

Gender Difference in Research Productivity and its Associated factors in Addis Ababa University: a Cross-Sectional study

Meselech Roro¹, Workeabeba Abebe², Abigia Wondimagegnehu¹, Adiam Nega¹, Selamawit Girma², Yalemwork Getnet¹, Birhan Tasew¹, Mulumebet Zenebe³, Yimtubezinash Woldeamanuel², Seble Assefa², Hanna Demisse², Meron Awraris², Etsehiwot Tilahun¹, Bezawit Ketema¹, Mahlet Yigeremu², Selamawit Hirpa¹, Meaza Gezu¹, Nuhamin Tekle², Ansha Nega¹, Mitike Molla Sisay^{1*}

Abstract

Background: Gender equity movements have increased the number of women going to higher institutions. However, the number of women participating in research is limited in creating a critical mass.

Objective: To assess the gender gap in research and its associated factors determinants among faculty at Addis Ababa University.

Method: We conducted a cross-sectional study from October 2018 to March 2019 using a structured self-administered questionnaire. University faculty who was lecturers and above level who served the University for more than a year were invited to participate in the study. Faculty were approached by data collection facilitators with graduate degrees and the secretary of the respective departments. We used descriptive and multivariate statistical methods to analyse the data.

Result: Of the 888 study participants, 161 (18.1%) females faculty participated in the study. It was found that three hundred ninety-seven male academics (54.6%) and 50 female academics (31.1%) had ever published articles in peer-reviewed journals ($p < 0.001$). Male faculty were more likely to publish in peer-reviewed journals than their female counterparts [AOR and (95% CI) 2.55 (1.68, 3.86)]. Faculty with a rank of assistant professors and above [AOR (95% CI) 3.47(2.31, 5.21)], those who have a Ph.D. as highest degree [AOR (95% CI) 2.98 (2.11, 4.19) and those who have affiliation with other institutions [AOR (95% CI) 2.59 (1.98, 3.56)], were more likely to publish in peer-reviewed journals than their counterparts.

Conclusion: Female faculty were less likely to be involved in research than men counterparts. The University needs to narrow the gender gap in research by designing and implementing an appropriate intervention strategy. [*Ethiop. J. Health Dev.* 2021; 35(SI-2):15-21]

Keywords: Addis Ababa University, female faculty, gender difference, publication, research

Introduction

Higher education has become highly competitive in the 20th century, where universities and colleges adopt a market-oriented strategy. The research outputs are the basis for institutions' stance and ranking (1, 2). Besides, the publication is one of the main criteria for academic promotion and securing research funds. In spite of that, studies have shown that female researchers produce less publication than their male counterparts (3, 4).

Despite gender equity movements globally, women's scientific research engagement remains limited across disciplines (3, 5, 6). As reported in a recent study by United Nations Educational, Scientific, and Cultural Organization (UNESCO), women are reported to account for only one-third of researchers worldwide (4). Accordingly, males published their research work almost five times more than females (7, 8). The difference in scientific patency was also documented (9). Furthermore, women's research participation is not visible as first authors but is limited to reviewing and related activities even in developed countries(10).

Although the number of female faculty at Addis Ababa University increases, their research involvement is not well documented. Therefore, this study examined the gender difference in research productivity and its associated factors among faculty at Addis Ababa University.

Methods

Setting: Addis Ababa University is the oldest University in Ethiopia, and it was founded in 1950. The University consists of 10 colleges, 12 institutions, and 365 graduate programs, of which 96 are Ph.D. programs as of June 2020 (11). Of the 2,987 academic staff working for the University, 478 of them (16%) are female faculty (12).

Study design and period: The study employed a cross-sectional design. The study was conducted from October 2018 to March 2019.

Study population: The study population includes all academic staff at Addis Ababa University.

Study participants

An academic staff who has served the University for more than one year, available on campus during the study period, and gave informed consent participated in the study. Faculty who were on sabbatical, study, or maternity leave and those who went for fieldwork were excluded from the study. Convenient sampling techniques were used to select participants based on their random availability at their office during the time of data collection.

Sample size

To determine our sample size of 682 participants, we used a simple population proportion formula using 95%

¹School of Public Health, College of Health Sciences, Addis Ababa University

²School of Medicine, College of Health Sciences, Addis Ababa University

³Center for Gender studies, College of Development Studies, Addis Ababa University

*Corresponding author: mitikemolla@gmail.com, mitike.molla@aau.edu.et

confidence limits, 50 percent population, and a design effect of 2. Adding 30% of the sample size to compensate for nonresponse gave us 887 potential participants.

Data collection instruments and procedure

Data were collected using a structured self-administered questionnaire. The tool had six parts: socio-demography, research activities, research-related courses and training, involvement in a grant application, and research output. Research output was assessed by asking the respondents any publication they have produced throughout their lifetime as of the day of the interview. The same is also for their academic rank.

Data collection was facilitated by ten individuals who had a graduate degree and a supervisor who were trained on the research objectives, the contents of the data collection tools, and approaches to be used to collect the data for a day. We assigned one data collector to each of the ten colleges. After contacting the department head, the data collectors approached the staff in person at their offices or in the university compound. The data collectors explained the purpose of the study and gave the information sheet individually for each staff and in subsequent follow-up for those who were absent on the day the data collectors visited their offices. After the informed consent was signed by the participants, the data collection tool was provided. The data collectors explained any unclear questions on the questionnaire. The data collectors collected the completed questionnaires on the same day or within two days after it was checked for completeness. In situations where the data collectors could not reach the faculty, department secretaries were asked to facilitate the data collection by reaching the staff when they come to the office. On top of that, the study team supervised the data collection process to assure the data quality, including its completeness and accuracy.

Data Analysis

The data were entered, cleaned, and analyzed using the SPSS version 24 software package. Results were summarized in tables, and graphs were used to present the study results. Following that, univariate and multivariate logistic regression models were fitted to identify independent factors associated with the outcome variable (peer-reviewed publication). A significant level was determined using a 95% confidence interval and P-value <0.05.

Ethical consideration

The Institutional Review Board (IRB) of the College of Health Science, Addis Ababa University approved the study. Only participants who gave informed consent participated in the study. Information about personal identification was not collected. All data were kept in a password-protected computer, and hard copies were locked in a safe place inaccessible to anybody other than the researchers.

Results

Socio-demographic characteristics

Out of the total 888 academicians included in this study, most of them, i.e. 727 (81.9%) were males and more than half (505, 56.9%) were less than 40 years of age. The majority of the participants (409, 46.1%) had first degree in their the educational level and 334 (37.6%) of them had third degree. A little over three-fourth of participants, i.e. 670 (76.6%), were ever married. Four hundred fifty-eight (72.3%) partners of the respondents had an educational status of degree and above, and 93(15%) of their spouses worked in academic or research institutions. About two-thirds of the respondents, i.e. 594 (67.1%), had children. Three hundred and ninety-seven (70.1%) faculty who reported having children had one or two children, and a third of them 157(32.2%) had their last-born child in the last 15 years. Slightly over half of the respondents, i.e. 436 (51.5%) were living in rented houses, while 270 of them (31.9%) lived in their personally owned houses (**Table 1**).

Table 1. Socio-demographic characteristics of study participants, Addis Ababa, Ethiopia, 2019

Variables		n	(%)
Sex	Male	727	81.9
	Female	161	18.1
Age	20-40 yrs	505	56.9
	>40 yrs	383	43.1
Marital status	Ever married	670	76.6
	Not married	216	24.4
Education	First degree	409	46.1
	Second degree	145	16.3
	Third degree	334	37.6
Partner's education (n=633)	Primary ^a	9	1.6
	Secondary	51	8.1
	Diploma	115	18.2
	Degree	247	39.0
	Masters and above	211	33.3
Partner's occupation(n=630)	Unemployed	111	17.6
	Government employed	289	45.9
	Private/NGO employed	211	33.5
	Others ^b	19	3.0
Have children	Yes	594	67.1
	No	291	32.9
No of children (n=566)	1-2	397	70.1
	3-6	169	29.9
Age of last child (n=566)	0-15yrs	442	79.5
	>15 yrs	114	20.5
Residential housing (n=846)	Own house	270	31.9
	Rented house	576	68.1

^aincludes illiterates and those who can only read and write. Others^b includes retired,

Research involvement

Most of the research activities in universities are student thesis followed by individual research [483 (76.8%) male and 83 (68.6%) females]. Their involvement in

thematic research and multicounty collaborative researches was limited to about 20% and 15% of the male and female faculty (**Figure 1**).

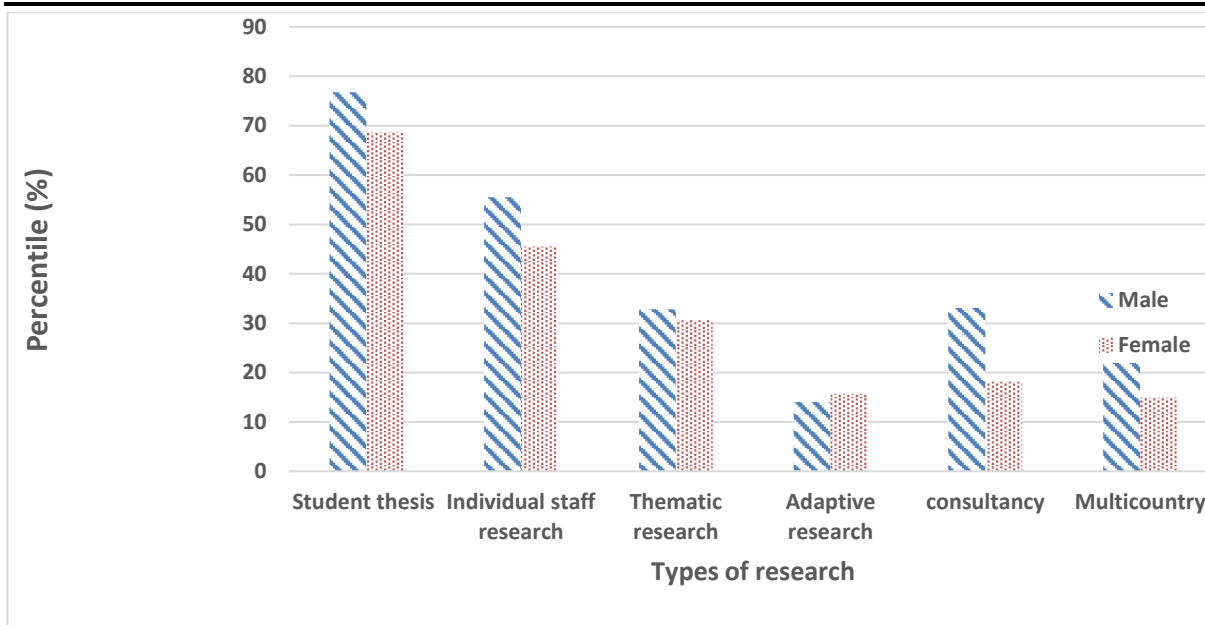


Figure 1. Types of researches conducted by study participants, Addis Ababa, Ethiopia, 2019

Peer-reviewed publication

In comparison with their female counterparts, a much larger proportion of male academics (54.6% of the males vs 31.1% females) had ever published an article in peer-reviewed journals ($P < 0.001$). Faculty who

reported having published articles, with a majority of 180 males (62.5%) and 20 females (74.1%) had published one to five articles ever as a primary author. A similar trend was observed with respect to research done in collaboration with other institutions (Table 2).

Table 2. Articles published and abstract presentations among faculty at Addis Ababa University, Addis Ababa, Ethiopia, 2019

Variables	Male n(%)	Female n(%)
Peer-reviewed articles ever published	397 (88.6)	50 (11.2)
Peer-reviewed articles published as a primary author (n=315)	180 (62.5)	20 (74.1)
Solo authors	108(37.5)	7 (25.9)
1-5		
>5		
Peer-reviewed articles published with *AAU collaborators (n=173)	93 (61.2)	16 (76.2)
1-5	59 (38.8)	5 (23.8)
>5		
Peer-reviewed articles published with other collaborators	85 (68.0)	8 (80.0)
1-5	40(40.9)	2(20)
>5		
Presentation in a conference as a primary author (AAU)	139 (74.7)	17 (81.0)
1-5	47 (25.3)	4 (19.0)
>5		
Published at least one book as a primary author AAU	62 (89.1)	7 (10.1)
Books published other than AAU	26 (96.3)	1(3.7)
Published book chapter in AAU	13 (81.3)	3 (18.7)

*AAU represents research activities after the faculty joined Addis Ababa University

Research related courses and training

Five hundred eleven male faculty (71.1%) and 118 female faculty (73.8%) said they had taken research methodology courses while they were undergraduate students. Similarly, 532 male respondents (74.0%) and 113 female respondents (70.2%) took research methodology courses during their graduate training. Only 257 males (35.9%) and 63 females (39.6%)

reported that they knew about research-related training provided by AAU. A third of the study participants of males and females (which is an equal proportion) had a chance to be involved in the in-service training provided by the Addis Ababa University. There was no statistically significant difference between male and female faculty in receiving research training (Table 3).

Table 3. Research methodology course and training received among faculty at Addis Ababa University, Addis Ababa, Ethiopia, 2019

Variable	Male n (%)	Female n (%)	P-value
Received research methodology course in the undergraduate Program			
Yes	511 (71.1)	118 (73.8)	0.497
No	208 (28.9)	42 (26.2)	
Received research methodology course in the graduate program			
Yes	532 (74.0)	113 (70.2)	0.603
No	187 (25.7)	44 (26.0)	
Knowledge about research related short courses training at AAU			
Yes			0.54
No	257 (35.9)	63 (39.6)	
Received research related training at AAU			
Yes	458 (64.1)	96 (60.4)	0.58
No	230 (32.3)	55 (34.8)	
Type of training * (n=285)	483 (66.4)	103 (65.2)	
Grant writing			
Manuscript writing	68 (29.6)	14 (25.5)	0.78
Proposal writing	71 (30.9)	11 (20.0)	0.24
Data analysis	(42.6)	19 (34.5)	0.56
Software application	97 (42.2)	24 (43.6)	0.61
Mentorship	93 (40.4)	20 (36.4)	0.88
	29 (12.6)	7 (12.7)	0.84

*Multiple responses

Involvement in a grant application

The majority of respondents had information about university research calls. There was no difference between male and female faculty. Three hundred fifty-two male participants (56.1%) and 69 female

participants (57.0%) were involved in grant applications either for international, national, or university calls. However, taking the principal investigator's role was more seen in males than females counteract ($P < 0.05$) (Table 4).

Table 4. Involvement in grant application among faculty at Addis Ababa University, Addis Ababa, Ethiopia, 2019

Variable	Male n (%)	Female n (%)	P-value
Involvement in grant application in the past five years			
Yes	352 (56.1)	69 (57.0)	0.84
No	276 (43.9)	52 (43.0)	
Role in grant application* (n= 421)			
PI	207 (58.8)	30 (43.5)	0.02
Co-PI	173 (49.0)	27 (39.1)	0.13
Research team member	186 (52.7)	34 (49.3)	0.60
Director / Co-director	16 (4.5)	1 (1.4)	0.24
Status of grant application in the past five years (n= 375)			
Unsuccessful	88 (26.9)	9 (18.8)	0.65
Succeed	196 (59.9)	30 (62.5)	0.94
Pending	43 (13.2)	9 (18.7)	0.14
Information about AAU research call			
Yes	507 (81.0)	91 (75.2)	0.15
No	119 (19.0)	30 (24.8)	

*Multiple responses

Factors affecting publication

Results of the multivariate analysis regression model showed that male faculty were more likely to publish than their female counterparts in the University [AOR (95% CI) 2.55 (1.68, 3.86)]. Faculty who have children were also more likely to publish than those who had no children [AOR(95% CI) 1.67 (1.02, 2.75)]. Lecturers

were less likely to publish articles compared to assistant professors and above [AOR(95% CI) 3.47(2.31, 5.21)]. Faculties with a Ph.D. are more likely to publish than academic faculty who had a master's degree and specialization in the medical field. [AOR (95% CI) 2.98 (2.11, 4.19)]. Faculty that has affiliation with other

institutions are two times more likely to have publication [AOR (95% CI) 2.59 (1.98, 3.56)] as compared to those faculty who had no affiliation with other institutions (**Table 5**).

Table 5. Factors affecting publication of peer-reviewed articles among academic faculties at AAU, Addis Ababa, Ethiopia, 2019

Variable	No (%)	COR (95% CI)	AOR (95% CI)
Sex			
Male	727 (81.9)	2.67 (1.86, 3.85)	2.68 (1.78, 4.05)
Female	161 (18.1)	1	1
Age			
20-40	505 (56.9)	1	1
41 & above	383 (43.1)	2.94(2.23, 3.87)	1.12 (0.78, 1.62)
Marital status			
Ever Married	670 (75.6)	2.21(1.61, 3.04)	0.78(0.45, 1.34)
Not married	216 (24.4)	1	1
Having children			
Yes	594 (67.1)	2.40 (1.80, 3.21)	1.65 (1.01, 2.71)
No	291 (32.9)	1	1
Academic rank			
Lecturer	398 (44.8)	1	1
Assistant Professor and above	490 (55.3)	5.77 (4.31, 7.72)	4.38(3.11., 6.17)
Admin position involvement in the last 5yrs			
Yes	447 (50.5)	0.54 (0.41, 0.70)	1.03 (0.74, 1.43)
No	439 (49.5)	1	1
Affiliation with other institutions			
Yes	462 (52.3)	(2.58, 4.48)	2.57 (1.86, 3.52)
No	422 (47.7)	1	1
Part-time engagement			
Yes	419 (47.4)	1	1
No	465 (52.6)	1.08, 1.84)	1.01 (0.74, 1.39)

Discussion

This study indicated that female faculty were less likely to publish in peer-reviewed journals than their male counterparts. Faculty who had lower academic rank were also less likely to publish. Compared to faculty who had no affiliation with other institutions, those with affiliation and those who have children had more research publications while both faculty were more involved in student thesis than other studies. Besides, the results of the study show that taking a role as a principal investigator (PI) for a research project was more apparent in males than in females.

A possible explanation for the less likelihood of publishing in a peer-reviewed journal could be related to their low participation in collaborative grant applications and multicountry studies.

This is also demonstrated in our findings where those who had an affiliation with other institutions published more. It is also worth recognizing that having international collaborations enable authors to publish in high-impact journals and acquire a more significant number of citations. The gender difference in research productivity might also be related to women's pregnancy, maternity leave, a disproportionate share of responsibilities at home, and a more significant role in supporting their family than male scientists. That a disproportionate share of parenting results in less research productivity by female faculty is also reported by several related studies (13-15). On the other hand, the number of associate professors and above is meager, which deters women from supervising Ph.D., who could

contribute to the new findings and publication. The is consistent with previous findings that indicated the low number of female faculty publications (14, 16-18).

It was found that faculty who have more children publish more implying that there is a positive relationship between having more children and publishing peer-reviewed articles. In real life, having children and maturing in the academic arena go in hand in hand. In other words, people tend to engage in research as they get mature. The hassle of settlement and livelihood at a younger age may limit participation in research (17).

Our analysis also revealed that taking a role as a principal investigator (PI) for research grants was more apparent in male faculty than in women faculty. Understandably, involvement as PI is likely to give a better opportunity for male researchers to publish in a peer-reviewed journal as a lead author. This finding is in agreement with the results of other studies conducted in developed countries which reported the invisibility of women's research participation as first authors; their participation was instead limited to reviewing and doing related activities(10, 19, 20).

In this study, it was found that lecturers and assistant professors were less likely to publish articles as compared to those with a rank of associate professor and above. And not surprisingly, research publication is one of the major criteria used by the University for promoting faculty as reported by other related studies. (14, 21-23).

Limitation

The study employed a self-administered questionnaire that only relied on participants' responses. We are aware that other important parameters such as impact factor of journals, citation of published articles, and variation in different disciplines were not examined in this study, and that be considered as a limitation of the study.

Conclusion

Our findings indicated that Addis Ababa University has to go to a great length to narrow the publication gap of peer-reviewed articles and the gap in grant writings for application between male and female faculty. Attention should also be put in place to rectify the University's ongoing gender imbalances by designing programs and policies that boost the active participation of female faculty in research.

Funding

Addis Ababa University (AAU) funded this study through thematic research.

Acknowledgments

The authors would also like to thank the data collectors and study participants for their time and contribution to the research.

References

1. Leland D, Moore J. Strategic focusing: Securing competitive advantage in Public Purpose. Sept-oct edition, 2007.
2. QS. World University Ranking 2018-Tables Information. 2018.
3. Sax L. J, Hagedom L S, Arredondo M, Dicrisi III F A. Faculty research productivity: Exploring the role of gender and family-related factors. *Research in Higher Education*. 2002;43(4):423-46.
4. UNESCO. Gender and Science. In *Women in Science - Explore data*. 2012.
5. Cole JR, Zuckerman H. The productivity puzzle: persistence and changes in patterns of publication of men and women scientists *Adv Motiv Achiev* 2. 1984:217-58.
6. Kelly CD, Jennions MD. The h index and career assessment by numbers. *Trends Ecol Evol* 2006;21:167-70.
7. Symonds MRE, Gemmell NJ, Braisher TL, Gorringe KL, Elgar MA. Gender Differences in Publication Output: Towards an Unbiased Metric of Research Performance. *PloS one*. 2006;1(1).
8. Ebadi A, Schiffauerova A. Gender difference in research output, funding and collaboration. *World Academy of Science, Engineering, and Technology International Journal of Humanities and Social Sciences*. 2016;10(4).
9. Ding WW, Murray F, Stuart TE. Gender differences in patenting in the academic life sciences. *Science* 2006;313:665-7.
10. Donaldson EL, Emes CG. The challenge of Women Academics: Reaching a critical mass in Research, Teaching, and Service. *The Canadian Journal of Higher Education*. 2000;XXX(3):33-56.
11. Addis Ababa University. Annual Report. June 2020.
12. Office of Academic Staff Affairs. Addis Ababa University. Academic staff profile. 2016/2017 (2009 E.C.).
13. Xie Y, Shauman KA. Sex differences in research productivity: new evidence about an old puzzle. *Am Sociol Rev*. 1996;63:847-70.
14. Regina R, Kaufman JC. The Gender Gap in Peer-Reviewed Publications by Physical Therapy Faculty Members: A Productivity. *American Physical Therapy Association*. 2011;91(1):121-31.
15. Sebo P, Maisonneuve H, Fournier JP. The gender gap in research: a bibliometric study of published articles in primary health care and general internal medicine *Family practice*. 2020; Epub 2020/01/15.
16. Stack S. Gender, children and research productivity. *Research in Higher Education Research in Higher Education*. 2004;45:891-920.
17. Linda J, Sax LSH, Marisol Arredondo, and Frank A, Dicrisi III. Faculty Research Productivity: Exploring the Role of Gender and Family-Related Factors *Research in Higher Education*. 2002;43(4).
18. Sarpong K, Ghanney EC, Acheampong D, Oguntuyo S. Bridging the gender gap in science and technology in Africa: The African Research Academies for Women (ARA-W) *Annals of Global Health* 2016;82(3):598. 2016;82(3):598.
19. Courtney A, Penna JAE, Daniel B. Larachc, Ashley M. Hessonb, Jennifer F. Waljeed, Marilyn Green Larache. The gender authorship gap in gynecologic oncology research. *Gynecologic Oncology Reports* 2019;29:83-4.
20. Filardo G dGB, Sass DM. Trends and comparison of female first authorship in high impact medical journals: observational study (1994-2014) *BMJ*. 2016;352.
21. Jung J. Gender Differences in Research Scholarship Among Academics: An International Comparative Perspective 2015:163-78.
22. Araujo EB, Araujo NAM, Moreira AA, Herrmann HJ, Andrade JS J. Gender differences in scientific collaborations: Women are more egalitarian than men. *PloS one* 2017;12(5).
23. Deutz DB, Vlachos E, Drongstrup D, Dorch BF, Wien C. Effective publication strategies in clinical research. *PloS one*. 2020;15(1).