

## Calcium Intake and Its Associated Factors among Female Population in Saudi Arabia

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**Abstract: Background:** Calcium (Ca) is the most plentiful mineral found in the human body. The teeth and bones contain the most calcium. Nerve cells, body tissues, blood, and other body fluids contain the rest of the calcium. Ca intake during early life can affect the bone health later in life. **Objectives:** to Estimate the amount of calcium intake among Umm Al-Qura University (UQU) female students, and identify factors those were associated with the consumption of calcium among the study group. **Methods:** Cross-sectional study design was carried among 267 female students, of age  $\geq 18$  years in Umm al-Qura University in Makkah. Students completed a questionnaire include questions about their socioeconomic characteristics, physical activity practices, dietary habits and 24 hours dietary recall. Nutrisurvey software 2007 used to analyze dietary intake and estimate calcium intake. Participants were stratified into two groups according to their mean usual dietary calcium intake, low calcium intake group ( $< 550$  mg/day) and high calcium intake group ( $\geq 550$  mg/day). **Results:** It was found that 96.25% of studied sample consumed Ca below DRI (1000 mg/day). Also, about 54.7% of sample consumed  $< 550$  mg/day. About 13.1% doesn't expose to sun light with calcium intake  $< 550$  mg/day. All the factors studied in this research were not statistically significant between the low and high Ca intake groups ( $P < 0.05$ ). **In conclusion:** This study reported a low habitual dietary calcium intake among female students at Umm Al-Qura University. And emphasize the community role in improving the nutritious food.

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### 1. Introduction

Adequate calcium (Ca) in children is necessary for the formation of peak bone mass and perhaps it is a reason for protection of losing the bone among adult (Abrams, 2011). Calcium is an essential mineral found in great abundance in the body. Ninety-nine percent of all the Ca in the body is found in the bones and teeth. The remaining one percent is in the blood. Ca plays important roles in nerve conduction, muscle contraction, and blood clotting. If Ca levels in the blood drop below normal, Ca will be taken from bone and put into the blood in order to maintain blood Ca levels. Therefore, to maintain adequate blood and bone Ca levels, it is important to consume enough Ca (Linda and Venessa, 2004).

Sources of Ca from food such milk, yogurt, and cheese are rich natural sources of Ca and are the major food contributors of this nutrient to people in the United States (Bailey *et al.*, 2010). Nondairy sources include vegetables, such as Chinese cabbage, kale, and broccoli. Spinach provides Ca, but its bioavailability is poor. Most grains do not have high amounts of Ca unless they are fortified; however, they contribute Ca to the diet because people consume them frequently. Foods fortified with Ca include many fruit juices and drinks, tofu, and cereals (NIH, 2013).

Osteoporosis is a clinically-silent disease in its early stages. Bone loss occurs without symptoms. It

can lead to hip and spine fractures later in life (Ghobadi and Hoseini, 2014). Osteoporosis is a multi-factorial disease with a major socioeconomic impact. Nutrition, lifestyle, and genetics contribute to the pathogenesis of osteoporosis (Premaet *et al.*, 2001). According to the National Institute of Health (NIH), "osteoporosis is defined as skeletal disorder characterized by compromised bone strength" predisposing a person to an elevated fracture risk. Bone strength primarily reflects the integration of bone density (grams of calcium per unit area or volume of bone) and bone quality (micro architecture of bone) (NIH, 2001). So dietary calcium intake is important for young adulthood to assure adequate bone mineral accretion and peak bone density (Nieves, 2005), yet evidence suggests that calcium intake begins to fall during adolescence (Fiorito *et al.*, 2006).

The daily Ca recommendation is 1,000 milligrams for people 19 to 50 years old, and 1,300 milligrams for children and teens 9 to 18 (NIH, 2012). It is recommended that you do not take more than the UL of calcium per day. High Ca intakes can lead to constipation, an increased chance for developing Ca kidney stones, and may inhibit the absorption of iron and zinc from food (Linda and Venessa, 2004). Accumulation of data on the calcium intake in the Saudi Arabia could provide a basis for a realignment of the lifestyle, in addition to promoting nutritional

educational interventions to enhance the intake of calcium rich foods. So the aims of the present study were to estimate the amount of calcium intake among female adolescents' students at Umm AL-Qura University, Saudi Arabia and to identify factors that were associated with the consumption of calcium.

## 2. Subjects and Methods

### 2.1. Design and participants

A cross-sectional study was conducted during the academic year 2014. The study included (277) female students, from different medical section (Medicine, Laboratories, Pharmacy, Nutrition, Nursing, Department of Health, Dentist and preparatory year) of Umm al-Qura University.

### 2.2. Instrument

A self-administered Questionnaire was developed to estimate dietary Calcium intake among (277) female students and its associated factors. The Questionnaire was administered to the students between regular class periods. Total of (10) students with missing data for any of the study variables were excluded, resulting in a final sample of (267). The questionnaire was designed to obtain the following information:

**2.2.1. Sociodemographic characteristics:** The questionnaire included the information about age, college, level of family income, marital status and mother's education level.

**2.2.2. Health and nutrition habits:** Such as type of snacks, period of exposure to sunlight, supplement intake of vitamin D and Calcium.

**2.2.3. Dietary measurement:** 24-hour recall: Information was collected on student food intake for three days (two work days and one weekend day) using diary-assisted 24-hour recall interviews (Crawford *et al.*, 1994). The 24-hour recall method was used to describe the average dietary intake of calcium obtained by the number of serving consumed from food that contain calcium such as milk and dairy products, vegetables, eggs etc. and the portion size.

**2.2.4. Physical activity:** The questionnaire was used to collect data about the type and duration of physical activity which the participants performed.

### 2.3. Data analysis

All data collected were tabulated and statistical analysis was performed using the Statistical Package for Social Science (SPSS V 16) (SPSS Inc., Chicago, IL, USA). Proportions were compared using chi-square test. Continuous variables were compared using independent sample t-test for two groups and ANOVA test for more than two groups. Nutrisurvey software 2007 used to analyze dietary intake and estimate calcium intake. Participants were stratified into two groups according to their mean usual dietary calcium intake. Because the mean dietary calcium intake in this study was  $559.34 \pm 32.15$  mg/day, a cutoff point of

550 mg/day was chosen to establish the two groups. Students with a calcium intake lower than 550 mg/d were allocated to the low calcium group, and students with a calcium intake of at least 550 mg/day were allocated to the high calcium group.

## 3. Results

After stratifying the participants according to their usual ca intake (low ca intake group and high ca intake group), both groups were comparable in several demographic and clinical characteristics.

Table (1) shows the descriptive characteristics of the studied sample. The sample consists of 267 female students, 78.3% of the sample were <19 year, while 21.7% were 18 – 19 years. The result revealed that 49.1% of the sample had Mother's education level of university or postgraduate. The highest percentage of study sample 32.6% were from clinical nutrition department. Regarding the monthly income level, 62.2% of the students had a monthly income  $\geq$  9000 SR per month.

**Table 1:** Demographics data of the students

| Measure                                 | Frequency | %     |
|---|-----------|-------|
| <b>Age group (year)</b>                 |           |       |
| (18-19).                                | 58        | 21.7  |
| <19.                                    | 209       | 78.3  |
| <b>Total</b>                            | 267       | 100.0 |
| <b>College</b>                          |           |       |
| Clinical nutrition.                     | 87        | 32.6  |
| Nursing.                                | 16        | 6.0   |
| Laboratory medicine.                    | 29        | 10.9  |
| Health administration.                  | 19        | 7.1   |
| Pharmacology                            | 9         | 3.4   |
| Medicine                                | 60        | 22.5  |
| Dentistry.                              | 2         | 0.7   |
| Preparatory year.                       | 45        | 16.9  |
| <b>Total</b>                            | 267       | 100.0 |
| <b>Monthly income/ (SR<sup>*</sup>)</b> |           |       |
| > 3000                                  | 8         | 3.0   |
| 3000 - > 6000                           | 33        | 12.4  |
| 6000 - > 9000                           | 60        | 22.5  |
| $\geq$ 9000                             | 166       | 62.2  |
| <b>Total</b>                            | 267       | 100.0 |
| <b>Marital status</b>                   |           |       |
| Married.                                | 36        | 13.5  |
| Single.                                 | 231       | 86.5  |
| <b>Total</b>                            | 267       | 100.0 |
| <b>Mother's education level</b>         |           |       |
| Illiterate- primary.                    | 43        | 16.1  |
| Secondary – High school.                | 93        | 34.8  |
| University – Graduate                   | 131       | 49.1  |
| <b>Total</b>                            | 267       | 100.0 |

\*SR = Saudi Riyals.

Fig (1) shows that 54.7% of female students consumed <550 mg/day calcium while 45.3% consumed  $\geq$  550 mg/day.

N=267

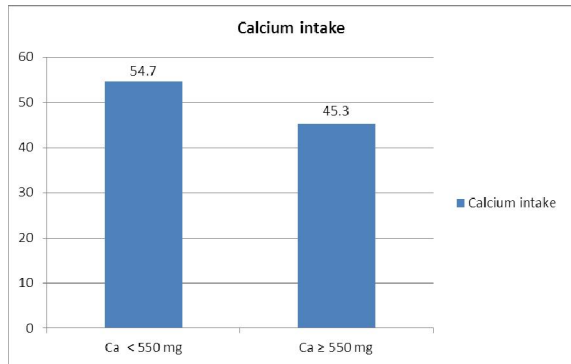


Figure (1): Frequency distribution of studied sample according to the two groups of calcium intake

Table (2) shows that 43% of students >19 year consumed Ca< 550 mg/day versus 11.6% from 18 – 19 year. Also it shows that 17.2% of the students were from clinical nutrition department and consumed Ca< 550 mg/day.

Table (3) shows that 15.7% of studied students did not practice any type of exercise and consumed <

550 mg/day calcium. About 25.5% of studied group were practice walking and falling in high Ca intake group (≥ 550 mg/day).

Table (4) shows that 16.9% of students consumed potato chips as snake and falling in low Ca intake group (< 550 mg/day). Also 17.7% of the sample were eating fast food 3-5 times/week and consumed Ca< 550 mg/day. Regarding soft drink, it was found that 5.6% of studied female were drinking soft drink <7 times /week and falling in Low Ca intake group (< 550 mg/day).

Table (5) shows the sun exposure habit of the participants. It reported that 7.9% of studied students falling in low Ca intake group (<550 mg/day), and didn't expose to sun light versus 5.2 % in high Ca intake group (≥ 550 mg/day). Also 10.3% of studied students in high Ca intake group (≥ 550 mg/day) were exposed to sun light (20 - 30) minutes/day compared to 9.9% of students in low Ca intake group (< 550 mg/day). On the other hand 39.0% of students were did not supplement with vitamin D and falling in low Ca intake group (< 550 mg/day).

Table (2): Socio-demographic data of the participants according to Ca intake

| Measure                         | Low Ca intake (< 550 mg/day) |      | High Ca intake* (≥ 550 mg/day) |      | P     |
|---------------------------------|------------------------------|------|--------------------------------|------|-------|
|                                 | F                            | %    | F                              | %    |       |
| <b>Age group (year)</b>         |                              |      |                                |      |       |
| (18-19)                         | 31                           | 11.6 | 27                             | 10.1 | 0.836 |
| >19                             | 115                          | 43.1 | 94                             | 35.2 |       |
| <b>Total</b>                    | 146                          | 54.7 | 121                            | 45.3 |       |
| <b>College</b>                  |                              |      |                                |      | 0.215 |
| Clinical nutrition              | 46                           | 17.2 | 41                             | 15.4 |       |
| Nursing                         | 9                            | 3.4  | 7                              | 2.6  |       |
| Laboratory medicine             | 14                           | 5.2  | 15                             | 5.6  |       |
| Health administration           | 12                           | 4.5  | 7                              | 2.6  |       |
| Pharmacology                    | 4                            | 1.5  | 5                              | 1.9  |       |
| Medicine                        | 35                           | 13.1 | 25                             | 9.4  |       |
| Dentistry                       | 2                            | 0.7  | 0                              | 0.0  |       |
| Preparatory year                | 24                           | 9    | 21                             | 7.9  |       |
| <b>Total</b>                    | 146                          | 54.7 | 121                            | 45.3 |       |
| <b>Monthly income(SR)</b>       |                              |      |                                |      | 0.206 |
| < 3000                          | 3                            | 1.1  | 5                              | 1.9  |       |
| 3000 - < 6000                   | 17                           | 6.4  | 16                             | 6.0  |       |
| 6000 – >9000                    | 35                           | 13.1 | 25                             | 9.4  |       |
| ≥ 9000                          | 91                           | 34.1 | 75                             | 28.1 |       |
| <b>Total</b>                    | 146                          | 54.7 | 121                            | 45.3 |       |
| <b>Marital status</b>           |                              |      |                                |      | 0.388 |
| Married.                        | 18                           | 6.7  | 18                             | 6.7  |       |
| Single.                         | 128                          | 47.9 | 103                            | 38.6 |       |
| <b>Total</b>                    | 146                          | 54.7 | 121                            | 45.3 |       |
| <b>Mother's education level</b> |                              |      |                                |      | 0.565 |
| Illiterate- primary             | 20                           | 7.5  | 23                             | 8.6  |       |
| Secondary - High school         | 52                           | 19.5 | 41                             | 15.4 |       |
| University – Graduate           | 74                           | 27.7 | 57                             | 21.3 |       |
| <b>Total</b>                    | 146                          | 54.7 | 121                            | 45.3 |       |

\*High ca intake group compared to each other

**Table (3): Physical exercise of the studied sample according to Ca intake**

| Measure                                | Low Ca intake (< 550 mg/day) |       | High Ca intake (≥ 550 mg/day) |       | P     |
|--|------------------------------|-------|-------------------------------|-------|-------|
|  | F                            | %     | F                             | %     |       |
| <b>Exercises</b>                       |                              |       |                               |       | 0.676 |
| Walk                                   | 69                           | 25.8% | 68                            | 25.5% |       |
| Swimming                               | 7                            | 2.6%  | 6                             | 2.2%  |       |
| Dance                                  | 17                           | 6.4%  | 18                            | 6.7%  |       |
| Other                                  | 11                           | 4.1%  | 9                             | 3.4%  |       |
| Not practicing                         | 42                           | 15.7% | 20                            | 7.5%  |       |
| <b>Total</b>                           | 146                          | 54.7% | 121                           | 45.3% |       |
| <b>*Times/week</b>                     |                              |       |                               |       | 0.629 |
| ≤ 2                                    | 63                           | 30.7% | 62                            | 30.2% |       |
| (3-4 times)                            | 29                           | 14.1% | 32                            | 15.6% |       |
| > 4 time                               | 12                           | 5.9%  | 7                             | 3.4%  |       |
| <b>Total</b>                           | 104                          | 50.7% | 101                           | 49.3% |       |
| <b>*Duration of exercise (min/day)</b> |                              |       |                               |       | 0.357 |
| <30                                    | 53                           | 25.9% | 44                            | 21.5% |       |
| 30 - < 60                              | 42                           | 20.5% | 52                            | 25.4% |       |
| ≥60                                    | 9                            | 4.4%  | 5                             | 2.4%  |       |
| <b>Total</b>                           | 104                          | 50.7% | 101                           | 49.3% |       |

\* = (n=205)

**Table (4): Parameter of food habits according to Ca intake**

| Measure                                   | Low Ca intake (< 550 mg/day) |       | High Ca intake (≥ 550 mg/day) |       | P     |
|---|------------------------------|-------|-------------------------------|-------|-------|
|   | F                            | %     | F                             | %     |       |
| <b>kind of snacks</b>                     |                              |       |                               |       | 0.138 |
| Fruits                                    | 16                           | 6%    | 23                            | 8.6%  |       |
| Vegetables                                | 11                           | 4.1%  | 6                             | 2.2%  |       |
| Potato chips                              | 45                           | 16.9% | 31                            | 11.6% |       |
| Sweets                                    | 37                           | 13.9% | 33                            | 12.4% |       |
| Nuts                                      | 14                           | 5.2%  | 14                            | 5.2%  |       |
| Do not eat                                | 23                           | 8.6%  | 14                            | 5.2%  |       |
| <b>Total</b>                              | 146                          | 54.7% | 121                           | 45.3% |       |
| <b>Times of eating fast food/week</b>     |                              |       |                               |       | 0.532 |
| ≤ 2                                       | 82                           | 30.8% | 69                            | 25.9% |       |
| (3-5 times)                               | 47                           | 17.7% | 32                            | 12%   |       |
| > 5 time                                  | 9                            | 3.4%  | 10                            | 3.8%  |       |
| Do not eat                                | 7                            | 2.6%  | 10                            | 3.8%  |       |
| <b>Total</b>                              | 145                          | 54.5% | 121                           | 45.5% |       |
| <b>Fat use for cooking</b>                |                              |       |                               |       | 0.801 |
| Corn oil                                  | 78                           | 29.2% | 54                            | 20.2% |       |
| Olive oil                                 | 25                           | 9.4%  | 23                            | 8.6%  |       |
| Butter                                    | 2                            | 7%    | 4                             | 1.5%  |       |
| Margarine                                 | 3                            | 1.1%  | 1                             | 4%    |       |
| Sunflower oil                             | 38                           | 26%   | 39                            | 32.2% |       |
| <b>Total</b>                              | 146                          | 54.7% | 121                           | 45.3% |       |
| <b>Times of drinking soft drinks/week</b> |                              |       |                               |       | 0.134 |
| < 4                                       | 67                           | 28.5% | 66                            | 24.7% |       |
| 4-7                                       | 19                           | 7.1%  | 18                            | 6.7%  |       |
| > 7                                       | 15                           | 5.6%  | 6                             | 2.2%  |       |
| Don't drink it                            | 36                           | 13.5% | 31                            | 11.6% |       |
| <b>Total</b>                              | 146                          | 54.7% | 121                           | 45.3% |       |
| <b>Times of drinking caffeine/week</b>    |                              |       |                               |       | 0.691 |
| < 4                                       | 64                           | 24%   | 55                            | 20.6% |       |
| 4-7                                       | 36                           | 13.5% | 27                            | 10.1% |       |
| > 7                                       | 21                           | 7.9%  | 16                            | 6%    |       |
| Don't drink it                            | 25                           | 9.4%  | 23                            | 8.6%  |       |
| <b>Total</b>                              | 146                          | 54.7% | 121                           | 45.3% |       |

**Table (5): Sun exposure according to Ca intake**

| Measure                             | Low Ca intake (< 550 mg/day) |      | High Ca intake (≥ 550 mg/day) |      | P     |
|-------------------------------------|------------------------------|------|-------------------------------|------|-------|
|                                     | F                            | %    | F                             | %    |       |
| <b>Times of exposing / week</b>     |                              |      |                               |      |       |
| < 3                                 | 63                           | 23.6 | 46                            | 17.2 |       |
| 3-4                                 | 25                           | 9.4  | 25                            | 9.4  | 0.305 |
| > 4                                 | 37                           | 13.9 | 36                            | 13.5 |       |
| Not exposed                         | 21                           | 7.9  | 14                            | 5.2  |       |
| <b>Total</b>                        | 146                          | 54.7 | 121                           | 45.3 |       |
| <b>*How long do you exposed(m*)</b> |                              |      |                               |      |       |
| < 20                                | 95                           | 40.9 | 78                            | 33.6 |       |
| 20 - 30                             | 23                           | 9.9  | 24                            | 10.3 | 0.555 |
| > 30                                | 7                            | 3.0  | 5                             | 2.2  |       |
| <b>Total</b>                        | 125                          | 53.9 | 107                           | 46.1 |       |
| <b>**Any uncovered part</b>         |                              |      |                               |      |       |
| Yes                                 | 108                          | 46.6 | 82                            | 35.3 | 0.247 |
| NO                                  | 17                           | 7.3  | 25                            | 10.8 |       |
| <b>Total</b>                        | 125                          | 53.9 | 107                           | 46.1 |       |
| <b>**Direct or behind the glass</b> |                              |      |                               |      |       |
| Direct                              | 81                           | 34.9 | 65                            | 28.0 | 0.770 |
| Behind the glass                    | 44                           | 19.0 | 42                            | 18.1 |       |
| <b>Total</b>                        | 125                          | 53.9 | 107                           | 46.1 |       |
| <b>Smoke status</b>                 |                              |      |                               |      |       |
| No                                  | 134                          | 50.2 | 113                           | 42.3 |       |
| Yes                                 | 10                           | 3.7  | 7                             | 2.6  | 0.294 |
| In the past                         | 2                            | 0.7  | 1                             | 0.4  |       |
| <b>Total</b>                        | 146                          | 54.7 | 121                           | 45.3 |       |
| <b>Vitamin D supplements</b>        |                              |      |                               |      |       |
| Yes                                 | 23                           | 8.6  | 13                            | 4.9  |       |
| No                                  | 104                          | 39.0 | 91                            | 34.1 | 0.877 |
| Sometimes                           | 19                           | 7.1  | 17                            | 6.4  |       |
| <b>Total</b>                        | 146                          | 54.7 | 121                           | 45.3 |       |
| <b>Calcium supplements</b>          |                              |      |                               |      |       |
| Yes                                 | 26                           | 9.7  | 10                            | 3.7  |       |
| No                                  | 105                          | 39.3 | 94                            | 35.2 | 0.640 |
| Sometimes                           | 15                           | 5.6  | 17                            | 6.4  |       |
| <b>Total</b>                        | 146                          | 54.7 | 121                           | 45.3 |       |

m\* = minute. \*\*=question for 232 students

#### 4. Discussion

Calcium is one of the major mineral components of the skeletal system and is also an essential nutrient required for nerve conduction, muscle contraction, hormone and enzyme secretion, and blood clotting. Adequate calcium intake is essential for normal growth and development of the skeleton and teeth and for adequate bone mineralization. Optimizing bone mass accretion in youth and adolescence is critical to attaining peak bone mass in adulthood (Bailey *et al.*, 2010). Lack of calcium is one of the main causes of osteoporosis in which the bones become extremely porous, are subject to fracture, and heal slowly, occurring especially in women (Bailey *et al.*, 2010).

For this reason, the presented study was conducted to describe the patterns of Ca intake and to identify socio-demographic factors that were associated with the consumption of Ca in UQU female students. A cross-sectional study was carried among 267 female students, of age ≥18 years in Umm Al-Qura University -Makkah.

Estimation of calcium intake among our subjects showed that nearly half were >19 years and having low calcium intake (<550 mg/day) compared to about one third having higher calcium intake (≥ 550 mg/day) for the same age group.

Calcium intake was demonstrated to be insignificantly associated with a number of variables

in this study ( $P$ -Value $>0.05$ ). These variables include age, college or education type, income, marital status and mother education. This result was in contrast to (**Farah, 2013**) study which showed that calcium intake was demonstrated to be significantly associated with a number of variables including gender, age, race/ethnicity and education. Moreover, a previous study by (**Yang et al., 1994**) concluded that calcium intake was found to be significantly correlated ( $r = 0.24$ ;  $P < 0.05$ ) with age group (13-15) years old in females. Moreover, (**Heaney et al., 1982**) explained that calcium intake in the younger ages was higher than in older ages, and reduced absorption efficiency further in old ages lowers effective intake. Besides that, estrogen withdrawal leads to a decrease in intestinal calcium absorption efficiency and in renal calcium conservation, both effects are equivalent to an effective increase in calcium intake requirement in old ages. Also, in agreement with (**Bailey, 2010**) regarding low calcium intake, only 15% of 9 to 13 years old females and  $\leq 10\%$  of females aged 14–18, 51–70, and  $\geq 71$  years met the adequate intake for calcium from diet alone.

Studying type, frequency and duration of exercise, the presented study revealed that from studied students with calcium intake  $< 550$  mg/day, 15.7% did not practice any type of exercise, and 30.7% practiced exercise  $\leq 2$  times a week. These figures were 7.5%, and 30.2% respectively for the group of  $\geq 550$  mg/day of calcium intake. 25.9% of low Ca intake group compared with 21.5% of high Ca intake group had exercise for  $< 30$  minutes/day. However, these figures are 20.5%, and 25.4% respectively for exercise  $\geq 60$  minutes/day.

The results of some studies on the association of physical activity, calcium intake and bone status are conflicting (**Burger et al., 1998**). A study conducted in KSA showed that the (57.1%) of the females in the study participated in moderate-intensity physical activity for 150 min or more per week (**Hazzaa, 2006**).

The presented study investigated some eating and drinking habits among participants and correlated them to calcium intake. It was shown that correlation of kind of snacks, frequency of eating fast food per week, fat use for cooking, frequency of drinking soft drinks per week and frequency of drinking caffeine per week revealed non-significant correlation. However, consumption of soft drinks was slightly more frequent among low calcium intake group than high calcium intake group. In agreement, it has been proven that soft drinks displace essential nutrients and contribute to overall poorer diets, and increased soft drink intake is related to lower consumption of milk and calcium (**Vartanian et al., 2007**).

Moreover, almost no differences were observed in consumption of fruits or vegetables as snack among the two groups (10.1% and 10.8% respectively).

Data related to exposure to sun revealed no statistical significant difference between the two groups regarding number, duration, direct or indirect exposure to sun. Similar results were also obtained for smoking and vitamin D or Ca supplementation.

## 5. Recommendation

**Based on the study findings, it is recommended to:**

1. Encourage adolescents to obtain dietary reference intake of calcium (1000mg/day), through consumption of calcium rich source to promote bone health and prevent osteoporosis.
2. Emphasize a healthy lifestyle that includes balanced diet, exercise and exposure to the sun.
3. Conduct community nutrition education programs to increase the awareness of calcium intake importance.

## 6. Conclusion

This study reported a low habitual dietary calcium intake among female students at Umm Al-qura University. It showed that nearly all of the studied sample (96.25%) consumed calcium below DRI (1000 mg/day). More than half of the sample (54.7%) consumed calcium less than 550 mg/day. Also these findings showed statistically not significant differences between low and high calcium intake groups regarding socioeconomic characteristics, physical activity practices, dietary habits and exposure to sunlight.

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