Original Article

Access this article online
Quick Response Code:

Website: www.jehp.net
DOI: 10.4103/jehp.jehp_993_20

The social-cognitive determinants of calcium intake for preventing osteoporosis in women in Isfahan: A cross-sectional study using path analysis

Mahin Nematollahi, Ahmad Ali Eslami

Abstract:

BACKGROUND: Osteoporosis is a common disease in women over age 45 years. Calcium intake is among the factors that help prevent osteoporosis. Identifying the social-cognitive determinants of calcium intake can have a major role in the development of osteoporosis prevention programs.

MATERIALS AND METHODS: This cross-sectional study was conducted on 400 women aged <50 years from 10 health centers by cluster sampling in Isfahan in 2016. A hypothetical social-cognitive model was assessed using path analysis, and the fit indices and explanatory power of the model were assessed. The constructs, including self-efficacy, outcome expectations, social support, and self-regulation, were taken as the explanatory variables and calcium intake as the criterion variable.

RESULTS: The mean age of the participating women was 34.07 years (standard deviation = 7.99) (range = 19–50), and their mean calcium intake was reported as 909.94 (12. 6) mg/day. The conceptual model was able to explain 73% of the variance in calcium intake and had good fit indices. Self-regulation was identified as the strongest predictor of calcium intake, and outcome expectation was eliminated from the model since it was the weakest explanatory factor of calcium intake.

CONCLUSIONS: The theoretical model of this study is recommended as a suitable framework for the development of targeted osteoporosis prevention interventions.

Keywords:

Calcium, osteoporosis, self-efficacy, self-regulation, women

Introduction

Osteoporosis is a silent disease in which the bones become weak and fragile and which is often asymptomatic until the first fracture occurs.[1,2] More than 200 million people around the world suffer from osteoporosis.[3,4] Studies indicate that a large number of Iranian women over age 50 years have osteoporosis.[5,6] The loss of bone mass begins with the onset of menopause (40–45 years) and measures should be designed and taken to prevent osteoporosis in women from youth.[7] Calcium intake helps prevent osteoporosis and should be supplied through the consumption of calcium-rich foods. Every adult requires 1000 mg of calcium per day.[1,8] Despite the copious evidence on the health benefits of calcium for the bones, women's calcium intake is generally less than the recommended amount.[9,10] Many studies have been conducted to identify the factors (personal, perceptual, and social) affecting calcium intake; however, their

Department of Health Education and Promotion, School of Health, Isfahan University of Medical Sciences, Isfahan, Iran

Address for correspondence:
Dr. Ahmad Ali Eslami, Department of Health Education and Promotion, School of Health, Isfahan University of Medical Sciences, Isfahan, Iran.
E-mail: eslamiaa@gmail.com

Received: 25-08-2020
Accepted: 07-03-2021
Published: 31-12-2021

How to cite this article: Nematollahi M, Eslami AA. The social-cognitive determinants of calcium intake for preventing osteoporosis in women in Isfahan: A cross-sectional study using path analysis. J Edu Health Promot 2021;10:462.

results have left certain points rather ambiguous.[11-16] For example, in a study conducted by Ievers-Landis *et al*. on 354 girls aged 8–11 years, self-efficacy and social support were identified as the predictors of calcium intake, and social support was found to affect calcium intake by way of self-efficacy. The cited study did not examine the role of outcome expectations, self-regulation, and demographic variables.[11] The results of a study conducted by Sharma on 718 young girls showed that self-efficacy is the most important predictor of calcium intake that affects calcium intake through outcome expectations; however, they also did not examine the role of social support, self-regulation, and demographic variables.[12] Barner *et al*. studied the social-environmental factors affecting calcium intake in 187 women over age 65 years and reported a significant relationship between calcium intake and self-efficacy, and they too did not examine the role of social support, self-regulation, outcome expectations, and demographic variables.[13]

In a study conducted by Hsieh *et al*. on 243 women over age 18 years, self-efficacy was identified as the strongest predictor of calcium intake, and social support had a relationship with calcium intake through self-efficacy; however, that study did not examine the relationship between self-regulation and calcium intake and the role of demographic variables either.[14] In a study conducted on 240 university students, Kim argued that reduced negative outcome expectations and increased self-efficacy improve calcium intake, but they also made no reference to the role of self-regulation, social support, and demographic variables.[15]

There are still many ambiguities and challenges about the relationship between these factors and their impact on calcium intake that perhaps conducting a study on the relationship between social-cognitive factors and calcium intake using a theoretical model can help answer some of these questions. Social-cognitive theory (SCT) constitutes an appropriate model for investigating the relationship of these factors with each other and with calcium intake. Given the concurrent emphasis placed on personal, behavioral, and cognitive factors in the SCT, this theory seems to have the right explanatory power for explaining and analyzing human behaviors and thus comprises an appropriate model for investigating the relationship of these factors with each other and with calcium intake.[16,17] Due to the important role of perceptual determinants in explaining calcium intake and their consistency with a number of constructs of the SCT, the present study was conducted to identify the determinants of calcium intake based on the SCT using path analysis in a group of women in Isfahan, Iran. Given the results of previous studies, the theoretical framework of the present study was developed as a predicted structural model [Figure 1] and is based on the following hypotheses:

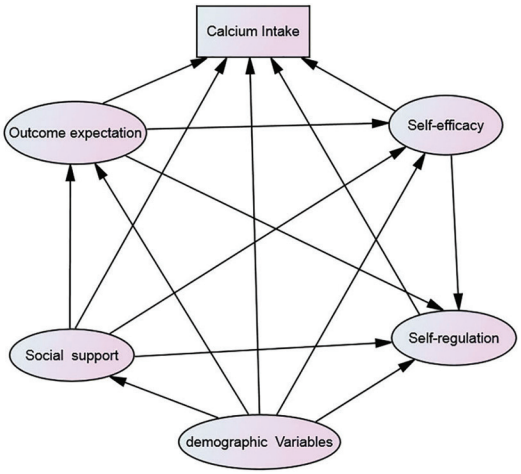

Figure 1: Social-cognitive theoretical model of factors influencing calcium intake

1. The increased effect of self-efficacy, outcome expectations, self-regulation, and social support on the relationship between demographic variables and calcium intake can positively affect calcium intake
2. Increased confidence in one's ability to overcome problems and barriers results in planning and adherence to the plan and increases calcium intake
3. Self-regulation contributes greatly to calcium intake, and the subject's increased capacity to use self-regulation mechanisms leads to her increased calcium intake
4. Enjoying social support and showing an increased self-perception of social support can positively affect calcium intake.

Materials and Methods

Study design and setting

The present cross-sectional study was conducted in Isfahan in 2016. With a 95% confidence interval (CI) (1.96), a test power of 80% (0.84), a calcium intake self-efficacy coefficient of 0.15,[18] and taking into account a potential withdrawal of 15%, the sample size was determined as 400.

Study participants and sampling

A multistage cluster random sampling method was used in this study: first, a random selection was made from the urban health centers of Isfahan, and since this city has 25 regions with different socioeconomic features, ten health centers were selected from it through cluster sampling. The population of the women covered by the centers was then determined, and the samples were selected in proportion to the size of each center. After an introduction session, the participants were briefed on the study objectives and the method of completion of the questionnaires, and they then submitted their informed consent and filled out the questionnaires. Any candidates with an osteoporosis

severity hindering their participation were excluded from the study.

Data collection tools and techniques

The data collection tools had three parts: Part 1 – a sociodemographic questionnaire with ten items, which examined age, education, marital status, occupation, and income; Part 2 – the Calcium Intake Questionnaire based on the SCT: the SCT-based questionnaire was designed by the researchers and contained four constructs: self-efficacy, outcome expectations, social support, and self-regulation, and each scale had five items, which were scored based on a ten-point Likert scale (from "totally disagree" =1 to "totally agree" =10). The exploratory factor analysis identified a four-factor model with a total variance of 72.3%. The results related of the confirmatory factor analysis (CFA) showed that the model was fit based on the SCT (CMIN/DF = 1.850, Comparative Fit Index [CFI] = 0.946, Tucker–Lewis Index (TLI) = 0.938, and root mean squared error of approximation [RMSEA] = 0.069 [90% CI: 0.057–0.081]), and all the scales were significant within an acceptable range.[19] Part 3 – the Calcium Intake Behavior Questionnaire, which was designed to assess women's performance in terms of calcium intake using a checklist similar to the Food Frequency Questionnaire, and with its validity and reliability confirmed in previous studies.[19-21] This questionnaire contained two parts; first, "how often do you use calcium-rich foods (e.g., milk, cheese, dough or yogurt-based beverages, yogurt, fish, green leafy vegetables, seeds, and fruits) per week?" and second, "what amount of calcium-rich foods do you use each time?"[19-21] Then, given the amount of calcium in each food item, the mean daily calcium intake was calculated and the participants were categorized into three groups: (a) low calcium intake of <800 mg/day, (b) moderate calcium intake of 800–1000 mg/day, and (c) normal calcium intake of >1000 mg/day, based on the recommended daily calcium for women aged 19–50 years.[1,8]

Ethical considerations

The study was conducted in accordance with the Declaration of Helsinki and after obtaining formal permission from Isfahan University of Medical Sciences and ethical approval from the university research deputy (grant number: 395203). The participants were briefed on the study objectives and methods and submitted their informed consent and were ensured of the confidentiality of their data.

Data analysis

Data were analyzed in SPSS-20 using the regression analysis at the significance level of <0.05. The explanatory power of the hypothetical social-cognitive model was assessed using the path analysis in Amos Graphic 23. The fit indices for assessing the hypothetical social-cognitive model were selected from three categories, i.e., absolute, comparative, and parsimony, and were calculated using the CFA. The acceptable values of the fit indices were as follows: CMIN/DF = (1–5), TLI >0.8, CFI >0.9, Parsimonious Comparative Fit Index (PCFI) >0.6, and RMSEA <0.05, and these values indicated the good fit of the hypothetical model.[22,23]

Results

Descriptive results

Of the 400 participants, 48 were excluded from the study, and 352 remained. The main characteristics examined in the participants included level of educational level (1.4% were illiterate, 3.7% had reading and writing literacy, 9.7% had primary school education, 12.8% had middle and high school education, 40.6% had high school diploma, and 31.8% had university education), marital status (87.2% were married, 10% were single, 1.7% were widowed, and 1.1% were divorced), employment (18.9% were employed and 81.1% were unemployed), and income (67.5% had little income, 27.8% had good income, and 4.7% had excellent income). The mean age of the participants was 34.07 years (standard deviation = 7.99) (range = 19–50). The mean calcium intake was 909.94 (12. 6) mg/day. The results after eating calcium-rich foods showed that 37.2% of the individuals consumed calcium <800 mg/day, 36.6% consumed 800–100 mg/day, and 25.9% consumed more than 1000 mg/day [Table 1].

The analysis of the relationships between the explanatory variables and calcium intake

Regression analysis results

The regression analysis was used to assess the explanatory power of the variables. First, a simple linear regression analysis was performed for all the underlying and main variables, and then, the hierarchical multiple regression analysis was used to assess the theoretical model. The results of the simple linear regression analysis on the explanatory power of the underlying and main variables in explaining calcium intake showed that income, employment status, and education have an acceptable explanatory role in calcium intake, while income status was found to have the greatest explanatory power (R^2 = 0.17). Furthermore, the results of the simple linear regression analysis on the explanatory power of the main variables (self-efficacy, social

Table 1: The level of calcium intake among women who participated in the study (*n*=352)

Daily calcium intake (mg/day)	Frequency, *n* (%)
Low calcium intake (<800)	131 (37.2)
Moderate calcium intake (800-1000)	130 (36.6)
Normal calcium intake (>1000)	91 (25.9)

support, self-regulation, and outcome expectations) for explaining calcium intake showed that all four constructs had acceptable explanatory roles while self-regulation (R^2 = 0.26) had the highest explanatory power [Table 2].

Next, to assess the theoretical framework of the research, a hierarchical multiple regression analysis was performed. First, the main variables were input into the model, and income, employment status, and education were added next. Table 3 presents a summary of the model, which shows that the first model was able to explain 0.31 of the predictive power of calcium intake (R^2 = 0.31, P = 0.001), and the second model was only able to add 0.01 to the explanatory power of the first model, which suggests a poor parsimony effect, and the first model was thus confirmed. Self-regulation was also identified as the strongest predictor of calcium intake (beta = 0.15, t[351] = 2.37, P = 0.01). The regression analysis showed that the theoretical framework of the study, which included the variables self-efficacy, social support, self-regulation, and outcome expectations, had an acceptable explanatory power for calcium intake.

The structural analysis of the relationships in the conceptual model of the study

To analyze the structural relationships between the explanatory factors of calcium intake, a model was drawn with all the constructs, namely self-efficacy, outcome expectations, social support, self-regulation, income, employment status and education, and employment status. Then, the paths through which income and education affected outcome expectations and social support, those through which outcome expectations and social support affected calcium intake, and the path through which outcome expectations affected self-regulation, which demonstrated poor relationships, were excluded from the model, and the final model was then assessed using path analysis. The fit indices show the acceptable fit of the proposed model with the data (CMIN/DF = 2.123, TLI = 0.94, CFI = 0.95, PCFI = 0.83, P = 0.001, and RMSEA = 0.05 [0.049–0.063]), and this model was able to predict 73% of the variance in calcium intake.

According to Figure 2 and the results obtained from the path analysis [Table 4], self-regulation was identified as the strongest factor determining calcium intake. The direct effects of social support, self-efficacy, and outcome expectations on calcium intake were very weak. The direct effect of self-efficacy on calcium intake was very weak, and self-efficacy exerted the highest effect on calcium intake through self-regulation. The indirect effect of social support on calcium intake through outcome expectations, self-efficacy, and self-regulation was acceptable and significant, and the strongest path pertained to self-regulation. The direct effect of outcome expectations on calcium intake was very weak, and outcome expectations exerted the greatest effect on calcium intake through self-regulation. The strongest direct effect on calcium intake pertained to self-regulation, while the strongest indirect effect pertained to social support through self-regulation. The direct effects of income and education on calcium

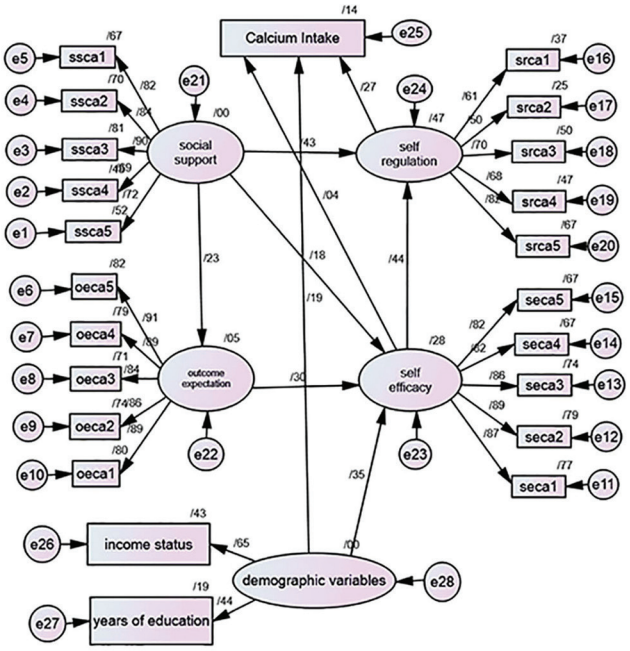

Figure 2: Structural equation analysis of the final social-cognitive model of calcium intake

Table 2: Simple linear regression analysis on the explanatory power of the study variables to predict calcium intake

Models	*R*	R^2 change	*F* change (df_1=1, df_2=350)	*P*	95% CI for B (lower-upper)
Age	0.04	0.002	0.55	0.38	−4.968-1.107
Years of education	0.13	0.01	6.36	0.01	−16.548-28.605
Marriage status	0.006	0.00	0.01	0.9	−51.868-45.286
Employment status	0.12	0.01	5.85	0.01	−128.215-−2.441
Income status	0.17	0.02	10.61	0.001	−7.325-63.444
Self-regulation	0.26	0.07	26.41	0.001	0.897-6.418
Self-efficacy	0.25	0.06	24.14	0.001	−0.096-4.793
Social support	0.17	0.03	11.46	0.001	−0.524-4.158
Outcome expectation	0.11	0.01	4.5	0.03	−1.731-2.495

CI=Confidence interval

intake were acceptable and significant. The indirect effect of income and education on calcium intake through self-regulation was weak and unacceptable. The direct effects of income and education on self-efficacy were acceptable and significant, but the indirect effect of income and education on calcium intake through self-efficacy was weak and insignificant.

Discussion

The present study was conducted to identify the social-cognitive determinants of calcium intake in a group of women in Isfahan. The explanatory power of constructs including self-efficacy, outcome expectations, social support, and self-regulation in explaining calcium intake was assessed using the path analysis. The results showed that the study's hypothetical model has a good explanatory power and acceptable fit indices, which agrees with the results obtained in studies by Ievers-Landis *et al*. and Sharma.[11,12] Moreover, the analysis of the structural equations showed that this hypothetical social-cognitive model can predict 73% of the variance in calcium intake behavior, which was reported as 16% in a study by Gammage. The conceptual framework in Gammage and Klentrou's study is based on variables including self-efficacy, barriers, and knowledge, but the present study has examined other factors related to this behavior (social support, outcome expectations, and self-regulation).[24] The results of the regression analysis in the present study showed that calcium intake has a significant relationship with income, employment status, and education, with income having the greatest explanatory power. Studies have shown that calcium intake can be inadequate in women mainly due to poverty.[8,25] A high income increases purchasing power and might lead to an increased consumption of calcium-rich foods. Akinpetide studied the role of women's health knowledge and behaviors in the prevention of osteoporosis and showed that calcium intake has a significant direct correlation with education.[26] In other words, people's knowledge about the benefits of calcium increases as their level of education increases, and they thus become more inclined to consume calcium. A study conducted by Shabani to determine employed nurses' knowledge of osteoporosis and a study by Miller conducted on a group of female teachers showed that calcium intake is low in working women,[27,28] which may be because employment increases women's preoccupations and reduces the opportunity to prepare and consume calcium-rich and healthy foods.

This section assesses the relationships observed in the proposed theoretical framework that was confirmed through the path analysis. The results of the path analysis in examining the first hypothesis of the study showed that income and education have direct effect on calcium intake and also indirect effects through self-efficacy, while an increase in the effect of self-efficacy on the relationship between demographic variables and calcium intake can weakly affect calcium intake. The present findings showed that self-efficacy has a poor direct effect on calcium intake, and the second proposed hypothesis of this study is thus not confirmed, although self-efficacy can indirectly affect calcium intake by affecting self-regulation, which concurs with the results obtained by Poddar *et al*., who proposed self-regulation as a mediator of self-efficacy and calcium intake.[29]

The combination of self-regulation and self-efficacy is likely an essential determinant of calcium intake. The present findings also showed that self-regulation is the strongest predictor of calcium intake, so the third proposed hypothesis of this study is confirmed. Moreover, self-regulation was found to have a favorable relationship

Table 3: Hierarchical multiple regression analysis of the study models to predict calcium intake

Models	*R*	Adjusted R^2	R^2 change	*F* change	df_1	df_2	*P*
Model 1*	0.31	0.08	0.09	9.03	4	347	0.001
Model 2**	0.35	0.1	0.12	6.89	7	344	0.001

*Predictors: Self-regulation, self-efficacy, social support, and outcome expectation, **Predictors: Self-regulation, self-efficacy, social support, outcome expectation, employment status, income status, and years of education

Table 4: Direct, indirect, and total effects of variables in the social-cognitive model of calcium intake

Variable	Coefficients	Demographic variables	Social support	Outcome expectation	Self-efficacy	Self-regulation
Outcome expectation	Direct	-	0.23*	-	-	-
	Indirect	-	0	-	-	-
	Total	-	0.23	-	-	-
Self-efficacy	Direct	0.34*	0.18*	0.3*	-	-
	Indirect	0	0.07	0	-	-
	Total	0.34	0.25	0.3	-	-
Self-regulation	Direct	0.1	0.44*	0	0.44*	-
	Indirect	0.13	0.1	0.12	0	-
	Total	0.23	0.54	0.12	0.44	-
Calcium intake	Direct	0.17*	0	0	0.04	0.26*
	Indirect	0.08	0.15	0.04	0.12	-
	Total	0.25	0.15	0.04	0.16	0.26

*Significant at the *P*=0.001

with the other constructs of the social-cognitive model, and the remaining constructs indirectly affected calcium intake through self-regulation. Bandura argues that self-regulation is a key construct for behavior change in the social-cognitive approach, and having a goal and proper plans for calcium intake increases self-esteem and makes the individual pay attention to the positive outcomes of calcium intake and improves her behavior.[16,17,30] This finding might indicate the key role of self-regulation in promoting calcium intake, which should be considered an important factor in calcium intake-promoting interventions. According to the present findings, social support has no direct effect on calcium intake and only affects calcium intake through the other constructs. The results of studies conducted by Ievers-Landis *et al*. and Simpson showed that the availability of social resources leads to an improved calcium intake.[11,25] Given these findings, it seems that social support alone is not a sufficient determinant of calcium intake, and Bandura also argued that the absence of social support is not a barrier to the performance of a behavior, although such absence can affect calcium intake by affecting the other constructs.[16,17,30]

The present findings showed that outcome expectations alone have no direct effect on calcium intake, and the fourth proposed hypothesis of this study is not confirmed, although outcome expectations do affect calcium intake through self-efficacy. The results obtained in studies conducted by Kim and Akinpetide showed that positive outcome expectations have an important role in the use of calcium-rich foods.[15,26] To explain these results, it can be argued that although the favorable outcomes of calcium intake are self-evident and well-demonstrated in research, the knowledge of these benefits alone does not lead to the performance of the behavior, and self-efficacy can reinforce the effect of outcome expectations on calcium intake. Bandura argued that if the target behavior has a close theoretical relationship with outcome expectations, its explanatory power will diminish compared to the other constructs of the SCT. Greater attention needs to be paid to the effect of outcome expectations on self-efficacy in interventions aiming to improve calcium intake.

The present findings on the explanatory power of the constructs of the SCT in explaining calcium intake showed that the proposed hypothetical model is acceptable and consistent with the results of previous studies and can be used as a framework in studies on calcium intake. Given the characteristics of the target group in this study, the findings may be useful for similar populations and target groups, but the current samples cannot be considered representative of the Isfahan population due to sampling bias. Assessments of the correlation of income and the social-cognitive constructs with calcium intake are influenced by the measurement tool (questionnaire) and sampling method used, which limits the generalizability of the results. Furthermore, it is not possible to change the structure of the conceptual model of the study over time, because causal inference is more based on the SCT than the existing data, and therefore, utmost care should be taken when using current data as the basis of an intervention, and further studies are suggested on the generalizability of the proposed hypothetical model for other social groups and in other environments. A strength of this study is its use of the SCT to investigate the determinants of calcium intake and use of a theoretical model to prove the hypothesis. The present study had some limitations too, including the completion of the questionnaires in self-report format, the short duration of the research, and the failure to examine the relationship between the demographic variables in the social-cognitive theoretical model, all of which indicate that the findings should be applied with caution. The analysis of structural equations in the hypothetical model of the study on the explanatory power of the constructs of the SCT in explaining calcium intake showed that some paths were weak and the relationship between some of the factors was overlooked. For example, the effect of self-efficacy on outcome expectations or the relationship between demographic variables and the other factors in the hypothetical model were not examined; future studies are recommended to further assess these issues.

In the present study, self-regulation was identified as the strongest predictor of calcium intake. This construct should, therefore, be more emphasized in designing and implementing calcium intake-promoting programs.[31] Given the poor scores of self-efficacy, social support, and outcome expectations in explaining calcium intake, further studies should be conducted to investigate the explanatory power of these three constructs, and health educators need to further emphasize these constructs in their calcium intake-promoting programs.

Conclusions

The results of this study were indicative of the importance of simultaneous examination of the constructs of the SCT in a theoretical model to explain calcium intake as a behavior. More attention should be paid to self-regulation in designing and implementing programs for the purpose of promoting calcium intake. In addition, calcium intake should be promoted among women through further educational interventions and by boosting their self-regulation.

Acknowledgments

We wish to express our gratitude to those who helped in conducting this study, including all the health

department officials, the health center workers, and the women who participated in the study. This article is extracted from a thesis for a master's degree in health education and promotion, which was financially supported by the Student Research Committee, School of Health, Isfahan University of Medical Sciences, Isfahan, Iran (grant number: 395203). The institute has played no role in the design, collection, analysis, and interpretation of the data and in writing the manuscript and has only made a limited financial contribution.

Financial support and sponsorship

This study was supported by Isfahan University of Medical Sciences with grant number: 395203.

Conflicts of interest

There are no conflicts of interest.

References

1. Sözen T, Özışık L, Başaran NÇ. An overview and management of osteoporosis. Eur J Rheumatol 2017;4:46-56.
2. Bandela V, Munagapati B, Karnati RK, Venkata GR, Nidudhur SR. Osteoporosis: Its prosthodontic considerations – A review. J Clin Diagn Res 2015;9:ZE01-4.
3. Vellucci R, Mediati RD, Ballerini G. Use of opioids for treatment of osteoporotic pain. Clin Cases Miner Bone Metab 2014;11:173-6.
4. Vijayakumar R, Büsselberg D. Osteoporosis: An under-recognized public health problem: Local and global risk factors and its regional and worldwide prevalence. Glob J Health Sci. 2016;1:2.
5. Irani AD, Poorolajal J, Khalilian A, Esmailnasab N, Cheraghi Z. Prevalence of osteoporosis in Iran: A meta-analysis. J Res Med Sci 2013;18:759-66.
6. Sharifi N, Majlessi F. Self-empowerment of female students in prevention of osteoporosis. Glob J Health Sci 2016;9:7.
7. Puttapitakpong P, Chaikittisilpa S, Panyakhamlerd K, Nimnuan C, Jaisamrarn U, Taechakraichana N. Inter-correlation of knowledge, attitude, and osteoporosis preventive behaviors in women around the age of peak bone mass. BMC Womens Health 2014;14:35.
8. Cormick G, Belizán JM. Calcium intake and health. Nutrients 2019;11:1606.
9. Kemi VE, Kärkkäinen MU, Rita HJ, Laaksonen MM, Outila TA, Lamberg-Allardt CJ. Low calcium: Phosphorus ratio in habitual diets affects serum parathyroid hormone concentration and calcium metabolism in healthy women with adequate calcium intake. Br J Nutr 2010;103:561-8.
10. Sidor P, Głąbska D, Włodarek D. Analysis of the dietary factors contributing to the future osteoporosis risk in young Polish women. Rocz Panstw Zakl Hig 2016;67:279-85.
11. Ievers-Landis CE, Burant C, Drotar D, Morgan L, Trapl ES, Kwoh CK. Social support, knowledge, and self-efficacy as correlates of osteoporosis preventive behaviors among preadolescent females. J Pediatr Psychol 2003;28:335-45.
12. Sharma SV, Hoelscher DM, Kelder SH, Day RS, Hergenroeder A. Psychosocial, environmental and behavioral factors associated with bone health in middle-school girls. Health education research. 2009;24:173-84.
13. Swaim RA, Barner JC, Brown CM. The relationship of calcium intake and exercise to osteoporosis health beliefs in postmenopausal women. Res Social Adm Pharm 2008;4:153-63.
14. Hsieh CH, Wang CY, McCubbin M, Zhang S, Inouye J. Factors influencing osteoporosis preventive behaviours: Testing a path model. J Adv Nurs 2008;62:336-45.
15. Kim MJ, Kim KW. Nutrition knowledge, outcome expectations, self-efficacy, and eating behaviors by calcium intake level in Korean female college students. Nutr Res Pract 2015;9:530-8.
16. Sabouri M, Shakibazadeh E, Mohebbi B, Tol A, Yaseri M, Babaee S. Effectiveness of an educational intervention using theory of planned behavior on health care empowerment among married reproductive-age women: A randomized controlled trial. J Educ Health Promot 2020;9:293.
17. Rankin A, Kuznesof S, Frewer LJ, Orr K, Davison J, de Almeida MD, *et al*. Public perceptions of personalised nutrition through the lens of Social Cognitive Theory. J Health Psychol 2017;22:1233-42.
18. Schmiege SJ. A Theoritically-Based Intervention to Increase Calcium Intake in Younge Women. USA: Arizona State University; 2005.
19. Nematollahi M, Eslami AA. Development and psychometric properties of a Calcium Intake Questionnaire based on the social cognitive theory (CIQ-SCT) for Iranian women. Health Promot Perspect 2018;8:54-62.
20. Harmouche-Karaki M, Mahfouz M, Obeyd J, Salameh P, Mahfouz Y, Helou K. Development and validation of a quantitative food frequency questionnaire to assess dietary intake among Lebanese adults. Nutr J 2020;19:1-9.
21. Mohammadifard N, Sajjadi F, Maghroun M, Alikhasi H, Nilforoushzadeh F, Sarrafzadegan N. Validation of a simplified food frequency questionnaire for the assessment of dietary habits in Iranian adults: Isfahan Healthy Heart Program, Iran. ARYA Atheroscler 2015;11:139-46.
22. Brown TA. Confirmatory factor analysis for applied research. 2nd ed. Guilford publications, New York, NY 10001-1020. 2015.
23. Mueller RO, Hancock GR. Structural equation modeling. In: The Reviewer's Guide to Quantitative Methods in the Social Sciences. 2nd ed. Routledge Publication,New York. 2018. p. 445-56.
24. Gammage KL, Klentrou P. Predicting osteoporosis prevention behaviors: Health beliefs and knowledge. Am J Health Behav 2011;35:371-82.
25. Marshall K, Teo L, Shanahan C, Legette L, Mitmesser SH. Inadequate calcium and vitamin D intake and osteoporosis risk in older Americans living in poverty with food insecurities. PLoS One 2020;15:e0235042.
26. Akinpetide GO. Osteoporosis Knowledge, Beliefs, and Bone Promotion Behaviors of Postmenopausal African American (AA) Women. USA: The University of Arizona; 2014.
27. Solimanha M, Asadi K, Shabani S, Mirblock AR, Karimi A, Kazemnezhad E. Knowledge level of nurses employed in orthopedic units on osteoporosis disease. J Holist Nurs Midwifery 2013;24:25-32.
28. Miller J, Chan L, Mehta K, Roberts R, Dickinson KM, Yaxley A, *et al*. Dietary intake of working women with children does not appear to be influenced by hours of employment: A secondary analysis of the Australian Health Survey (2011-2013). Appetite 2016;105:106-13.
29. Poddar KH, Hosig KW, Anderson ES, Nickols-Richardson SM, Duncan SE. Web-based nutrition education intervention improves self-efficacy and self-regulation related to increased dairy intake in college students. J Am Dietetic Assoc 2010;110:1723-7.
30. Bandura A. Health promotion by social cognitive means. Health Educ Behav 2004;31:143-64.
31. Moradnejad S, Montazeri A, Sadeghi R, Tol A, Yekaninejad MS, Mohebbi B. The effectiveness of educational intervention to improve health promoting behavior on prevention of osteoporosis among women: Application of BASNEF model. Hayat 2020;26:309-26.