ASSESSMENT OF DIETARY CALCIUM INTAKE AMONG FEMALE UNIVERSITY STUDENTS

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ABSTRACT

Introduction: Calcium is an essential micronutrient that contributes to human well-being and its function is very pronounced for bone and teeth health. Inadequacy in calcium intake can increase susceptibility to metabolic bone fractures such as osteoporosis. **Aims:** The aim of this study was to evaluate the dietary calcium intake (DCI) among young female adults in IIUM Kuantan followed by identifying the strength of associated factors with amount of dietary calcium intake. **Material and Methods:** A total of 75 young female adults aged between 19 and 25 years old were recruited to assess their DCI using 3-days diet recall and Calcium Food Frequency Questionnaires. Two modified questionnaires were used to identify the associated factors such as personal, environmental, knowledge, attitudes and practices factors that affecting their DCI. **Result:** This study found that mean DCI among young female adults was 377.93 (±179.08) mg/day which was lower than the recommended value by RNI 2017. Pearson Correlation showed a fairly positive association between personal (r = 0.248, p = 0.032), attitudes (r = 0.386, p = 0.001) and practices (r = 0.354, p = 0.002; r = -0.418, p = 0.000) factors with the amount of DCI. **Conclusion:** This study has provided additional information about the inadequacy in dietary calcium intake among young female adults from previous studies, therefore interventions from various level of local health authorities is warranted.

KEYWORDS: Calcium, Osteoporosis, Young, Adults, Factors, Calcium, Intakes

INTRODUCTION

Calcium is an essential micronutrient which is very pronounced important for bone and teeth health. Recommended Nutrient Intake 2017 (RNI) established by Ministry of Health (MOH) (2017) has stipulated that calcium intake required for female adult aged between 19-39 years old is 1000 mg/day. Many studies found that young adults particularly females are at risk of low calcium intake than the recommended value. A systematic review by Balk et al. (2017) revealed that globally calcium intake in adult ranged between 175 to 1233 mg/day. This study has collected data from 74 countries which included in the region of Asia, Africa, Europe and South America. Asians are likely to depict lower calcium intake which is at average of 500 mg/day. This finding is proven to be reliable to Malaysian population because a cross-sectional study conducted by Yahya, Makbul, Daud, & Aziz

(2018) recorded the similar value of dietary calcium intake among Malaysian adults. Inadequacy in calcium intake can increase susceptibility to metabolic bone fractures such as osteoporosis. International Osteoporosis Foundation (IOF) defined osteoporosis as progressive porous bone disease that result in bone fragility and fractures in long term period. This disease is scarce in clinical appearance and symptom-less until there is crack or fracture noticed at the bone hence, they called it as "silent thief" (Kamau , 2011). The prevalence of osteoporosis become more prominent when accompanied with several risk factors such as gender, nutrient intake, education level and ethnicity (Wang et al., 2019). Furthermore, many studies suggested that women are prone to develop osteoporosis than men especially during postmenopausal period in older age (Saei Ghare Naz, Ozgoli, Aghdashi, & Salmani, 2015; Chan et al., 2020). In addition, women need to have higher awareness of bone health. Some naturally occurring events throughout the life cycle such as menarche, pregnancy, breastfeeding, menopause and several hormonal activities have association with the calcium content in the body which predominantly affect the bones. Moreover, according to National Osteoporosis Foundation, women develop relatively thinner bones than men that increase the tendency towards getting porous bones. Several literatures suggested the accrual of peak bone mass happened during early adulthood (Shivane et al., 2012; Rashid, 2015). Heany et. al (2000) and Dent (1973) suggested that failure to reach the optimum level of bone mass density will increase the susceptibility to the bone fractures in later life. Hence, this study was conducted to determine the pattern and factors affecting dietary calcium intake among female adults in IIUM Kuantan, Pahang.

MATERIAL AND METHODS

A total of 75 female students aged between 19 and 25 years old were recruited from six Kulliyyah in IIUM Kuantan namely Kulliyyah of Sciences, Allied Health Sciences, Pharmacy, Nursing, Medicine and Dentistry. Those who are pregnant and under prescription of Glucocorticoids were excluded. This study has been granted with approval from the Kulliyyah Postgraduate Research Committee and International Islamic University Malaysia Research Ethical Committee *(IREC KAHS-11/2020)*. Three days dietary history was recorded by asking what the participant had consumed for three consecutive days (e.g. Thursday, Friday and Saturday). During the interview, participants were asked about their usual food intake at 3 main meals (i.e. breakfast, lunch and dinner) and in between meals (i.e. afternoon snack, evening snack and supper). They were asked on the time of the meal, the net quantity of food consumed, method of food preparation, portion size and food brands. The portion size of food was recorded in its real size or by using household measure. Some participants were unable to give the precise measurement of the food, alternatively, the researcher estimated the amount using food exchange measurement. Then, the information on food intake and its portion were translated into total calorie, macronutrients and micronutrients intakes using Nutritionist Pro© software.

Food Frequency Questionnaires (FFQ)

This FFQ consist of eight food items such as milk (all type of milk), sliced cheese, yogurt, tempeh, tofu, cauliflower/broccoli, dark green leafy vegetables and ice cream. This FFQ is a self-administered questionnaire and there were several options composed for frequency and amount of per intake of each calcium food such as "<1, 1, 2, >3". The participants were required to tick according to right frequency and amount per intake of calcium food in a week. After that, the data collected were transferred into FFQ Nutritionist Pro to generate the amount of calcium.

Self-administered Questionnaires

Personal and environmental factors questionnaires were measured using seven items in total in which three items consist of self-conscious, part of dietary behavior and physical activities were classified into personal factors. Whilst environmental factors composed of four items that include media influence, peer influence, family influence and availability

Knowledge, attitude and practice of calcium intake questionnaire consist of three domains and nine items. Questions regarding knowledge include "Calcium is good for bone health", "Adequate calcium intake can delay osteoporosis" and "Milk and dairy products is the only source of calcium food". Meanwhile, questions demonstrating attitude were divided into 4 items such as "I am concern about my calcium intake", "I find milk product is constipating", "I tend to avoid milk products because of the cost" and "I tend to avoid milk products because of the calories". Questions related to practice of calcium intake include 2 items which are "I always drink milk" and "I only can drink cold milk".

Participants were required to fill each of the factors according to the satisfactory ranking from "1 – strongly disagree", "2 – disagree", "3 – average", "4 – agree" and "5 – strongly agree" to demonstrate the strength of the factors. No scoring or scaling method were involved.

RESULTS

Comparison of DCI with RNI 2017

Based on Table 1, significant difference was observed between the mean of DCI by young female adults in IIUM Kuantan with the recommended value from RNI Malaysia 2017 ($p <$ 0.001).

Reference value (mg/day)	Mean (±SD) (mg/day)	Percentage from RNI	*p* value
1000 **(RNI, 2017)**	377.93 (±179.08)	37.8%	P<0.001*

Prevalence of High Calcium Food intake among Young Female Adults

Overall, the sequence for prevalence of high calcium food intake by the young female adults were starting with milk, green leafy vegetables, cauliflower and broccoli, tempeh, ice cream, tofu, yogurt, not taking any calcium food, and sliced cheese.
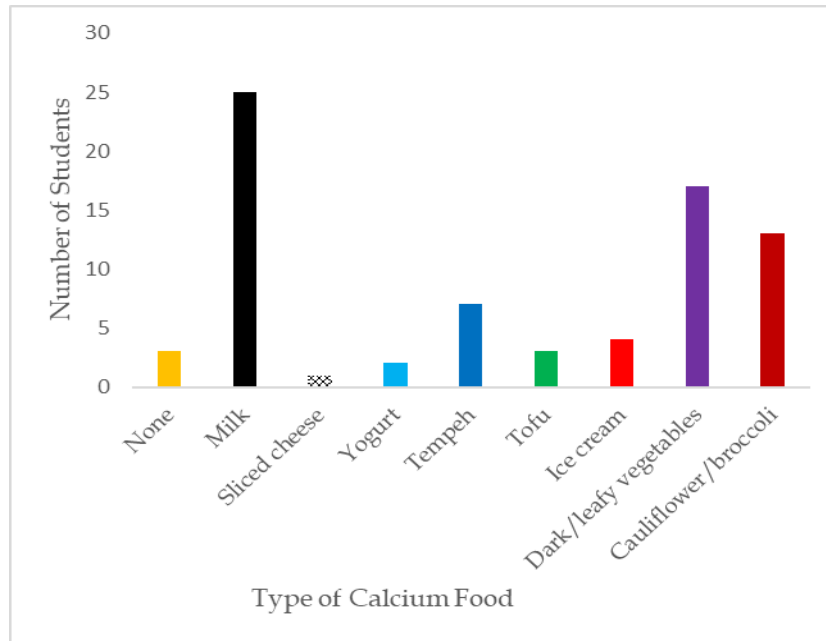

Figure 1. Prevalence of high calcium food consumed by young female adults

The strength of Association of Personal and Environmental Factors with DCI

Based on Table 2, there is a positively fair correlation between item "self-conscious" and the amount of DCI ($r = 0.248$, $p = 0.032$).The rest personal factors such as "part of dietary behaviour" (r = 0.145, p = 0.215) and "physical activity" (r = 0.214, p = 0.065) were not significant. On the other hand, within the environmental factors group, no significant correlation were found in "media influence" (r = 0.046, p = 0.695), "peer influence" (r = 0.010, p = 0.934), "family influence" (r = 0.024, p = 0.840) and "availability" (r = -0.032, p = 0.787) with the amount of DCI.

Total 2. Relationship between Knowledge, Attitude and PracticesFactors		*r*	*p* value
Personal	Self-conscious	0.248	0.032
	Part of Dietary Behaviour	0.145	0.215
	Physical Activity	0.214	0.065
Environmental	Media Influence	0.046	0.695
	Peer Influence	0.010	0.934
	Family Influence	0.024	0.840
	Availability	-0.032	0.787

The Relationship between Knowledge, Attitude and Practices Factors with DCI

Based on Table 3, there was no significant relationship between knowledge and the amount of DCI. Meanwhile, for attitude factors, only one item i.e. "I am concern about my calcium intake" factor (r = 0.386, p = 0.001) showed a positively fair correlation with the amount of DCI. For practice group, item "I always drink milk" (r = 0.354, p = 0.002) demonstrated a positively fair correlation with amount of DCI. Meanwhile, item "I only can drink cold milk" (r = -0.418, p = 0.000) indicated there was a negatively fair correlation with amount of DCI.

Factors		r	p value
Knowledge	Calcium is good for bone health	-0.014	0.905
	Adequate calcium intake can delay osteoporosis	0.146	0.214
	Milk and dairy products are the only source of calcium	-0.12	0.305
Attitudes	I am concern about my calcium intake	0.386	0.001
	Milk is constipating	0.170	0.145
	I tend to avoid milk because of the cost	-0.065	0.579
	I tend to avoid milk because of the calorie	-0.060	0.607
Practices	I always drink milk	0.354	0.002
	I only can drink cold milk	-0.418	0.001

DISCUSSION

This study aims to evaluate the amount of DCI and its relationship between associated factors. Findings demonstrated that young female adults in IIUM Kuantan consume lower DCI than the recommended RNI 2017. Several other studies also reported lower calcium intake among university students. For examples, Yap et. al (2019) and Hakim et. al (2012) evaluating dietary calcium intake had reported lower median of DCI at 348.3 mg/day & 421.63 mg/day respectively. Meanwhile, a study by Yahya, et. al had reported a slightly higher mean of DCI (520.6 mg/day) although the amount only equivalent to only half of the RNI Malaysia 2017. The prevalence of high calcium food among young adults can be vary. In this study, milk was chosen as the best source of calcium among others. As the matter of fact, milk has become the largest contributor to calcium intake among college students and adults as suggested in several literatures (Douglas et al., 2010; Durá, 2008; Rouf, Sui, Rangan, Grech, & Allman-Farinelli, 2018). However, disparity in ethnicity might govern the choice of calcium food. In a study among Chinese adults, vegetables and

legumes scored at the first tier than other high calcium food (Huang et al., 2018). Apart from that, university students in Poland prone to consume more cheese as their main source of calcium food and milk came as the second choice (Włodarek, Głabska, & Lange, 2014). Cultural and historical background of a particular country also can be a plausible factors of difference in milk and dairy product preferences (Brázdová, Klimusová, Vorlová, & Fiala, 2014). Personal and environmental factors can indirectly affect the amount of DCI. In this study, DCI showed a positive correlation with self-conscious from personal factor. However, this finding was found to be inconsistent with other findings in two studies where environmental factors such as family influence, peer influence and availability became more impactful to calcium intake among college students rather than self-conscious (Rose, Williams, Rengers, Kennel, & Gunther 2018; Angela Rose et al., 2015). Nevertheless, it was good to highlight that having self-conscious can become such remarkable driver for the young female adults to consume milk and other high calcium food. Self-conscious is relevant with self-efficacy towards dietary behavior in social cognitive theory suggested by Bandura (2004). This can be further explained by having self-efficacy or self-conscious to consume calcium food can lead to a continuous commitment to consume calcium-rich food in order to achieve favorable outcomes such as attaining strong bone and delaying osteoporosis in elderhood. Other than that, knowledge, attitude and practices factors also might imply an association with DCI. With respect to knowledge factor, this study demonstrated that knowledge has no association with amount of DCI. This finding was in line with several studies where knowledge failed to be a significant determinant to DCI among young adults (Jamil et. al, 2010; Khan et. al , 2014; Amin & Mukti, 2017). It can be assumed that university students still have limited knowledge regarding the ramification of enough calcium intake to bone health in future. Marcinow (2015) emphasized that young adults need to be reinforced with knowledge regarding the importance of consuming adequate calcium intake for their age group to develop awareness to elicit changes in dietary practices towards increasing calcium-rich food consumption. Thus, local health authorities need to forecast an extensive intervention to educate young generation regarding the importance of calcium intake starting from early life stage. Only one item in attitude factor showed significant association towards the amount of DCI (i.e. "I am concern about my calcium intake"). Having this attitude has inspired the participants to increase their calcium intake. A similar outcome was observed in a study by Chapman et. al (2013) reported that concern about calcium intake were significant among high calcium group participants. Interestingly, this finding also has a good connection with self-efficacy in social cognitive theory developed by Albert Bandura as discussed earlier. Both items in practices factor have a fair correlation with DCI. "I always drink milk" item showed a positive relationship with DCI. The significance of this result were in line with a literature by Kim & Kim (2015) which imply regular intake of dairy food such as milk increase their calcium intake as compared to those who rarely consume it. Ozdogan, Yardimci, & Ozcelik (2017) stated that the regularity of milk intake is due to the nutritional value, easy to consume and provide satiety and fullness. Meanwhile, "I only can drink cold milk" item was inversely related to DCI. This finding indicated most of the participants preferred room temperature milk as compared to cold milk. This findings is somewhat contradicting to study by Ozdogan, Yardimci, & Ozcelik (2017) whereby young adults preferred to consume cold milk more than hot milk.

Even though Lacroix et al. (2016) mentioned the adults agreed that cold milk has an enjoyable taste and influence them to drink it., but it seems like a different scenario in our population of study. The potential weaknesses of this study rely on its design which is non-randomization and small sample size. In addition, participants might over-report or under-report their food intake which interfere the actual calcium intake. Anyhow, in this study two dietary assessment methods (i.e. 3-days diet recall, food frequency questionnaire) were used to counter check and resolved the most consumed food by the participants.

CONCLUSION

The dietary calcium intake (DCI) by female students in IIUM Kuantan did not meet the recommended value in RNI 2017. In this study, milk was preferred as compared to other sources of calcium. scored at the first place in terms of prevalence of high calcium food consumed by the female students. Factors such as self-conscious, behavioral, and practices depict significant association with DCI with fair strength of association.

ACKNOWLEDMENT

REFERENCES

Amin, S., Mukti, N. A. (2017). Assessment of Knowledge Level on Osteoporosis among a Private University Students in Malaysia. *Imperial Journal of Interdiscipinary Research*, *3*(3), 141–145.

Angela Rose, Gillis, B., Boucherle, L., Seger, J., Kennel, J., & Gunther, C. (2015). Availability, Food and Meal Association, and Family Influences Predict College Students' Calcium Consumption. *Journal of Nutrition Education and Behavior*, *47*(4), S64. https://doi.org/10.1016/j.jneb.2015.04.169

Balk, E. M., Adam, G. P., Langberg, V. N., Earley, A., Clark, P., Ebeling, P. R., … Dawson-Hughes, B. (2017). Global dietary calcium intake among adults: a systematic review. *Osteoporosis International*, *28*(12), 3315–3324. https://doi.org/10.1007/s00198-017-4230-x

Bandura, A. (2004). Health promotion by social cognitive means. *Health Education and Behavior*, *31*(2), 143–164. https://doi.org/10.1177/1090198104263660

Brázdová, Z. D., Klimusová, H., Vorlová, L., & Fiala, J. (2014). Food preference for milk and dairy products. *Acta Veterinaria Brno*, *83*, S41–S44. https://doi.org/10.2754/avb201483S10S41

Chan, C. Y., Subramaniam, S., Mohamed, N., Ima-Nirwana, S., Muhammad, N., Fairus, A., Chin, K. Y. (2020). Determinants of bone health status in a multi-ethnic population in Klang Valley, Malaysia. *International Journal of Environmental Research and Public Health*, *17*(2), 1–16. https://doi.org/10.3390/ijerph17020384

Chapman, K. M., Chan, M. W., & Clark, C. D. (2013). *Journal of the American College of Nutrition women . Factors Influencing Dairy Calcium Intake in Women*. (May 2015), 37–41. https://doi.org/10.1080/07315724.1995.10718518

Douglas, C. C., Rumbak, I., Barić, I. C., Kovačina, M., Piasek, M., & Ilich, J. Z. (2010). Are new generations of female college-student populations meeting calcium requirements: Comparison of American and Croatian female students. *Nutrients*, *2*(6), 599–610. https://doi.org/10.3390/nu2060599

Hakim, N. H. A., Muniandy, N. D., & Danish, A. (2012). Nutritional Status Uni Student Malaysia.Pdf. *Asian Journal of Clinical Nutrition*, Vol. 4, pp. 77–78.

Huang, F., Wang, Z., Zhang, J., Du, W., Su, C., Jiang, H., … Wang, H. (2018). Dietary calcium intake and food sources among Chinese adults in CNTCS. *PLoS ONE*, *13*(10), 1–8. https://doi.org/10.1371/journal.pone.0205045

Jamil, W. A. N. W., Aziz, M. E., Foo, L. H. (2010). Knowledge , Attitude and Dietary and Lifestyle Practices on Bone Health Status among Undergraduate University Students in. *Health and the Environment Journal*, *1*(1), 34–40.

Kamau, E., Thesis, D., Ageing, H., & Services, E. (2011). *Osteoporosis in the elderly, pharmacological and non pharmacological prevention and treatment*.

Khan, Y. H., Sarriff, A., Khan, A. H., & Mallhi, T. H. (2014). Knowledge, attitude and practice (KAP) survey of osteoporosis among students of a tertiary institution in Malaysia. *Tropical Journal of Pharmaceutical Research*, *13*(1), 155–162. https://doi.org/10.4314/tjpr.v13i1.22

Kim, M. J., & Kim, K. W. (2015). Nutrition knowledge, outcome expectations, self-efficacy, and eating behaviors by calcium intake level in Korean female college students. *Nutrition Research and Practice*, *9*(5), 530–538. https://doi.org/10.4162/nrp.2015.9.5.530

Lacroix, M.-J., Desroches, S., Turcotte, M., Painchaud Guérard, G., Paquin, P., Couture, F., & Provencher, V. (2016). Salient beliefs among Canadian adults regarding milk and cheese consumption: a qualitative study based on the theory of planned behaviour. *BMC Nutrition*, *2*(1), 1–15. https://doi.org/10.1186/s40795-016-0087-1

Marcinow, M. L. (2015). *Determinants of Dietary Calcium Intake in Young Adult Population*. Ministry of Health (MOH). (2017). Recommended Nutrient Intakes for Malaysia (RNI). In *A Report of the Technical Working Group on Nutritional Guidelines*.

Ozdogan, Y., Yardimci, H., & Ozcelik, A. O. (2017). Young adults' milk consumption habits and knowledge about milk. *Studies on Ethno-Medicine*, *11*(1), 106–113. https://doi.org/10.1080/09735070.2017.1311699

Rashid, B. A. (2015). *Socio Demographic Factors Associated with Osteoporosis among Female in Baghdad*. *8*(2).

Rose, A. M., Williams, R. A., Rengers, B., Kennel, J. A., & Gunther, C. (2018). Determining attitudinal and behavioral factors concerning milk and dairy intake and their association with calcium intake in college students. *Nutrition Research and Practice*, *12*(2), 143–148.

https://doi.org/10.4162/nrp.2018.12.2.143

Rouf, A. S., Sui, Z., Rangan, A., Grech, A., & Allman-Farinelli, M. (2018). Low calcium intakes among Australian adolescents and young adults are associated with higher consumption of discretionary foods and beverages. *Nutrition*, *55–56*, 146–153. https://doi.org/10.1016/j.nut.2018.04.005

Saei Ghare Naz, M., Ozgoli, G., Aghdashi, M. A., & Salmani, F. (2015). Prevalence and Risk Factors of Osteoporosis in Women Referring to the Bone Densitometry Academic Center in Urmia, Iran. *Global Journal of Health Science*, *8*(7), 135–145. https://doi.org/10.5539/gjhs.v8n7p135

Shivane, V. K., Sarathi, V., Lila, A. R., Bandgar, T., Joshi, S. R., Menon, P. S., & Shah, N. S. (2012). Peak Bone Mineral Density and Its Determinants in an Asian Indian Population. *Journal of Clinical Densitometry*, *15*(2), 152–158. https://doi.org/10.1016/j.jocd.2011.12.007

Wang, P., Abdin, E., Shafie, S., Chong, S. A., Vaingankar, J. A., & Subramaniam, M. (2019). Estimation of prevalence of osteoporosis using osta and its correlation with sociodemographic factors, disability and comorbidities. *International Journal of Environmental Research and Public Health*, *16*(13). https://doi.org/10.3390/ijerph16132338

Włodarek, D., Głabska, D., & Lange, E. (2014). The effect of dairy products choice on calcium dietary intake in female university students of nutritional faculty. *Roczniki Państwowego Zakładu Higieny*, *65*(1), 35–39.

Yahya, N. F. S., Makbul, I. A. A., Daud, N. M., & Aziz, Q. A. S. A. (2018). Relationship between body mass index, calcium intake and vitamin D status with bone mineral density among young adults: A preliminary investigation. *Pakistan Journal of Nutrition*, *17*(4), 156–162. https://doi.org/10.3923/pjn.2018.156.162

Yap, S. Y., Aziz, Y., A., A., & Yusof, H. M. (2019). Ethnic variation in osteoporosis risk factors: dietary calcium, vitamin D intake and body mass index (BMI). *Food Research*, *3*(December), 741–748. https://doi.org/10.26656/fr.2017.3(6).168