

## TREND IN DIETARY CALCIUM INTAKE AMONG ELDERLY IN KUANTAN, PAHANG

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### ABSTRACT

**Introduction:** Dietary calcium intake is important in body system regulation. Inadequate intake among elderly may lead to various health issues such as osteoporosis and hip fracture. In order to counter the problem, this study was carried out to identify dietary calcium intake among elderly in Kuantan, Pahang. **Methods:** A face to face interviewer-administered session was done individually with seventy-nine (n=79) subjects aged  $\geq 60$  years to collect data on sociodemographic background, health status and dietary intake. Diet history method was used to obtain information related to dietary intake and analyzed using Nutritionist Pro Software. *P*-value was set at  $p < 0.05$  as statistically significant. **Results:** Almost all elderly subjects had dietary calcium intake lower than recommendation, which was 92.4%, and only 7.6% of total elderly met the recommended intake. This study found that the mean dietary calcium intake was  $421.7 \pm 344.3$  mg/day which is lower than Recommended Nutrient Intakes (RNI) for Malaysian. Mean calcium intake was significantly lower than RNI in both gender ( $p < 0.001$ ). The difference of calcium intake between male and female elderly was not significant; with mean dietary calcium intake for male and female were  $414.2 \pm 344.3$  mg/day

and  $426.0 \pm 347.8$  mg/day, respectively. From the analysis, dietary calcium intake in elderly from non-dairy sources ( $228.4 \pm 149.3$  mg) is higher than dairy sources (median (IQR) = 0.0 (326.0) 5mg). **Conclusions:** In conclusion, inadequate dietary calcium is an issue among elderly people in Kuantan which may lead to several health problems. Hence, appropriate strategies need to be taken in order to ensure optimum nutritional status among this at risk population.

**KEYWORDS:** Elderly, Calcium intake, Nutrient, Dietary intake

## INTRODUCTION

A proper nutrient intake is vital for any age group and is particularly important for elderly (Chor et al., 2013). Nutrients play some protective roles among elderly to remain healthy and prevention of etiology and progression of diseases, for example, those related to bone metabolism (vitamin D, calcium, magnesium and phosphorus) (Gennari, 2001; Palacios, 2006) and cognitive functions (thiamine, riboflavin, niacin and pyridoxine) (Huskisson, Maggini & Ruf, 2007). Calcium is also one of the main minerals that make up the bone mass and density which is very important to human body. Healthy bone is very important in mobility especially for older people. As mentioned by Sanders, Nowson, Kotowicz, Briffa, Devine and Reid (2009), calcium deficiency may lead to a reduction in bone mass by increasing bone resorption in order to preserve the level of ionized calcium in the extracellular fluid of human body. Deficiencies in key nutrients might lead to various health complications, such as calcium deficiency, which can cause bone fracture and osteoporosis (Bhatia, 2008; Harinarayan & Ramalakshmi, 2015).

Calcium is one of the important key nutrients in the human body and is well-known for its significant role in vascular contraction, vasodilation, muscle functions, nerve transmission, intracellular signaling, and hormonal secretion (Beto, 2015). A number of studies raised concerns about inadequate intake of calcium among elderly population (Arabi et al., 2010; Meng et al., 2010; Fisberg et al., 2013). Furthermore, emerging studies also demonstrated that the percentage of adequate calcium intake is lower than recommended among Malaysian elderly (Chee et al., 2002; Normah et al., 2014; Chong et al., 2015). Another study by Hawa, Sakinah and Hermizi (2013) also indicated that calcium deficiency exists among elderly population in Malaysia; which can lead to detrimental effects to health. Hence, this study aimed to assess total dietary calcium intake among elderly as well as calcium intake from dairy and non-dairy sources. As no such study has been performed in Kuantan, baseline information on dietary calcium intake in this population will be obtained to explore the trend of intake.

## METHODS

### Sociodemographic characteristics

A total of 79 subjects aged 60 years old and above were recruited through convenience sampling method from Felda Bukit Goh, Kuantan, Pahang, Malaysia. Interviewer-administered questionnaire was performed on the elderly who met the inclusion criteria at their home. Inclusion criteria are male and female aged  $\geq 60$  years old, Malaysian citizen, and able to communicate either in Malay or English. Elderly who are terminally ill, bedridden, on dialysis or on tube feeding were excluded from the study. The questionnaire involved collecting information on sociodemographic data (age, gender, marital status, race, living status, household income, educational level, smoking status and health status).

### **Anthropometric measurement**

Height of subjects was measured using portable stadiometer (SECA 213, Hamburg, Germany). Reading of height measurement was taken to the nearest 0.1cm. Weight of subjects was measured using an electronic flat scale (SECA 803, Hamburg, Germany). Reading of weight was taken to the nearest 0.1kg. Body mass index (BMI) was derived based on the following equation: weight in kilogram divided by height in meter square;  $BMI = \text{weight (kg)} / \text{height (m)}^2$ .

### **Dietary intake assessment**

Data on dietary intake were collected using diet history method. Subjects were asked to report on their usual dietary intake for one whole day from breakfast, morning tea, lunch, afternoon tea, dinner and supper. The information was recorded according to household measurement, for example one cup of rice and one tablespoon of sugar (Suzana et al., 2015). Questions specifically related to sources of calcium from food such as milk and milk products were also asked. Calcium supplement intake was excluded from the calculation of total calcium intake. From the analyzed data, the total calcium intake, total calcium intake from dairy and non-dairy sources were identified and assessed. Mean calcium intake was calculated and compared with the intake level recommended by Recommended Nutrient Intakes (RNI) for Malaysian (2017).

### **Statistical analysis**

Data was analysed using IBM SPSS (Statistical Package for Social Sciences) version 12.0. Descriptive statistics including mean, percentage and standard deviation (SD) was reported for normally distributed variables of all demographic data. Non-normally distributed data were reported as median and interquartile range (IQR). For the first objective, descriptive analysis was used to describe the mean intake of dietary calcium and one sample t-test was used to identify mean differences between dietary calcium intake and calcium requirement. The second objective was to find the difference of dietary calcium intake between male and female, hence the data was analyzed using independent sample t-test. The statistical significance was set at  $p < 0.05$ . Lastly, for the third objective, the descriptive analysis was used in order to assess the sources of dietary calcium intake, either from dairy or non-dairy sources.

### **Ethical approval**

Ethical approval for this study has been granted by the Research Ethics Committee of International Islamic University Malaysia (IIUM/504/14/11/2/IREC 618). Informed consent was secured from each subject prior to data collection where the participation of the subjects was ensured to be voluntary. Their confidentiality was also protected by presenting the results in only the aggregate form without referring specifically to any individuals.

## **RESULTS**

There was a total of 79 subjects, of which 29 (36.7%) were male and 50 (63.3%) were female. Table I illustrates the sociodemographic data of the subjects. Majority of subjects were married (74.7%) while the rest of subjects were widower (25.3%). In addition, more than half of the subjects lived with their spouse and children (60.8%). Majority of the subjects' income were <RM1000 (65.8%), followed by RM1000-RM2000 (29.1%) and the least is >RM3000 (5.1%). Most of the subjects' educational background was up to primary education (60.8%), while 27.8% had no formal education and only 11.4% had secondary education. Most of the subjects were non-smoker (83.5%), 12.7% already quit smoking and the remaining were smokers (3.8%). For the health status, most of the subjects did not

have any illness (81%) during the past 3 months, and only 19% have illness during that time. However, most of the subjects visited healthcare facilities within the last 3 months (86.1%), while those with no visit was 13.9%. The visits were required as most of the subjects which were 83.5% have health problems particularly non-communicable diseases such as diabetes and hypercholesterolemia. Meanwhile, those who are healthy were only 16.5%.

**Table I** Socio-demographic characteristics of the elderly subjects

Characteristics	Frequency N=79	Percentage (%)
Gender		
Male	29	36.7
Female	50	63.3
Marital status		
Married	59	74.7
Single	0	0
Divorced	0	0
Widower	20	25.3
Living status		
With spouse	11	13.9
With spouse & children	48	60.8
With children	20	25.3
Alone	0	0
Household income (RM)		
<1000	52	65.8
1000-2000	23	29.1
>3000	4	5.1
>5000	0	0
Highest educational status		
None	22	27.8
Primary education	48	60.8
Secondary education	9	11.4
College or university	0	0
Smoking status		
Smoker	3	3.8
Ex-smoker	10	12.7
Non-smoker	66	83.5
Health status		
Illness in last 3 months		
Yes	15	19.0
No	64	81.0
Visited healthcare facility for the last 3 months		
Yes	68	86.1
No	11	13.9
Health problem		
Yes	66	83.5
No	13	16.5

Mean dietary calcium intake of all subjects was  $421.7 \pm 344.3$  mg/day. Almost all elderly subjects had dietary calcium intake lower than recommendation, which was 92.4%, while only 7.6% of total elderly subjects met the recommended intake. Table II shows comparison between mean dietary calcium intake according to gender and Recommended Nutrient Intakes (RNI) for Malaysian (2017). The intakes among male and female were significantly lower than RNI.

**Table II** Differences of mean dietary calcium intake according to gender compared to Malaysian RNI (2017)

Variable	Male (n=29) Mean $\pm$ SD	RNI	p-value	Female (n=50) Mean $\pm$ SD	RNI	p-value
Total Calcium Intake (mg)	414.2 $\pm$ 344.3	1000	0.001*	426.0 $\pm$ 347.8	1200	0.001*

\* $p < 0.05$ , one sample t-test

The results on dietary calcium intake among male and female subjects are shown in Table III. It shows that mean intake of male was  $414.2 \pm 344.3$  mg/day and female was  $426.0 \pm 347.8$  mg/day. From the analysis, there was no significant mean difference on dietary calcium intake between gender ( $p=0.968$ ).

**Table III** Difference of dietary calcium intake among elderly male and female

Variable	Male Mean (sd) (n= 29)	Female Mean (sd) (n= 50)	Mean Difference (95% CI)	t-statistics (df)	p-value
Total Calcium Intake (mg)	414.2, (344.3)	426.0, (347.8)	-11.8 (-172.9,149.2)	-0.146, (77)	0.968

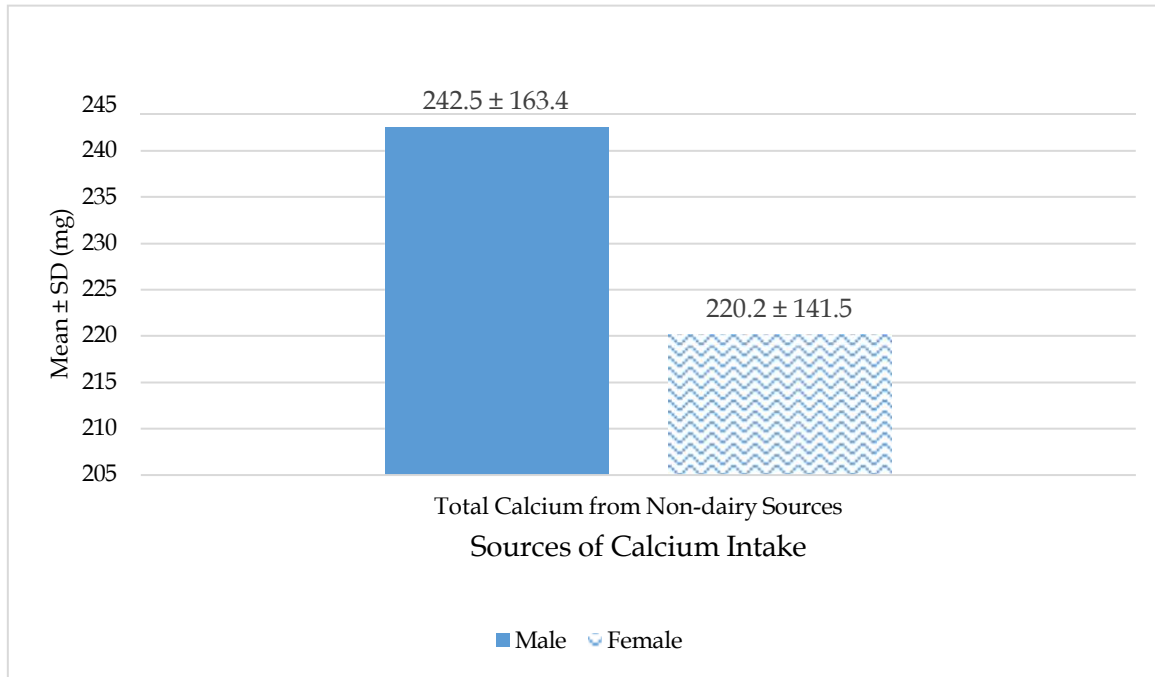
\* $p < 0.05$ , independent t-test

Table IV shows that the dietary calcium intake from non-dairy sources among elderly in Kuantan is higher compared to dairy. Besides, median (IQR) result of this analysis revealed that female consume 0.0 (361.5) mg calcium from dairy sources while male subjects' intake was 0.0 (308.0) mg. Meanwhile, non-dairy sources intake appeared to be higher in male than female (Figure I).

**Table IV** Mean calcium intake from dairy and non-dairy sources

Variable	Total subjects (n)	Mean (SD)
Total calcium from dairy (mg)	79	0.0 (326.0)*5
Total calcium from non-dairy (mg)	79	228.4 (149.3)

\* median (IQR)



**Figure 1.** Sources of calcium intake from non-dairy sources based on gender

## DISCUSSION

The present study showed that elderly subjects had lower amount of dietary calcium intake compared to recommended level. Our result was consistent with systematic review by Borg et al. (2015) who reported high prevalence of dietary calcium inadequacy among elderly in Europe, North America, Australia and New Zealand. The results were also in accordance with Lee et al. (2007), Viñas et al. (2011), Mensink et al. (2013) and Yoon et al. (2016). Furthermore, another study by Marshall et al. (2001) also found that their subjects did not meet the estimated needs for calcium. Several studies among Malaysian elderly also revealed inadequate intake of dietary calcium compared to recommended level (Shahar, Earland & Rahman, 2000; Normah et al., 2014). High percentage of subjects with low calcium intake can be attributed to poor appetite (Pilgrim et al., 2015), lack of money (Lahiri et al., 2015) and lack of knowledge (Hickson, 2006); which are possible factors associated for not acquiring and consuming nutritious food.

Compared with the percentage of dietary calcium intake among elderly in a study by Chee et al. (2002); only 3.9% of their subjects met calcium intake recommendation. This present study identified slightly higher percentage of dietary calcium intake within recommendation which was 3.7% higher than finding of Chee et al. (2002) study. In Singapore, Ling et al. (2007) showed mean daily calcium intake was 650 mg/day among elderly and only 7.8% from their total subjects had calcium intake more than recommended intake of 1000 mg/day. Another study in Brazil conducted by Fisberg et al (2013) reported higher percentage of inadequate intake of dietary calcium than ours which was 97.5%.

Our finding demonstrated that gender does not affect intake of dietary calcium which is in line with a study by Arabi et al. (2010). Similar findings were also reported by Fisberg et al. (2013) and Suriah et al. (1996) that there was no significant difference between genders in dietary calcium intake. Furthermore, a systematic review by Balk et al. (2017) indicated that average calcium intake was generally lower in women than men, but there were no clear

patterns across countries regarding relative calcium intake by gender. In contrast, a number of reports revealed consideration and awareness among women about health aspects are greater than men which can be clearly observed through food selection (Courtenay, 2000; Girois et al., 2001; Thiele & Weiss, 2003).

In addition, finding of this present study also found that elderly consumed more calcium intake from non-dairy sources which is consistent with another study conducted in Malaysia by Chee et al. (2002); who also found that intake of dietary calcium was mainly from non-dairy sources. Chee et al. (2002) demonstrated that the percentage of calcium intake from various food sources was from vegetables and bean sources (32%), dairy products (26%), eggs, meat and seafood (16%) and cereals (12%). Sources of food from non-dairy sources in the study appeared to be similar with our findings. Other studies conducted in Asian countries also demonstrated higher calcium intake from non-dairy sources than dairy sources (Pongchaiyakul et al., 2008; Talaei et al., 2016). This can be explained by intestinal lactase expression differences and the influence of socio-cultural aspects across regions (van den Berg et al., 2014). Prevalence of lactose intolerance has been reported to be lower in Northern European population due to greater lactase expression preservation (Wilt et al., 2010); in comparison to Asian, African American, Hispanic and American Indian populations (Swallow, 2003).

However, the result was in contrast with a study by Adegboye et al. (2012) that revealed dairy foods were the major source of dietary calcium among Danish adults which accounting for 56% of total calcium intake. The differences in the characteristic of study population may contribute to the difference in calcium intake sources. The subjects of the previous study had highest educational level which can contribute to better food choices in comparison to the elderly subjects in our study. Poliquin et al. (2009) also demonstrated that most of the calcium intake comes from dairy products which are milk and milk products, while other foods contributed to the lowest amount of calcium. Alarming result of this present study demonstrated median intake of calcium from dairy sources was zero milligram for both female and male subjects. This might be contributed by the cost of dairy products which may not be affordable for low income population which has also been highlighted by Hasnah et al. (2012). A study conducted in Myanmar also revealed poor calcium intake from dairy sources and a significant contributor of household income towards daily calcium intake (Aung et al., 2010).

The limitation of this study includes the use of convenience sampling rather than the gold standard of random sampling. Moreover, the subjects were recruited from one agricultural settlement, hence the findings may not represent the whole elderly population in this setting. However, it should be noted that this study was able to identify calcium intake from food sources either from dairy and non-dairy sources. In addition, calcium intake from food sources is encouraged compared to supplements due to potential adverse effects of supplements to health (Haller et al., 2008, Restani et al., 2016). Furthermore, recommendation of supplements intake may not be appropriate for the elderly population with limited household income. Assessing the elderly persons' knowledge on sources of calcium in food would be beneficial to facilitate improvement of their dietary calcium intake.

## CONCLUSIONS

In conclusion, this study indicates that calcium intake was lower than national recommendation among elderly living in Kuantan, Pahang. Appropriate nutrition education programmes need to be planned and implemented accordingly for this population. Nutrition intervention should be provided to the elderly to avoid further nutritional problems or illness as a result of poor dietary calcium intake.

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