Dietary Pattern, BMI and Calcium Status of Female College Students

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Abstract
This study investigated the relationship between dietary patterns, BMI and calcium status of 102 female College Students (15-26 years) studying in B.B.K.D.A.V.College for Women in Amritsar District of Punjab (India). About 81.7% of the subjects consumed 3 meals/day and the frequency of daily milk consumption was high (71.2%). Consequently, their mean Body Mass Index (BMI) (22.23±0.69kg/m²) was within the normal range and their serum calcium concentration (9.15±4.16 mg/dl) was also within the recommended value (8.10-10.40mg/dl). Statistically significant difference (p<0.01) was found in the BMI among age groups as the females belonging to 23-26yrs of the age had highest mean BMI (26.88 kg/m²) followed by those from age 19-22yrs (21.30 kg/m²) and 15-18yrs (21.29 kg/m²). BMI was positively correlated (p<.05) with serum calcium concentration. No significant difference in serum calcium was found between rural and urban students. Vegetarians and non-vegetarians too did not differ in serum calcium. More research is needed to determine if a relationship exists between serum calcium concentration and BMI, as well as calcium intake and body composition.
Key words: Dietary patterns, Serum calcium, BMI, Female Students

INTRODUCTION

Dietary habits pattern are very important for individual's well-being the society as a whole. The prevalence of overweight and obesity has increased globally among both adults and adolescents [1]. The World Health Organization (WHO) has recommended a diet low in fat, sugar and salt, and high in fruit and vegetables in order to protect against the development of obesity [2].The association between poor diet and obesity is well established globally and regionally [3,4] indicating a low consumption of fruit and vegetables and high consumption of energy-dense food and drinks, along with irregular meal consumption and frequent consumption of snacks. Studies have examined the association between dietary patterns and weight status in primary school aged children and in adolescents.It was found that regular meal patterns were associated with lower standardized body mass index (BMI-z) while breakfast skipping, high consumption of snacks, sugary beverages and low consumption of fruit and vegetables were associated with increased BMI-z [5-8]. Another study on North Indians reported that decline in activity coupled with high calorie intake were the leading causes of obesity [9]. The obesity was found more prevalent in women than men and urban compared to rural dwellers. Such information is needed in the state of Punjab given the escalating problem of obesity among adolescents.

Calcium makes up 1.5% to 2% of total body weight and is mostly found in bones and teeth [10]. In the diet, calcium can be found in milk and dairy products, some seafood, vegetables, legumes, and dried fruits. The study conducted on south Indians[11] showed that daily dietary calcium intake of both rural and urban subjects was low when compared with that of the

recommended dietary allowance (RDA) of 400 mg/d for adults (both sexes) issued by the Indian Council of Medical Research (ICMR) [12]. The first indication of an inverse relation between calcium intake and body weight came 1984 [13]. Since then, this inverse relation between calcium intake and body composition or body weight has been observed in a large variety of populations [14-19]. In a few other studies, however, no effects were found [20-21] while, in three studies, a gender-specific effect for an altered calcium intake was observed (22–24). Some researches [25] showed that percent body fat correlates with BMI. Another study [26] concluded that dairy calcium was inversely associated with BMI, weight change, waist to height ratio, and fat mass. It was also found that with an increase in dairy calcium, the risk for abdominal obesity was significantly decreased. Researchers found an increase in calcium intake as dairy consumption increased, which led to participants having lower BMIs than the participants who had lower dairy consumption [27]. Based on the

results of the previous studies which have not all shown a similar outcome, we are to find the possible correlation between serum calcium, dietary pattern and anthropometrics of the female college students.

OBJECTIVES

The main objectives of this study were:

1. To assess the dietary patterns of the female students.
2. To determine the serum calcium of the study population.
3. To determine the relationship between serum calcium and anthropometric data of the participants.

MATERIALS AND METHODS

The present study was conducted in the Department of Zoology at B.B.K D.A.V College for women, Amritsar. The cohort of female students in the college represents different age groups (15-26yrs) and residential status i.e. urban and rural. The students with incomplete data, eating disorders, other metabolic disorders or those taking calcium supplements were excluded from the study. A total of 102 female students from the age group varying from 15yrs to 26yrs were selected for the study. Anthropometric data of the students i.e. weight (kg) and height (m) was recorded. Weight was measured using a digital weighing scale. Height was measured without shoes. Body Mass Index (BMI) was calculated as weight (kg) divided by height squared (m^2). BMI. The biochemical analysis to determine the serum calcium concentration was performed, using OCPC kit (Delta labs, Maharashtra). Informed consent was obtained from the participants before taking their blood samples. The dietary pattern of the participants was recorded with the help of the food frequency questionnaire based on the three-day food record. This study was approved by institutional ethical committee.

Statistical analyses were carried out using SPSS software for Windows, version 16. Data were expressed as means ± SD. Statistical significance was determined by using the t-tests ,ANOVA and Pearson correlation test. Significant difference was accepted when P-values were less than 0.05.

RESULTS

Out of the 102 female students involved in the study 38.2% (n=39) belonged to age group 15-18yrs. 43% were between 19-22yrs. About 18.6% were between 23-26yrs. 69.6% of the students were urban dwellers and 30.3% had rural background.

1. Dietary patterns of the participants

The frequency of the meal consumption amongst the participants was studied. Majority (81.7%) ate three times daily, 11.5% claimed to eat two times per day whereas 1.9% ate four times and 2.8% ate five times a day (figure 1). 89.4% of the participants were vegetarian and 8.7% were non-vegetarian.
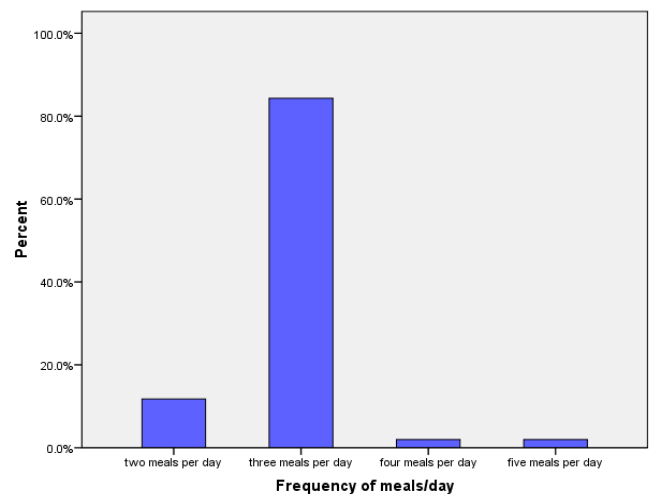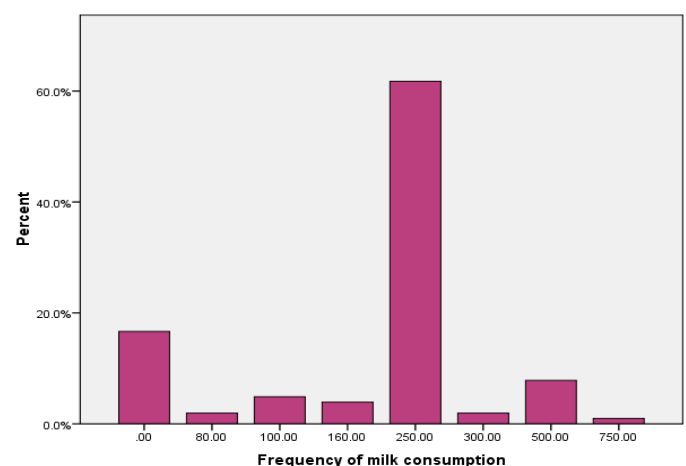

Figure 1: Frequency of meals per day

Figure 2: Frequency of milk consumption

An appreciable number (39.4%) of the participants consumed fruits daily. 52.9% consumed fruits sometimes and 5.8% were found to eat fruits rarely.

Regarding the snacking pattern it was observed that only 6.7% consumed snacks daily. Majority (84.6%) of the participants had snacks sometimes while 6.7% rarely consumed snacks. The favourite foods of the participants in the category of snacks were grill sandwiches, samosas, spring rolls and noodles.

The study revealed that majority (71.2%) of the student had the habit of consuming milk daily. 3.8% consumed milk weekly. 6.7% consumed milk rarely. 16.3% of the student revealed that they never take milk (figure 2). However, milk consumption was not found to have any significant correlation with serum calcium concentration (p<.05).

2. The anthropometric characteristics of the study population

The anthropometric data of the participants is presented in the table-1. The students (N=102) were divided into 3 groups on the basis of their age i.e. 15-18yrs (n=39), 19-22yrs (n=44) and 23-26yrs (n=19).

Table 1: Anthropometric characteristics of population on the basis of age groups

Anthropometric parameters	15-18yrs (n=39)	19-22yrs (n=44)	23-26yrs (n=19)
Weight(kg)*	53.10** ± 11.15	54.61** ± 8.92	67.16** ± 9.02
Height(m)*	1.57 ± 0.06	1.60 ± 0.05	1.57 ± .006
BMI(kg/m^2)*	21.29** ± 4.22	21.30** ± 3.21	26.88** ± 2.85
Underweight (%)	38.5	36.4	Nil
Normal(%)	48.7	54.5	15.8
Overweight(%)	12.8	9.1	84.2

*mean ± std. deviation **p<0.01

There were statistically significant differences in the weight of the students among age groups (p<0.01) is depicted in table 2. The mean weight of the female students with 23-26yrs of age was highest 67.16kg followed by those belonging to age 19-22yrs (54.61kg) and age group 15-18yrs had the lowest mean weight (53.1kg). No significant difference was observed w.r.t. the height in three age groups (Table-2). Further, BMI of the three age groups also revealed statistically significant difference (p<0.01). Females belonging to 23-26yrs of the age had highest mean BMI (26.88 kg/m^2) followed by those with age 19-22yrs (21.30 kg/m^2) and 15-18yrs (21.29 kg/m^2). It was interesting to note that age group15-18yrs had almost same BMI as in the age group 19-22yrs.

The study population was categorized into three groups on the basis of Body Mass Index (BMI). The three groups were 1.Underweight (BMI<20kg/m^2) 2. Normal (BMI= 20-25kg/m^2) and 3. Overweight (BMI>25kg/m^2).31(30.39%) participants were categorized as underweight, 46(45.09%) as having normal weight and 25(24.5%) as overweight. The descriptive statistics including the age, weight, height and BMI amongst the underweight, normal and overweight participants is depicted in Table-2.

Table 2: Anthropometric characteristics of the population on the basis of BMI group

Anthropometric parameters	Underweight (N=31)	Normal (N=46)	Overweight (N=25)
Weight(kg)*	45.32 ± 4.72	56.47 ± 5.23	69.88 ± 9.42
Height(m)*	1.59 ± 0.05	1.58 ± 0.05	1.57 ± 0.06
Serum Calcium (mg/dl) *	8.96 ± 0.63	9.21 ± 0.63	9.28 ± 0.82

*mean ± std. deviation

Within the three different age groups,this distribution was observed as 38.5% Underweight, 48.7% Normal and 12.8% overweight in 15-18yrs old females; 36.4% underweight, 54.5% Normal and 9.1% overweight in 19-22 yrs old females; 15.8% Normal and 84.2% overweight in 23-26yrs old females (Table-1).

3. Calcium status of the female students

The mean serum calcium concentration of the 102 participants was 9.15mg/dl which lies within the recommended value (8.1-10.4mg/dl). It is quite appreciable that the female students (15-26yrs) had a good calcium status.

3.1 Calcium status of the female students Vs BMI

Table-2 depicts the serum calcium concentration of the three BMI groups i.e. underweight, Normal and overweight female students. The table shows that the mean serum calcium concentration of

female students who were either normal (9.21 mg/dl) or overweight (9.28 mg/dl) was greater than the mean serum calcium concentration of underweight females (8.96mg/dl). However ANOVA reveals that this difference was not significant (p>0.05). Hence, the three BMI groups did not differ significantly w.r.t serum calcium concentration.

The mean BMI of the population was 22.23 kg/m^2. Further the Pearson's correlation between serum calcium and BMI was statistically significant (r=0.203 ,p<.05) , indicating that BMI is positively correlated with serum calcium concentration(figure 3).
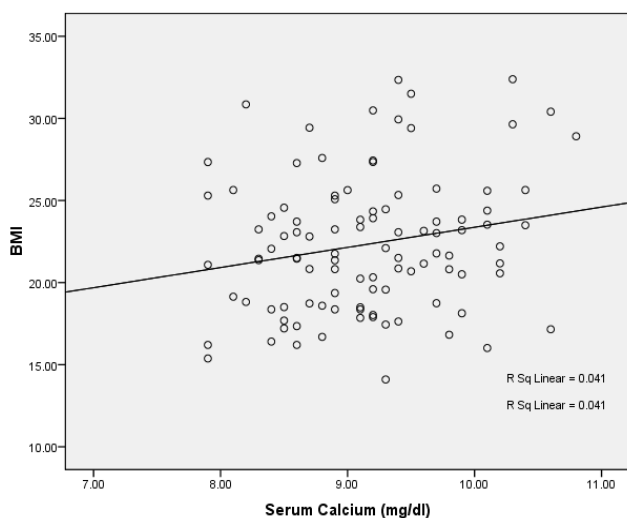
Figure 3: Corelation between serum Calcium BMI

3.2 Calcium status in vegetarian Vs Non vegetarian

A perusal of table-3 depicts that there was no statistically significant difference (t=0.751) in the serum calcium concentration of vegetarian and non vegetarian.

Table 3: Serum Calcium w.r.t. Dietary Habits

	Dietary Habit	N	Mean	S.D	t
Serum Calcium	vegetarian	93	9.14	.67	0.751* (NS)
	non-vegetarian	9	9.32	.85	

*p >0.05, NS=Not significant

3.3 Calcium status Vs residential status

Table-4 reveals that there is no significant difference (t=1.398) between urban and rural students w.r.t. serum calcium concentration.

Table 3: Serum calcium conc. w.r.t. Residential Status

	Residential Status	N	Mean	S.D	t
Serum Calcium	Urban	71	9.2	0.73	1.39* (NS)
	Rural	31	9.0	0.57	

*p >0.05, NS=Not significant

DISCUSSION

The results show that the female college students from age group 15-26yrs had normal mean serum calcium concenteration (9.15mg/dl). Most of the participants belonged to middle income group which sufficed for the provision of the adequate or 3 square meals per day. However meal skipping was also observed in 11.5% females which was found to be associated with the habit of the intermittent snacking (2.93%), intake of fruits (4.1%) or lack of time (4.69%). The occurrence of meal skipping was highest in the lower age group i.e. 15-18yrs. The students representing this age group in the indian system of education are in the phase of preparation for the entry into the professional colleges which predisposes them to anxiety due to difficulty in time management and demands considerable span of study daily. All these factors may lead to skipping of meals.

The frequency of milk consumption showed that 71.2% of the female students drank milk daily. Studies [28] report that intake of milk is needed to meet the adequate calcium concentration. One study also approves of this fact. Further, the students might have met the adequate calcium need by consuming vegetables and other calcium rich foods as stated in an earlier study [29]. It is interesting to note that though the habit of meal skipping was prevalent in 15-18yrs age group, majority of these students (74.4%) consumed milk daily, which may account for the compensation of the calcium status in this age group. Though majority of the students listed grill sandwiches,

pizza, samosas and noodles as their favourite food, they revealed that they have to consume milk because of the parental pressure.

The present study revealed that there was no significant difference in the serum calcium concentration of rural and urban female students. This finding is consistent with the earlier study done on rural and urban south Indians [30]. The vegetarians and non vegetarians did not exhibit any significant difference w.r.t serum calcium concentration. This may be attributed to the fact that non vegetarians in this study were found to consume the non veg food, mainly chicken and fish only once or twice a week and that too in a very small proportion. As regards the BMI, 84.2% of females from age group 23-26yrs were overweight. There is evidence suggesting that the rise in overweight is very steep for older adolescents rising to approximately 15% in the age group 15-17ryrs to about 47% in the age group 18-24yrs [31-32]. Moreover the questionnaire did

not asses all the dietary intakes but assessed only specific foods which might have failed to identify other influential dietary factors contributing to weight gain in this age. The present study reported a positive association between serum calcium concentration and BMI (Figure 5) which corroborates with the finding of a health survey conducted in Troms Ø [33].

CONCLUSION

This study reported that the female college students representing the age group 15-26yrs had a normal mean serum calcium concentration (9.15mg/dl) which reflects the rising awareness amongst the youth abort the importance of consuming calcium rich food items. However it is important that the interventions for the preventions of the obesity in the age group 23-26yrs are tailored and the consumption of the obsogenic foods is reduced. It is also important to

examine in more detail the possible reasons of these dietary patterns. Irrespective of the association between vegetable and fruit intake with serum calcium, the increase in the consumption of the fruits and vegetables is recommended for the health promotion of female students. Future research is needed ti investigate into moderators of this associations between BMI and dietary patterns.

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