
PUBLIC HEALTH RESEARCH

The Osteoporosis Knowledge, Belief and Calcium Intake Behaviour among Students in a Medical Sciences University

Wan Ling Chiang¹ and Mohammad Husni Ahmad Jamal²

¹Centre for Research and Graduate Studies, Cyberjaya University College of Medical Sciences, Selangor.

²Faculty of Medicine, Cyberjaya University College of Medical Sciences, Selangor.

*For reprint and all correspondence: Mohammad Husni Ahmad Jamal, Faculty of Medicine, Cyberjaya University College of Medical Sciences, Perstarian Bestari, Cyber 11, 63000 Cyberjaya, Selangor Darul Ehsan, Malaysia.

Email: husni@cybermed.edu.my

ABSTRACT

Received	12 April 2019
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Introduction	This study determines the association between osteoporosis knowledge, health belief and calcium intake behaviour among students in a medical sciences university.
Methods	This study was conducted using cross sectional design. Malaysian students, aged 18 to 40 were selected using stratified randomisation method. The osteoporosis knowledge, health belief and calcium intake behaviour of participants were obtained through a validated questionnaire.
Results	The response rate of the study was 93.0% (n=333). More than 80% of participants had been exposed to information related to osteoporosis knowledge and calcium-rich foods. The mean score of osteoporosis knowledge test (OKT)= 50.4±6.48, perceived susceptibility= 14.2±4.02, perceived seriousness= 20.4±4.67, perceived benefits of calcium= 23.1±3.94, perceived barriers to calcium= 14.4±3.99 and health motivation= 21.6±3.79. Only 37.8% of participants consumed adequate dairy products. There were significant correlations between OKT and perceived benefits of calcium (r=0.127, p=0.020), perceived barriers to calcium (r=-0.208, p<0.001) and health motivation (r=0.173, p=0.002). Perceived seriousness to osteoporosis, health motivation and OKT significantly predicted intake of dairy products (p<0.001).
Conclusions	The osteoporosis knowledge was moderate, health belief was moderate and consumption of dairy products was low. The osteoporosis knowledge and health belief were correlated but not the behaviour of dairy products consumption. Young adults had moderate osteoporosis knowledge and consumption of dairy products was low. Future educational programme should focus on osteoporosis knowledge, health belief as well as determining factors that influence behaviour of consumption of dairy products.
Keywords	Osteoporosis knowledge - Osteoporosis health belief - Consumption of dairy products - Young adults.

INTRODUCTION

Osteoporosis is defined as “a progressive systemic skeletal disease characterised by low bone mass and micro- architectural deterioration of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture”.¹ It occurs when bone resorption outpaces bone formation. The threshold values for osteoporosis and the reference measurement is derived from bone density measurements in a population of healthy young adults (called a T-score), where a T-score ≤ -2.5 is classified as osteoporosis.¹

Osteoporosis is a global concern with an estimated 9 million new osteoporotic fractures worldwide in 2000.² Study estimated that an osteoporotic fracture occurs every 3 seconds, causing more than 8.9 million fractures annually.² The prevalence of osteoporosis in Malaysia was reported as 24.1% in 2005, predominantly affecting the hip.³ Osteoporosis is an increasingly important health problem with significant impact on morbidity, mortality, quality of life as well as cost. The overall cost spent in osteoporotic patients is rising. In South Korea, the direct and indirect medical costs for the osteoporotic fractures accelerated from USD \$8.8 million in 2007 to USD \$149.3 million in 2011.⁴ In 1997, the direct hospitalisation cost for hip fractures in 1997 was estimated at RM22 million in Malaysia, not taking into account the costs incurred in rehabilitation and long-term nursing care.⁵ Without appropriate intervention to reduce the incidence of fractures, this cost will rise and will have a significant impact on the healthcare financing system.

Nutrition and exercise play an important role in preventing osteoporosis and falls. A healthy

balanced diet, as well as adequate calcium are important for bone health. The recommended calcium intake for Malaysian adults is 1000mg/day.⁶ The Malaysian Adult Nutrition Survey reported that the median intake of calcium among Malaysians was only 353mg (men 374mg; women 333mg).⁷ The insufficient of calcium intake may be due to cultural or dietary habits, lactose intolerance and lack of knowledge about calcium-rich food source.⁸

The lack of osteoporosis knowledge may be one of the reasons for insufficient calcium intake in Malaysian adults. Research should focus on intervention programmes that increase the knowledge of osteoporosis. However, knowledge does not guarantee practical implementation of positive behavioural changes. The health belief would strengthen the will of individual to practically implement knowledge into positive behavioural changes. Studies should also focus on young adults since the key factor to prevent osteoporosis is to optimise the peak bone mass during the early years. Therefore, osteoporosis studies should focus on the association between osteoporosis knowledge, health belief and calcium intake behaviour in Malaysian young adults to provide information for the development of health programmes.

The purpose of this study was to determine the influence of demographic characteristics on knowledge, health belief and calcium intake behaviour (consumption of dairy products), to examine the association between osteoporosis knowledge, health belief and calcium intake behaviour (consumption of dairy products), as well as to predict the consumption of dairy products based on demographic characteristics, OKT and OHBS. The conceptual framework is shown in Figure 1.

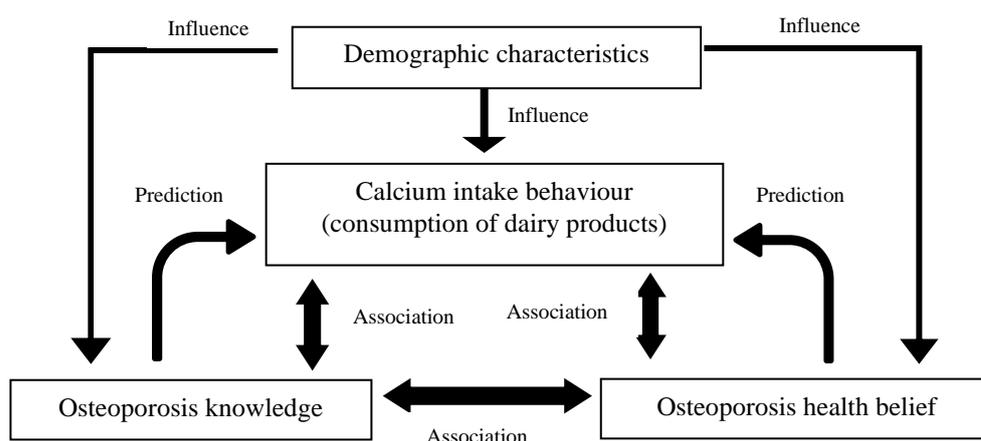


Figure 1 Conceptual framework on the association between knowledge, health belief and calcium intake behaviour and the demographic characteristics

METHODS

The study was conducted in Cyberjaya University College of Medical Sciences (CUCMS) using cross-

sectional design. The target population was 2238 of Malaysian students. The participants were Malaysian students, aged between 18 to 40 of all

courses. Non-Malaysian students and students aged below 18 or above 40 were not included in the study. The sample size of the study was calculated using $z\text{-score}=1.96$ for 95% confidence interval, 5% margin of error and 50% prevalence. After taking into account the study population (<10000) and problem of drop out, the sample size of the study was 358.

Printed survey form including consent form, personal information sheet and three questionnaires (Osteoporosis Knowledge Test, Osteoporosis Health Belief Scale and Osteoporosis Preventing Behaviour Survey) was used in the study. This study selected 16 questions from the original OKT, where the first 8 question focused on the risk factors of osteoporosis and another 8 questions focused on nutrition. All OKT questions had only one correct answer. Answer with "don't know" was incorrect. The answers of all 16 questions were coded as 0=incorrect and 1=correct, with possible range of scores from 0 to 16. The total score of OKT of each participant was calculated and classified as low, moderate or high score. Thirty questions were adapted from the original OHBS and were divided into 5 subscales, which were perceived susceptibility to osteoporosis, perceived seriousness of osteoporosis, benefits of calcium intake, barriers to calcium intake and health motivation. The OHBS in this study used a 5-point Likert scale (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree) for its rating, with possible range of score for each subscale was 6 to 30 and a possible total score range from 30 to 150. Subscale with a total score of 6-13 was classified as low, 14-21 was classified as moderate and 22-30 was classified as high. Four questions related to dietary calcium intake were selected from the original OPBS. Answers in question 1 to 3 were rated by using 0=none per week, 1=one per week, 2=two per week, 3=three per week, 4=four per week, 5=five per week, 6=six per week, 7=one per day, 14=two per day and 21=three per day, with possible score range 0-63. The rating was modified based on the Malaysia guidelines, where it recommended one to three servings of dairy products daily for adults⁹. A total score of 7 and above was interpreted as having adequate intake and less than 7 as inadequate intakes. Answers in question 4 were rated as 0=no and 1=yes.

Pilot testing was performed prior to the actual study to test the research procedure and to identify potential problem. Based on the feedback from the pilot testing, the research procedure was appropriate and data analysed was acceptable. Therefore, the research procedure was maintained for the actual study. Validation of questionnaire was performed. Face validity was performed for OKT, OHBS and OPBS. Test-retest reliability of the OKT and OHBS was done using intraclass correlation coefficient (ICC). The construct validity was performed on OHBS. The within scale (internal

consistency) reliability of the OHBS was evaluated using Cronbach's alpha.

Data was analysed using IBM Statistic package for Social Science (SPSS) version 24. All variables were tested for normality using Kolmogorov-Smirnov test. Demographic characteristics were described in the form of descriptive statistic. Parametric test (Independent t-test or one-way analysis of variance (ANOVA) test) or non-parametric test (Mann-Whitney U test and Kruskal Wallis test) were used. Correlations were used to determine the degree of relationship between variables. Multiple linear regression analysis was used to predict the consumption of dairy products.

Ethical approval of this study was obtained from CUCMS Research Ethics Review Committee (CRERC). Written consent was obtained from all participants prior to completion of survey form. All information was kept confidential.

RESULTS

Validation of questionnaires

The preliminary evidences for content validity of OKT^{10,11,12} and OHBS¹³ have been established. Therefore, content validity of OKT and OHBS were not measured in this study. Face validity of OKT, OHBS and OPBS showed that the questionnaires were clear and easy to understand. Therefore, no amendment was made.

Test-retest reliability of OKT showed that the ICC was significant and the strength was good ($r=0.769$, $p<0.001$). Meanwhile, the ICC for perceived susceptibility to osteoporosis ($r=0.802$, $p<0.001$), perceived seriousness to osteoporosis ($r=0.794$, $p<0.001$) and health motivation ($r=0.828$, $p<0.001$) were significant and the strength were good. The ICC for perceived benefits of calcium ($r=0.539$, $p=0.015$) and perceived barriers to calcium ($r=0.734$, $p<0.001$) were significant but strength were moderate.

Construct validity was performed to determine validity of OHBS. Results showed that Kaiser-Meyer-Olkin (KMO) value was 0.743 and value for Bartlett's Test of Sphericity was significant ($p<0.001$), indicating the adequacy of data for factor analysis. Exploratory factor analysis (EFA) was performed to identify the factor model. The analysis yielded 5 factors, with eigenvalues greater than 1.0 and was confirmed with parallel analysis. Varimax rotation was performed where items loading less than 0.40 were eliminated.

The within scale (internal consistency) reliability of the OHBS was evaluated using Cronbach's alpha (α). Subscales that had good strengths were perceived susceptibility to osteoporosis ($\alpha=0.819$), perceived seriousness to osteoporosis ($\alpha=0.827$) and perceived benefits of calcium ($\alpha=0.812$). The strengths for perceived barriers to calcium ($\alpha=0.766$) and health motivation ($\alpha=0.792$) were acceptable.

Osteoporosis knowledge, belief and behaviour

Demographic data

The response rate of the study was 93.0% (n=333). All questionnaires obtained were included in this study. This study included 95 male and 238 female

participants, aged between 18 to 40 of all courses in 2018. The mean age of participants was 21 years old. Demographic characteristics of this study is shown in Table 1.

Table 1 Frequency of demographic characteristics

Demographic characteristics	Frequency	%
Gender		
Male	95	28.5
Female	238	71.5
Age		
18-20	176	53.2
21-30	155	46.8
Ethnicity		
Malay	214	64.3
Chinese	48	14.4
India	52	15.6
Others	19	5.7
Education		
Medicine	87	26.1
Homeopathic medical science	10	3.0
Pharmacy	51	15.3
Psychology	66	19.8
Allied health	64	19.2
Others	55	16.5
Personal history of osteoporosis/hip fracture		
Yes	4	1.2
No	329	98.8
Family history of osteoporosis/hip fracture		
Yes	25	7.5
No	308	92.5
Exposure to information related to osteoporosis knowledge		
Yes	288	86.5
No	45	13.5
Exposure to information related to calcium-rich foods		
Yes	293	88.0
No	40	12.0

The most popular sources of information related to osteoporosis knowledge and calcium-rich foods was internet website. A total of 86.5% of participants (n=288) had been exposed to information related to osteoporosis knowledge. All participants of Bachelor of Homeopathic Medical Science (BHMS) (n=10) and pharmacy courses (n=51) had been exposed to information related to osteoporosis knowledge, followed by MBBS students (94.3%). A total of 88.0% of participants (n=293) had been exposed to information related to calcium-rich foods. All BHMS students (n=10) had been exposed to information related to calcium-rich foods, followed by MBBS students (94.3%) and pharmacy students (92.9%).

Data distribution

Parametric tests were used to determine the association between demographic characteristics and OKT score and OHBS subscales even though p-value showed that more than 50% of data were not

normally distributed ($p < 0.05$). This is because most of the z-value for skewness and kurtosis were within the range of -1.96 to 1.96. Moreover, the sample size of the study was large and histograms, normal Q-Q plots and box plots showed that data were approximately normally distributed. Meanwhile, non-parametric tests were used for the association between demographic characteristics and OPBS because p-value of all data were not normally distributed ($p < 0.05$), histograms, normal Q-Q plots and box plots showed that data were not normally distributed, all histograms were skewed to right and more than 85% of z-value for skewness and kurtosis of OPBS were not within the range of -1.96 to 1.96.

Demographic characteristics and OKT

The mean score of osteoporosis knowledge test (OKT) was 50.4 ± 16.48 (mean \pm SD) out of 100. About 55.9% of participants had moderate score (50-79%), 39.6% had low score (0-49%) and only 4.5% had high score (80-100%). The association

between demographic characteristics and OKT score is shown in Table 2.

Table 2 Association between demographic characteristics and OKT score

Demographics	N	Mean score (SD)	P-value
Gender			
Male	95	8.2 (2.52)	0.478
Female	238	8.0 (2.68)	
Age			
18-20	176	7.4 (2.59)	<0.001**
21-30	155	8.8 (2.50)	
Ethnicity			
Malay	214	8.2 (2.64)	0.162
Chinese	48	7.8 (2.35)	
Indian	52	8.3 (2.67)	
Others	19	6.8 (2.97)	
Education			
MBBS	87	9.2 (2.68)	<0.001**
BHMS	10	9.6 (2.46)	
Pharmacy	51	9.0 (2.09)	
Psychology	66	6.7 (2.65)	
Allied health	64	7.6 (2.18)	
Others	55	7.4 (2.44)	
Personal history of osteoporosis/hip fracture			
Yes	4	7.5 (2.08)	0.665
No	329	8.1 (2.64)	
Family history of osteoporosis/hip fracture			
Yes	25	8.6 (2.14)	0.261
No	308	8.0 (2.67)	
Exposure to information related to osteoporosis knowledge			
Yes	288	8.4 (2.47)	<0.001**
No	45	5.9 (2.69)	
Exposure to information related to calcium-rich foods			
Yes			
No	293	8.2 (2.56)	0.013*
	40	7.1 (2.98)	

** Significant at the 0.01 level (2-tailed). * Significant at the 0.05 level (2-tailed).

Demographic characteristics and OHBS
OHBS subscale with a total score of 6.0 to 13.9 is classified as low, 14.0 to 21.9 is classified as moderate and 22.0 to 30.0 is classified as high. Overall, participants in this study had moderate perceived susceptibility (14.2±4.02), moderate

perceived seriousness (20.4±4.67), moderate perceived barriers to calcium (14.4±3.99), moderate health motivation (21.6±3.79) and high perceived benefits of calcium (23.1±3.94). The association between demographic characteristics and OHBS subscales is shown in Table 3.

Table 3 Association between demographic characteristics and OHBS score

Demographics	Perceived susceptibility		Perceived seriousness		Benefits of calcium		Barriers to calcium		Health motivation	
	Mean (SD)	p-value	Mean (SD)	p-value	Mean (SD)	p-value	Mean (SD)	p-value	Mean (SD)	p-value
Gender										
Male	14.1 (4.20)	0.845	20.3 (5.44)	0.875	22.7 (4.16)	0.321	14.3 (3.69)	0.754	21.7 (3.71)	0.771
Female	14.22 (3.95)		20.4 (4.34)		23.2 (3.85)		14.5 (4.11)		21.6 (3.82)	
Age										
18-20	14.1 (3.94)	0.805	20.5 (4.55)	0.655	22.9 (3.73)	0.495	14.8 (4.01)	0.069	21.1 (3.82)	0.011*
21-30										

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	14.2 (4.09)		20.3 (4.85)		23.2 (4.20)		14.0 (3.96)		22.2 (3.69)	
Ethnicity										
Malay	14.6 (3.85)	0.008**	21.2 (4.00)	<0.001**	23.1 (3.64)	0.319	14.4 (3.70)	0.437	21.9 (3.70)	0.031*
Chinese	14.2 (3.70)		18.9 (5.04)		22.8 (3.14)		15.09 (3.83)		21.7 (2.71)	
Indian	12.5 (4.15)		18.5 (5.37)		23.4 (4.74)		13.9 (4.90)		21.6 (3.80)	
Others	14.4 (5.19)		20.9 (6.45)		21.6 (6.06)		15.00 (4.75)		19.2 (5.96)	
Education										
MBBS	13.9 (4.11)	0.702	19.4 (4.57)	0.036*	22.7 (4.05)	0.278	14.0 (3.84)	0.007**	22.2 (4.21)	0.015*
BHMS	12.6 (3.31)		18.5 (3.38)		24.3 (3.95)		10.8 (2.74)		21.2 (2.90)	
Pharmacy	14.0 (4.34)		20.5 (4.73)		24.1 (3.97)		13.8 (4.21)		22.6 (2.71)	
Psychology	14.3 (3.83)		21.9 (4.15)		22.7 (4.32)		15.5 (4.42)		20.4 (4.42)	
Allied health	14.3 (3.80)		20.4 (5.10)		22.8 (3.78)		14.6 (3.74)		21.9 (2.95)	
Others	14.7 (4.19)		20.4 (4.74)		23.2 (3.36)		14.9 (4.05)		21.1 (3.79)	
Personal history of osteoporosis/hip fracture										
Yes	20.0 (4.39)	0.004**	22.3 (5.85)	0.427	20.5 (1.73)	0.194	20.0 (4.69)	0.005**	20.3 (4.5)	0.465
No	14.1 (3.97)		20.4 (4.66)		23.1 (3.95)		14.4 (3.94)		21.6 (3.78)	
Family history of osteoporosis/hip fracture										
Yes	16.1 (3.77)	0.013*	19.0 (4.99)	0.130	22.3 (4.71)	0.339	13.9 (3.15)	0.470	21.0 (3.67)	0.390
No	14.0 (4.00)		20.5 (4.64)		23.1 (3.87)		14.5 (4.05)		21.7 (3.79)	
Exposure to information related to osteoporosis knowledge										
Yes	14.2 (3.97)	0.847	20.5 (4.51)	0.205	23.3 (3.89)	<0.001**	14.3 (3.88)	0.026*	21.9 (3.60)	0.002**
No	14.1 (4.37)		19.6 (5.59)		21.3 (3.85)		15.7 (4.50)		20.0 (4.53)	
Exposure to information related to calcium-rich foods										
Yes	13.9 (4.03)	0.011*	20.4 (4.76)	0.693	23.2 (4.05)	0.137	14.3 (3.98)	0.021*	21.7 (3.78)	0.157
No	15.7 (3.64)		20.7 (4.02)		22.2 (2.89)		15.8 (3.82)		20.8 (3.76)	

** Significant at the 0.01 level (2-tailed). * Significant at the 0.05 level (2-tailed).

Demographic characteristics and OPBS

Overall, more than 200 participants (61.5%) consume inadequate dairy products. About 18.7% of participants did not drink milk and only about 12% of them took milk at least once a day. About 42.3% of participants did not consume yogurt and 34.4% of participants did not take cheese. Majority of

participants (95.5%) did not take calcium supplement. This study found that there was no statistically significant differences between all demographic characteristics and consumption of dairy products score. Table 4 shows the comparison of demographic characteristics and intake of dairy products.

Table 4 Comparison of demographic characteristics and OPBS

Demographics	N	Median (Min-Max)	Z	P-value
Gender				
Male	95	0.7 (0.0-4.4)	-0.858	0.391
Female	236	0.7 (0.0-5.0)		

Age				
18-20	174	0.7 (0.0-5.0)	-0.108	0.742
21-30	155	0.7 (0.0-4.4)	(1.0)*	
Ethnicity				
Malay	212	0.7 (0.0-4.3)	-4.691	0.196
Chinese	48	0.6 (0.0-5.0)	(3.0)*	
Indian	52	0.8 (0.0-5.0)		
Others	19	1.1 (0.0-3.6)		
Education				
Medicine	87	0.7 (0.0-4.3)	-4.134	0.530
Homeopathic medicine	10	0.7 (0.0-2.0)	(5.0)*	
Pharmacy	51	0.6 (0.0-4.4)		
Psychology	65	0.7 (0.0-5.0)		
Allied health	64	0.9 (0.0-3.6)		
Others	54	0.6 (0.0-5.0)		
Personal history of osteoporosis/hip fracture				
Yes	4	0.7 (0.0-1.1)	-0.401	0.689
No	327	0.7 (0.0-5.0)		
Family history of osteoporosis/hip fracture				
Yes	25	0.6 (0.0-3.1)	-0.321	0.749
No	306	0.7 (0.0-5.0)		
Exposure to information related to osteoporosis knowledge				
Yes	287	0.7 (0.0-5.0)	-0.374	0.708
No	44	0.7 (0.0-4.3)		
Exposure to information related to calcium-rich foods				
Yes	293	0.7 (0.0-5.0)	-0.112	0.911
No	38	0.6 (0.0-4.4)		

* *Chi-Square (df)*.

Correlations between age, OKT, OHBS and OPBS (Consumption of dairy products)

Table 5 represents the correlation between age, OKT, OHBS, calcium intake behaviour

(consumption of dairy products) and calcium supplement. Figure 2 shows positive correlation between age, OKT and OHBS. Figure 3 shows negative correlation between age, OKT and OHBS.

Table 5 Correlation between age, OKT, OHBS, behaviour of calcium intake (consumption of dairy products) and calcium supplement

	Perceived susceptibility		Perceived seriousness		Benefits of Ca intake		Barriers to Ca intake		Health motivation		OKT score		Ca intake behavior		Ca supplement	
	r	p-value	r	p-value	r	p-value	r	p-value	r	p-value	r	p-value	r	p-value	r	p-value
Perceived susceptibility	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perceived seriousness	0.175	<0.001**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benefits of Ca intake	-0.095	0.084	0.317	<0.001**	-	-	-	-	-	-	-	-	-	-	-	-
Barriers to Ca intake	0.212	<0.001**	0.182	<0.001**	-0.036	0.517	-	-	-	-	-	-	-	-	-	-
Health motivation	-0.150	0.006**	0.169	0.002**	0.290	<0.001**	-0.110	0.047*	-	-	-	-	-	-	-	-
OKT score	-0.039	0.483	0.048	0.381	0.127	0.020*	-0.208	<0.001**	0.173	0.002**	-	-	-	-	-	-
Ca intake behavior	0.008	0.887	0.056	0.307	0.006	0.916	0.029	0.596	-0.009	0.864	-0.020	0.710	-	-	-	-
Ca supplement	0.040	0.466	-0.058	0.293	-0.050	0.361	-0.060	0.278	0.098	0.076	0.038	0.487	0.043	0.436	-	-
Age	0.013	0.812	-0.016	0.772	0.003	0.955	-0.120	0.030*	0.149	0.007*	0.355	<0.001**	-0.076	0.166	-0.007	0.894

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

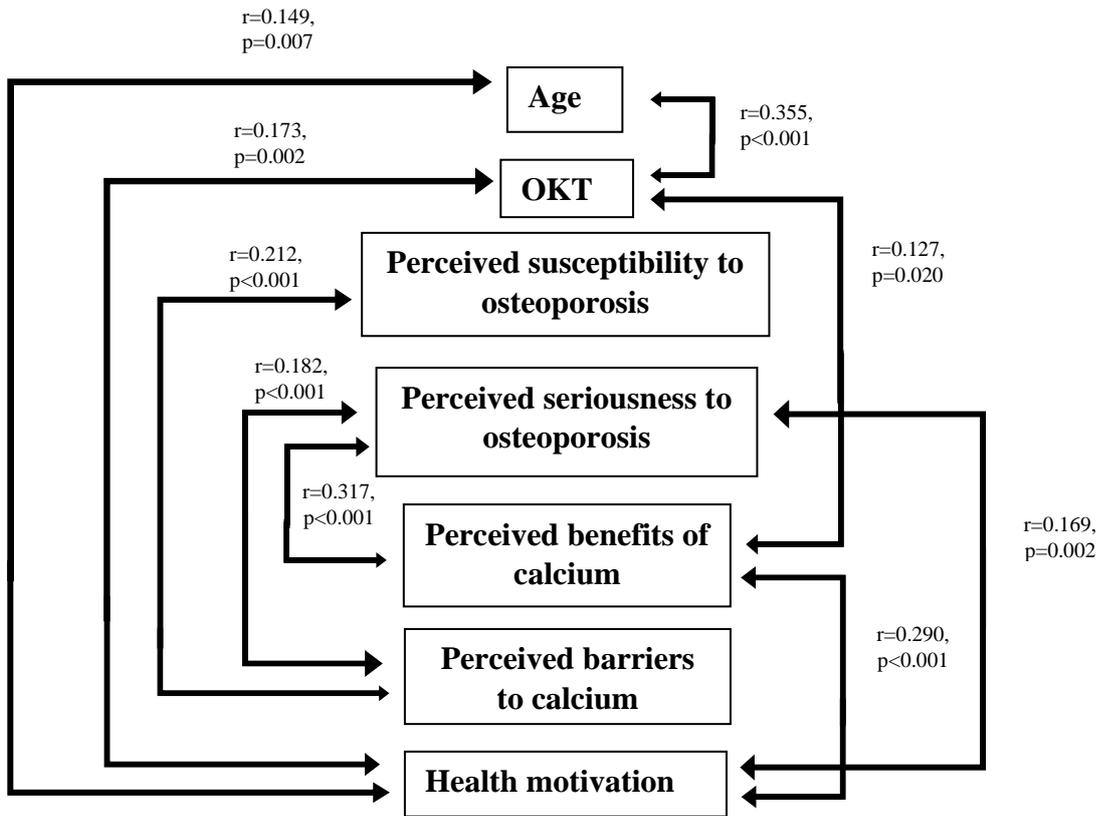


Figure 2 Positive correlation between age, OKT and OHBS

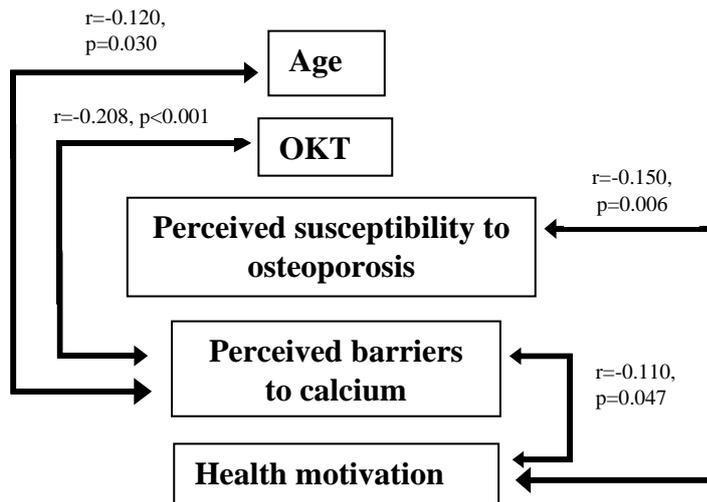


Figure 3 Negative correlation between age, OKT and OHBS

Prediction of dairy products
 Three predictors (OKT, perceived seriousness to osteoporosis and health motivation) significantly predicted intake of dairy products ($p<0.001$). The

total variance described by the model was 6.0%, $p<0.001$. Table 6 represents the variables that predicted the intake of dairy products.

Table 6 Summary of multiple linear regression analysis for variables predicting intake of dairy products

Variable	B	Standard error B	Beta
OKT	-0.058	0.018	-0.175*
Perceived seriousness to osteoporosis	-0.023	0.010	-0.122*
Health motivation	0.039	0.013	0.171*

Note. *R square* = 0.060, **p*<0.001.

DISCUSSION

Participants characteristics

In this study, more than 70% of the participants were female, similar to a local study where 77.4% of participants was female.¹⁴ The majority of the participants (53.2%) aged between 18 to 20, similar to other studies.^{14,15,16} This is because majority of participants were undergraduate students and only a small number of participants were postgraduate students. More than 80% of participants disclosed that they had been exposed to information related to osteoporosis knowledge and calcium-rich foods, mainly from internet website. This indicates that most of the young adults have internet access and internet website is a common source for information searching.

Osteoporosis knowledge

About 55.9% of the participants in this study had moderate OKT score. This is because 12.0 to 13.5% of the participants had not been exposed to information related to osteoporosis and calcium-rich foods. Only about half of the participants (39.6-50.2%) reported that they obtained the information related to osteoporosis and calcium-rich foods from academic courses. Some courses such as psychology courses do not include osteoporosis and calcium-rich foods in its syllabus because it is not part of their course structures. Meanwhile, some courses only cover the topic of osteoporosis at the later semester. For example, MBBS students who were in first semester reported that they had not been taught about osteoporosis and calcium-rich foods in university. Even though internet website is the most popular source of information, with more than 60% of the participants obtained their information from the internet website, not all information from the internet website is accurate and therefore may provide deceiving information related to osteoporosis and calcium-rich foods.

This study reported that senior students scored better in osteoporosis knowledge compared to junior students. This may be because the topic of osteoporosis is not included in the early semester of certain courses such as MBBS. Moreover, topic of osteoporosis is not part of the course structures for foundation and diploma courses. Therefore, junior students had lower OKT score compared to senior students.

Education group was also significantly associated with OKT score in this study, similar to findings from another study.¹¹ In current study, BHMS students had the highest OKT score, followed by MBBS students and pharmacy students. A local study found that students from Kulliyyah of Allied Health Sciences had highest score of osteoporosis knowledge, followed by students from Kulliyyah of Medicine and Kulliyyah of Pharmacy but no significant difference was observed among these three groups.¹⁷

In this study, participants who had been exposed to information related to osteoporosis knowledge and calcium-rich foods had higher scores, in line with findings from another study.¹⁸

Findings from current study also showed that individuals with better osteoporosis knowledge recognised the benefits of having adequate calcium to prevent osteoporosis and were more motivated to overcome the barriers to calcium as well as to make positive behavioural changes.

In summary, findings from current study showed that various sources affect the osteoporosis knowledge of young adults. Examples of sources are internet website, curriculum studies, health professionals and family members. Since majority of the young adults are accessible to internet, information related to osteoporosis can be posted in internet website as part of the health campaigns to increase the awareness of osteoporosis. Current study also reported that osteoporosis knowledge influences health belief and motivation of young adults. This reflects the importance of developing educational programmes to increase the knowledge of osteoporosis as the initial stage to encourage positive behavioural changes in young adults.

Osteoporosis health belief

Overall, participants in this study thought that they were moderately susceptible to osteoporosis and the seriousness of osteoporosis was moderate. This may be because young adults thought that osteoporosis is a disease that mainly affects women age over seventy years.¹⁹ Moreover, individuals do not perceive themselves to be at risk of a disease until they begin to experience physical symptoms.²⁰ One study reported that more than half of the participants thought that osteoporosis is a curable disease and hence lowered their perceived seriousness to osteoporosis.²¹ The perception of benefits of

calcium intake of participants was high. This may be because most of them had been exposed to information related to osteoporosis and calcium-rich foods and were aware of the benefits of calcium. Besides, participants in this study had moderate perceived barriers to calcium intake and moderate health motivation. This may be due to factors such as difficulty in accessing calcium-rich foods that prevent them from consuming calcium regularly and therefore are not highly motivated to make behavioural changes. A study discovered that barriers to meet the recommended dietary calcium for young Canadian adults were high cost, inconvenient packaging of milk products and use of hormones by dairy farmers to encourage milk production.²²

This study found that participants' health motivation is influenced by their health belief. For example, participants who perceived themselves to be more susceptible to osteoporosis were more likely to perceive osteoporosis as a serious disease, thought that it was difficult to obtain adequate calcium and were less motivated to make behavioural changes. Study also discovered that participants who were more likely to perceive osteoporosis as a serious disease had higher perceived benefits calcium intake and were more motivated to make health behavioural changes even though they also had higher perceived barriers to calcium intake. Current study revealed that participants who had higher perceived barriers to calcium intake had lower health motivation to make any positive behavioural changes. On the other hand, individuals with higher perceived benefits of calcium intake were more motivated to make positive health behavioural changes.

This study reported that the older the individuals, the lower their perceived barriers to calcium intake and higher health motivation compared to younger individuals. This may be because senior students in this study have better osteoporosis knowledge compare to the junior students. Therefore, they have better knowledge in resolving the difficulties when consuming calcium-rich foods and are more confident and motivated to make positive behavioural changes. This is inconsistent with other studies that reported older adults had greater barriers to calcium intake when compared to younger adults (≤ 45 years old).^{23,24} This difference may be because in current study all participants were young adults.

Participants with personal or family history of osteoporosis/ hip fractures thought that they were more susceptible to osteoporosis, which was in line with findings of other studies.^{25,26} This is because they were aware that osteoporosis is a genetic disease and that they were susceptible to osteoporosis.

Exposure to information related to osteoporosis knowledge was significantly

associated with perceived benefits of calcium intake, consistent to finding from other studies.^{14,27} Moreover, participants who had been exposed to osteoporosis knowledge had lower perceived barriers to calcium intake and higher health motivation. Similarly, study also found out participants who had been exposed to calcium-rich foods had lower scores for perceived susceptibility to osteoporosis and perceived barriers to calcium intake.

In summary, findings from current study suggested that there was significant association between osteoporosis knowledge and health belief. And participants with better knowledge had higher health belief. According to the theoretical approach of Health Believe Model, a high osteoporosis health belief would expect a high chance of positive behavioural changes. Therefore, future studies should focus on increasing the exposure rate of information related to osteoporosis, in order to increase the osteoporosis knowledge and encourage positive health belief among young adults, which then promotes positive behavioural changes and reduces the incidence of osteoporosis in Malaysia.

Consumption of dairy products

In this study, more than half of the participants (61.5%) did not consume adequate dairy products, similar to other studies.^{15,28,29} This may be due to dietary or cultural habits, lactose intolerance or lack of knowledge about osteoporosis and calcium-rich foods. Moreover, participants may not aware about the requirement of daily calcium intake (1000mg/day) and calcium supplement can be an alternative to meet the requirement.

All demographic characteristics, OKT and OHBS were not significantly associated with the consumption of dairy products. This may be inaccurate due to recall bias and the sample size of the variables were not evenly distributed. OKT, perceived seriousness to osteoporosis and health motivation were significant predictors of consumption of dairy products. It is predicted that the higher the OKT score, the lower the consumption of dairy products and the higher the perceived seriousness to osteoporosis, the lower the consumption of dairy products. This may be due to the influence of latent variables that are not tested in this study. It is also predicted that the higher the health motivation, the higher the consumption dairy products. This indicates that individuals who are more motivated to make behavioural changes are more likely to consume more dairy products.

Only minority of students (4.5%) were taking calcium supplements regularly despite low intake of dairy products. This may be due to majority of participants are not aware of the requirement of daily calcium intake (1000mg/day) and thought that they are consuming adequate dietary calcium.

Limitations of the study

The study had several limitations. First, the information gathered was at a single point in time and does not show a cause and effect relationship between variables. Second, all variables were self-reported and participants might not report their actual thoughts or opinions. Moreover, recall bias might occurred on the consumption of dairy products section. Third, this study was not equally distributed for gender. Forth, the results of this study cannot be generalised to the general population of young adults since this study was conducted in a medical sciences university. Fifth, this study only focuses on the consumption of dairy products rather than the total dietary calcium intake. Sixth, the latent variables were not identified in this study. Other characteristics that might affect the consumption of dairy products such as financial status, accessibility to dairy products, lactose intolerance was not examined.

CONCLUSION

Participants in this study had moderate osteoporosis knowledge and moderate osteoporosis health belief. More than half of the participants did not consume adequate dairy products. Current study reported that osteoporosis knowledge and health belief was correlated. Osteoporosis knowledge alone does not lead to positive behavioural changes in young adults. Based on the theoretical approach of Health Believe Model, a high osteoporosis health belief would expect a high chance of positive behavioural changes.

Recommendations of the study

Internet website can be utilised as one of the sources for future educational programme for young adults. This is because majority of them obtained information through internet website. Information related to osteoporosis, details of health campaigns etc. can be posted in internet website for public viewing. Support groups can also be created in internet website so that public can use it to discuss their concerns or for sharing purposes.

Future educational programmes should focus on improving the knowledge of osteoporosis in young adults. Examples of information that should be included are the risk factors and impacts of osteoporosis, benefits of calcium intake, as well as strategies to combat the barriers to calcium intake. Knowledge of osteoporosis alone does not guarantee implementation of positive behavioural changes. Therefore, future programmes should also focus on osteoporosis health belief.

Young adults' attitude towards dietary calcium intake and the reasons of low consumption of dairy products should be determined in future studies. Other osteoprotective behaviours such as intake of vitamin D, dietary calcium intake and weight-bearing physical activity should also be

examined. Food frequency questionnaire and 3-day food diary can be used to access daily intake of dietary calcium and vitamin D.

Experimental research designs should be used to determine the causal inference between independent variables and outcome. Structural equation modelling, a causal modelling should be used to define the association between latent constructs and observable variables.

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