

REVIEW

DEVELOPMENT AND VALIDATION OF THE BILINGUAL (ENGLISH-MALAY) VERSION OF KNOWLEDGE ON CALCIUM SUPPLEMENT-12 (KNOWCAS-12) QUESTIONNAIRE

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ABSTRACT

To date, specific questionnaire assessing knowledge on calcium supplement is unavailable. Thus, we aimed to develop and validate this questionnaire. Four areas of knowledge (calcium in general, dietary calcium, benefits and risk of calcium supplement, and practices that reduce its benefits) were identified through literature review and interviews with ten doctors. Twelve items were created in English and reviewed by two family medicine specialists, an orthopaedic surgeon, and a pharmacist. A bilingual (English-Malay) questionnaire was produced via back-to-back translation and face validity was tested on seven patients. Discriminative validation was done by comparing knowledge scores between patients, medical students and doctors. Test-retest reliability was tested with a two weeks interval. Subsequently, the questionnaire was piloted on 100 patients. The KnowCaS-12 scores of doctors were significantly higher than those of patients ($p < 0.001$) and students ($p < 0.001$), indicating good discriminative validity. Although the Cronbach's alpha was 0.68, it had good test-retest reliability [Spearman's rho correlation: 0.40, $p = 0.02$; pre- and post-test score median (IQR): 8.00 (3.00) and 9.00 (2.00) respectively, p -value of Wilcoxon Signed Ranks test: 0.08]. The pilot study showed 52.5% of the participants took calcium supplement. Their median (IQR) for KnowCaS-12 was 7.00 (6.00), which was not significantly different from those who did not take calcium supplement. In conclusion, the bilingual KnowCaS-12 questionnaire appears to have good content validity, face validity, discriminative validity and test-retest reliability, thus it can be used for future studies. Practice of consuming calcium supplement seems to be common and users' knowledge regarding calcium supplement was only moderate.

Keywords: questionnaire design, validation studies, knowledge, calcium, dietary supplements

INTRODUCTION

Calcium is an important mineral for human physical structure and physiological function. Almost 99% of calcium in our body is stored in bones¹. The remaining calcium is found in teeth, soft tissues and extracellular fluid¹. It is required for various physiological processes of the human body including muscle contraction, digestion, blood clotting, and neurotransmission². Various harmful effects have been found to be associated with low calcium including osteoporosis and fracture^{1,2}. It occurs due to inadequate dietary intake, reduced calcium absorption, or increased calcium excretion¹.

Calcium can be found naturally in dairy foods like milk, cheese and yogurt, as well as fortified bread, cereals and beverages³. A number of local diets are also rich with calcium such as green vegetables (e.g. spinach), grains (e.g. soy bean and yellow dhal), tofu, tempeh, shrimp paste, cinaluk, and budu³⁻⁵. However, calcium content in the local food is generally lower than the western foods and inadequate to meet the recommended healthy intake⁶.

Consumption of dietary calcium is good enough in maintaining bone health, thus daily calcium

supplement may not be necessary⁷. However, it has been shown that people living in countries with low dairy diets are more common to have low dietary intake⁸⁻¹⁰. Therefore, it is not surprising that many people believed their dietary calcium intake was inadequate to maintain their good health particularly in preventing osteoporosis and fracture^{11,12}. This has led to regular use of calcium supplement even though it is inappropriate and unindicated^{10,13,14}.

Calcium supplement is defined as calcium contained in a commercially available product that is consumed to supplement daily diet^{13,15}. It is not considered as a drug and its consumption is not intended to prevent or treat diseases^{13,15}.

Practice of taking calcium supplement may be influenced by many factors including knowledge, perception and beliefs regarding calcium, dietary calcium and the medical problems related to calcium deficiency, such as osteoporosis^{10-12,16-18}. A number of studies have developed and validated tools to measure their participants' knowledge on calcium and/or dietary calcium^{19,20}. Some tools assess these topics as a part of measuring knowledge on osteoporosis or vitamin D²¹⁻²³. Unfortunately, tools that assess

specific knowledge related to calcium supplement are lacking.

Due to this, a brief and easily administered questionnaire that measure this knowledge is required. It should be easily understood by various ethnic groups as Malaysia is a multi-ethnic country where multiple languages are used. As Bahasa Malaysia is the national language and English is the second language, the majority of Malaysians can speak both languages at least at minimum proficiency level. Thus, a bilingual questionnaire is believed to be useful for our local setting. In this study, we aimed to develop and validate a bilingual questionnaire in both English and Bahasa Malaysia languages that could measure the participants' level of knowledge with regards to calcium supplement. It is hope that this tool can identify gaps in knowledge among our local population which could lead to inappropriate use of calcium supplement.

METHODS

Development of the questionnaire

Four areas of knowledge regarding calcium supplement were identified through literature review^{17,19-23} and interviews with ten primary care doctors. These included general knowledge related to calcium, dietary calcium, risk and benefit of calcium supplement, and practices that reduce the benefits of calcium supplement (Table 1). Twelve related statements with 'yes', 'no' and 'don't know' responses were then created in English. Correct answer for each item was awarded with one point, whereas incorrect answer or 'don't know' response was given 0. Therefore, the total score ranged from 0 to 12. The higher the score, the higher the level of knowledge on calcium supplement.

Content validation of the questionnaire

Content validation of the 12 items was done by two family medicine specialists, an orthopaedic surgeon and a pharmacist. The relevance, clarity and conciseness of each item were appraised. The general knowledge regarding calcium were perceived to be important by the experts, thus item 1, 2 and 3 were retained. Item 9 ("Coffee can be taken together with calcium supplement") was rephrased to "Coffee does not reduce the benefit of calcium supplement when taken together". The experts believed that the revised item was better to assess the unfavourable effect of taking calcium supplement with coffee simultaneously.

Translation of the initial 12 items

The 12 items were independently translated into Malay by two qualified English teachers who were also native speakers of Malay language. The two translated versions were then compared and discussions were made to reconcile any differences. Finally, a harmonised Malay version of the questionnaire was produced after consensus was achieved. This version was then independently back-translated into English by another two qualified English teachers who were also native Malay speakers. These two English versions were subsequently compared with the original questionnaire. Any differences and similarities were discussed. A consensus decision was made by the panel of experts on the wordings and phrasing of items in both languages. The final bilingual 12-items version were then compiled for validation.

Face validation of the questionnaire

The final bilingual version of the questionnaire was distributed to seven patients at a university-based primary care clinic who could speak both Malay and English. They were 4 males and 3 females, aged between 20 to 70 years old. Two of them were Malay, three were Chinese, and two were Indian. During this session, they were asked to complete the questionnaire. Their comprehension of the questionnaire's instructions and each item in both languages was assessed to identify problematic words, phrases and instructions. Their suggestions for improvement was also obtained.

Some of the patients commented that item 10 ("*Foods with high iron content (e.g.: liver) do not reduce the benefit of calcium supplement when taken together*") was quite confusing, especially for those who do not consume liver. Therefore, the example of food given in the statement was removed.

Discriminative validation

Discriminative validation was done to examine the ability of the revised scale in differentiating the knowledge level among three groups of people: 20 primary care doctors, 20 medical students and 20 primary care patients. All of them were recruited from the same clinic. The primary care doctors were mainly postgraduate trainees and the medical students were at their final year of medical school, doing primary care attachment. We hypothesised that the doctors would have the highest scores, whereas the patients would have the lowest scores. Kruskal Wallis test with a post-hoc analysis was carried out to assess the difference in the median scores among the groups. The findings were considered significant if p was less than 0.05.

Table 1: Four constructs of the initial 12 items assessing knowledge regarding calcium supplement

Presumptive constructs of knowledge	Number of items	Items	Correct answer
General knowledge on calcium	3	Item 1: Calcium is important for bone health. <i>(Kalsium adalah penting untuk kesihatan tulang.)</i>	Yes
		Item 2: Calcium requirement increases with increasing age. <i>(Keperluan kalsium meningkat selaras pertambahan usia.)</i>	Yes
		Item 3: Daily requirement of calcium is the same for both women and men of the same age. <i>(Keperluan harian kalsium adalah sama bagi lelaki dan perempuan yang sama usia.)</i>	No
Dietary calcium	3	Item 4: Green vegetables are known to have good source of calcium. <i>(Sayuran hijau diketahui mempunyai sumber kalsium yang baik.)</i>	Yes
		Item 5: Calcium from food is better absorbed into body than calcium from supplements. <i>(Kalsium daripada makanan adalah lebih mudah diserap ke dalam tubuh berbanding kalsium daripada makanan tambahan.)</i>	Yes
		Item 6: Calcium supplement is only needed when dietary intake of calcium is inadequate. <i>(Kalsium tambahan adalah diperlukan hanya sekiranya kalsium di dalam diet seharian tidak mencukupi.)</i>	Yes
Risk and benefit of calcium supplement	3	Item 7: All calcium supplements that we eat will be absorbed into the body. <i>(Kesemua kalsium tambahan yang dimakan akan diserap sepenuhnya oleh tubuh.)</i>	No
		Item 8: Calcium supplement is safe to be taken at higher doses than recommended for age. <i>(Kalsium tambahan adalah selamat untuk diambil dalam dos yang lebih tinggi daripada yang disarankan bagi had umur.)</i>	No
		Item 12: Constipation is a known side effect of calcium supplement. <i>(Sembelit dikenali sebagai kesan sampingan daripada pengambilan kalsium tambahan)</i>	Yes
Practices that reduce the benefits of calcium supplement	3	Item 9: Coffee can be taken together with calcium supplement. <i>(Kopi boleh diambil bersama dengan kalsium tambahan.)</i>	No
		Item 10: Foods with high iron content (e.g.: liver) do not reduce the benefit of calcium supplement when taken together. <i>(Makanan yang mengandungi kandungan zat besi yang tinggi (seperti hati) tidak mengurangkan faedah yang diperolehi daripada kalsium tambahan bila dimakan bersama.)</i>	No
		Item 11: Iron tablets do not reduce the benefit of calcium supplement when taken together. <i>(Tablet zat besi tidak mengurangkan faedah yang diperolehi daripada kalsium tambahan bila dimakan bersama.)</i>	No

Test-retest reliability

In this study, test-retest reliability was used to measure the consistency of the knowledge score tested in two weeks apart. It was done on 30 final year medical students who underwent their primary care attachment at the time of the data collection. A reliable scale should demonstrate moderate correlation between the scores of test 1 and 2 and the scores should not be significantly different ($p > 0.05$).

Pilot study

The bilingual version of the questionnaire with 12 revised items was distributed to 100 conveniently sampled patients from the same clinic. Their written consent was sought before they completed the questionnaire on their own.

Inter-item correlations for each of the 12 items were also examined. The items should theoretically be correlated with items belonging to the same area of knowledge. Items with many low correlation ($r < 0.30$) should be excluded²⁴. Subsequently, assessment of the item-total correlations (ITC) were done. This was done to ensure homogeneity among these items²⁵. The items should be correlated with the total scale score. Thus, the ITC values should be between 0.20 and 0.80 with mean ITC of at least 0.25 or

above²⁵. The internal consistency (Cronbach's Alpha) of the questionnaire should be between 0.70 and 0.90²⁵.

Ethical considerations

This study received an approval from the Research Ethics Committee of the Universiti Kebangsaan Malaysia (project code of FF-2014-073). Permission from the clinic coordinator was also obtained. All the participants gave their written consent for participating in this study.

RESULTS

Discriminative validation of the bilingual KnowCaS-12 questionnaire showed a significant difference ($p < 0.001$) in the total scores among the primary care doctors, medical students and primary care patients (Table 2). The doctors recorded the highest score (Median of 10.00; IQR 3.00), followed by the medical students (Median of 5.50; IQR 1.00) and the patients (Median of 5.00; IQR 4.00). Post hoc analysis showed significant differences in scores between doctors and students ($p < 0.001$), as well as doctors and patients ($p < 0.001$). However, the scores difference between students and patients were not significantly different ($p = 0.17$).

Table 2: Kruskal Wallis test for discriminative validation

Group	Mean (SD)	Median (IQR)	p-value*
Primary care doctors ^a	10.05 (1.73)	10.00 (3.00)	<0.001
Medical students ^a	5.65 (0.93)	5.50 (1.00)	
Primary care patients ^b	4.95 (2.56)	5.00 (4.00)	

^aThe data was not normally distributed, ^bThe data was normally distributed;

* $p < 0.05$ = significant, Post-hoc analysis (Bonferonni correction level of significance: $p < 0.02$):

Doctors and patients: $p < 0.001$, Doctors and students: $p < 0.001$, Patients and students: $p = 0.17$

To examine the consistency of the bilingual KnowCaS-12 questionnaire over time, test-retest analysis was carried out using Spearman's rho correlation as Test 2 was not normally distributed. The test showed fairly good correlation between test 1 and 2 which was statistically significant (Spearman's rho correlation coefficient: 0.42, $p = 0.02$). There was no significant difference (p-value of Wilcoxon Signed Ranks test: 0.08) between the scores of test 1 [Median (IQR): 8.00 (3.00)] and test 2 [Median (IQR): 9.00 (2.00)].

The median (IQR) for age of the participants in the pilot studies was 48.50 (29.00) years old (Table 3). Almost a half of them were Malay (49.0%), followed by Chinese (25.0%), Indian (23.0%) and other ethnics (3.0%). The majority of them were female (70.0%), employed (62.0%) and had attained at least secondary education (85.0%). About 46.7% of the participants who disclosed their family income (21/45) earned less than RM2300 per month. Only 90 participants revealed their practice of consuming calcium

supplement in which 52.5% (47/90) of them admitted of taking calcium supplement. Among those who took the supplement, only 14.9% (7/47) took it every day. There was no significant difference in the characteristics between those who took calcium supplement and those who did not (Table 3).

Analysis of the pilot study showed that each item had a number of inter-item correlation (IIC) of > 0.30 , except item 2. The inter-item correlation (ITC) of item 1, 2, 3 and 4 were also low (ranged between 0.05 and 0.12). The item 1 to 3 assessed knowledge on calcium in general and item 4 assessed on the dietary source of calcium. Compared to other items, these items did not contain the term 'calcium supplement'. Nevertheless, none of the items with poor IIC and ITC was removed as the panel of experts believed that items on calcium in general and dietary source of calcium were important. The Cronbach's alpha value for KnowCaS-12 was $\alpha = 0.68$.

Table 3: Characteristics of the participants in the pilot study

Sociodemographic and clinical characteristics	Overall (n=100)	Taking calcium supplement (n=43)	Not taking calcium supplement (n=47)	p- value**
	n (%)	n (%)	n (%)	
	or Median (IQR)	or Median (IQR)	or Median (IQR)	
Age (years)*	48.5 (29.0)	49.0 (27.0)	44.0 (31.0)	0.61 ^a
Gender				
Female	70 (70.0)	26 (41.3)	37 (58.7)	0.06 ^b
Male	30 (30.0)	17 (63.0)	10 (37.0)	
Ethnicity				
Malay	49 (49.0)	20 (45.5)	24 (54.5)	0.67 ^b
Non Malay	51 (51.0)	23 (50.0)	23 (50.0)	
Educational status				
No formal/ primary education	15 (15.0)	4 (28.6)	10 (71.4)	0.21 ^b
Secondary education	56 (56.0)	24 (48.0)	26 (52.0)	
Tertiary education	29 (29.0)	15 (57.7)	11 (42.3)	
Employment status				
Employed	62 (62.0)	27 (47.4)	30 (52.6)	0.92 ^b
Unemployed	38 (38.0)	16 (48.5)	17 (51.5)	
Family income [#]				
RM <2300/month	21 (46.7)	9 (42.9)	12 (57.1)	0.45 ^b
RM ≥2300/month	24 (53.3)	13 (54.2)	11 (45.8)	
Smoking status				
Non-smokers/ Ex-smokers	93 (93.0)	40 (51.3)	38 (48.7)	0.09 ^c
Current smokers	7 (7.0)	6 (85.7)	1 (14.3)	
Family history of osteoporosis				
Yes	12 (12.0)	3 (25.0)	9 (75.0)	0.09 ^b
No/ Not sure	88 (88.0)	40 (51.3)	38 (48.7)	
Presence of co-morbidities				
Yes	51 (51.0)	22 (48.9)	23 (51.1)	0.83 ^b
No	49 (49.0)	21 (44.6)	24 (53.3)	

*Data was not normally distributed; **Significance: $p < 0.05$

[#]Only 45 participants declared their family income; Taking calcium supplement: 22 participants, Not taking calcium supplement: 23 participants

^aMann-Whitney test; ^bChi-Square test; ^cChi-Square test with continuity correction

The participants' mean (SD) and median (IQR) for KnowCaS-12 score were 7.07 (2.67) and 7.00 (4.00) respectively. The score at 25th centile was 5.00 and the score at 75th centile was 9.00. There was no significant difference (p -value for Mann-Whitney test: 0.26) in the level of knowledge score between the participants who took calcium supplements [Median (IQR): 7.00 (6.00)] and those who did not [Median (IQR): 7.00 (3.00)]. However, significantly more participants who did not take calcium supplement answered correctly for item 7 ("All calcium supplements that we eat will be absorbed into the body", $p=0.01$) and 9 ("Coffee can be taken together with calcium supplement", $p=0.04$) compared to those who did (Table 4). The proportions of those answered correctly for other items were not significantly different between the two groups.

DISCUSSION

A good questionnaire that assesses knowledge should be able to differentiate the level of knowledge between those who are expected to

have better knowledge than those with poor knowledge. In this study, the doctors were expected to have the higher scores than medical students and patients. This was proven as the doctors had significantly higher KnowCaS-12 score than the other two groups. Unfortunately, the level of knowledge on calcium supplement among medical students appeared to be similar with the laymen, indicating their knowledge about calcium supplementation is still inadequate.

Test-retest analysis of the bilingual KnowCaS-12 questionnaire done among medical students demonstrated that the questionnaire was consistent over time. The scores of the tests done in two-weeks apart were significantly correlated with no significant difference. Another test to measure reliability of a questionnaire is by testing its internal consistency. Unfortunately, the Cronbach's alpha value for KnowCaS-12 was $\alpha: 0.68$, which was below than the acceptable value of 0.70²⁵. The IIC of item 2 and ITC of item 1, 2, 3 and 4 were poor as well. This indicates that KnowCaS-12 was

not correlated and homogenous. Since items 1 to 4 were noted to be different than the other items as these items did not contain the term 'calcium supplement', there is a possibility that KnowCaS-12 is multidimensional. Presence of multidimensionality violates the homogeneity assumption, thus resulting low internal consistency²⁶. In this study, the panel of experts believed that this multidimensionality is important and items 1 to 4, which were assessing on calcium in general and dietary source of calcium, should not be removed. This is because having this knowledge could influence someone's

decision to consume calcium supplement as well. Nevertheless, the Cronbach alpha value can still be higher than 0.7 in the presence of multidimensionality if the questionnaire contains enough items^{26,27}. Inadequate items may also be responsible for low internal consistency of KnowCaS-12 and adding more items could increase the value of alpha. Even though the internal consistency of KnowCaS-12 was below the acceptable level, its reliability is fairly good due to good test-retest reliability. This is adequate for a questionnaire that assess knowledge like KnowCaS-12.

Table 4: The difference in proportions of correct answers between those who took calcium supplement (n=47) and those who did not (n=43)

Items	Taking calcium supplement n (%)	Not taking calcium supplement n (%)	p-value*
Item 1: Calcium is important for bone health. (<i>Kalsium adalah penting untuk kesihatan tulang.</i>)	44 (93.6)	36 (83.7)	0.25 ^a
Item 2: Calcium requirement increases with increasing age. (<i>Keperluan kalsium meningkat selaras pertambahan usia.</i>)	33 (70.2)	35 (81.4)	0.22 ^b
Item 3: Daily requirement of calcium is the same for both women and men of the same age. (<i>Keperluan harian kalsium adalah sama bagi lelaki dan perempuan yang sama usia.</i>)	20 (42.6)	27 (62.8)	0.06 ^b
Item 4: Green vegetables are known to have good source of calcium. (<i>Sayuran hijau diketahui mempunyai sumber kalsium yang baik.</i>)	30 (63.8)	23 (53.5)	0.32 ^b
Item 5: Calcium from food is better absorbed into body than calcium from supplements. (<i>Kalsium daripada makanan adalah lebih mudah diserap ke dalam tubuh berbanding kalsium daripada makanan tambahan.</i>)	31 (66.0)	26 (60.5)	0.59 ^b
Item 6: Calcium supplement is only needed when dietary intake of calcium is inadequate. (<i>Kalsium tambahan adalah diperlukan hanya sekiranya kalsium di dalam diet seharian tidak mencukupi.</i>)	38 (80.9)	35 (81.4)	0.95 ^b
Item 7: All calcium supplements that we eat will be absorbed into the body. (<i>Kesemua kalsium tambahan yang dimakan akan diserap sepenuhnya oleh tubuh.</i>)	21 (44.7)	31 (72.1)	0.01^b
Item 8: Calcium supplement is safe to be taken at higher doses than recommended for age. (<i>Kalsium tambahan adalah selamat untuk diambil dalam dos yang lebih tinggi daripada yang disarankan bagi had umur.</i>)	29 (61.7)	32 (74.4)	0.20 ^b
Item 9: Coffee does not reduce the benefit of calcium supplement when taken together. (<i>Kopi tidak mengurangkan faedah yang diperolehi dari Kalsium tambahan bila dimakan bersama.</i>)	25 (53.2)	32 (74.4)	0.04^b
Item 10: Foods with high iron content do not reduce the benefit of calcium supplement when taken together. (<i>Makanan yang mengandungi kandungan zat besi yang tinggi tidak mengurangkan faedah yang diperolehi daripada kalsium tambahan bila dimakan bersama.</i>)	16 (34.0)	16 (37.2)	0.75 ^b
Item 11: Iron tablets do not reduce the benefit of calcium supplement when taken together. (<i>Tablet zat besi tidak mengurangkan faedah yang diperolehi daripada kalsium tambahan bila dimakan bersama.</i>)	14 (29.8)	15 (34.9)	0.61 ^b
Item 12: Constipation is a known side effect of calcium supplement. (<i>Sembelit dikenali sebagai kesan sampingan daripada pengambilan kalsium tambahan</i>)	20 (42.6)	16 (37.2)	0.61 ^b

During the development of KnowCaS-12, the cut-off point to differentiate those with good or poor knowledge was not determined. Since the 75th centile score of the participants in the pilot study was 9, which was slightly lower than the median score of the doctors in the discriminative validation testing (Median: 10), it could be used as the cut-off point for having good knowledge. The experts' opinion on the optimum level of knowledge regarding calcium supplement that one should have can be sought as well. By using this cut-off point, only 27% of the participants in the pilot study were considered to have good level of knowledge on calcium supplement and there was no statistical difference of level of knowledge between participants who took calcium supplement and those who did not (Chi-square value: 0.17, p-value: 0.68). Similar insignificant difference in level of knowledge between the two groups if continuous scores of knowledge were used and tested using Mann-Whitney test ($p=0.26$). The insignificant results may be due to inadequate sample size used in the pilot study, thus the finding should be interpreted cautiously. This pilot study also suggests that the use of calcium supplement was quite common (52.2%), but its prevalence should be examined in another population with adequate sample size. The level of knowledge on calcium supplement among users appears to be moderate, which was not significantly different than those who did not take calcium supplement. Nevertheless, the analysis of knowledge on calcium supplement in this pilot study should be replicated with a bigger sample of population so that difference between users and non-users can be confidently determined.

Even though the bilingual KnowCaS-12 has been shown to be reasonably good to measure knowledge regarding calcium supplement, it has a number of limitations. Firstly, the understanding of the participants on the meaning of 'calcium supplement' was not assessed. They might not be aware of what calcium supplement was and this could affect the validity of their answers. This can be overcome by giving the definition of 'calcium supplement' before they answer the knowledge questionnaire. Secondly, the only example of foods containing high level of iron for item 10, which was liver, was removed after face validation phase. This could affect the validity of participants' answers if they do not know the foods with high iron content. Instead of removing the example, more examples should be included particularly common food in Malaysia. The bilingual KnowCaS-12 may also contain inadequate items which resulted in low internal consistency. To have better reliability, more items can be added but this could compromise the participants' concentration and interest in answering the questionnaire as it takes longer time to complete. Nevertheless, KnowCaS-12 is believed to be adequately good tool to measure primary

care patients' knowledge on calcium supplement with satisfactory reliability as its test-retest reliability was good and acceptable validity. Thus, we recommend that the KnowCaS-12 to be used for future studies regarding calcium supplementation and its practice among Malaysian patients. This may add further insight into the practice and cost-effectiveness of calcium supplementation in the Malaysian setting.

CONCLUSION

The bilingual KnowCaS-12 questionnaire is a valid and reliable tool to measure patients' knowledge regarding calcium supplement. It has good content validity, face validity, test-retest reliability and discriminative ability. Therefore, KnowCaS-12 can be used for future studies at a primary care setting. Practice of consuming calcium supplement also seems to be common and the level of users' knowledge regarding calcium supplement was only moderate.

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REFERENCES

1. Nordin BEC. Nutritional considerations. In Nordin BEC (ed). Calcium, phosphate and magnesium metabolism. Churchill Livingstone: Edinburgh, UK, 1976.
2. Theobald HE. Dietary calcium and health. *Nutrition Bulletin* 2005;**30**(3):237-277.
3. Institute of Medicine. Ross AC, Taylor CL, Yaktine AL, Del Valle HB (ed). Dietary Reference Intakes for Calcium and Vitamin D. National Academies Press (US): Washington, DC, 2011.
4. Malaysian Osteoporosis Society. Clinical guidance on management of osteoporosis 2012. Available from: <http://www.moh.gov.my/attachments/7513.pdf>
5. Tee E, Siong MIN, Azudin MN, Idris K. Nutrient composition of Malaysia. Institute of Medical Research: Kuala Lumpur, 1997.
6. Salau RB, Hasan MN. Evaluation and Analysis of Dietary Essential Mineral Micronutrients in Selected Malaysian Foods Using FAAS and ICP-MS. *Modern Applied Science* 2014;**8**(6):103-11.

7. Green JH, Booth C, Bunning R. Acute effect of high-calcium milk with or without additional magnesium, or calcium phosphate on parathyroid hormone and biochemical markers of bone resorption. *Eur J Clin Nutr* 2003;**57**:61-8.
8. Administrative Committee on Coordination/Sub-Committee on Nutrition (ACC/SCN). 3rd Report on the World Nutrition Situation 1997.
9. Chee WSS, Suriah AR, Zaitun Y, Chan SP, Yap SL, Chan YM. Dietary calcium intake in postmenopausal Malaysian women: comparison between the food frequency questionnaire and three-day food records. *Asia Pac J Clin Nutr* 2002;**11**(2):142-146.
10. Pon LW, Noor-Aini MY, Ong FB, Adeeb N, Seri SS, Mohamed AL, Shamsuddin K, Mohamed AL, Hapizah N, Mokhtar A, Wan HWH. Diet , nutritional knowledge and health status of urban middle-aged Malaysian women. *Asia Pac J Clin Nutr* 2006;**15**:388-99.
11. Gerend MA, Erchull MJ, Aiken LS, Maner JK. Reasons and risk: factors underlying women's perceptions of susceptibility to osteoporosis. *Maturitas* 2006;**55**(3):227-237.
12. Chan SP, Scott BB, Sen SS. An Asian viewpoint on the use of vitamin D and calcium in osteoporosis treatment: physician and patient attitudes and beliefs. *BMC Musculoskelet Disord* 2010;**11**(1):248.
13. Bailey RL, Gahche JJ, Miller PE, Thomas PR, Dwyer JT. Why US adults use dietary supplements. *JAMA Intern Med* 2013;**173**(5):355-361.
14. Zhou W, Langsetmo L, Berger C, Poliquin S, Kreiger N, Barr SI, Kaiser SM, Josse RG, Prior JC, Towheed TE, Anastassiades T, Davison KS, Kovacs CS, Hanley DA, Papadimitropoulos EA, Goltzman D, CaMos Research Group. Longitudinal changes in calcium and vitamin D intakes and relationship to bone mineral density in a prospective population-based study: the Canadian Multicentre Osteoporosis Study (CaMos). *J Musculoskelet Neuronal Interact* 2013;**13**(4):470-479
15. Mangano KM, Walsh SJ, Kenny AM, Kerstetter JE. Calcium Intake in the United States from Dietary and Supplemental Sources across Adult Age Groups : New Estimates from the National Health and Nutrition Examination Survey 2003-2006. *J Am Diet Assoc* 2011;**5**(111):687-95.
16. Tyler C V, Werner JJ, Panaite V, Snyder SM, Ford DB, Conway JL, Young CW, Powell BL, Smolak MJ, Zyzanski SJ. Barriers to supplemental calcium use among women in suburban family practice: a report from the Cleveland Clinic Ambulatory Research Network (CleAR-eN). *J Am Board Fam Med* 2008;**21**(4):293-299.
17. Oudshoorn C, Hartholt KA, Leeuwen JPTM Van, Colin EM, Van N. Better knowledge on vitamin D and calcium in older people is associated with a higher serum vitamin D level and a higher daily dietary calcium intake. *Health Educ J* 2012;**71**(4):474 -482.
18. Edmonds E, Turner LW, Usdan SL. Osteoporosis knowledge, beliefs, and calcium intake of college students: Utilization of the health belief model. *Open Journal of Preventive Medicine* 2012;**2**(1):27-34.
19. Glanz K, Steffen A. Development and reliability testing for measures of psychological constructs associated with adolescent girls' calcium intake. *J Am Diet Assoc* 2008;**108**:857-861.
20. Chemaly CT, MacIntyre UE, Abrahamse H. Calcium intake and knowledge among white adolescent girls in Gauteng, South Africa. *SAJCN* 2004;**17**(3):102-108.
21. Toh LS, Lai PSM, Wu DB-C, Wong KT, Low BY, Anderson C. The development and validation of the osteoporosis prevention and awareness tool (OPAAT) in Malaysia. *PLoS ONE* 2015;**10**(5):e0124553
22. Winzenberg TM, Oldenburg B, Frendin S, Jones G. The design of a valid and reliable questionnaire to measure osteoporosis knowledge in women: the Osteoporosis Knowledge Assessment Tool (OKAT). *BMC Musculoskeletal Disorders* 2003;**4**:17.
23. Anderson KD, Chad KE, Spink KS. Osteoporosis knowledge, beliefs, and practices among adolescent females. *Journal of Adolescent Health* 2005;**36**:305-312
24. Field A. *Discovering Statistics Using SPSS*. SAGE Publication: London, 2009.

25. Streiner DL, Norman GF. Health measurement scales: A practical guide to their development and use. Oxford University Press: Oxford, 2008.
26. Tavakol M, Dennick R. Making sense of Cronbach's alpha. *International Journal of Medical Education*. 2011;2:53-55.
27. Streiner DL. Starting at the beginning: An introduction to coefficient alpha and internal consistency. *Journal of Personality Assessment*. 2003;80(1):99-103.