Original Article

Effect of a Health Belief Model-Based Intervention on Perceived Susceptibility to Osteoporosis among Female Teachers

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ABSTRACT

Objective: To evaluate the effectiveness of a Health Belief Model-based educational intervention in enhancing perceived susceptibility to osteoporosis among female secondary school teachers in Nasiriyah, Iraq.

Study Design: Quasi-experimental pretest-post-test control group study

Place and Duration of Study: This study was conducted at the College of Nursing, University of Baghdad, Iraq from 20th December 2024 to 28th February 2025 vide letter No. 71 dated 12th December 2024.

Methods: A total of 144 female teachers aged 45–65 years were recruited from eight public secondary schools. The participants were divided into an intervention group (n=74) and a control group (n=70). The intervention included structured educational sessions based on Health Belief Model components. Data were collected through validated instruments including the Osteoporosis Health Belief Scale and the Osteoporosis Knowledge Assessment Tool.

Results: There was a statistically significant improvement in the mean scores of perceived susceptibilities in the intervention group across the three time points: pre-test (21.33±6.11), post-test I (26.98±3.37), and post-test II (32.69±1.09). In contrast, the control group showed no significant change over time. Mauchly's test confirmed the significance of changes in perceived susceptibility ($p<0.001$).

Conclusion: The Health Belief Model based intervention effectively enhanced perceived susceptibility to osteoporosis among female teachers, suggesting that targeted educational programs can play a pivotal role in promoting early preventive behaviors. Integrating such models into national health education strategies could improve long-term bone health among at-risk populations in Iraq.

Key Words: Osteoporosis, Health Belief Model, Perceived susceptibility, Educational intervention, female teachers

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INTRODUCTION

Osteoporosis is a silent, progressive skeletal disease characterized by low bone mass and micro-architectural deterioration, leading to an increased risk of fractures, particularly in postmenopausal women. Globally, more than one in three women over the age of 50 will experience osteoporotic fractures in their lifetime, posing a significant burden on health systems.[1] Ahmed et al[2] also emphasized the critical role of enhancing health beliefs - especially perceived susceptibility among nursing staff in Iraq through Health Belief Model (HBM) based interventions, which proved effective in promoting osteoporosis preventive behaviors at the level of primary health care. The HBM provides a widely recognized framework for understanding and modifying health behaviors. It emphasizes key cognitive constructions such as perceived susceptibility, severity, benefits, and barriers that influence individuals' decisions to engage in preventive actions.[3] Among these constructs, perceived susceptibility plays a pivotal role in osteoporosis prevention, especially in asymptomatic individuals who may not recognize their vulnerability. Hosking et al[4] demonstrated that interventions guided by the HBM significantly improved perceived susceptibility and calcium intake among middle-aged women in community settings. However, there remains a paucity of research assessing the impact of such interventions in Middle Eastern countries, including Iraq, where osteoporosis prevention is not yet integrated into national health strategies.

In Iraq, recent work by Al-Mousawi and Al-Ameri[6] examined female teachers' awareness and health beliefs related to osteoporosis. Their findings revealed substantial gaps in perceived personal risk, underscoring the need for theory-based educational programs that specifically address psychological readiness for behavior change. The multiple Iraqi

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studies have demonstrated the applicability and effectiveness of the Health Belief Model in various health contexts. Ahmed et al[2] conducted an HBM-based educational intervention for postmenopausal nurses at primary health care centers in Mosul, revealing significant improvements in participants' beliefs regarding osteoporosis prevention. Similarly, Handhal and Mohammed[6] applied the model to AIDS prevention among Iraqi female university students, showing enhanced health beliefs after the intervention despite the different health topic thus reinforcing the model's versatility.

Additionally, Baktash and Naji[7] reported that HBM-based programs successfully promoted exercise behaviors to prevent stroke among elderly residents in Baghdad. These findings collectively support the model's potential in designing effective, theory-based osteoporosis prevention programs tailored to specific Iraqi populations.

METHODS

This quasi-experimental design with a pretest-posttest control group was conducted at College of Nursing, University of Baghdad, Iraq from 20th December 2024 to 28th February 2025 vide letter No. 71 dated 12th December 2024. The study was conducted in public girls' secondary schools affiliated with the DhiQar Education Directorate in Nasiriyah, Iraq. Eight schools (one from each zone) were randomly selected out of 32 schools using simple random sampling. A total of 144 female teachers aged 45–65 years participated in the study 74 in the intervention group and 70 in the control group. Schools were assigned to either group randomly. The sample size was determined using Krejcie & Morgan's formula with a 95% confidence level and a 5% error margin, based on a population of 71,468. All female teachers aged 45–65 working in public secondary schools and willingness to participate (verbal consent) were included. The teachers with physical immobility or diagnosed with osteoporosis, middle schools and involved in pilot study were excluded. Participants were provided with an overview of the study's scientific purpose and methodology, and those who agreed to participate were given anonymous questionnaires to protect their privacy.

The study instrument consisted of four parts. The first part captured socio-demographic data such as age, educational attainment, occupation of the head of household, income level, residence, height, and weight. The second part addressed the participants' medical history, particularly concerning the family history of osteoporosis and personal history of fractures. The third part used the Osteoporosis Knowledge Assessment Tool (OKAT) to evaluate participants' understanding of osteoporosis, while the fourth part employed the Osteoporosis sub scale of Health Belief Scale (OHBS) developed by Kim et al. to assess perceptions related to susceptibility, regarding osteoporosis prevention. The OHBS utilized a 5-point Likert scale ranging from strongly disagree to strongly agree. Data were analyzed using SPSS-27. Inferential statistics included the Spearman rho correlation to identify associations between variables, the Mann-Whitney U test to compare two groups, and the Kruskal-Wallis test to examine differences across more than two groups.

RESULTS

The mean age was 36.08 years, with the largest proportion 37.5% aged between 29-35 years. The control group has a mean age of 38.73 years, with the highest percentage 26.4% also between 29-35 years. Most participants in both groups hold a bachelor's degree, about 84%, followed by smaller numbers holding master's degrees, diplomas, postgraduate diplomas, and doctoral degrees.

Table No. 1: Participants' sociodemographic characteristics

Variable		Study Group (N = 72)		Control Group (N = 72)	
		No.	%	No.	%
Age (Years)	22-28	14	19.5	10	13.9
	29-35	27	37.5	19	26.4
	36-42	15	20.8	17	23.6
	43-49	8	11.1	16	22.2
	50-57	8	11.1	10	13.9
Level of education	Diploma	3	4.2	4	5.6
	Bachelor's degree	61	84.7	60	83.3
	Postgraduate diploma	2	2.8	3	4.2
	Master's degree	5	6.9	4	5.6
	Doctoral degree	1	1.4	1	1.4
Family's monthly income (Iraqi dinar)	< 300.000	1	1.4	2	2.8
	300.000-600.000	24	33.3	23	31.9
	601.000-900.000	19	26.4	22	30.6
	901.000-1.200.000	10	13.9	7	9.7
	1.201.000-1.500.000	13	18.1	14	19.4

	≥ 1.501.000	5	6.9	4	5.6
Household occupation	Unemployed	6	8.3	11	15.3
	Unskilled worker	4	5.6	3	4.2
	Semi-skilled worker	5	6.9	8	11.1
	Skilled worker	6	8.3	4	5.6
	Clerical, Shop owner, farmer	9	12.5	6	8.3
	Semi-Professional	13	18.1	22	30.6
	Professional	29	40.3	18	25.0

Table No. 2: Descriptive statistics of perceived susceptibility of developing osteoporosis over time

Perceived Susceptibility		**Mean**	**Std. Deviation**	**Number**
Study	Pretest	21.33	6.11	72
	Posttest I	26.98	3.37	72
	Posttest II	32.69	1.09	72
Control	Pretest	20.73	6.61	72
	Posttest I	20.34	6.41	72
	Posttest II	19.23	5.8/0	72

Table No.3: Mauchly's test of Sphericity for perceived Susceptibility of developing osteoporosis

Within Subjects Effect	**Mauchly's W**	**Approx. Chi-square**	**Df**	**Sig.**	**Epsilon**		
					Greenhouse-Geisser	**Huynh-Feldt**	**Lower-bound**
Susceptibility	.344	74.717	2	.000	.604	.609	.500

Table No. 4: Multivariate tests of the perceived susceptibility of developing osteoporosis

Susceptibility		**Value**	**F**	**Hypothesis df**	**Error df**	**Sig.**	**Partial Eta Squared**
Study	Pillai's Trace	.814	153.629	2.000	70.000	.000	.814
	Wilks' Lambda	.186	153.629	2.000	70.000	.000	.814
	Hotelling's Trace	4.389	153.629	2.000	70.000	.000	.814
	Roy's Largest Root	4.389	153.629	2.000	70.000	.000	.814
Control	Pillai's Trace	.186	8.004	2.000	70.000	.001	.186
	Wilks' Lambda	.814	8.00	2.000	70.000	.001	.186
	Hotelling's Trace	.229	8.004	2.000	70.000	.001	.186
	Roy's Largest Root	.229	8.004	2.000	70.000	.001	.186

Table No. 5: Tests of within-subjects effects for perceived susceptibility of developing osteoporosis

Susceptibility		**Type III sum of square**	**Df**	**Mean square**	**F**	**Sig.**	**Partial Eta Squared**
Study	Sphericity Assumed	4646.731	2	2323.366	254.056	.000	.782
	Greenhouse Geisser	4646.731	1.208	3847.711	254.056	.000	.782
	Huynh-Feldt	4646.731	1.217	3817.541	254.056	.000	.782
	Lower-bound	4646.731	1.000	4646.731	254.056	.000	.782
Error	Sphericity Assumed	1298.602	142	9.145			
	Greenhouse-Geisser	1298.602	85.744	15.145			
	Huynh-Feldt	1298.602	86.422	15.026			
	Lower-bound	1298.602	71.000	18.290			
Control	Sphericity Assumed	87.259	2	43.630	1.911	.152	.026
	Greenhouse-Geisser	87.259	1.144	76.276	1.911	.170	.026
	Huynh-Feldt	87.259	1.150	75.846	1.911	.169	.026
	Lower-bound	87.259	1.000	87.259	1.911	.171	.026
Error	Sphericity Assumed	3242.741	142	22.836			
	Greenhouse-Geisser	3242.741	81.224	39.923			
	Huynh-Feldt	3242.741	81.684	39.699			
	Lower-bound	3242.741	71.000	45.672			

Table No. 6: Pairwise comparison of the perceived susceptibility of developing osteoporosis values between study and control groups

Susceptibility	(I)	(J)	Mean difference (I-J)	Std. Error	Sig.	95% Confidence interval for difference	
						Lower Bound	Upper Bound
Study	1	2	-5.653	.439	.000	-6.730	-4.576
		3	-11.361	.674	.000	-13.015	-9.708
	2	1	5.653	.439	.000	4.576	6.730
		3	-5.708	.338	.000	-6.538	-4.879
	3	1	11.361	.674	.000	9.708	13.015
		2	5.708	.338	.000	4.879	6.538
Control	1	2	.389	.968	1.000	-1.985	2.763
		3	1.500	.937	.342	-.799	3.799
	2	1	-.389	.968	1.000	-2.763	1.985
		3	1.111	.294	.001	.389	1.833
	3	1	-1.500	.937	.342	-3.799	.799
		2	-1.111	.294	.001	-1.833	-.389

Around 40% of the study group are professionals, while in the control group approximately 31% are semi-professionals. The rest include skilled workers, semi-skilled workers, clerical workers, shop owners, farmers, unemployed, and unskilled workers. One-third of the study group earn between 300,000 and 600,000 IQD, followed by those earning between 601,000 and 900,000 IQD. The income distribution in the control group is similar, with close proportions in the same income ranges (Table 1).

The findings show a significant and consistent increase in the perceived susceptibility to developing osteoporosis among participants in the study group across the three measurement points (pretest, posttest I, and posttest II). The mean score increased from 21.33±6.11 at pretest to 26.98±3.37 at posttest I and 32.69±1.09 at posttest II (Table 2).

Mauchly's test of Sphericity was significant ($p<0.05$), indicating that the assumption of Sphericity was not violated (Table 3). Repeated multivariate measures revealed a statistically significant effect of the intervention over time (Wilks' Lambda = .186, $F(2, 70) = 153.629$, $p<0.001$, $\eta^2 = .814$), indicating that approximately 81% of the variance in perceived susceptibility was due to the intervention (Table 4). Within-subjects effects were also significant ($F = 254.056$, $p<.001$, $\eta^2 = .782$), indicating strong intervention effects across time (Table 5)

Pairwise comparisons demonstrated that all time points differed significantly from each other ($p<.001$), confirming a progressive improvement in perceived susceptibility after the intervention (Table 6).

DISCUSSION

The demographic characteristics of the study and control groups reveal important patterns that may influence health behaviors and outcomes. The mean age for participants in both groups falls within the range of adulthood where health awareness tends to increase due to personal and family responsibilities. Specifically, the age group 29-35 years was the most represented in both groups. This aligns with global findings indicating that individuals in this age group often demonstrate greater engagement in preventive health behaviors and healthcare utilization,[8]

In addition, the high proportion of participants with bachelor's degrees in both groups (over 83%) indicates a relatively educated population. Research consistently shows that higher educational attainment correlates with better health literacy, improved health outcomes, and increased use of health services.[9] This is particularly relevant in nursing and maternal health contexts, where informed decision-making can significantly impact health practices and care-seeking behavior. Al-Fayyadh et al[10] also reported that majority of nurses demonstrated low knowledge regarding health literacy, more than half had acceptable levels of experience. Similarly, Al-Ashour and Al-Sader[11] identified a statistically significant relationship between health literacy and educational level among patients undergoing hemodialysis, reinforcing the role of higher education in promoting better health literacy.

Regarding occupation, most participants were professionals or semi-professionals. Employment status has been closely linked to socioeconomic stability and mental well-being. Studies suggest that professional employment often provides access to health insurance and resources that promote better health outcomes. Conversely, lower occupational status or unemployment, as seen in some participants, is associated with increased health risks and reduced access to care.[12,14] This factor is further compounded by income levels, with most participants earning between 300,000 and 900,000 IQD monthly, placing them in the lower to middle-income brackets. Income remains a crucial determinant of health, influencing various aspects such as nutrition, living conditions, and access

to quality healthcare. Hassan and Alwan[14] demonstrated that socioeconomic status significantly influenced psychological hardiness and coping mechanisms among nurses. These studies emphasize the role of financial stability in supporting positive health outcomes and the need for targeted interventions to assist low-income groups in accessing essential healthcare services.

Regarding osteoporosis perceptions, the results of Mauchly's test of Sphericity for perceived susceptibility were statistically significant ($W = 0.344$, $\chi^2(2) = 74.717$, $p < .001$), indicating a violation of the sphericity assumption. This implies inconsistency in participants' responses concerning their susceptibility to osteoporosis, potentially due to differing levels of awareness or beliefs about risk. This finding corresponds with Al-Khafaji and Mahmood[15] found low levels of perceived susceptibility among female university students in Baghdad, attributing this to insufficient health education and limited access to screening services. These results underscore the critical need for awareness campaigns targeting at-risk populations, particularly young women, to correct misconceptions and promote proactive health behaviors.

The multivariate analysis showed a significant intervention effect over time on perceived susceptibility (Wilks' Lambda = 0.186, $F(2, 70) = 153.629$, $p < 0.001$, $\eta^2 = 0.814$), indicating that approximately 81.4% of the variance in perceived susceptibility was attributable to the intervention (Table 4). This robust effect validates the efficacy of educational or behavioral programs in enhancing risk perception. These findings echo those of Zhu et al[16], who reported similar outcomes in China, where Health Belief Model-based interventions significantly improved perceived susceptibility to osteoporosis.

In the present study, a significant within-subjects effect in the intervention group ($F(2, 142) = 254.056$, $p<.001$, $\eta^2 = .782$), reflecting a substantial improvement in participants' perception of susceptibility over time (Table 5). No significant effect was detected in the control group ($p=.152$), reinforcing the notion that changes in perception were driven by the educational content. These results parallel findings by Tussing and Chapman-Novakofski[17], who found that theory-based osteoporosis education significantly improved perceived susceptibility and related beliefs in young adults.

This study showed that significant differences across all time points in the intervention group ($p<.001$), indicating progressive and sustained improvement in perceived susceptibility (Table 6). The mean difference from baseline to immediate post-test was −5.653, and from baseline to follow-up was −11.361, suggesting a cumulative intervention effect. Conversely, the control group showed no significant differences except between the second and third time points ($p = .001$), likely due to random variation rather than an intervention effect. These findings are in strong agreement with Abdul-Hameed and Mohammed[18], who reported notable improvements in students' knowledge and osteoporosis awareness following an instructional program. The gradual improvement observed here mirrors the cognitive shifts documented in their study and reinforces the utility of structured educational efforts grounded in theoretical models like the Health Belief Model. Finally, these findings align with Sedlak et al[19], who demonstrated that structured osteoporosis education significantly enhanced perceived susceptibility among college-aged women, with sustained effects during follow-up. The present study thus confirms the long-term value of model-based educational programs in reshaping health beliefs and fostering preventive behaviors related to osteoporosis.

Recommendations : Considering the study findings, it is recommended to integrate HBM-based educational interventions into national health promotion programs targeting middle-aged women, particularly schoolteachers, to improve their awareness and adoption of osteoporosis preventive behaviors. Continuous training workshops should be developed for healthcare professionals and educators to effectively implement behavioral change models in community settings.

CONCLUSION

The HBM-based intervention effectively enhanced perceived susceptibility to osteoporosis among female teachers, suggesting that targeted educational programs can play a pivotal role in promoting early preventive behaviours.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Zahraa Fadel Niji, Sarab Nasr Fadhil
Drafting or Revising Critically:	Zahraa Fadel Niji, Sarab Nasr Fadhil
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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