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EFFECTIVENESS OF HEALTH BELIEF MODEL BASED EDUCATIONAL INTERVENTION ON OSTEOPOROSIS HEALTH BELIEF SCALE AMONG FEMALE ACADEMICIAN IN MALAYSIA

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Abstract: **Worldwide the burden of osteoporosis is increasing as both prevalence and incidence of osteoporosis and its related fracture is increasing. Health Belief Model is appropriate as a conceptual model for prevention of disease behavior. The objective of this study was to develop and evaluate the effect of an educational intervention based on Health Belief Model regarding osteoporosis belief among female academician in Malaysia. A single blinded randomized controlled trial was conducted among 212 female academicians; intervention was conducted for 12 weeks; data was collected at baseline, immediately, one month and three months after intervention. Data was analyzed by Statistical Package for Social Sciences version 20. After intervention, from baseline to three months follow up there was a significant increase in the mean score of beliefs (215.2 - 225.1, p<0.001). Controlling for baseline socio-demographic data, the GLM model showed a significant difference between groups (F=8.403, p<0.001) and within groups for beliefs score (F=13.806, p<0.001).These results provided evidence for the effectiveness of an educational intervention in promoting osteoporosis knowledge which suggests that increase knowledge on osteoporosis can improve exercise and calcium intake even after three months of intervention, but policy should implement for long term intervention to sustain this effectiveness.**

Keywords: **Osteoporosis, Belief, Female, Health Belief Model, Malaysia.**

I. INTRODUCTION

Worldwide the burden of osteoporosis is increasing as both prevalence and incidence of osteoporosis and its related fracture is increasing. Due to its silent nature, osteoporosis is detected as an incidental diagnosis. Osteoporosis is undiagnosed until an accidental fall occurs. Regardless with gender, it affects both male and female, but female has higher incidence than male. According to the World Health Organization (2012)[1], osteoporosis is ranked second after cardiovascular disease. Osteoporosis increased with age, and differed by gender, race and also varies from country to country; the prevalence of osteoporosis in Malaysia was 24.1% but no update data is available yet [2].

The Health Belief Model was established as a framework for health screening and immunization[3]. Last few years HBM extended to use some diseases like osteoporosis [4-7]. The relationship among the constructs of Health Belief Model can applied to osteoporosis prevention. The perceived susceptibility and perceived severity of osteoporosis predict the perceived benefits of physical activity and calcium consumption to prevent osteoporosis. If perceived susceptibility and perceived severity of osteoporosis increase, then perceived benefits of physical activity and calcium consumption to prevent the osteoporosis will also increase. The perceived barriers and self-efficacy for physical activity and calcium

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consumption are inversely related. If perceived barriers to physical activity and calcium consumption decrease, then self-efficacy for physical activity and calcium consumption will increase. Therefore, osteoporosis prevention education would increase the perceived susceptibility, perceived severity, perceived benefits of physical activity and calcium consumption to prevent the disease.

The objective of this study was to develop and evaluate the effect of an educational intervention based on Health Belief Model regarding osteoporosis belief among female academician in a public university, Malaysia. The concept map for of development of educational booklet for osteoporosis is shown is Figure I below.

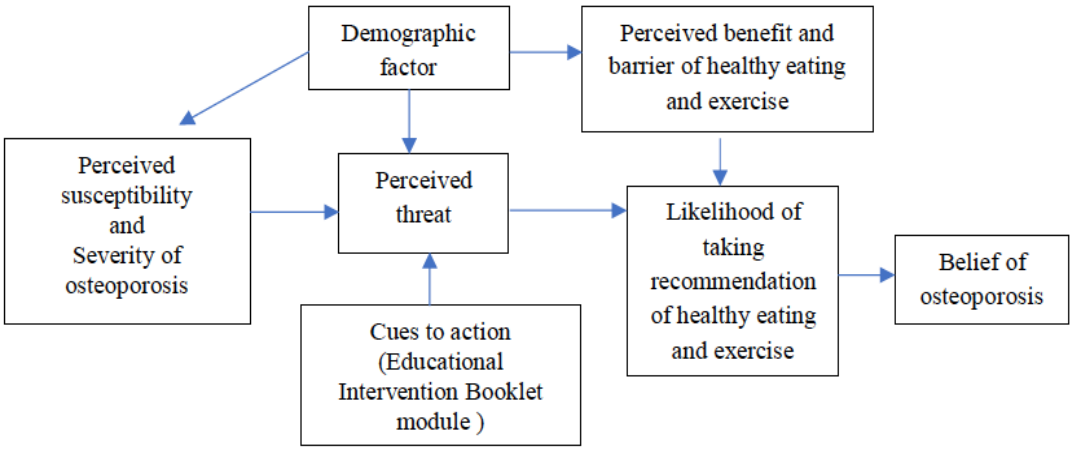

FIGURE I: CONCEPT MAP OF DEVELOPMENT OF EDUCATIONAL BOOKLET FOR OSTEOPOROSIS

II. METHODS AND MATERIALS

This study was single blinded randomized controlled trial. The study population was full time female academician (age 25-55 Years); invited to participate with informed consent form. A multi-stage random sampling was used; respondents of different faculties were randomized into intervention and control group; allocation concealment was implemented by sequentially numbered, opaque, sealed envelopes by the main researcher. Six hundred and twenty-four female academicians were screened at their respective faculties. Response rate was 91% at baseline. Finally, the number of participants during study period was 212 at baseline (114 in the intervention and 98 in the control), 201 immediately (108 in the intervention and 93 in the control), 193 at one month (103 in the intervention and 90 in the control) and 193 participants (103 in the intervention and 90 in the control group) who completed the three months post intervention assessment. Health Belief Model was used as theoretical framework.

A structured questionnaire on Osteoporosis Health Belief Scale (OHBS) was used for data collection (November 2016 – January 2017). The OHBS is a 42-item instrument consisting of seven subscales; susceptibility, severity, benefits to exercise, benefits to calcium intake, barriers to exercise, barriers to calcium intake, and health motivation; each consists of 6 items [8]. Pre-test was done to validate by factor analysis (Eigen value OHBS=4.09) and Cronbach's alpha coefficient (OHBS=0.91). Answers were coded by 5-point Likert scale from 'strongly agree' to 'strongly disagree'; scored by assigning '1' for 'strongly disagree' answers and '5' for 'strongly agree' answers. Possible scores for each subscale ranged from 6 to 30 with a low score indicating a low perception and a high score indicating a high perception.

An educational intervention of three months duration (12 weeks) was given with a follow up motivational sessions by telephone. The control group received the same educational intervention material after the completion of the study. To evaluate the effect of the intervention, data were collected at baseline, immediately, one month and three months after intervention for both groups. Data analysis was conducted using Statistical Package for Social Sciences (version 20). Descriptive and multivariate statistics (GLM) were used for analysing the data. In this study a per protocol analysis was done that included only those participants who completed the protocol for the intervention that they were originally allocated. This research project has been granted ethical approval from the Ethical Review Board of Universiti Putra Malaysia (UPM/TNCPI/RMC/1.4.18.2) and registered under Australia New Zealand clinical trial which is available in following link: http://www.anzctr.org.au/ACTRN 12616001699459.

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III. RESULTS

A. Participants' Belief on Osteoporosis at Baseline:

Table I describes the mean belief score of participants in the intervention and control groups for each category of belief measurement at baseline. There was a significant difference between intervention and control groups only for seriousness of osteoporosis (p = 0.014).

TABLE I: COMPARISON OF MEAN SCORES OF OSTEOPOROSIS BELIEF MEASUREMENT BETWEEN INTERVENTION AND CONTROL GROUPS AT BASELINE (N = 212)

Osteoporosis Belief category		Intervention (n=114) n (%)	Control (n=98) n (%)	t-value	p-value
Susceptibility	(mean ± SD)	11.22 ± 3.94	11.63± 3.99	1.028	0.305
	(min-max)	(5-18)	(5-20)		
Seriousness	(mean ± SD)	24.94±5.13	23.14±5.23	-2.476	0.014*
	(min-max)	(0-27)	(7-35)		
Benefits Exercise	(mean ± SD)	22.68±3.59	22.90±3.36	0.297	0.796
	(min-max)	(6-29)	(6-30)		
Benefits Calcium Intake	(mean ± SD)	16.04±2.45	15.79±2.32	-1.014	0.312
	(min-max)	(8-20)	(8-20)		
Barriers Exercise	(mean ± SD)	19.57±3.70	18.94±3.99	-1.414	0.159
	(min-max)	(11-30)	(6-30)		
Barriers Calcium Intake	(mean ± SD)	21.43±4.03	21.20±4.16	-0.229	0.819
	(min-max)	(6-30)	(9-30)		
Health Motivation	(mean ± SD)	14.83±2.84	15.15±2.72	0.923	0.357
	(min-max)	(6-19)	(6-20)		
Total belief	(mean ± SD)	218.04±16.18	215.18±19.41	-1.284	0.200
	(min-max)	(165-257)	(111-257)		
*Significant at level p<0.05					

B. Between- group Comparison on Belief at Immediately After Intervention:

Table II describes means score of participant's beliefs in the intervention and control groups immediately after intervention. The mean score of perceived susceptibility, perceived seriousness of osteoporosis and perceived benefits toward calcium intake was significant between intervention and control group. The intervention group had higher total beliefs score than control group and a significant difference was found between two groups (t = -5.443, p < 0.001).

TABLE II: COMPARISON OF MEAN SCORES OF OSTEOPOROSIS BELIEF MEASUREMENT BETWEEN INTERVENTION AND CONTROL GROUPS IMMEDIATELY AFTER INTERVENTION (N = 201)

Osteoporosis Belief category		Intervention (n=108) n (%)	Control (n=93) n (%)	t-value	p-value
Susceptibility	(mean ± SD)	13.45 ± 3.9	11.86 ± 3.91	-3.072	0.002*
	(min-max)	(5-24)	(5-20)		
Seriousness	(mean ± SD)	24.87±5.62	23.15±5.24	-2.408	0.017*
	(min-max)	(13-35)	(9-35)		
Benefits Exercise	(mean ± SD)	23.63±2.76	22.92±3.48	-1.730	0.085
	(min-max)	(12-30)	(6-30)		
Benefits Calcium Intake	(mean ± SD)	16.21±1.72	15.49±2.29	-2.691	0.008*
	(min-max)	(12-20)	(8-20)		
Barriers Exercise	(mean ± SD)	22.73±3.51	22.28±4.22	-0.872	0.384
	(min-max)	(12-30)	(6-29)		
Barriers Calcium Intake	(mean ± SD)	19.68±3.96	18.92±3.95	-1.474	0.142
	(min-max)	(10-26)	(12-30)		

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Health Motivation	(mean ± SD)	27.47±3.51	27.43±3.92	-0.080	0.936
	(min-max)	(20-35)	(7-35)		
Total belief	(mean ± SD)	228.63±16.65	215.66±19.46	-5.443	<0.001*
	(min-max)	(186-280)	(109-250)		
*Significant at level p<0.05					

C. Between- group Comparison on Belief at One Month After Intervention:

Table III demonstrates distribution and means score of participant's beliefs in the intervention and control groups at one month after intervention. The mean score of beliefs on susceptibility and seriousness of osteoporosis was significantly different between intervention and control group. The mean total beliefs score on osteoporosis was 225.45 (SD = 15.67) in the intervention group and 214.95 (SD = 19.50) in the control group at one month post intervention. The intervention group had higher score of total beliefs than control group and independent t-test showed a significant difference between the two groups (t = - 4.448, p < 0.001).

TABLE III: COMPARISON OF MEAN SCORES FOR BELIEF MEASUREMENTS BETWEEN INTERVENTION AND CONTROL GROUPS ONE MONTH AFTER INTERVENTION (N = 193)

Osteoporosis Belief category		Intervention (n=103) n (%)	Control (n=90) n (%)	t-value	p-value
Susceptibility	(mean ± SD)	13.27 ± 3.47	12.30 ± 3.73	-2.026	0.044*
	(min-max)	(5-24)	(5-20)		
Seriousness	(mean ± SD)	25.37±4.75	22.95±5.01	-3.721	<0.001*
	(min-max)	(13-35)	(9-35)		
Benefits Exercise	(mean ± SD)	22.97±2.78	22.82±3.18	-0.372	0.710
	(min-max)	(12-30)	(6-30)		
Benefits Calcium Intake	(mean ± SD)	15.75±1.81	15.34±2.15	-1.514	0.131
	(min-max)	(12-20)	(8-20)		
Barriers Exercise	(mean ± SD)	22.15±3.92	22.00±4.18	-0.287	0.774
	(min-max)	(12-30)	(6-29)		
Barriers Calcium Intake	(mean ± SD)	19.51±3.83	18.49±3.65	-2.011	0.082
	(min-max)	(10-26)	(12-30)		
Health Motivation	(mean ± SD)	27.10±3.43	27.30±4.00	0.401	0.689
	(min-max)	(20-35)	(7-35)		
Total belief	(mean ± SD)	225.45±15.78	214.96±19.50	-4.448	<0.001*
	(min-max)	(186-280)	(109-250)		
*Significant at level p<0.05					

D. Between- group Comparison on Belief at Three Months After Intervention:

Table IV describes means of participant's beliefs score in the control and intervention groups at three months after intervention. The mean perceived susceptibility and seriousness score of osteoporosis was significant between two study groups. The mean total beliefs score on osteoporosis was 225.06 (SD = 15.67) ranging from 186-280 in the intervention group and 215.12 (SD = 19.60) ranging between 109 - 250 in the control group at three months post intervention. The intervention group had higher score of total beliefs than control group and a significant difference was found between two groups (t = - 4.222, p < 0.001).

TABLE IV: COMPARISON OF MEAN SCORES FOR BELIEF MEASUREMENTS BETWEEN INTERVENTION AND CONTROL GROUPS THREE MONTHS AFTER INTERVENTION (N = 193)

Osteoporosis Belief category		Intervention (n=103) n (%)	Control (n=90) n (%)	t-value	p-value
Susceptibility	(mean ± SD)	13.27 ± 3.43	12.17 ± 3.71	-2.321	0.021*
	(min-max)	(5-24)	(5-20)		
Seriousness	(mean ± SD)	25.33±4.72	22.67±5.11	-4.070	<0.001*
	(min-max)	(13-35)	(9-35)		

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Benefits Exercise	(mean ± SD)	22.93±2.75	22.99±3.14	-0.130	0.896
	(min-max)	(12-30)	(6-30)		
Benefits Calcium Intake	(mean ± SD)	15.75±1.81	15.35±2.09	-1.519	0.130
	(min-max)	(12-20)	(8-20)		
Barriers Exercise	(mean ± SD)	22.15±3.92	22.05±4.28	-0.184	0.854
	(min-max)	(12-30)	(6-29)		
Barriers Calcium Intake	(mean ± SD)	19.46±3.80	18.62±3.52	-1.414	0.159
	(min-max)	(10-26)	(12-30)		
Health Motivation	(mean ± SD)	27.08±3.42	27.22±4.02	0.284	0.777
	(min-max)	(20-35)	(7-35)		
Total belief	(mean ± SD)	225.45±15.78	214.96±19.50	-4.222	<0.001*
	(min-max)	(186-280)	(109-250)		
*Significant at level p<0.05					

E. Within-Group Comparison of Belief on Osteoporosis:

Tables V shows the intervention group, the mean belief scores increased significantly on perceived susceptibility to osteoporosis whereas barriers of exercise decreased significantly after intervention. There was a significant increase in total beliefs towards osteoporosis (p<0.001). Table VI demonstrates in the control group, the benefits of calcium intake decreased (p = 0.011) significantly. Overall, the distribution of participants in the control group of beliefs towards osteoporosis showed no significant change after three months.

Overall, the results of this study showed the educational intervention had a positive effect in improving beliefs on susceptibility of osteoporosis and total beliefs towards osteoporosis and reduced barriers towards exercise; while it did not affect perceived health motivation, benefits and barriers of calcium intake.

TABLE V: WITHIN GROUP (INTERVENTION) COMPARISON OF BELIEFS AT BASELINE AND THREE MONTHS AFTER INTERVENTION (N = 103)

Osteoporosis Belief category	Pretest (mean ± SD) (min-max)	Post test (mean ± SD) (min-max)	Mean change	t-value	p-value
Susceptibility	11.22 ± 3.94	13.27 ± 3.43	+2.05	-5.104	<0.001*
	(5-18)	(5-24)			
Seriousness	24.94 ± 5.13	25.33 ± 4.72	+0.39	-0.702	0.484
	(7-35)	(13-35)			
Benefits Exercise	22.68 ± 3.69	22.93 ± 2.75	+0.25	-0.638	0.525
	(6-29)	(12-30)			
Benefits Calcium Intake	16.04 ± 2.45	15.75± 1.81	-0.29	1.195	0.234
	(8-20)	(12-20)			
Barriers Exercise	23.09 ± 3.07	22.15± 3.92	-0.94	2.133	0.035*
	(15-30)	(12-30)			
Barriers Calcium Intake	19.40 ± 3.61	19.46± 3.80	-0.06	-0.131	0.896
	(6-30)	(12-30)			
Health Motivation	27.33 ± 3.71	27.08 ± 3.42	-0.25	0.649	0.518
	(7-35)	(7-35)			
Total belief	218.04 ± 19.18	225.12 ± 15.67	+7.02	-3.902	<0.001*
	(111-257)	(109-250)			
*Significant at level p<0.05					

TABLE VI: WITHIN GROUP (CONTROL) COMPARISON OF BELIEFS AT BASELINE AND THREE MONTHS AFTER INTERVENTION (N = 90)

Osteoporosis belief category	Pretest (mean ± SD) (min-max)	Post test (mean ± SD) (min-max)	Mean change	t-value	p-value
Susceptibility	11.63 ± 3.99	12.17 ± 3.71	+0.54	-1.510	0.134
	(5-20)	(5-20)			

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Seriousness	23.14 ± 5.23	22.67 ± 5.11	-0.47	1.240	0.218
	(7-35)	(9-35)			
Benefits Exercise	22.90 ± 3.36	22.99 ± 3.14	-0.09	0.365	0.716
	(6-30)	(6-30)			
Benefits Calcium Intake	15.79 ± 2.32	15.35± 2.09	-0.44	2.580	0.011*
	(8-20)	(8-20)			
Barriers Exercise	22.41 ± 4.12	22.05± 4.28	-0.36	0.908	0.366
	(6-29)	(6-29)			
Barriers Calcium Intake	18.94 ± 4.02	18.62 ± 3.52	-0.32	-0.880	0.381
	(6-30)	(12-30)			
Health Motivation	27.17 ± 4.05	27.22 ± 4.02	+0.05	-0.216	0.830
	(7-35)	(7-35)			
Total belief	215.18 ± 19.41	215.12 ± 19.60	-0.06	0.242	0.809
	(111-257)	(109-250)			
*Significant at level p<0.05					

F. Between and within group's comparison of knowledge using GLM repeated measures:

The effect of intervention on changes on belief was further analysed by using the GLM repeated measures test to detect the differences in change within and between groups for continuous data and controlling for baseline socio-demographic data (. The results show a significant difference between groups ($F = 8.403$, $p < 0.001$) and within groups for beliefs score ($F = 13.806$, $p < 0.001$). Bonferroni adjusted alpha calculated based on alpha (0.05) divided by six pairs to test the null hypothesis (adjusted alpha = 0.008) time of intervention comparison in both intervention (Table VII) and control group (Table VIII) .

TABLE VII: COMPARISON OF CHANGE IN BELIEF SCORE WITHIN INTERVENTION GROUP USING GLM REPEATED MEASUREMENTS (N = 103)

Time (I)	Mean ± SD	Time (J)	Mean difference (J-I)	t-value	p-value
1	218.04±16.18	2	+10.59	-5.651	<0.001*
		3	+7.41	-4.112	<0.001*
		4	+7.02	-3.909	<0.001*
2	228.63±16.65	3	-3.18	2.514	0.013
		4	-3.57	2.821	0.006*
3	225.45±15.78	4	-0.39	3.323	<0.001*
4	225.06±15.47				
T1: Pretest, T2: Posttest, T3: One-month follow-up, T4: Three-month follow-up * Significant difference at level< 0.008					

TABLE VIII: COMPARISON OF CHANGE IN MEAN BELIEF SCORE WITHIN CONTROL GROUP USING GLM REPEATED MEASUREMENTS (N = 90)

Time (I)	Mean ± SD	Time (J)	Mean difference (J-I)	t-value	p-value
1	215.18±19.41	2	+0.48	-1.123	0.264
		3	-0.23	0.465	0.643
		4	-0.06	0.242	0.809
2	215.66±19.46	3	-0.71	1.127	0.262
		4	-0.54	0.709	0.480
3	214.95±19.50	4	+0.17	0.269	0.789
4	215.12±19.60				
T1: Pretest, T2: Posttest, T3: One-month follow-up, T4: Three-month follow-up * Significant difference at level< 0.008					

IV. DISCUSSION

In this current study, participants in intervention group perceived a low susceptibility to osteoporosis at baseline and after intervention it was significant (p<0.001). But among the control group, susceptibility to osteoporosis was not statistically significant (p<0.134). It is possible that due to the lack of knowledge regarding osteoporosis, they perceived low susceptibility to osteoporosis. In addition, considering the low personal and family history of osteoporosis, it was expected that our study respondents did not perceive themselves to be at risk. Another possible explanation for low perceived osteoporosis susceptibility could be the absence of any physical symptoms of osteoporosis. It has been postulated that most individuals do not perceive themselves to be at risk of a disease until they begin to experience physical symptoms [9] . As osteoporosis is a 'silent disease' and the prevalence of osteoporosis is much higher after menopause [10] it is not surprising that most of these participants did not perceive they were at risk.

Ghaffari et al. (2012) [11] conducted a study in Iran to determine the effect of Health Belief Model based intervention on promoting nutritional behaviours about preventive osteoporosis among women which showed a significant increase in the mean score of perceived susceptibility, seriousness, benefits, barriers among women in the experimental group; immediately before, immediately after, and 2 months after the intervention ($p < 0.001$) which is consistent with our findings.

In this current study, perceived benefit for exercise was not significant for both groups at baseline and after intervention. Therefore, factors such as cultural on perceived benefit for exercise regarding osteoporosis and availability of screening services may be a salient factor operating to influence women behaviours that may not be detected by the health beliefs model.

Regarding perceived exercise barriers reported by Malak & Toama, (2015), [12] before program most teachers in both groups belonged to a medium level of barriers with about one third of the teachers in the control and the intervention groups agreeing regarding this subscale, which similar to a previous study that indicated few women perceived barriers to exercise participation [13]. The same findings were reported by Hazavehei et al. (2007) [4] and Franko et. al., (2008) [14]. But unfortunately, the current study no significant differences observed before and after the educational intervention among the both groups regarding perceived exercise barriers.

Overall, health education programs based on Health Belief Model increased the variables that could encourage people to engage in osteoporosis preventive measures. The majority of the intervention group had high feelings of susceptibility and seriousness towards development of osteoporosis and in the view of the benefits of exercise and calcium intake, the barriers of exercise and calcium intake after educational program. On a more positive note, these women were highly health motivated. Prevention is better than cure. Thus, it is important for osteoporosis prevention programs to educate women to prevent this chronic disease.

V. CONCLUSION

In this current study, Health Belief Model was used as a theoretical framework for educational intervention among the female academicians to assess belief regarding osteoporosis. This framework was used to comprehend the health behaviour for the purpose of recommended health action at individual level which may applicable in a community aspect for preventive action for osteoporosis.

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