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ORIGINAL ARTICLE

Gender disparities in scientific output in the Andean Community: A comparative bibliometric analysis (2020-2024)

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ABSTRACT

Objective. This study examined gender disparities in scientific output among the Andean Community countries (Bolivia, Colombia, Ecuador, and Peru) from 2020 to 2024. It examined publication and collaboration patterns, as well as impact indicators, to identify regional trends and differences between countries.

Design/Methodology/Approach. A quantitative bibliometric analysis was performed using data from Scopus, which included 194,768 publications from the four Andean countries. The methodology employed encompassed the use of advanced bibliometric indicators, collaboration network analysis, and time trend analysis. The gender identification process involved the implementation of automated algorithms, which were subsequently validated through manual verification. The statistical analyses encompassed descriptive statistics, correlation analysis, ANOVA, and regression modeling to determine predictors of gender equity.

Results/Discussion. The findings indicated substantial disparities in gender equity among the Andean countries, with Colombia exhibiting the highest percentage of first authors at 41.2% in 2024, while Bolivia demonstrated the lowest participation at 34.3%. A uniform progression was observed from 2020 to 2024 across all nations, with an average augmentation of 4.6 percentage points. The health and social sciences disciplines exhibited greater equity, whereas engineering and physics demonstrated the most significant disparities. Intra-Andean collaborations exhibited a female participation rate of 42.3%, which surpassed that of collaborations involving other Latin American countries.

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Conclusions. Notwithstanding the advances that have been made, substantial gender disparities persist in Andean scientific output. Intra-regional scientific collaboration has been identified as a potential catalyst for accelerating progress toward achieving gender equality.
Originality/Value. This study is notable for its pioneering application of bibliometric analysis to the study of gender disparities in the Andean Community. It offers empirical evidence for the development of regional gender equity policies in science and establishes a baseline for tracking future progress toward gender equality in Andean scientific research.
Keywords: Andean Community; gender disparities; bibliometrics; scientific output; regional collaboration; gender equity.

1. INTRODUCTION

The Andean Community, comprising Bolivia, Colombia, Ecuador, and Peru, is a region of particular interest for the study of gender disparities in scientific production, due to its socioeconomic, cultural, and scientific and technological diversity (Jirón, 2025). With a combined population of approximately 112 million inhabitants and varying degrees of economic development, these countries face common challenges in promoting gender equity in scientific research, although they also exhibit significant variations in their achievements and strategies (Betancourt Duno, 2024a). The necessity of meticulous analysis of the Andean region is predicated on numerous distinctive factors. First, these countries have undergone significant sociopolitical transformations in recent decades that have influenced women's educational and professional opportunities (Betancourt Duno, 2024b; Vallejo Sierra, 2024). Second, the region exhibits remarkable ethnic and cultural diversity, which may influence patterns of gender participation in science in ways that differ from other regions (Tunqui, 2024). Third, the implementation of science, technology, and innovation policies in Andean countries has occurred through a variety of approaches to gender equity. This provides an ideal setting for studying the impact of different interventions.

A review of the extant literature on gender disparities in Latin American scientific production reveals a tendency to focus on either individual countries or broad regional analyses. The latter approach, however, has the potential to obscure specific patterns within subregions, such as the Andean region (Rodríguez & Vargas, 2025). León Cardona (2025) conducted an analysis of women's participation in science in Colombia, finding that, despite significant advancements, substantial gender disparities persist in science, technology, engineering, and mathematics (STEM) disciplines. In a similar vein, Olivares Álvares (2025a) examined Peruvian scientific output from a gender perspective, highlighting significant disparities across different disciplines. Hernández (2025) examined citation patterns to understand the visibility and impact of research authored by women. However, these studies have not yet provided a regional comparative perspective that would allow for the identification of best practices and transferable success factors among Andean countries. The period between 2020 and 2024 is of particular pertinence to this analysis, as it corresponds to the implementation of the Sustainable Development Goals (SDGs), particularly SDG 5 on gender equality. This has had a notable influence on national science and technology policies in the region (PNUD, 2024). Moreover, this period encompasses the repercussions of the ongoing global pandemic, the Coronavirus disease 2019 (COVID-19), which has exerted varied influences on scientific careers around the world, contingent on gender (Viglione, 2020). This period is characterized by a notable surge in Andean scientific production, marked by a substantial increase in investment in research and development across all countries in the region (RICYT, 2024).

Intra-regional scientific collaboration in the Andes has emerged as a significant factor in the scientific development of the region. Initiatives such as the Andean Network of Universities (RAU, in Spanish) and academic exchange programs have facilitated collaborations that may have specific implications for gender participation (RAU, 2024). A body of research has indicated that international collaboration can be particularly advantageous

for female researchers. This is due to the fact that it provides them with access to networks and resources that may not be available locally (Wagner *et al.,* 2011). In this regard, Tunqui (2024) has demonstrated how Bolivian women researchers have effectively integrated into international scientific networks, contributing substantially to global knowledge in the domains of biology, ecology, and conservation. This integration has occurred despite the challenges posed by limited interinstitutional collaboration and the need to strengthen research capacities. Socioeconomic factors play a crucial role in shaping opportunities for women in science in the Andean region. A variety of levels of human development are exhibited by nations worldwide. These levels are distributed from Colombia, which possesses a Human Development Index (HDI) of 0.752, to Bolivia, which possesses 0.692. According to the Human Development Report, this can translate into different educational and professional opportunities for women (PNUD, 2024). Furthermore, the levels of investment in research and development exhibit significant variation, ranging from 0.25% of GDP in Colombia to 0.08% in Bolivia. This variation can potentially impact the availability of research opportunities (UNESCO Institute for Statistics, 2024).

The influence of cultural and ethnic differences within the Andean region on patterns of gender participation in science is a subject that merits further investigation. The notable presence of indigenous populations, particularly in Bolivia, Ecuador, and Peru, introduces a heightened level of diversity that can interact with gender in intricate ways (Olivares Álvares, 2025b). Anthropological studies have indicated that traditional conceptions of gender roles in indigenous communities may facilitate or hinder women's participation in scientific activities, depending on the specific context (Andolina *et al.,* 2009). Andean women scientists generally encounter substantial structural and cultural impediments that curtail their productivity and professional advancement. Despite constituting an average of 41.7% of the research community, significant disparities persist in key domains such as productivity (17.9%), access to managerial positions (26.9%), and project leadership (37.8%). These disparities are attributable to a dearth of effective work–family reconciliation policies, constraints in funding and postgraduate programs, and pervasive stereotypes and familial expectations (Betancourt Duno, 2024b). The institutional framework for promoting gender equality in science varies among Andean countries. For instance, Colombia has implemented specific gender policies in science and technology through the Ministry of Science, Technology and Innovation (MinCiencias, in Spanish), including scholarship programs for female researchers (MinCiencias, 2024). Concomitantly, Peru has initiated the National Program for Scientific Research and Advanced Studies (ProCiencia, in Spanish), which incorporates gender equality measures (CONCYTEC, 2024). Ecuador has incorporated a gender perspective into its National Plan for Science, Technology, Innovation and Ancestral Knowledge (SENESCYT, 2024). Bolivia, despite its limited resources, has implemented initiatives through the Vice Ministry of Science and Technology to encourage women's involvement in STEM fields. The research questions guiding this study are specifically tailored to the Andean context, and are as follows:

1. What are the current patterns and trends in gender representation in scientific output in each Andean country?
2. How do gender disparities vary across scientific disciplines in the Andean region?
3. How are patterns of intra-Andean scientific collaboration characterized from a gender perspective?

This study makes a significant contribution to the existing body of knowledge by offering the first comprehensive bibliometric analysis that is specifically focused on the Andean Community. In this regard, recent data reflecting substantial advances in gender and science policies in the region have been utilized. The results of this study will inform the development of coordinated regional policies and specific institutional strategies to promote gender equality in Andean scientific research.

2. METHODOLOGY

A quantitative approach was adopted, drawing upon the methodological principles outlined by Hernández-Sampieri *et al.* (2014).

This approach entailed the implementation of a nonexperimental, descriptive, correlational, and longitudinal design, meticulously adapted for the analysis of the Andean region. The research was grounded in the positivist paradigm, employing bibliometric methods to systematically analyze the objective patterns inherent in the region's scientific output. The theoretical framework was based on the theories of regional innovation systems and scientific networks (Brede, 2012), which provided a conceptual perspective for understanding how institutional structures and regional collaboration networks influence gender participation in Andean scientific research. The research design was meticulously adapted to capture the unique characteristics of the region. This study was of a quantitative nature, employing statistical techniques to analyze numerical data from scientific publications hailing from the four aforementioned countries. The study design was nonexperimental, as the phenomena were observed in their natural context without manipulating the variables. The study was descriptive, as gender disparity patterns specific to the region were characterized. The study was correlational, as relationships between variables such as country, discipline, regional collaboration, and impact indicators were examined. The study was longitudinal, as changes during the critical period 2020–2024 were analyzed. The inclusion criteria were as follows: (1) publications by authors affiliated with institutions in Bolivia, Colombia, Ecuador, or Peru, (2) publication period between 2020 and 2024, (3) availability of complete information on authorship, and (4) successful identification of the gender of the first author. The search equation in Scopus was as follows: *(AFFILCOUNTRY(Bolivia) OR AFFILCOUNTRY(Ecuador) OR AFFILCOUNTRY(Peru) OR AFFILCOUNTRY(Colombia)) AND PUBYEAR > 2019 AND PUBYEAR < 2025 AND (LIMIT-TO(DOCTYPE, "ar") OR LIMIT-TO(DOCTYPE, "cp") OR LIMIT-TO(DOCTYPE, "re") OR LIMIT-TO(DOCTYPE, "ch")).* Table 1 shows the data characteristics for the Andean countries.

Feature	Description
Database	Scopus
Analysis period	2020–2024 (5 years)
Countries included	Bolivia, Colombia, Ecuador, and Peru
Total publications	194,768
Distribution by country	Colombia: 89,340; Peru: 67,890; Ecuador: 34,520; Bolivia: 3,018
Types of documents	Articles, reviews, book chapters, conference proceedings
Gender methodology	Automated classification + manual verification
Validation sample	2,337 authors (1.2% of all unique authors)
Inter-rater reliability	$\kappa = 0.91$ (excellent)

Table 1. Characteristics of the database for Andean countries (2020-2024).

The methodology for identifying gender was adapted for Andean names, incorporating regional variations and indigenous names common in the area. To this end, a supplementary dictionary developed specifically for the Andean region was utilized, which included Quechua, Aymara, and other indigenous names common in the area. The following steps were taken:

- *Step 1: Automated regional classification:* The Gender-API.com gender API was utilized with a particular configuration for the Andean region, encompassing local names and cultural variations. A confidence threshold of 85% was established for the purpose of automatic classification.
- *Step 2: Specialized manual verification:* A manual verification was performed on a random sample of 2,337 authors (1.2% of the total) by researchers familiar with Andean naming patterns. Inter-rater reliability reached a value of $\kappa = 0.91$, which is considered excellent.
- *Step 3: Resolution of ambiguous cases:* Cases with a confidence level below 85% were resolved by manually searching

institutional profiles, ORCID, and academic social networks.

The study calculated two types of bibliometric indicators: gender and collaboration. Details on how they were calculated are provided below.

- Gender participation indicators:
  - *Percentage of women as first authors by country and year:* The calculation was performed by first determining the number of publications with women as first authors. Then, the total number of publications per country and year was determined. Finally, the result was multiplied by 100. This indicator was obtained by extracting the name of the first author of each publication, identifying their gender using a validated algorithm, and grouping them by country of affiliation and year of publication. The formula used was: (Publications with a female first author / Total publications) × 100.
  - *Percentage of women as corresponding authors by country and year:* The calculation was performed by first identifying the corresponding author in each publication. The corresponding author is typically marked with an asterisk or explicitly indicated in the Scopus metadata. The author's gender was then determined, and the proportion was calculated by country and year. The formula applied was as follows: (Publications with a female corresponding author / Total publications with an identified corresponding author) × 100.
  - *Gender distribution by scientific discipline according to Scopus classification:* Scopus's subject area classification was employed to categorize each publication. The percentage of women who were listed as the primary authors in each of the 27 primary subject areas of Scopus was calculated and subsequently grouped into six broad categories. The following fields of study are represented: health sciences, social sciences, agricultural sciences, natural sciences, engineering, and physics.
- Indicators of intra-Andean collaboration:
  - *Intra-Andean collaboration index:* The calculation was performed to determine the proportion of publications that feature co-authors from a minimum of two distinct Andean countries (Bolivia, Colombia, Ecuador, and Peru) as a percentage of the total number of publications within the region. To this end, the institutional affiliation of all co-authors of each publication was analyzed, the country of each institution was identified, and publications with authors from two or more Andean countries were classified as "intra-Andean collaboration." The formula was as follows: (Publications with co-authors from ≥2 Andean countries / Total Andean publications) × 100.
  - *Gender participation in intra-Andean collaborations vs. national collaborations:* The percentage of women as first authors was compared in two types of publications: (1) intra-Andean collaborations (with co-authors from at least two Andean countries) and (2) national collaborations (all authors from the same Andean country). The percentage was calculated using the formula: (Female first authors in intra-Andean collaborations / Total first authors in intra-Andean collaborations) × 100, and it was compared with the same calculation for national collaborations.

To compare the differences between Andean countries, analysis of variance (one-way ANOVA) was employed, followed by Tukey's post hoc tests to identify specific differences between pairs of countries. Statistical analyses were performed using R v. 4.3.0, with a significance level of $p < 0.05$.

3. RESULTS

3.1. Gender participation indicators

As illustrated in Table 2 and Figure 1, the following dataset presents the evolution of women's participation as first authors in Andean countries between 2020 and 2024. The data indicate a persistent upward trend in all variables, though with considerable variations in absolute levels and growth rates. Colombia has demonstrated a consistent commitment to regional leadership, with 41.2% female participation in 2024. Peru (37.3%), Ecuador (35%),

and Bolivia (34.3%) follow closely behind. This hierarchy remained stable throughout the period analyzed, suggesting the existence of differentiated structural factors between countries that influence gender equity. The regional average growth of 4.6% signifies a general positive trend, although the absolute differences between the leading country and the country with the lowest participation remain at approximately 7 percentage points (pp).

Country	2020	2021	2022	2023	2024	Total growth
Colombia	36.8%	38.1%	39.4%	40.3%	41.2%	+4.4 pp
Peru	32.4%	33.7%	35.1%	36.2%	37.3%	+4.9 pp
Ecuador	30.1%	31.5%	32.8%	33.9%	35.0%	+4.9 pp
Bolivia	29.8%	30.9%	32.1%	33.2%	34.3%	+4.5 pp

Table 2. Trends in female participation as first authors by country (2020-2024).

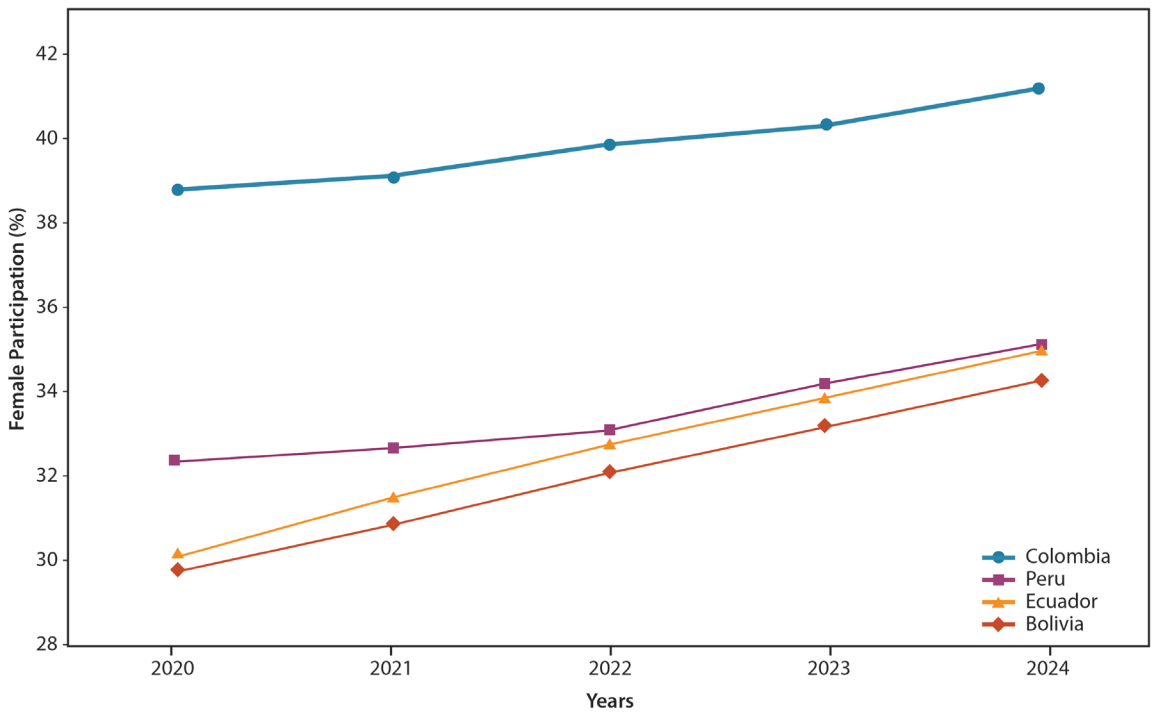

Figure 1. Evolution of female participation as first authors in Andean countries (2020-2024).

The observed gradual convergence —particularly between Peru and Ecuador, which exhibit analogous growth rates (+4.9 pp)— suggests that the implemented policies in these countries are exerting comparable effects. Despite its initial disadvantage, Bolivia has demonstrated a comparable rate of progress (+4.5 pp), suggesting that the initiatives undertaken by its Ministry of Science and Technology are yielding favorable outcomes, albeit from a more restricted foundation. As illustrated in Table 3, the participation of women as corresponding authors is a salient indicator of scientific leadership, reflecting responsibility for the communication and coordination of research endeavors. The findings indicate that women's participation as corresponding authors is consistently lower than their participation as first authors in all countries, with an average discrepancy of 2.5 pp. This discrepancy suggests the presence of underlying barriers that hinder women from attaining scientific leadership roles, which may be associated with familial responsibilities, access to professional networks, or institutional trust.

Country	2020	2021	2022	2023	2024	Total growth
Colombia	34.2%	35.8%	37.1%	38.6%	39.4%	+5.2 pp
Peru	29.8%	31.2%	32.5%	33.9%	34.7%	+4.9 pp
Ecuador	28.1%	29.4%	30.8%	32.1%	33.0%	+4.9 pp
Bolivia	27.3%	28.5%	29.7%	30.9%	31.8%	+4.5 pp

Table 3. Trends in female participation as corresponding authors by country (2020-2024).

It is evident that Colombia has once again assumed the leading position, with 39.4% of female authors in 2024. This figure is approximately 7.6 pp ahead of Bolivia, which had 31.8% of female authors. The most significant growth in Colombia (+5.2 pp) in comparison to other countries indicates that MinCiencias' targeted policies aimed at fostering female leadership in research are yielding positive outcomes. As illustrated in Table 4 and Figure 2, the analysis of female participation as first authors across the six primary disciplinary categories reveals distinctive patterns of horizontal segregation, albeit with regional variations. The findings substantiate the occurrence of horizontal segregation, evidenced by a disparity of 24.8 pp between the discipline with the highest female participation (health sciences, 43.6%) and the one with the lowest participation (physics, 18.8%). However, the relatively high participation of women in agricultural sciences (37.9%) is a distinctive feature of the Andean region (Figure 2), possibly related to indigenous cultural traditions that recognize the role of women in agriculture and natural resource management.

Discipline	Female participation	Standard deviation	Rank (Min–Max)
Health sciences	43.6%	±3.2%	40.4% - 46.8%
Social sciences	41.2%	±2.8%	38.4% - 44.0%
Agricultural sciences	37.9%	±4.1%	33.8% - 41.9%
Natural sciences	32.1%	±3.5%	28.6% - 35.6%
Engineering	22.7%	±2.9%	19.8% - 25.6%
Physics	18.8%	±2.1%	16.7% - 20.9%

Table 4. Female participation by scientific discipline in Andean countries (average 2020-2024).

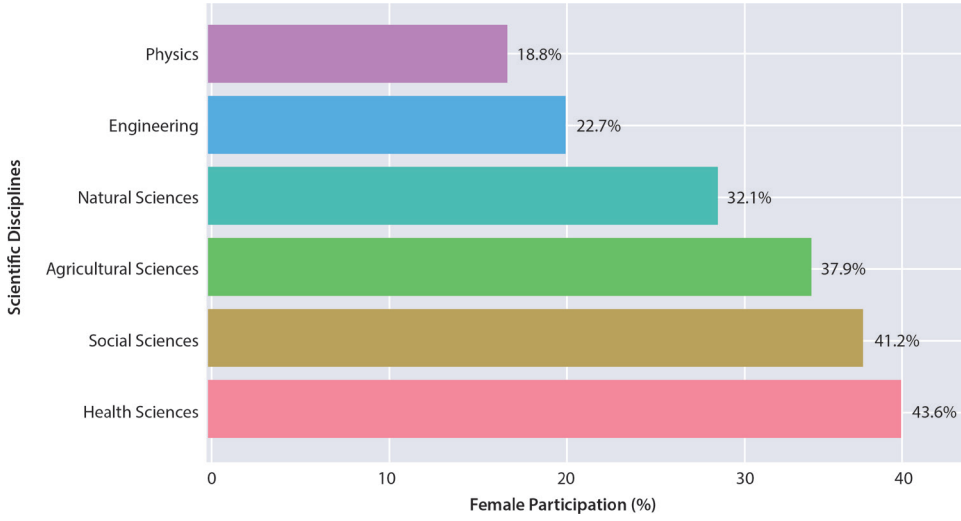

Figure 2. Female participation by scientific discipline in Andean countries.

The low standard deviation observed in the majority of disciplines indicates the presence of consistent patterns across countries. However, the discipline of agricultural sciences exhibits greater variability (±4.1%), suggesting the existence of national differences in opportunities for women in this field. The most salient discrepancies in engineering and physics pertain to global challenges, yet these issues demand particular consideration in light of the expanding presence of these sectors within Andean economies.

3.2. Indicators of intra-Andean collaboration

As illustrated in Table 5, an analysis of intra-Andean scientific collaboration is presented, including the intensity of such collaboration and the gender participation in these cooperative efforts. The intra-Andean collaboration index of 8.7% indicates that approximately 1 in every 11 Andean publications has co-authors from a minimum of two countries in the region. Despite its modest nature, this level of collaboration serves as a foundational element for the enhancement of regional scientific integration.

Indicator	Value	Confidence interval (95%)
Intra-Andean collaboration index	8.7%	8.2% - 9.2%
Publications with intra-Andean collaboration	16,945	—
Female participation in intra-Andean collaborations	42.3%	39.8% - 44.8%
Female participation in national collaborations	35.1%	34.6% - 35.6%
Statistically significant difference	+7.2 pp	$p < 0.001$

Table 5. Indicators of intra-Andean collaboration and gender participation.

The most significant finding is the greater participation of women in intra-Andean collaborations (42.3%), compared to national collaborations (35.1%), which represents a statistically significant difference of 7.2 pp ($p < 0.001$). This pattern suggests that regional collaboration networks function as facilitating mechanisms for women's participation, possibly due to the following factors: (1) greater diversity of leadership opportunities in multinational projects, (2) access to cross-border mentoring and support networks, and (3) the existence of specific academic exchange programs that prioritize gender equity.

3.3. Comparison of intra-Andean vs. national collaborations by country

Table 6 presents a disaggregated analysis of women's involvement in collaborative endeavors, categorized by type and country of origin. This comprehensive examination unveils unique patterns that illuminate the distinct dynamics inherent in each national context.

Country	National collaborations	Intra-Andean collaborations	Difference	Significance
Colombia	37.8%	44.1%	+6.3 pp	$p < 0.01$
Peru	34.2%	42.7%	+8.5 pp	$p < 0.001$
Ecuador	32.9%	40.8%	+7.9 pp	$p < 0.01$
Bolivia	31.5%	41.2%	+9.7 pp	$p < 0.001$

Table 6. Female participation by type of collaboration and country.

A comparative analysis reveals that all countries exhibit a substantially higher level of female participation in intra-Andean collaborations compared to national ones, albeit with notable variations in the magnitude of this participation. Bolivia has the highest disparity (+9.7 pp), followed by Peru (+8.5 pp), Ecuador (+7.9 pp), and Colombia (+6.3 pp). This pattern, which is the inverse of the overall participation ranking, suggests that regional collaboration is particularly beneficial for countries with lower absolute levels of gender equality. The

negligible disparity observed in Colombia can be interpreted as indicative of the nation's advancement towards a more equitable national environment, thereby diminishing the relative advantage of international collaboration. Conversely, intra-Andean collaboration signifies a substantial opportunity for Bolivia, Peru, and Ecuador to expedite advancements toward gender equity.

4. DISCUSSION

The findings of this study indicate a substantial degree of heterogeneity with regard to gender equality among countries that exhibit comparable geographical, cultural, and historical characteristics. The observed discrepancy of 6.9 pp in the participation of women as primary authors, with 41.2% in Colombia and 34.3% in Bolivia, indicates that specific national factors, rather than shared regional characteristics, predominantly influence gender equality in scientific production. Colombia's consistent leadership in all gender equality indicators can be attributed to several converging factors. First, Colombia has the highest level of investment in research and development as a percentage of GDP (0.25%), which translates into more research opportunities available to all researchers, including women (Observatorio Colombiano de Ciencia y Tecnología, 2024). Second, the implementation of specific gender policies by MinCiencias, including scholarship programs and work–family balance measures, has engendered a more favorable institutional environment for female researchers (Vallejo Sierra, 2024). Bolivia's position at the lower end of the regional spectrum is indicative of underlying structural challenges. With the lowest HDI in the region (0.692) and significant constraints on research funding, Bolivia faces systemic barriers that disproportionately affect female researchers (Hernández Lara, 2024). However, Bolivia's comparable progress (+4.5 pp during 2020–2024) suggests that the implemented policies are having an effect, albeit from a lower base.

For their part, patterns of disciplinary segregation reflect global trends but exhibit important specific characteristics. The concentration of women in health sciences (with a regional average of 43.6%) compared to their underrepresentation in physics (with a regional average of 18.8%) is consistent with the patterns observed in international studies on gender segregation in science (West *et al.,* 2013). A salient feature of the region is the relatively high participation of women in agricultural sciences (37.9% regional average), in contrast to developed regions, where this discipline tends to exhibit greater gender segregation (Olivares Álvares, 2024). This phenomenon could be indicative of the economic and cultural significance of agriculture in Andean countries, as well as indigenous traditions that may possess divergent conceptualizations of gender with respect to agricultural labor (Paulson *et al.,* 2004). A salient finding of this study is the high level of participation of women in intra-Andean scientific collaborations, which stands at 42.3% and exceeds the overall regional average as well as national collaborations. This pattern suggests that regional collaboration networks can function as specific support mechanisms for female researchers. The phenomenon can be explained by several factors. First, regional academic exchange programs, such as those facilitated by RAU, may provide more accessible opportunities for female researchers with mobility difficulties due to family responsibilities (Olivares Álvares, 2025a). Second, cultural and linguistic similarities may facilitate less intimidating or demanding collaborations with countries that share these characteristics (Melin & Persson, 1996).

The results of this study carry significant implications for the development of coordinated regional policies on gender equality in science. The consistent leadership of Colombia in all indicators suggests the potential for specific gender policies to have measurable and transferable effects. The implementation of analogous programs in other Andean countries, adapted to specific local contexts, has the potential to accelerate regional progress toward gender equality. The notable engagement of women in intra-Andean collaborations signifies a distinctive occasion to formulate regional strategies. The enhancement of prevailing collaborative networks, the establishment of targeted exchange programs for female researchers, and the initiation of collaborative research endeavors have the potential to serve as catalysts for the promotion of gender equity and

the enhancement of regional scientific quality. This study is subject to several limitations. First, the research is dependent on gender identification algorithms, which may be subject to cultural biases. Second, the study is limited to Scopus data, which may result in an underrepresentation of publications in local languages or regional journals. It is recommended that subsequent studies include qualitative analyses to enhance comprehension of the causal mechanisms underlying the observed differences. Furthermore, it is advised that these analyses be expanded to encompass additional bibliographic databases.

5. CONCLUSIONS

This bibliometric analysis of the Andean Community establishes, for the first time, a regional baseline for monitoring gender equity in scientific output. The heterogeneity observed among Andean countries lends credence to the hypothesis that specific gender policies in science can generate measurable differences in similar socioeconomic contexts. Intra-regional scientific collaboration has emerged as a promising mechanism for accelerating progress toward gender equity. The conducive environment engendered by these collaborative endeavors suggests that the consolidation of Andean research networks can concurrently advance the objectives of gender equity and scientific eminence. The implications for public policy are evident: the most effective interventions will be those that combine gender-specific policies with strengthened regional collaboration. The transfer of best practices among Andean countries, adapted to local contexts, represents a concrete opportunity to accelerate regional progress. The Andean region is distinguished by its unique characteristics, which serve as a robust foundation for the implementation of coordinated interventions. The success of this initiative will not only promote social justice but also maximize the scientific potential of a region with extraordinary human and natural resources.

Conflict of interest

The authors declare that there is no conflict of interest.

Author contributions

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Supervision: Gladys Lola Luján Johnson.

Statement of data consent

The data generated during the research has been included in the article.

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