%), and those that were reported rarely led to consequences. Men reported cases of resigning after such incidents. Among women, 26% indicated their harasser was their supervisor, and 8% reported being silenced (Fig. 4b). Other outcomes included professional repercussions or witnessing impunity for the perpetrator. Some women reported that harassment cases in their departments, particularly in male-dominated ecology labs, were silenced, with perpetrators shielded by colleagues (Table 1).

Correspondence analysis (ANACOR) confirmed gender-based differences in workplace experiences, showing distinct clustering patterns between men and women. The first two dimensions explained 31.9% and 10.3% of the variance, respectively (Fig. 3). Women were more likely to report affirmative experiences of gender bias, while men predominantly reported an absence of such experiences, suggesting limited exposure. These trends were especially pronounced among early-career individuals, underscoring how gender and career stage intersect to shape experiences of discrimination in academic settings.

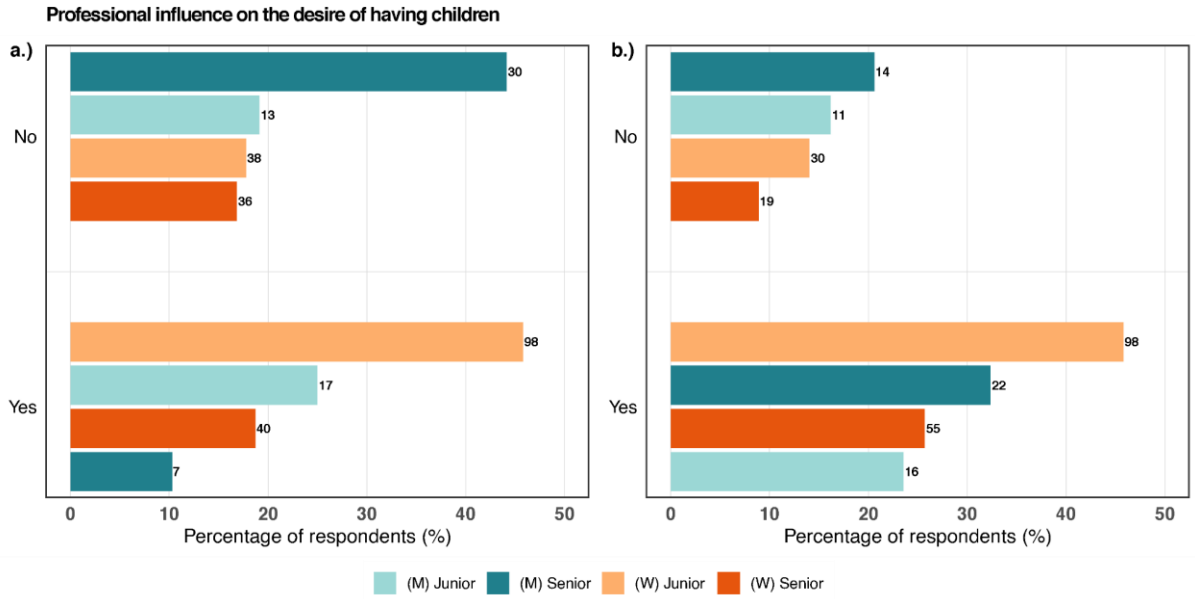

Figure 1. Career decisions influencing parenthood. **a.)** Question 42:`Does your professional choice influence your desire to have children?`; **b.)** Question 43: `Do you agree with the statement that maternity leave has a negative impact on women's careers?` The data for both graphs represent the distribution of responses ("Yes" and "No") by gender (Men/Women) and seniority (Junior/Senior). The number at the end of the bars represents the number of respondents in each category. Responses classified as "Not applicable" or "Did not answer" were excluded.

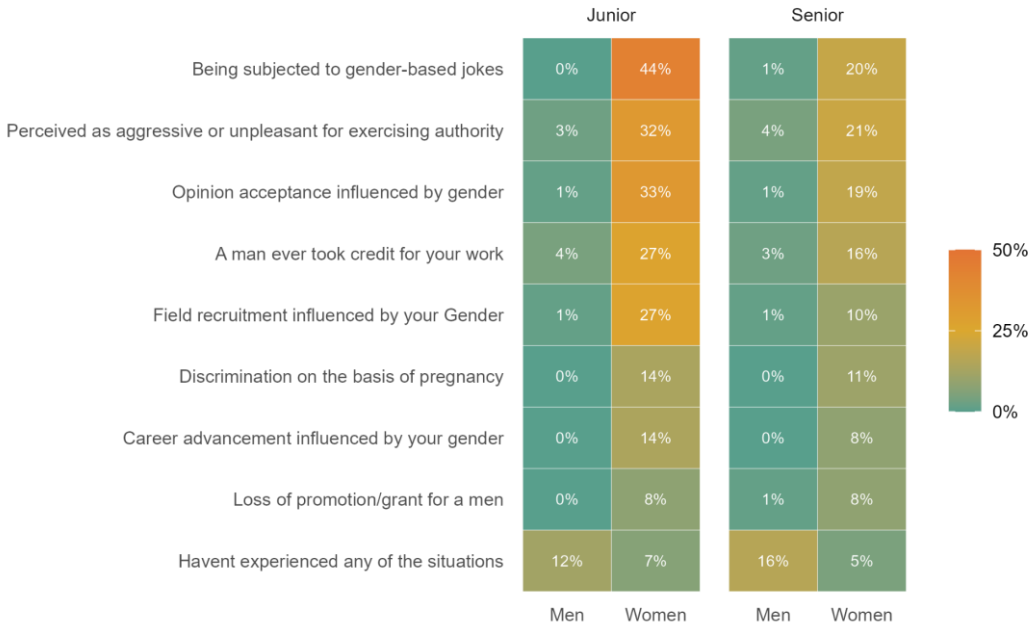

Figure 2. Relative frequency of reported experiences of moral harassment or gender-based discrimination (Question 31: 'Have you experienced any of the following situations in your professional career?') by gender and professional level. This heatmap represents the proportion of respondents reporting each situation described in Question 31, stratified by gender (Men/Women) and seniority (Junior/ Senior). Responses classified as "Not applicable" or "Did not answer" were excluded.

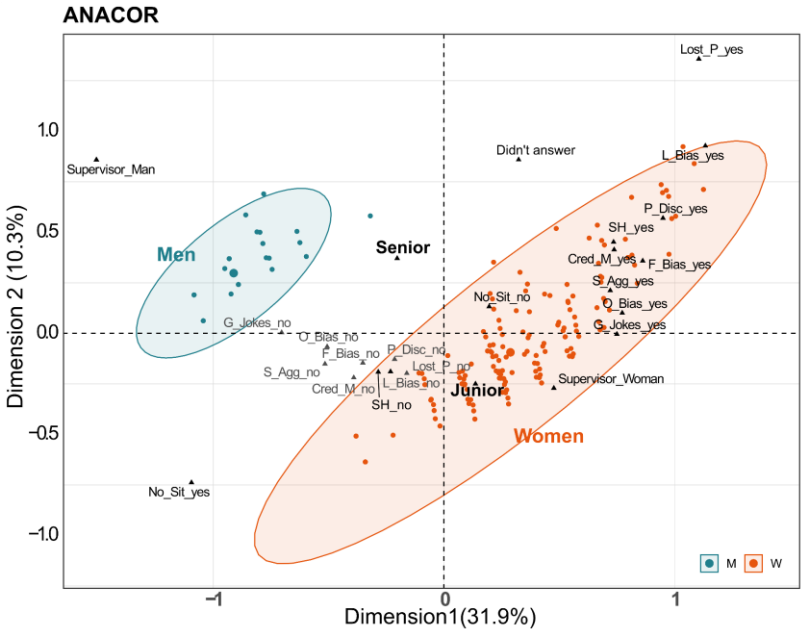

Figure 3. Correspondence analysis (ANACOR) of the associations between gender identity (Men and Women, represented by different colours), supervisor's gender, gender discrimination, sexual harassment, and career stages (Junior and Senior, highlighted in bold). Points represent the respondent's answers. Acronyms inside the figure represents: Supervisor_Man and Supervisor_Woman = the supervisors' gender; Lost_P_yes and Lost_P_no = If they have lost a promotion/benefit (e.g., productivity grant) to a man, even though they put in equal effort; L_Bias_yes and L_Bias_no = If they have felt that their gender was decisive in not getting a leadership position; P_Disc_yes and P_Disc_no = If they have faced discrimination for being pregnant or for being a woman who could become pregnant.; F_Bias_yes and F_Bias_no = If they have felt that their gender was decisive in not being invited to participate in fieldwork; Cred_M_yes and Cred_M_no = If a man has taken credit for work they did; S_Agg_yes and S_Agg_no = If they were seen as aggressive or unpleasant for exercising authority or expressing opinion; O_Bias_yes and O_Bias_no = If they have felt that their gender was decisive in having their opinion accepted; G_Jokes_yes and G_Jokes_no = If they have experienced uncomfortable situations involving jokes related to their gender; No_Sit_yes and No_Sit_no = if they haven't experienced any of the situations described; SH_yes and SH_no = if they have experienced sexual harassment; Didn't answer = they prefer not to answer.

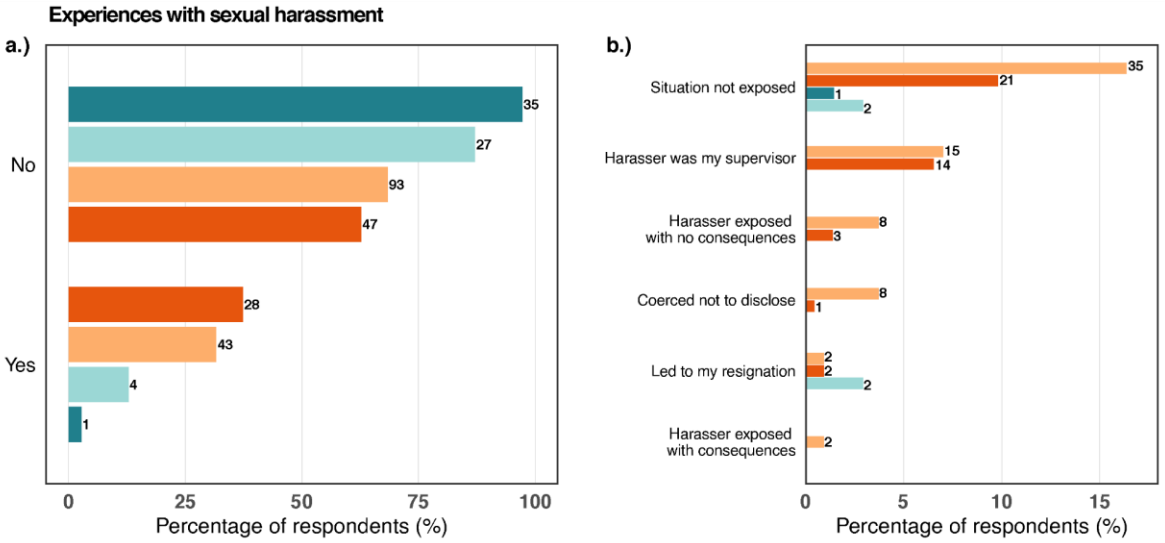

Figure 4. Relative frequency of reported experiences of sexual harassment by gender and professional level. **a.)** Responses to Question 32 ("Have you ever experienced sexual harassment by a colleague at work?"), stratified by gender (Men/Women) and seniority (Junior/Senior). Bars represent the proportion of respondents who answered "Yes" or "No" within each subgroup, with absolute numbers shown. **b.)** Reported consequences of sexual harassment among respondents who answered "Yes" (Question 33: "If you answered YES to the previous

question, please indicate which situations apply to what happened"), also stratified by gender and seniority. Responses classified as "Not applicable" or "Did not answer" were excluded.

Among respondents who indicated having had a formal Master's and/or PhD supervisor, the majority (M = 78%, W = 75%) reported that their most recent supervisor was a man (Table 1). When asked about the need for assistance during fieldwork, significant gender differences emerged ($\chi^2 = 17.07$, *p-value* < 0.001) (Table 1). While most respondents cited workload as the primary reason for bringing assistants (M = 43%, W = 38%), men more frequently mentioned educational purposes (M = 28%, W = 16%). In contrast, women more often cited concerns related to personal safety (M = 15%, W = 29%) (Table 1).

Annual average scientific productivity over the past four years also differed by gender and career stage ($\chi^2 = 26.4$, *p-value* < 0.001) (Table 2 and SI, Table S1 and S2). While 35% of men reported publishing 4 to 7 papers annually, 52% of women reported publishing 1 to 4 papers (Fig. 5). This scenario changes when considering career stages. Among early-career stages, the majority of women (59.4%) reported publishing 1 to 4 papers in the past four years, compared to 36.7% of men. Men at this stage were more likely to report higher productivity: 23.5% published 4 to 8 papers, compared to just 4.2% of women (SI, Table S1 and S2). In contrast, gender gaps widened at the senior career stage. While the majority of senior men (46%) published between 4 and 8 papers, most senior women (40.4%) remained in the 1-4 category (SI, Table S1 and S2). Moreover, 14% of senior men reported publishing more than 10 papers over the past four years, compared to only 5.1% of senior women. Significant gender differences were also observed in the factors that hinder and accelerate scientific productivity. Men most commonly cited administrative responsibilities as barriers (33%), while women more frequently pointed to lack of funding and resources, as well as family responsibilities (14% each) ($\chi^2 = 18.26$, *p-value* = 0.05) (SI, Table S3 and S4). Regarding factors that enhance productivity, men most often cited age (27%), while women highlighted geographic origin

(25%) and socioeconomic background (24%) ($\chi^2 = 17.3$, *p-value* = 0.06). Overall, both genders identified a lack of funding and resources as the main impediment to productivity, and socioeconomic background as the most influential facilitator (SI, Table S3 and S4).

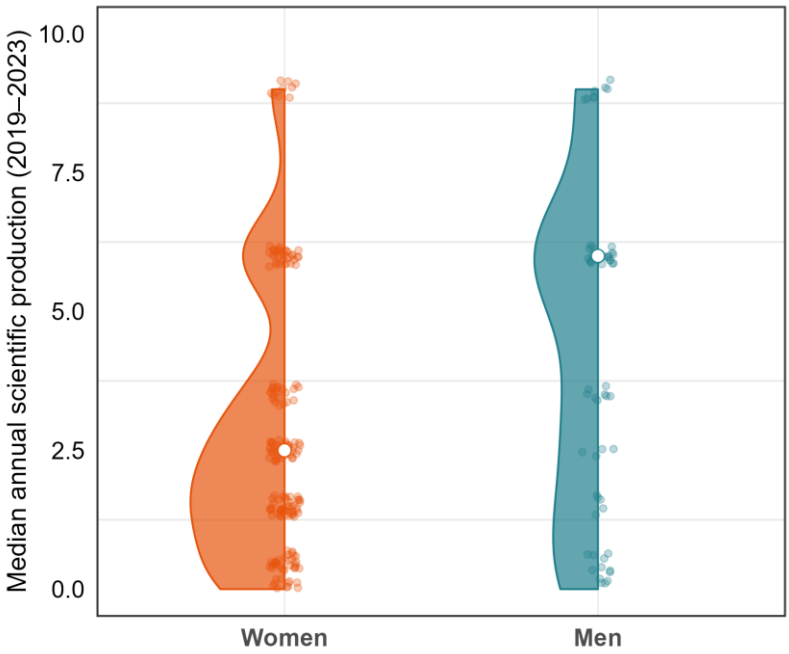

Figure 5. Productivity by gender and career stage (Question 39: 'What is your average scientific production per year over the last 4 years (papers, book chapters, books), i.e., from 2019 to the present?') by gender (Men/Women). This violin plot represents the distribution of respondents' reported annual scientific production. Responses classified as "Not applicable" were excluded.

DISCUSSION

Here, we highlight the structural challenges faced by ecologists in Brazil across various aspects of their personal and professional lives. Our findings reveal that challenges vary by gender and career stage. Our results suggest that the underrepresentation of women between the PhD level and faculty positions results from factors such as gender inequality, the disproportionate burden of domestic and caregiving work, institutional biases, and a lack of support networks. At the same time, the main challenges in obtaining research funding and fellowships include implicit bias in evaluation processes, limited access to influential mentors, and career interruptions associated with motherhood. While economic and administrative factors are the main influences on men's careers and productivity, women face persistent discrimination and experience a greater impact of personal life on their career trajectories and

productivity. Mostly, our survey highlighted that different perceptions related to the current state of gender inequality can affect the retention of women in academia and the productivity of those who persist in academic careers.

Personal life choices have a higher impact on women's careers and on their retention in the academic field. For instance, women were shown to be the ones who often compromise in relationships, as a higher proportion of senior women reported relocation because their partner had to move. In contrast, a significant proportion of men reported that their partner had experienced career problems after moving. Women are still the ones who often have to give up on their career trajectory to accommodate their partners. Besides having to compromise, the women who answered our survey were still able to continue their scientific careers; however, this is not always the case [18].

Another personal factor concerns women's careers and maternity choices. Our survey reveals that 65% of women reported that their career influences their desire to have children, whereas the opposite is true for men. The reality for Brazilian women still suggests that they must choose between having children and pursuing their careers. The lack of institutional support, the professional impact of maternity leave, and the "publish or perish" phenomenon exacerbate the tension between maternity and continuing in the research path, [19–21]. Moreover, the majority of respondents agreed with the statement that maternity leave has a negative impact on women's careers. This perception stems from the fact that women often face various challenges after returning from maternity leave. For instance, nearly half of women in Brazil experience job loss or termination [22], also becoming less hireable [21], and are more likely to feel pressured after returning from maternity leave [23]. Changing the negative view on this critical social benefit (a right conceded by the Brazilian government to women in their first six months of postpartum) requires a systematic shift in how parenthood is treated in public and private institutions in Brazil. It stems from individual changes in how we perceive pregnancy and

298 early-stage parenthood, as well as institutional and social changes, including increased
299 infrastructure to support the work of early mothers and reduced asymmetry in paternity and
300 maternity leave, thereby perpetuating gender equality [23].

301 In the professional environment, gender discrimination and harassment remain
302 significant challenges to women's persistence in the academic field. Three in every 10
303 respondents said they had already suffered from sexual harassment from a colleague, and from
304 that situation, 2 in every 10 had the supervisor as the harasser. These are expressive numbers,
305 but sadly, they only reproduce more of the reality in Brazil, where 46.7% of women have
306 already suffered some kind of moral or sexual harassment
307 (https://forumseguranca.org.br/painel-violencia-contra-a-mulher/). This pattern is not
308 exclusive to global southern countries; studies have shown a similar proportion of sexual
309 harassment situations in European and North American countries [24–26], as the pattern of not
310 reporting these situations, leaving them unpunished. Institutional policies that secure a safe
311 environment for women and guarantee their right to report sexual assaults are primarily needed
312 to start changing this global scenario (e.g., [27]).

313 Situations leading to gender-based discrimination were even more expressive, with
314 99% of women in our survey reporting suffering from one or more of the described situations.
315 For instance, most women answered that they had already been "perceived as aggressive or
316 unpleasant for exercising authority." This microaggression underscores that women are still
317 not perceived as leaders, and when they do hold leadership positions, their legitimacy is often
318 questioned [7]. Further, this type of comment on women's behaviour can be seen as pathologising
319 women's characters, triggering overcompensation and burnout [28]. While all women are more
320 likely to face a subtle form of workplace gender discrimination or microaggressions than their
321 male counterparts, this is especially pronounced for Black women[29]. Despite our efforts to
322 widely disseminate the questionnaire, our sample included limited racial and ethic diversity,

with only 6.5% of women and 7.4% of men self-identifying as Black (SM, fig. S1). In Brazil, more than 50% of the population identifies as black or mixed race; however, when examining racial diversity within post-graduate programs, only 3% of female researchers are black or mixed [30]. While our results highlight this critical disparity in access to postgraduate education, additional data are needed to better understand the specific structural and institutional challenges faced by black women in ecology. Ultimately, from a broad perspective, women who rise to higher positions are those who find ways to better cope with frequent reminders of non belonging[1]. Dealing mechanisms can include strategies that aim to change coworkers' perceptions of themselves, such as performing a male-stereotyped behaviour, employing coping strategies, internalising and reframing the situation, or seeking social support [31].

How people perceive their work environment may also contribute to gender inequalities [32]. Here, we showed that men failed to perceive particular gender favouritism in leadership positions. This brings a critical perspective concerning gender bias in academia. Male faculty members still hold the higher positions; however, they don't perceive gender bias in their work environment. The underrepresentation of women in leadership positions is a global issue, with extensive literature supporting this claim [2,7,33,34]. However, perceiving the overall issue is not the same as acknowledging the pattern in their workplace. A change in male perception is crucial, as they still hold the majority of leadership positions, and needs to be improved by increasing sensitivity to gender-based aspects [7]. Most discussions held in ecological conferences and graduate programs about gender bias often lack male representatives (empirical observation)[35]. Promoting programs that gather data on gender, race, and other minority groups within each university may help visualise local patterns and pressure for affirmative action that promotes equity and increases diversity in the university faculty. Moreover, these data-based pieces of information need to be assessed by those who design and implement institutional policies (men in the majority) [32].

Gender gaps in scientific productivity persist as a significant pattern in academia [20]; here, we demonstrate that disparities in productivity may change across career stages. While earlier-career respondents have the same average production, men who advance to higher positions increase their production, whereas women mostly remain at their early-career average production levels. A meta-analysis[20] study showed that men are more productive as a group. Other evidence suggests that articles led by male supervisors have fewer than 20% female co-authors [12]. As it stands, the first factor contributing to this productivity gap is an implicit bias, where men perpetuate the notion that women are less productive, leading them to prefer working with other men. Interestingly, when asked about their preference for teamwork, both men and women stated that they would work with both genders without preference. Relatedly, a significant number of men and women in our survey reported receiving help from women. This answer highlights the fact that women are credited less than men. Specifically, men tend to prefer publishing with other men [36], but are often assisted by women, who are less likely to be credited as authors [37].

Regardless of gender, most respondents cite a lack of funds and resources as the main impediment to increasing their productivity. Although there was a gender disparity in impediment factors, primarily related to administrative responsibilities, it may be attributed to the proportion of men and women in senior positions, with women respondents predominantly enrolled in postgraduate programs, in which administrative duties are typically minimal. Looking specifically at senior positions, there was no difference between men and women in impediment factors to productivity (SI, Table S4). Most respondents perceive their geographic origin and socioeconomic status as the leading accelerators to their productivity, highlighting Brazilian social inequalities [38]. Although our survey has a geographic and social gap, it may also have highlighted a deficit in the academic environment. Where a significant social gap

still exists, only individuals with middle to high socioeconomic status can succeed in their professional careers and attain prominent positions.

Studies emphasise the disproportionate pressure faced by women, people of colour, and other minorities to engage in administrative and committee activities due to institutional mandates for diversity [39]. The underrepresentation of these groups, combined with the institutional push to increase their participation in such activities, is overwhelming. This added burden reduces the time available for research, thereby impacting their overall productivity. Although we know that diversity provides a broader perspective on institutional matters, such as hiring and educational committees [40,41], policies aimed at creating more equitable and diverse boards should carefully consider the additional workload placed on these individuals. The need to overcome implicit bias in faculty recruitment can be addressed by increasing awareness of the recruitment team's potential biases, implementing blind proof evaluations, recording teaching presentations of candidates, and establishing affirmative action quotas. Achieving lasting change requires moving beyond symbolic efforts and committing to meaningful mentorship, advocacy, and shared responsibility [42].

Our results reaffirm the complexity underlying gender inequality, with personal and professional factors hindering women's permanence and productivity in academia. However, a fundamental change may alter this background: leaders in academia need to recognise the issues behind the lack of institutional diversity and systematically implement policies and data-driven actions to address these challenges (fig. 6, Box 1). Specifically, men must truly engage in gender-based initiatives. Moreover, we need to promote inclusive research environments and foster collaborations among early-career researchers, breaking the pattern of men publishing primarily among themselves and increasing women's productivity and leadership in ecological studies. Finally, we note that although significant progress has been made in research funding in Brazil, it remains the primary factor influencing scientific productivity.

Funding policies in Brazil are based on conservative metrics, including journal impact factor, number of graduate students and number of published papers [43]. This results in a disproportionate distribution of funding, both geographically and by gender, where male researchers from the southeastern region of Brazil tend to receive more funding than researchers in the North or Northeast[3,44]. As a middle-income country with a depreciated currency, Brazilian researchers must contend with a lack of infrastructure and financial resources while facing production pressures to maintain the minimal resources necessary for their work. Whereas increasing international funding has been a short-term solution [45], it doesn't change the disproportionate scenario we face. Funding agencies should develop inclusive metrics for evaluating research proposals and constantly encourage targeted research calls to increase diversity.

The purpose of our survey was to highlight the challenges faced by Brazilian ecologists throughout their professional careers, with a focus on identifying possible differences by gender and career stage. However, we encountered difficulties in engaging men to participate in our survey, as well as a lack of representation from other genders and diverse racial and ethnic identities. Our survey also failed to gather a robust sample across all Brazilian states, despite numerous attempts to increase participation. We acknowledge that the experiences presented here may vary across various cultural and socioeconomic backgrounds, and we emphasise the need for research focused on this specific social structure. Our limited sample size of male respondents underscores the need to raise awareness of the importance of these studies for developing data-driven solutions to address gender inequalities and to engage in initiatives that promote social, racial, and gender visibility in science. Moreover, an open question remains regarding which factors are most influential in the decision to leave academia, particularly among respondents who have already exited the field, and this issue warrants further exploration in future research.

In conclusion, our findings reveal the multifaceted and interconnected nature of gender inequality in Brazilian ecology, shaped by institutional and structural factors that hinder women's representation, retention, and productivity across academic career stages. Persistent disparities in caregiving responsibilities, funding access, leadership positions, and exposure to discrimination are compounded by limited institutional support and inequitable policies. Addressing these challenges demands coordinated action that combines inclusive institutional reforms, equitable parental leave, proactive mentorship, and genuine engagement from male leaders (fig.6, box 1). Efforts to collect and analyse disaggregated data on gender, race, and socioeconomic background are essential to guide evidence-based interventions, promote diversity, and foster a research environment in which all individuals can thrive. Recognising and dismantling systemic barriers is a prerequisite for strengthening scientific innovation and ecological research in Brazil.

Figure 6. Summary of actions aimed at reducing gender inequalities and increasing diversity in ecological careers in Brazil, based on the analysis of the questionnaire responses presented in this study. See Box 1 for further details. Illustration credit: Juliana Ciccheto.

BOX 1: How do we overcome these challenges?

1. **Initiatives that increase gender representation and visibility without increasing the workload of minority representatives:** Most initiatives aimed at improving the representation of minority groups often result in additional responsibilities for their members. For instance, an institutional evaluation process that enforces gender parity within a faculty council where representation is already unequal tends to place a disproportionate burden on the minority gender. Efforts to foster gender parity in academic environments must therefore account for the invisible and often uncompensated labour disproportionately carried out by minority groups.
2. **Equitable maternity and paternity leave policies:** Women in Brazil are entitled to a maternity leave of four to six months, as mandated by the country's constitutional law. In comparison, men are entitled to a 5-day leave. This discrepancy is stated by a conservative view that it is not the man's responsibility to care for the newborn baby. Caring for a newborn baby is not an individual job, as the African proverb says: it takes a village to raise a child. Equal maternity and paternity leave represents a balance not only in the workload of raising a family, but also in the professional consequences of choosing to have one.
3. **Actively promote gender and racial inclusion in departments with higher levels of inequality:** Opening targeted positions to ensure equitable representation of underrepresented groups in public and private institutions.
4. **Men need to engage more in gender-based discussions:** While we have people in leadership positions coping with or ignoring the fact of gender under-representation

and lack of diversity in research institutions, we will not be able to change the inequality pattern currently stated.

5. **Setting up a committee focused on fostering diversity, equity, and inclusion, particularly in matters of gender and race, across university policies and practices:** gather data, build workshops, discuss policies, and implement institutional guidelines to address multiple forms of discrimination and sexual harassment.
6. **Establish rigorous institutional policies for addressing moral and sexual harassment in research institutions and universities:** The job security that Brazilian Professors often have is one of the challenges in reporting and pursuing institutional punitive actions for moral and sexual discrimination, such as the dismissal of the professor or supervisor. Because of that, it is important and urgent that we include federal policies that consider sexual, moral, and gender-based harassment and abuse of power as grounds for dismissal from public academic office.

Acknowledgments

We gratefully acknowledge all the individuals who participated in our survey - your time and perspectives were essential to this work. We are especially thankful to the members of the '*Women in Ecology'* Project for their valuable insights and ongoing support throughout the development of this study. We want to extend our particular thanks to Amanda Leão for her work on constructing the questionnaire. We also extend our acknowledgements to those who provided thoughtful feedback during our conference presentations; their engagement and contributions greatly enriched our research.

Data sharing statement

Data and R code are available in [https://github.com/MulheresEcologas/quest_pesquisa_barreiras.git]. The database for this study is published in Zenodo: https://doi.org/10.5281/zenodo.18244507

Ethics statement

This study was conducted in accordance with ethical standards. It was approved by the Human Research Ethics Committee of the Federal University of Bahia (CEpEE/UFBA), under the Certificate of Presentation for Ethical Assessment (CAAE) 69100023.3.0000.5531. We state that we obtained informed consent from all subjects. The term is provided in the supplementary information.

Funding

APLC was supported by a postdoctoral grant from VPCCB/FIOCRUZ. JRMC and MEFS were supported by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES). This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Author contributions statement

APLC; JRMC; MEFS; LNP; LDV; and EDB.

Conceptualisation: Initial idea; formulation or evolution of overarching research goals and aims.

- E.D.B., L.N.P, A.P.L.C., and J.R.M.C.

Data curation: Management activities to annotate (produce metadata), scrub data and maintain research data (including software code, where it is necessary for interpreting the data itself) for initial use and later re-use.

- A.P.L.C., M.E.F.S., and E.D.B.

Formal analysis: Application of statistical or other formal techniques to analyse or synthesise study data.

- A.P.L.C.; J.R.M.C, and E.D.B.

Investigation: Conducting a research and investigation process or data/evidence collection.

- A.P.L.C. and E.D.B.

Methodology: Development or design of methods; data collection.

- A.P.L.C.; E.D.B.; J.R.M.C.; M.E.F.S.; L.N.P.; and L.D.V.

Project administration: Management and coordination responsibility for the research activity planning and execution.

- A.P.L.C. and E.D.B.

Supervision: Oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team.

- E.D.B.; L.D.V. and A.P.L.C.

Validation: Verification, whether as a part of the activity or separate, of the overall replication/reproducibility of results/experiments and other research outputs.

- A.P.L.C.; J.R.M.C.; M.E.F.S., and E.D.B.

Visualisation: Preparation, creation and/or presentation of the published work, specifically visualisation/data presentation.

- E.D.B.; A.P.L.C., and J.R.M.C.

Writing – original draft: Preparation, creation and/or presentation of the published work, specifically writing the initial draft (including substantive translation).

- A.P.L.C.

Writing – review & editing: Preparation, creation and/or presentation of the published work by those from the original research group, specifically critical review, commentary or revision – including pre- or post-publication stages.

- E.D.B.; A.P.L.C.; J.R.M.C.; M.E.F.S.; and L.D.V.

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TABLES

Table 1: Key results from the questionnaire applied to Brazilian researchers, with responses classified by gender. The table includes the answer options for each survey question (Category), the number of responses in each category (Answers), and the proportion of responses in each category as a percentage of the total responses for each gender (Percentage). It also presents the chi-squared test statistic used to assess differences in responses between genders (chi-squared test) and the corresponding p-value indicating the statistical significance of these differences (P-value).

	Men		**Women**	
Category	**Answers**	**Percentage**	**Answers**	**Percentage**
If you have moved to a new city, state, or country in the past five years, what were the motivating factors? Please check all categories that apply to your move:				
χ^2: 16.13 | p-value: 0.04				
Better life quality	11	18%	28	14%
Better salary	9	15%	16	8%
Focus on research	8	13%	34	16%
Increased status at work	3	5%	13	6%
Live close to family and friends	2	3%	13	6%
The only job offer that I had	4	7%	16	8%
Postgraduate programme preference	12	20%	61	29%
Relocating because my partner has moved	1	2%	15	7%
Starting a temporary or permanent contract	10	17%	11	5%
If you have moved residence to advance your career, please check the categories that describe the consequences of your move:				
χ^2: 1.11 | p-value: 0.98				
Children moved but suffered a significant adverse impact	1	2%	4	3%
Children moved with no or minimal adverse impact	7	14%	15	13%
Partner or other significant person has moved in with me, but has career problems	6	12%	11	9%
Partner or significant other has moved in with me, and the relationship has had a significant negative impact	7	14%	21	18%
Partner or significant other has moved in with me, with no significant negative impact on the relationship	19	37%	41	34%
Partner or significant other hasn't moved in with me, and the relationship has had no significant adverse impact	7	14%	16	13%
Partner or significant other hasn't moved in with me, but has had a significant negative impact on the relationship	4	8%	12	10%
Do you prefer to work in a team that is:				

χ^2: 15.22 | p-value: <0.001				
Indifferent	55	81%	117	55%
Primordially female	13	19%	93	43%
Primordially male	0	0%	4	2%
Colleagues who are most helpful in your current position are primarily:				
χ^2: 12.21 | p-value: <0.001				
Both	42	62%	92	43%
Men	2	3%	39	18%
Women	24	35%	82	38%
In your current job, which of the following situations do you observe?				
χ^2: 29.22 | p-value: <0.001				
Men are easily hired and/or promoted	13	18%	102	45%
Men are not easily hired and/or promoted	3	4%	6	3%
No gender disparity in hiring and promotion	42	58%	72	31%
Women are easily hired and/or promoted	5	7%	3	1%
Women are not easily hired and/or promoted	9	13%	46	20%
If you work in a public institution, which of the following situations do you observe?				
χ^2: 27.45 | p-value: <0.001				
Men are easily selected for leadership positions	11	10%	63	22%
Men outnumber women in my department	36	32%	102	35%
No gender disparity	14	12%	30	10%
No gender-based leadership	33	29%	29	10%
Women are easily selected for leadership positions	5	4%	18	6%
Women outnumber men in my department	14	12%	46	16%
Have you experienced any of the following situations in your professional career? Choose all that apply:				
χ^2: 158.97 | p-value: <0.001				
Has a man ever taken credit for your work	5	14%	93	13%
Being subjected to gender-based jokes	1	3%	136	20%
Career advancement is influenced by your gender	0	0%	48	7%
Discrimination based on pregnancy	0	0%	52	8%
Field recruitment is influenced by your gender	2	6%	80	12%
Haven’t experienced any of these situations	19	54%	24	3%

Loss of promotion/grant for a man	1	3%	35	5%
Opinion acceptance is influenced by gender	2	6%	110	16%
Perceived as aggressive or unpleasant for exercising authority	5	14%	113	16%
Have you experienced sexual harassment from a colleague?				
χ^2: 17.55 | p-value: <0.001				
No	62	93%	140	66%
Yes	5	7%	71	34%
If you answered YES to the previous question, have you experienced sexual harassment from a colleague? Indicate which situations apply:				
χ^2: NA | p-value: NA				
Coerced not to disclose the situation	0	0%	9	8%
The harasser has been exposed, resulting in consequences	0	0%	2	2%
The harasser has been exposed with no consequences	0	0%	11	10%
The harasser was my supervisor	0	0%	29	26%
The situation led to my resignation	2	40%	4	4%
The situation led to the harasser's resignation	0	0%	0	0%
The situation was not exposed	3	60%	56	50%
If you have completed postgraduate studies (e.g., specialisation, master's, or PhD), your last supervisor was:				
χ^2: 0.22 | p-value: 0.74				
Men	53	78%	160	75%
Women	15	22%	53	25%
If you have conducted fieldwork and brought someone with you as a field assistant, please identify the specific reason for doing so. Choose all that apply:				
χ^2: 17.07 | p-value: <0.001				
Amount of work	58	43%	162	38%
Company	20	15%	69	16%
Educational experience	38	28%	68	16%
Worried about personal security	20	15%	125	29%
What is your average scientific production per year over the last 8 years (papers, book chapters, books), from 2015 to the present?				
χ^2: 26.40 | p-value: <0.001				
0	5	7%	24	11%
<1	8	12%	29	14%

>10	6	9%	7	3%
1-3.9	17	25%	110	52%
4-7.9	24	35%	33	15%
8-9.9	8	12%	10	5%
Do you have children?				
χ^2: 2.53 | p-value: 0.15				
No	38	56%	143	67%
Yes	30	44%	72	33%
Does your professional choice influence your desire to have children?				
χ^2: 17.92 | p-value: <0.001				
No	43	64%	74	35%
Yes	24	36%	138	65%
Do you agree with the statement that maternity leave has an adverse effect on women's careers?				
χ^2: 5.68 | p-value: 0.02				
No	25	40%	49	24%
Yes	38	60%	153	76%

Table 2: Description of the main factors identified as impediments to achieving higher scientific productivity, classified by gender. The table includes the factors that may influence individual productivity rates (e.g., Race or Ethnicity, Socioeconomic Level, Geographic Origin, Family Responsibilities, Teaching Responsibilities, Administrative Responsibilities, Job Insecurity, Lack of Funding, Lack of Work Resources, and Gender Discrimination). It also shows the number of respondents for each factor (Answers), the proportion of respondents within each gender category (Percentage), the chi-squared test statistic for differences in responses between genders (chi-squared test), and the corresponding p-value indicating the statistical significance of these differences (P-value).

Factor	**Men**		**Women**	
	Answers	**Percentage**	**Answers**	**Percentage**
Big Accelerator Factors				
χ^2: 2.68 | p-value: 0.99				
Socioeconomic level	9	23%	24	24%
Geographical origin	6	15%	19	19%
Family responsibilities	4	10%	15	15%
Teaching responsibilities	3	7%	10	9%

Ethnicity	4	10%	8	8%
Accelerator Factors				
χ^2: 17.30 | p-value: 0.06				
Geographical origin	13	16%	48	25%
Socioeconomic level	18	23%	47	24%
Ethnicity	11	14%	36	18%
Age	21	27%	22	11%
Teaching responsibilities	6	7%	11	5%
Big Impediment Factors				
χ^2: 17.08 | p-value: 0.07				
Lack of funding	31	29%	93	26%
Lack of resources	24	22%	76	22%
Family responsibilities	4	3%	37	10%
Lack of job security	8	7%	33	9%
Socioeconomic level	5	5%	28	8%
Impediment Factors				
χ^2: 18.26 | p-value: 0.05				
Lack of resources	30	18%	89	14%
Lack of funding	19	19%	89	14%
Family responsibilities	26	15%	88	14%
Administrative responsibilities	25	33%	67	11%
Gender discrimination	4	2%	64	10%
Teaching responsibilities	22	13%	61	10%
Neutral Factors				
χ^2: 17.7 | p-value: 0.07				
Age	26	12%	94	13%
Teaching responsibilities	21	9%	89	12%
Ethnicity	25	11%	81	12%
Administrative responsibilities	12	5%	79	11%
Gender discrimination	33	15%	78	11%
Lack of job security	26	12%	76	11%

618