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Original Article

Early Exposure to Research Program: An Approach to Improve the Academic Success and Performance of Postgraduate Students

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Abstract

Background: Early exposure to research activities is recognized as a key factor in enhancing research skills and academic achievement. This study aimed to evaluate the effect of the Early Exposure to Research Program (EERP) on research performance and academic success in postgraduate students.

Methods: This educational intervention utilized a quasi-experimental, case-control design with pre- and post-test assessments. The study was conducted from September 2021 to October 2023 at the School of Nutritional Sciences and Dietetics. Thirty-four students participated in the intervention group and 34 in the control group. Valid and reliable researcher-developed questionnaires assessed student satisfaction and research performance. Academic achievement was measured by mean course scores. Statistical analysis was conducted using Chi-square and independent t-tests, and effect sizes were interpreted for mean differences.

Results: The EERP significantly improved research performance among the postgraduate students, with notable increases in published articles (60.7 *vs*. 25.0%, p=0.005), research training participation (35.7 *vs*. 3.6%, p=0.003), and other research activities for MSc students, and enhanced training (50.0 *vs*. 0%, p=0.046) and article reviewing (66.7 *vs*. 16.7%, p=0.079) for PhD students. Academic achievement was higher in the intervention group, with mean course scores for MSc students of 18.16 compared to 16.29 in the control group (d=1.78), and for PhD students, 17.96 *vs*. 16.66 (d=1.32). No significant differences were observed in baseline characteristics between groups.

Conclusion: Implementing similar programs can enhance research performance and academic achievement among postgraduate students. It is recommended that such approaches be incorporated into postgraduate educational curricula. Future research should use randomized designs and longer follow-up to confirm and expand these findings.

Keywords: Academic success, Case-control studies, Curriculum, Personal satisfaction, Research, Students, Surveys and questionnaires

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Introduction

Research is a cornerstone of medical education, fostering critical thinking, problem-solving, and evidence-based practice among future healthcare professionals (1). Research skills are fundamental to both undergraduate and postgraduate education, contributing to the development of competent healthcare professionals and advancing academic achievement (2,3). However, research productivity among postgraduate students varies widely, influenced by factors such as prior research experience, mentorship, and institutional support (2). Despite the recognized importance of research training, many postgraduate programs struggle to provide comprehensive research education due to dense curricula and limited opportunities for skill development (4). This often results in students lacking critical research competencies, such as appraising scientific literature, understanding diverse research methodologies, and communicating findings effectively (4). Participation in research offers long-term benefits by equipping medical students with essential skills such as communication, time management, critical thinking, and analytical abilities. Additionally, it enhances their problem-solving capacity, clinical competencies, and motivation for learning (5,6). Despite the significance of research skills, many educational programs do not provide sufficient training in these areas (7).

Early exposure to research has emerged as a critical and promising strategy for addressing these challenges and for developing competent graduates (8-10). By integrating research training early in postgraduate curricula, students can develop a strong foundation in research methods, enhancing their academic performance and engagement in scholarly activities. Recent studies suggest that such exposure not only strengthens research skills but also improves clinical competencies, analytical abilities, and motivation for learning (9,11).

Problem statement

A significant knowledge gap exists in postgraduate medical education regarding structured, early research training, particularly in fields like nutritional sciences. Many students enter these programs with limited research experience and low confidence, which hinders their engagement with research literature and academic success (11). Needs assessments at the School of Nutritional Sciences and Dietetics indicate that MSc and PhD students often struggle with critical appraisal, diverse research methods, and scientific communication (oral feedback). The absence of dedicated early research courses further limits opportunities to develop these skills. Therefore, evaluating interventions such as the Early Exposure to Research Program (EERP) is essential to bridge this gap and enhance students' research capabilities and academic outcomes (12).

Conceptual framework

This study is grounded in Kolb's Experiential Learning Theory (ELT), which describes learning as a cyclical process involving four stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation (13). ELT posits that knowledge is created through the transformation of experience, making it an ideal framework for research training. The EERP aligns with ELT by engaging students in hands-on research activities (concrete experience), encouraging reflection on these experiences (reflective observation), fostering understanding of research methodologies (abstract conceptualization), and enabling application in new contexts (active experimentation) (14,15).

This study aims to evaluate the impact of the EERP on the research performance and academic achievement of postgraduate students in the School of Nutritional Sciences and Dietetics.

We hypothesize that participation in the EERP will lead to improved research performance and higher academic achievement among postgraduate students compared to those who do not participate, as the program provides structured experiential learning opportunities aligned with Kolb's ELT.

This study addresses a critical gap in postgraduate medical education by providing empirical evidence on the benefits of early research exposure. Its findings could inform curriculum development, encouraging the integration of structured research training in postgraduate programs. By enhancing students' research skills, EERP could lead to better-prepared graduates who contribute to advancing medical knowledge and practice (9). Additionally, the study

aligns with global priorities in academic medicine, emphasizing research training as a key component of postgraduate education (12). The results may also guide policy-making, promoting equitable access to research training across diverse student populations.

Materials and Methods

This research was an educational intervention study utilizing a quasi-experimental design with two groups (case-control) and pre- and post-test assessments. The study was carried out at the School of Nutritional Sciences and Dietetics, Tehran University of Medical Sciences, from September 2021 to October 2023. Initially, all first-semester students who expressed interest in participating in the Early Exposure to Research Program were included in the intervention group (36 postgraduate students). However, 2 MSc students were excluded due to insufficient participation, resulting in 34 participants (28 MSc and 6 PhD students). From among the other first-semester students who did not wish to participate in the program, 34 students (28 MSc and 6 PhD) were randomly selected to form the control group. It should be noted some of the MSc students in this study had prior research experience, while all of the participating PhD students had previous research experience. Baseline characteristics (sex, age, academic year, residence, previous university) were compared between the groups (Table 1).

Instruments

Valid and reliable researcher-made questionnaires were utilized to assess students' satisfaction and research performance. To establish the validity of the questionnaires, feedback from six faculty members was sought. For reliability testing, the test-retest method was applied, with 25 students completing the questionnaires a week apart. The correlation coefficient for the program satisfaction questionnaire was 0.98, and for the research performance questionnaire, it was 0.78.

The research performance index was calculated as the sum of 13 closed-ended items, each scored 0 or 1, with equal weighting. These items covered research participation, project involvement, publications, workshops, conference presentations, and research-related achievements. The satisfaction questionnaire included 7 items rated on a 5-point Likert scale.

Program details

The EERP was designed to enhance research skills among MSc and PhD students in the School of Nutritional Sciences and Dietetics at Tehran University of Medical Sciences, grounded in Kolb's ELT. ELT's four-stage cycle-concrete experience, reflective observation, abstract conceptualization, and active experimentation guided the program's structure, fostering skill development through practical, student-centered learning (13).

Introduced during an initial meeting, EERP was optional, allowing first-semester students to enrol. The program employed student-centered instructional strategies, including problem-based learning and a structured timetable with designated training sessions. These strategies aligned with ELT by promoting active engagement and structured learning experiences tailored to research skill development.

In the first session, the students were introduced to the program's structure and assigned research questions, providing a concrete experience. They developed research proposals and conducted literature reviews, engaging in reflective observation and abstract conceptualization. Weekly training sessions covered essential research methods, including systematic reviews, meta-analysis, statistical analysis, scientific writing, and software tools (*e.g.*, SPSS, EndNote). These sessions facilitated abstract conceptualization and active experimentation as students applied skills to research projects. Students also attended workshops at the Student Research Center and were encouraged to improve their English language skills, reinforcing ELT's cycle through practical application and reflection.

To promote collaboration, small groups of two or three students were assigned shared data with distinct research questions, fostering teamwork and motivation (Table 2). Group discussions enabled reflective observation, while collaborative project development supported active experimentation and abstract conceptualization. This setup encouraged students to share insights, refine approaches, and complete research projects, aligning with ELT's emphasis on collaborative learning.

Monthly seminars on nutrition science topics provided concrete experiences, exposing students to cutting-edge research. These sessions facilitated

Table 1. Demographic characteristics of the case and control groups

	Major						Age				Sex		Place of living		Previous university		Related work experience	
	MSc				PhD													
	Nutritional sciences	Community nutrition	Clinical nutrition	Nutrition in crisis	Nutritional sciences	Food and nutrition policy	<25	25-29	30-34	≥35	Female	Male	Dorm	Home	National university	Azad university	Yes	No
Case	35.7	60.7	3.6	-	100	-	47.1	38.2	14.7	-	76.5	23.5	55.9	44.1	79.4	20.6	64.7	35.3
Control	29.6	63.0	3.7	3.7	100	-	40.7	55.6	-	3.7	66.7	33.3	51.9	48.1	88.9	11.1	40.7	59.3

reflective observation and abstract conceptualization as students discussed and analyzed the presented topics, enhancing their understanding of research concepts. Faculty-funded research projects further supported active experimentation, allowing students to apply learned skills to real-world initiatives, with mentorship ensuring practical application and skill refinement.

The EERP's design ensured students cycled through ELT's four stages, systematically developing research competencies. By integrating hands-on activities, collaborative learning, and structured training, the program equipped students with critical skills for research and academic success. The optional nature and early accessibility of EERP, combined with its focus on experiential learning, positioned it as an effective model for postgraduate medical education, fostering both individual and collaborative research capabilities.

Data collection

Data collection occurred at baseline and after the intervention. All the participants provided written informed consent; confidentiality was ensured by anonymizing responses and limiting data access to the research team.

Statistical analysis

Chi-square tests were used for categorical variables with sufficient expected counts (≥5), such as work experience and sex, while Fisher's exact test was applied for variables with lower expected counts (*e.g.*, age categories ≥35 and 30–34 years, PhD majors).

For research performance outcomes (*e.g.*, publication rates, research training participation), Chi-square tests were used to compare categorical proportions

Table 2. Early exposure to research program educational sessions

Teaching format	Content	Time	Period
Individual training	Type of research methods, various statistical analysis methods, use of SPSS software, EndNote, how to select an appropriate journal, and evaluation and review of research projects and scientific papers	60 *min*-weekly (30 *min* theoretical/ 30 *min* practical)	The first 12 weeks
Group training	How to search important databases, systematic review and meta-analysis, scientific writing, and standard review checklists for variety of studies	60 *min*-weekly (30 *min* theoretical/ 30 *min* practical)	The first 12 weeks
Practical training	Preparing systematic review and meta-analysis project, conducting practical research in the field of nutrition (how to collect dietary data: FFQ, dietary recall, dietary record-how to enter data to the software: how to work with nutritionist IV-continue writing a paper)	60 *min*-weekly	From the 13th week to the end (ongoing, project-dependent)

Table 3. The mean score of MSc students among in case and control groups

	Case	Control
Total average	18.16	16.29
Seminar	19.08	16.38
Research methods	18.66	16.42
Current topics in nutrition	17.87	15.87

* T-test was used for statistical analysis.

between groups, as these variables were reported as percentages with adequate expected counts. Continuous variables (*e.g*., mean academic achievement scores) were compared using independent t-tests, as these data were continuous and met normality assumptions. Effect sizes (Cohen's d for mean differences; Cramer's V for categorical comparisons) and 95% confidence intervals were reported to quantify the magnitude of observed effects.

Statistical analyses were performed using SPSS software (Version 16.0, SPSS Inc., Chicago). A p-value <0.05 was considered statistically significant.

Ethical considerations

The study was approved by the university ethics committee (IR.TUMS.MEDICINE.REC.1400.1486).

Results

Analysis of demographic characteristics (Table 1) revealed no significant differences between the intervention (EERP) and control groups in related work experience, previous university, place of living, sex, age, or major (all p>0.05). These findings confirm the absence of baseline demographic differences, suggesting that EERP's effects on research performance and academic achievement are attributable to the intervention. The EERP was evaluated using the Kirkpatrick model up to level three, focusing on program outcomes (16,17).

Response (satisfaction)

Student satisfaction was measured using a validated researcher-made questionnaire with a 5-point Likert scale, assessing aspects such as monthly seminars, group projects, interactions, teacher-student relationships, educational processes, acquired skills, and

Table 4. The mean score of PhD students among the case and control groups

	Case	Control
Total average	17.96	16.66
Advanced research methods	18.91	17.94

* T-test was used for statistical analysis.

overall outcomes. Among 28 MSc students in the intervention group, 46.4% (n=13) reported very high satisfaction, 35.7% (n=10) high, 14.2% (n=4) moderate, and 3.58% (n=1) low satisfaction. Among 6 PhD students, 33.3% (n=2) reported very high satisfaction, 33.3% (n=2) high, 16.6% (n=1) moderate, and 16.6% (n=1) low satisfaction.

Learning

Research project progress in the intervention group was completed according to the planned timeline, as assessed by project milestones.

Behavior

Academic achievement was evaluated by comparing mean scores in research-related courses between intervention (n=28 MSc, n=6 PhD) and control groups (n=28 MSc, n=6 PhD). For MSc students, mean scores were: total average (18.16 *vs*. 16.29), seminar (19.08 *vs*. 16.38), research methods (18.66 *vs*. 16.42), and current topics in nutrition (17.87 *vs*. 15.87), as shown in table 3. For PhD students, mean scores were: total average (17.96 *vs*. 16.66) and advanced research methods (18.91 *vs*. 17.94), as shown in table 4.

Research performance was assessed using a 13-item questionnaire. For MSc students, no significant differences were found between intervention and control groups before the program (p-values: 0.147).

After the EERP, the intervention group of MSc students demonstrated significant improvements in several research performance outcomes, as detailed in table 5. Specifically, 60.7% (17 out of 28) of the intervention group published articles compared to 25.0% (7 out of 28) in the control group, with a p-value of 0.005 and an odds ratio of 4.64 (95% CI: 1.48–14.55). Additionally, 35.7% (10 out of 28) of the intervention group participated in research training workshops or classes, compared to 3.6% (1 out of 28) in the control group, yielding a p-value of 0.003

Table 5. Impact of the EERP on MSc students' research performance

	Before			After		
	Case per(number)	Control per(number)	p-value*	Case per(number)	Control per(number)	p-value*
Research study	17.9(5)	28.6(8)	0.38	82.1(23)	71.4(20)	0.311
Research project	28.6(8)	3.6(1)	0.388	67.9(19)	78.6(22)	0.485
Published article	7.1(2)	3.6(1)	0.531	60.7(17)	25.0(7)	0.005
Published book/ educational guideline	3.6(1)	-	0.313	14.3(4)	3.6(1)	0.160
Research training in the form of workshops or classes	14.3(4)	7.1(2)	0.362	35.7(10)	3.6(1)	0.003
Participating in students' festivals	3.6(1)	3.6(1)	1.000	7.1(2)	3.6(1)	0.553
Experience reviewing articles in scientific journals or conferences	3.6(1)	-	0.313	28.6(8)	-	0.002
Membership in student research center	14.3(4)	3.6(1)	0.147	60.7(17)	17.9(5)	0.001
Join the talent association	10.7(3)	3.6(1)	0.282	7.1(2)	7.1(2)	1.000
Paper presentations as oral or poster in scientific seminars, *etc*	17.9(5)	14.3(4)	0.626	50.0(14)	17.9(5)	0.008
Attracting grant from out-of-school resources	-	-	-	32.1(9)	3.6(1)	0.005
Received a scholarship from the national elite foundation	3.6(1)	-	0.304	10.7(3)	-	0.075
Patent and innovation	-	-	-	-	-	-

* Chi-square test was used for statistical analysis.

and an odds ratio of 14.29 (95% CI: 1.67–122.22). Furthermore, 28.6% (8 out of 28) of the intervention group gained experience reviewing articles for scientific journals or conferences, while none (0 out of 28) in the control group did, with a p-value of 0.002; the odds ratio was not calculable due to a zero cell. Membership in the student research center was achieved by 60.7% (17 out of 28) of the intervention group compared to 17.9% (5 out of 28) in the control group, with a p-value of 0.001 and an odds ratio of 7.14 (95% CI: 2.14-23.81). Paper presentations were made by 50.0% (14 out of 28) of the intervention group *vs.* 17.9% (5 out of 28) in the control group, with a p-value of 0.008 and an odds ratio of 4.60 (95% CI: 1.39-15.24). External grants were secured by 32.1% (9 out of 28) of the intervention group compared to 3.6% (1 out of 28) in the control group, with a p-value of 0.005 and an odds ratio of 12.60 (95% CI: 1.47-107.88). Finally, 10.7% (3 out of 28) of the intervention group received a National Elite Foundation scholarship, while none (0 out of 28) in the control group did, with a p-value of 0.075; the odds ratio was not calculable due to a zero cell. For PhD students, pre-program differences were significant only for paper presentations (83.3 *vs*. 0%, p=0.003). Post-program improvements included research training workshops (50.0 *vs*. 0%, p=0.046, OR not calculable) and reviewing articles (66.7 *vs*. 16.7%, p=0.079, OR=10.00, 95% CI: 0.78–128.08), as shown in table 6.

Discussion

The aim of this study was to evaluate the impact of the EERP on the research performance and academic achievement of postgraduate students in the School of Nutritional Sciences and Dietetics. The EERP was

Table 6. Impact of the EERP on PhD students' research performance

	Before			After		
	Case per(number)	Control per(number)	p-value*	Case per(number)	Control per(number)	p-value*
Research study	100.0(6)	100.0(6)	-	100.0(6)	83.3(5)	-
Research project	83.3(5)	100.0(6)	0.296	83.3(5)	83.3(5)	0.388
Published article	66.7(4)	83.3(5)	0.505	100.0(6)	100.0(6)	-
Published book/ educational guideline	33.3(2)	-	0.121	-	-	-
Research training in the form of workshops or classes	33.3(2)	-	0.121	50.0(3)	-	0.046
Participating in student festivals	-	-	-	16.7(1)	-	0.296
Experience reviewing articles in scientific journals or conferences	16.7(1)	-	0.296	66.7(4)	16.7(1)	0.079
Membership in student research center	16.7(1)	-	0.296	50.0(3)	33.3(2)	0.558
Join the talent association	33.3(2)	-	0.121	16.7(1)	-	0.296
Paper presentations as oral or poster in scientific seminars and ...	83.3(5)	-	0.003	33.3(2)	-	0.121
Attracting grant from out-of-school resources	-	-	-	33.3(2)	-	0.121
Received a scholarship from the national elite foundation	-	-	-	-	-	-
Patent and innovation	-	-	-	-	-	-

* Chi-square test was used for statistical analysis.

designed as a structured research training intervention based on Kolb's ELT to enhance students' research capabilities through hands-on experience, reflection, conceptualization, and active experimentation.

Study findings and alignment with existing literature

Positive impact on academic performance

The study findings demonstrated that the EERP significantly improved academic achievement among both MSc and PhD students. The mentioned results align with recent evidence from structured research training programs globally. Shen *et al* (18) conducted a longitudinal study of 2,213 medical students and found that academic performance in research training courses was significantly associated with increased research productivity (p=0.014). Similarly, a curriculum-based research training program at Zhejiang University School of Medicine showed consistent improvements in student publications over time, with the proportion of students with publications reaching 26.7% (18).

The effectiveness of early research exposure in enhancing academic performance is further supported by Cho *et al* (19), who found that 94% of the students exposed to early clinical and research experiences reported high satisfaction levels and improved academic motivation. These findings corroborate the observation that early structured research training creates a foundation for sustained academic improvement.

Enhanced research performance and skills development

The EERP's impact on research performance was evident across multiple domains. MSc students indicated significant improvements in publishing articles, receiving research training, gaining

experience in article review, joining research centers, and presenting at scientific conferences. For PhD students, the program significantly enhanced participation in research training and showed borderline improvements in article review experience (p=0.079).

These outcomes are consistent with findings from the University of Sydney Medical Program, where Kaur *et al* (20) evaluated mandatory research projects among 513 medical students. Their study showed that 84% of the students reported acquiring necessary research skills after completing structured research projects, compared to only 37% who felt adequately prepared beforehand (χ^2=8.99, p=0.02). The satisfaction scores in their study averaged 5.0/10, with 59% of the students reporting above-average satisfaction (20).

Research mentorship programs have shown similar positive outcomes. The Research Mentorship Program (RMP) at Tehran University of Medical Sciences demonstrated 100% mentor satisfaction and 93% mentee satisfaction, with participants indicating higher quantity and quality of publications from their theses (21). Master's students in the RMP completed their programs in 4-5 semesters compared to the average of 6 semesters for non-participants, and 100% graduated with accepted papers *vs*. 54% in the control group (21).

Theoretical framework and Kolb's ELT

The present study's grounding in Kolb's ELT proved to be an effective theoretical framework for research training. The four-stage cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation provided a structured approach to developing research competencies. This aligns with recent implementations of Kolb's theory in medical education.

Wijnen-Meijer *et al* (14) demonstrated that course designs based on Kolb's experiential learning cycle, integrating experience, theory, and simulation, constitute valuable additions to medical education. Students particularly appreciated discussing personally experienced cases and opportunities to practice in simulated environments (14). The cyclical nature of experiential learning allows students to build progressively on their experiences, moving from concrete practice to theoretical understanding and back to improved practice (22).

Research skills and competency development

The findings demonstrated that structured early exposure to research significantly improves research skills and academic performance among postgraduate students. This is consistent with recent systematic reviews that highlight the essential research competencies expected of medical graduates and the positive impact of integrated research training within medical curricula. For example, Lee *et al* (7), systematically reviewed the literature and identified that medical students are expected to graduate with a robust set of research skills, including critical appraisal, data analysis, scientific communication, and ethical conduct in research. The review further emphasized that structured research experiences embedded within the curriculum are strongly associated with higher levels of student research competency and preparedness for evidence-based practice (7).

The study results support these findings: students who participated in the EERP showed marked improvement in their ability to critically appraise literature, engage in scholarly activities, and communicate research findings effectively. This aligns with the systematic review's conclusion that early and structured research training not only enhances research skills but also fosters greater confidence and motivation for lifelong learning (7).

The program's emphasis on practical research engagement, combined with mentorship and structured feedback, mirrors successful international models. The Medical Scholar Research Pathway Program (MSRPP) at a community-based medical school indicated that participants were twice as likely to seek formal research support and had significantly higher scholarship output compared to non-participants (1). Early indicators suggested that formal research program participation led to measurable differences in matching into competitive residencies (1).

Student satisfaction and program evaluation

High satisfaction levels among EERP participants align with research methodology workshop evaluations using Kirkpatrick's model.

Debata *et al* (23) evaluated a research methodology workshop among 132 postgraduate students and found significant improvements in knowledge scores (pre-test: 10.55±2.537; post-test: 12.43±2.484; p<0.001).Participant feedback proved vital for program improvement, with workshops meeting the overall participant requirements (23).

The four-level Kirkpatrick evaluation model has proven effective for assessing educational interventions in medical education. Chellaiyan and Suliankatchi used this model to evaluate a health research methodology workshop, finding that 66.7% of medical students showed a 30% increase in post-workshop scores, indicating workshop effectiveness. The effect size (Cohen's d) was 1.743, demonstrating substantial learning gains (24).

While results of the current study are predominantly positive, some studies report mixed outcomes from research training programs. Early exposure programs have shown variable effectiveness depending on implementation quality, institutional support, and student characteristics (25). A systematic review by Lee *et al* noted that while early research exposure generally benefits students, the magnitude of benefits varies significantly across different educational contexts and program designs (7).

Challenges and barriers

Despite positive outcomes, the study encountered several challenges that are commonly reported in research training programs.

Time constraints for instructors, initial student reluctance to accept research projects, and resistance to group collaboration mirror findings from other institutions. The University of Sydney study identified competing academic demands (74% of the students) and lack of dedicated research time (62% of the students) as the primary barriers to research completion (20).

These challenges highlight the importance of institutional support and curriculum integration. Based on evaluation feedback, the University of Sydney MD program incorporated substantial changes, including a dedicated 14-week research block in the third year, addressing the time constraint issue identified by students (20).

Strengths and limitations

To the best of the authors' knowledge, this study represents the first evaluation of an early exposure research program for graduate students in Iran. The key strengths include enhanced student interactions, a peer education approach, and collaborative group work, which fostered a dynamic learning environment and supported skill development.

However, the study has several limitations. First, it was not possible to control for external factors, such as additional training students may have received outside the EERP, which could have influenced their performance. Second, the non-randomized design introduces potential selection bias, as students who opted to participate in EERP may have had higher baseline research motivation. Third, possible information exchange between the intervention and control groups during the study may have affected the results. Finally, the voluntary nature of participation may have led to a self-selection bias, with students possessing stronger academic backgrounds more likely to enrol, potentially skewing the outcomes.

Conclusion

The EERP successfully enhanced both research performance and academic achievement among postgraduate students in nutritional sciences. The program's grounding in Kolb's ELT provided an effective framework for developing research competencies through structured, progressive learning experiences.

These findings align with international evidence supporting early research exposure as a valuable component of medical education, while highlighting the importance of institutional support, dedicated time allocation, and quality mentorship in achieving optimal outcomes. The positive results support broader implementation of similar programs in postgraduate medical education, with attention to addressing common barriers such as time constraints and ensuring adequate institutional support for both students and faculty mentors.

Ethics approval and consent to participate

Ethical approval for this study was obtained from the Ethics Committee of Tehran University of Medical Sciences (IR.TUMS.MEDICINE.REC.1400.1486).

Written informed consent was obtained from all the participants.

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Conflict of Interest

There was no conflict of interest in this manuscript.

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