EFFECT OF OBESITY AND DIETARY FACTORS ON BONE MINERAL DENSITY LEVELS AMONG FEMALE STUDENTS IN UMM AL-QURA UNIVERSITY

Hassan M. Bukhar¹, Ibrahim Saad Nada², ³, Eslam A. Header¹, ⁴

¹Dept. of Clinical Nutrition in the Faculty of Applied Medical Sciences, Umm al-Qura University Makkah, KSA. ²Laboratory Department, Faculty of Applied Medical Sciences, Umm al Qura University, Makkah, Saudi Arabia, ³Community Medicine Department, Faculty of Medicine, Al Azhar University. ⁴Department of Nutrition and Food Science Faculty of Home Economics Minufiya University, Egypt.

ABSTRACT
Background: Nutrition is one of the most important factors influencing human health. Also, nutrition plays a role in the etiology of osteoporosis disease. This disease is a serious metabolic bone disorder that often results in hip fracture and is usually asymptomatic in its initial stages.

Objective: Assess the prevalence of osteoporosis among female university students.

Methods: A cross sectional study was carried out during the period from 1/1/2010 to 30/6/2010 among a random sample of (257) university female students were chosen from Umm Al Qura of Makkah. The age of sample from 19-24 years old. Data were collected through an interview with case by using a special questionnaire; bone mineral density (BMD) and body composition have also been measured.

Results: Osteoporosis was present in 7% of cases while, osteopenia was current in 32.3% of cases. Moreover there was a highly positive significant relationship at level (1%) between osteoporosis induced and each of body fat %, fat weight, and BMI.

Conclusion: The prevalence of osteoporosis among university students was positively and significantly associated (p<0.001) with increased body fat. The study results suggested that inevitable decrease in body fatness and weight with less consumption of carbonated beverages, taking into consideration variety and balanced diets and increasing nutrition education programs will improve bone health and nutritional status.

Key words: Osteoporosis, Osteopenia, Bone mineral density, Body fat, University students and Umm Al-Qura University.

INTRODUCTION
Osteoporosis is the most common metabolic disease in western society Ilich et al. (1996) characterized by low bone mass, where Diane, reported that a normal bone mineral density BMD is in the range of ±1SD of the mean value of peak bone mass in young adult 30 years old women (Diane, 2001). Osteoporosis occurs when BMD is lower than -2.5SD which often leading to a decrease in quality of life Bennell et al. (2000). Lower bone mineral density was found in greater proportion among older females. Majority needed intervention inclusive of awareness through health education and medication Baig et al. (2009). Several studies stated that one in three women and one in 12
men over the age of 50 years being affected in the UK and with health care resources being estimated at 5 million sterling pounds per day, osteoporosis poses a significant public health problem Bennell et al. (2000). Furthermore, it is a serious metabolic bone disorder that often results in hip fracture and is usually asymptomatic in its initial stages Hazavehei et al. (2007).

An international trend indicates that hip fractures can rise from 1.7 million in 1990 to 6.3 million by 2050 and that figure is relevant to Saudi Arabia with recent socio-economic progress and change in living conditions resulted in increased life expectancy Cooper et al. (1992). Studies in Saudi Arabia showed that BMD of the normal Saudi population is lower than the normal Caucasian US population Ghannam et al. (1999). At Saudi Arabia level, a study in King Khalid University Hospital, Riyadh, in 437 female adult patients, aged 20-87 demonstrated that most of the sample suffers from osteoporosis with lower BMD estimation of lumbar spine for 31%, followed by femoral neck (14%), forearm (11%), and heel (6%) El-Desouki et al. (2005).

Adolescence, characterized by changes in height, weight and body composition, is also a crucial period for bone mineral accrual Kun et al. (2000). Approximately 40% of peak bone mass, a major determinant of osteoporosis, is accumulated during adolescence. This in girls will protect against post-menopausal osteoporosis Matkovic et al. (1994). In fact, peak bone mass, is influenced by genetic, nutritional, lifestyle and hormonal factors (Marwaha et al., 2011). However, the increasing proportion of underweight young women may lead to an increase in those with low bone mass (Fujii et al., 2009).

Alarming figures from national surveys indicated that poor dietary habits for many teenagers and young adults worldwide showed that they would not meet the recommended intake of calcium, 13% of 11–18 year olds have a poor vitamin D status. The dietary intake is characterized by higher consumption of processed energy dense food and soft carbonated drinks. Regarding adverted life-style including physical activity and smoking; 64% of girls aged 15 years participate in less than 30 minutes of physical activity five times per week and 33% of 15–18 year olds teenagers’ smoke (H S E, 2003 & P N D, 2003). This in the long run might end on obesity and increased fat mass.

In several observational studies, intake of carbonated beverages was associated with reduced bone mass, decreased calcium level in the blood, and increased fracture risk (Mahmood et al., 2008). Soft drink consumption has exploded over the past three decades (Nielsen and Popkin, 2004), demonstrating a per capita availability increase from 22 gallons to 52 gallons (Gerrior et al., 1998 & Jacobson, 2005). In the USA, carbonated soft drinks and milk are the two most popular non-alcoholic beverages, accounting for 39.1% of total beverage consumption (American Beverage Association What America drinks, 2008). A recent study in Saudi Arabia in 5033 boys and 4400 girls aged 10 to 19 years on dietary intake and obesity showed that Sugar-sweetened carbonated beverage (SSCB) consumption varied from 5.93 to 9.04 servings a week by age, and was
significantly higher than consumption of non-caloric sweetened "Diet" carbonated beverage (DCB), which varied between 0.92 and 1.52 servings per week (Collison et al., 2010). Thus, obesity combined with poor dietary habits can increase osteoporosis.

Therefore, our investigation aimed to assess the osteoporosis among female university students which grants an important research area on poor dietary pattern and with higher body obesity.

SUBJECTS AND METHODS:

1- Subjects

A cross-sectional study was carried out in the period from 1/1 to 30/6/2010 among 19-24 years old. The study included 257 randomly selected female students from clinical nutrition, nurse, pharmacy, laboratory medicine, departments and faculty of medicine enrolled at Umm Al Qura University in Makkah Governorate.

2- Methods

Data were collected by interview using a special medical questionnaire to explore knowledge about health beliefs concerning osteoporosis as well as dietary habits. Students were asked to report their dietary behaviors such as snacking (potato chips, ice cream, nuts, pastries, pizza, fast food, chocolate, biscuit and dessert) and beverages (tea, coffee, carbonated beverages, milk and natural juice) which they ate during a day.

Anthropometric data for height and weight were completed on the same day on which BMD was measured. Height was recorded without shoes; using a wall stadiometer to the nearest 1 mm. Subjects were weighed using a clinical balance wearing light clothing and without shoes to the nearest 0.1 kg. Body Mass Index (BMI) was calculated as weight (in kg)/height (in m²) (Garrow and Webster, 1985). On daily basis, calibration of the scale and stadiometer were conducted.

BMD from students’ wrist was measured by bone densitometry scan using BeamMed made by (sunlight) 7000/8000 series, Type/CSB serial No.5718 (BeamMed made, 2004). The World Health Organization (WHO) definition of osteoporosis, osteopenia and normal bone density is used throughout this study (Matkovic et al., 1994).

Body composition was measured using Bodystat®1500. The standard and detailed methods for measurements of BMD and body composition were showed somewhere else The Bodystat®1500 BeamMed made by (sunlight).

Statistical packaging spreadsheet software (SPSS) version 16. was used for statistical analysis (SPSS, 2008). Mean±SD (range) and analysis of variance (ANOVA) test were used as appropriate. Anthropometric measurements, dietary and BMD parameters were compared between the groups. The results were reported as mean (95%). P<0.05 was considered significant.
RESULTS:

Figure 1 shows scan of the wrist analysis for BMD to reveal that 7% of students were osteoporotic while, osteopenia demonstrated in 32% of them.

Types of beverages intake by the three BMD groups is shown in table 1, where the most common drink in osteoporotic patients was coffee (38.9%), compared with osteopenia and normal students (36.1%, and 23.1% respectively). A similar trend was observed for carbonated beverages (27.8%, 24.1% and 22.4% respectively). Milk consumption in contrast was the lowest in all groups, but it was not consumed at all in osteoporotic students compared to osteopenic and normal students (0%, 8.4%, and 4.5% respectively).
Table (1): Proportions of types of beverage intake by the three groups (%):

<table>
<thead>
<tr>
<th>Groups Parameters</th>
<th>Normal</th>
<th></th>
<th>Osteopenia</th>
<th></th>
<th>Osteoporosis</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N0.</td>
<td>%</td>
<td>N0.</td>
<td>%</td>
<td>N0.</td>
<td>%</td>
</tr>
<tr>
<td>Tea</td>
<td>29</td>
<td>18.6</td>
<td>13</td>
<td>15.7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Coffee</td>
<td>36</td>
<td>23.1</td>
<td>30</td>
<td>36.1</td>
<td>7</td>
<td>38.9</td>
</tr>
<tr>
<td>Carbonated beverages</td>
<td>35</td>
<td>22.4</td>
<td>20</td>
<td>24.1</td>
<td>5</td>
<td>27.8</td>
</tr>
<tr>
<td>Milk</td>
<td>7</td>
<td>4.5</td>
<td>7</td>
<td>8.4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Natural juice</td>
<td>45</td>
<td>28.8</td>
<td>12</td>
<td>14.5</td>
<td>6</td>
<td>33.3</td>
</tr>
<tr>
<td>Others</td>
<td>4</td>
<td>2.6</td>
<td>1</td>
<td>1.2</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table (2): Students’ distribution according to BMD levels and snack meals consumption (%):

<table>
<thead>
<tr>
<th>Groups Parameters</th>
<th>Normal</th>
<th></th>
<th>Osteopenia</th>
<th></th>
<th>Osteoporosis</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N0.</td>
<td>%</td>
<td>N0.</td>
<td>%</td>
<td>N0.</td>
<td>%</td>
</tr>
<tr>
<td>Potato chips</td>
<td>36</td>
<td>23.1</td>
<td>18</td>
<td>21.7</td>
<td>5</td>
<td>27.8</td>
</tr>
<tr>
<td>Biscuit</td>
<td>3</td>
<td>1.9</td>
<td>2</td>
<td>2.4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Chocolate</td>
<td>63</td>
<td>40.5</td>
<td>37</td>
<td>44.6</td>
<td>6</td>
<td>33.3</td>
</tr>
<tr>
<td>Fast food</td>
<td>18</td>
<td>11.5</td>
<td>9</td>
<td>10.8</td>
<td>2</td>
<td>11.1</td>
</tr>
<tr>
<td>Pizza</td>
<td>1</td>
<td>.6</td>
<td>2</td>
<td>2.4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pastries</td>
<td>14</td>
<td>9.0</td>
<td>11</td>
<td>13.3</td>
<td>2</td>
<td>11.1</td>
</tr>
<tr>
<td>Nuts</td>
<td>3</td>
<td>1.9</td>
<td>1</td>
<td>1.2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ice cream</td>
<td>9</td>
<td>5.8</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>11.1</td>
</tr>
<tr>
<td>Dessert</td>
<td>2</td>
<td>1.3</td>
<td>2</td>
<td>2.4</td>
<td>1</td>
<td>5.6</td>
</tr>
<tr>
<td>Other</td>
<td>7</td>
<td>4.4</td>
<td>1</td>
<td>1.2</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

The percentage of preferred snack meals among the three BMD classes was illustrated in table 2. About 33.3% of the snack consumed by osteoporotic students was chocolate; the followed by was potato chips by 27.8% of osteoporotic compared to the osteopenic and normal students (21.7% and 23.1% respectively). However, nuts as a good snacking choice was lacking from the osteoporosis students consumption.

When means of BMI was compared for the three groups, the study found that as in Figure 2 the subjects with osteoporosis had statistically a significant higher BMI (P<0.05) compared with osteopenia and normal students, (28.3±7.7, 24±7.5 and 22.3±4.4kg/m² respectively).

Mean values with ±SD for fat mass%, fat weight mass (kg), dry lean mass%, and lean mass weight (kg) for the studied sample are shown in table 3. The mean of fat mass% for osteoporosis group was significantly higher (P<0.001) than osteopenia and normal students (37.8±9.83, 32.1±7.7 and 30.8±6.1 % respectively).

This is hold true for fat weight mass (kg) in osteoporotic students where a significant difference between means (P<0.001) was observed in comparison to osteopenia and normal students (28.9±16.5, 20.1±9.1 and 17.2±6.1kg respectively). However, no significant difference was reported for dry lean mass (%), where it was 12.9±3.9 for osteoporotic, 12.6±6.1 for osteopenic and then 11.5±5.1 for normal students.
Concerning lean weight mass (kg), the mean was significantly higher (P<0.01) for osteoporotic than in osteopenic and normal students (41.5±9.3, 37.8±8.7 and 35.7±8.3 (kg) respectively). In general, there are trends which went up as BMD score went down.

### Table (3): Mean±SD values of fat mass %, fat mass weight (kg), dry lean mass %, and lean mass weight (kg) classified by BMD categories for the studied samples:

<table>
<thead>
<tr>
<th>Groups Parameters</th>
<th>RR</th>
<th>Normal</th>
<th>Osteopenia</th>
<th>Osteoporosis</th>
<th>ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean±SD</td>
<td>Mean±SD</td>
<td>Mean±SD</td>
<td>F</td>
</tr>
<tr>
<td>Fat mass %</td>
<td>14-20</td>
<td>30.8±6.1</td>
<td>32.1±7.7</td>
<td>37.8±9.83</td>
<td>8.202</td>
</tr>
<tr>
<td>Fat weight mass kg</td>
<td>13-19</td>
<td>17.2±6.1</td>
<td>20.1±9.1</td>
<td>28.9±16.5</td>
<td>17.4</td>
</tr>
<tr>
<td>Dry lean mass %</td>
<td>75-81</td>
<td>11.5±5.1</td>
<td>12.6±6.1</td>
<td>12.9±3.9</td>
<td>1.387</td>
</tr>
<tr>
<td>Lean weight mass kg</td>
<td>29%/BW</td>
<td>35.7±8.3</td>
<td>37.8±8.7</td>
<td>41.5±9.3</td>
<td>4.523</td>
</tr>
</tbody>
</table>

*kg.: kilogram  RR: Recommended Range*

### DISCUSSION

Peak bone mass is a key determinant of skeletal health throughout life (Lips, 2001). The attainment of peak bone mass is influenced by genetic and environmental factors. However, nutritional factors have considerable effects (Heaney et al., 2000 & Saggese et al., 2001). Our results revealed that about 7% of female students had osteoporosis (T-score of -2.5 or lower), while osteopenia (T score between -1 and -2.4) demonstrated in 32.3% of them. Previously, results of pharmacist students in Iowa City, USA, showed that the mean (±SD) T- and Z-scores for these participants were 0.03±1.30 and 0.52±1.13, respectively. Out of the Iowa study, the total number of the women whom screened and had an increased risk of fracture, based on a T-score of -1 or less, was 62 (19.4%), whereas approximately two-thirds of all women had better-than-average BMD (Harris et al., 2011).

Most of osteoporotic patients in the current study preferred coffee, compared with osteopenic and normal ones. These results are in accordance with El Maghraoui who noticed that, using multiple regression analysis, only age, BMI, and high coffee consumption were independently associated to the osteoporosis status (ElMaghraoui et al., 2010). This findings was reported as well in a recent study, where in men with coffee consumption of 4 cups or more per day had 4% lower BMD at the proximal femur (p = 0.04) compared with low or non-consumers of coffee, yet no significant difference had noticed in women (Hallström et al., 2010).

The National Osteoporosis Foundation suggested that the consumption of three or more cups of coffee per day may affect bone density with high caffeine consumption is linked to an increased lifetime risk of low bone density. The foundation had elucidated that caffeine decreases slightly the ability of the body to absorb calcium, hence, it advises to keeping caffeine to moderate (NOF, 2011).

Sugar sweetened soft drinks became a major source of added sugar in the American diet (Bray et al., 2004 & Gurthrie and Morton, 2000) and have...
been linked to adverse nutritional and health consequences such as obesity (Bray et al., 2004 & Heller et al., 2001 & Raben et al., 2002). The same results were observed for carbonated beverages in our study. Evidence supports an association between soft drink consumption and decreased bone mineral density (BMD) (Ma and Jones, 2004 & Wyshak, 2000 & McGartland et al., 2003). This could be explained on the light of that the higher content of phosphorous in Soda drinks was associated with decreasing level of blood calcium and increasing urinary calcium excretion, which may lead to osteoporosis later in life Mahmood et al. (2008).

To define obesity, BMI is usually used, where obese people are those with BMI >30. BMI is a number calculated from a person's weight and height (Garrow and Webster, 1985 & Mei et al., 2002). A direct measure is the body composition analysis by electric impedance technique, where lean and fat masses are determined with 13-19kg of total body fat is from fat mass to be considered as normal level. Also, it was found that bone speed of sound (SOS) is reduced in adolescent females with increased adiposity Holmes et al. (2010).

It has been reported in the past that obesity significantly decreases the risk for osteoporosis but did not decrease the risk for osteopenia Andreoli et al. (2011). Overweight and obese adolescents in the final stages of sexual maturity have been found to had higher BMD in relation to their normal-weight counterparts; however, cohort studies will be necessary to evaluate the influence of such characteristic on bone resistance in adulthood and, consequently, on the incidence of osteopenia and osteoporosis at older ages (Cobayashi et al., 2005). Additionally, for a given body size measured either by body composition or height women with greater fat mass have greater BMD (Ho-Pham et al., 2010).

Several studies reported that BMD is related positively to weight and BMI, although, no clear evidence either was that to lean or fat masses (Reid, 2002 & Wang et al., 2005). This positive association might be a result of increased mechanical loading on the skeleton due to affect of higher body weight. Furthermore, the secretion of endocrine and paracrine factors that strongly influence neighboring cell function and distant activities by fat mass and fat cells is long time well established fact. Thus, the role of adipocytes as active tissues associated and in particular fat mass with the secretion of bone-active hormones from the pancreatic β-cell (i.e. insulin, amylin, resistin and preptin); and secretion of bone-active factors (i.e. estrogen, leptin, and adiponectin) might influences and regulates BMD Wang et al. (2005).

However, a recent study has documented a high prevalence of obesity in postmenopausal women with fragility fracture, but not with lower BMD. Nearly one in four postmenopausal women with fractures is obese. When compared to non-obese women, obese women with a prevalent fracture were more likely to be current cortisone users, to report early menopause, to report fair or poor general health, to use arms to assist standing from a sitting position, and to report
more than two falls in the past year Premaor et al. (2010).

The final argument can be clarified on the light of that fat mass, as mentioned above, can generate estradiol from testosterone in post menopausal obese women. Out of these products namely, the cytochrome P450 enzyme, aromatase, could be expressed, which inhibit the pathway of osteoclastogenesis in the bone marrow, hence, less osteoclast generated, leading to slower rates of bone loss (Gimble et al., 1996 & Cohen, 2001).

Nevertheless, in obese individuals, adiposity, insulin resistance and effects of thiazolidine dione treatment enhance skeletal fragility of bones. Moreover, both exogenous glucocorticoid use and endogenous over production of cortisol for a prolonged period are associated with low BMD and a significantly greater risk of fracture, as stated in several studies (Li et al., 2005 & Van Staa et al., 2002).

A similar finding was reported in the current research, where BMI and fat% for osteoporotic students were significantly higher than osteopenic students. A recent supportive evidence came from study to agree with our results and suggest that both lean mass and fat mass are important determinants of BMD (Garrow and Webster, 1985 & Mei et al., 2002).

Furthermore, the key finding of a Chinese study in the relation between obesity and BMD found that, when confounding factor such as the mechanical loading effects of body weight on bone mass is controlled for, fat mass (or PFM) is inversely correlated with bone mass Lan-Juan et al. (2007). In supportive studies increased bone-marrow adiposity in postmenopausal women with osteoporosis was showed, and a negative association between bone-marrow fat and rate of bone formation was confirmed Rozman et al. (1989) & Justesen et al. (2001) & Verma et al. (2002).

An opposite view was presented in a study about contributions of lean and fat masses with BMD, both BMD and body compositions were measured, the study found that in 921 mixed races women (African-American, Asian, Latino and Caucasian), aged 20–25 years, lean mass rather than fat mass was more positively related to BMD Wang et al. (2005).

A recent study on CONGENIC mice, which have suppressed skeletal and hepatic insulin-like growth factor 1, found that a noticeable reduced bone mass, explicitly on the trabecular bone had taken place Rosen et al. (2004). Furthermore, the fat mass on bone marrow and the liver on these mice were elevated, yet, they have normal total body weight. The research group found interestingly that a marked reduction in bone formation as well as the number of osteoblast progenitors had occurred. It could be explained by inhibition of osteoblast lineage differentiation and shifting towards adipocytic differentiation, suggesting that from this model, fat redistribution, rather than generalized adiposity, might be a better indicator of impaired osteoblastogenesis.

Number of potential strengths and weaknesses could affect the present results interpretation. The participants were randomly drawn from the university population which should ensure its validity. The electric impedances measurements of fat mass,
lean mass and bone mass, although not direct, are accurate and reliable, which ensure the internal validity of the study. However, the number of students was relatively small, which might affect generalisability of these findings. The sample lifestyles, nutritional and physical activity may differ from other populations. The study design was cross-sectional, and it is not possible to make any cause-and-effect inference on the relationship between lean mass, fat mass and BMD.

CONCLUSION

Osteoporosis and osteopenia were prevalent among female students. There was a positive significant relationship at level (0.1%) between prevalence of osteoporosis and body fat mass. Thus, our investigation suggested that measurement of BMD should include younger adult addition to the standard age of 50 or above and A bone density scan must be measured annually to reduce the risk of bone fractures. Also, Maintaining healthy body weight and BMI in the normal range meanwhile providing healthy snacks and meals options and to prohibit selling carbonated beverages for students in the universities in Saudi Arabia was encouraged to avoid excessive caffeine, soft drinks, and processed food intake.

REFERENCES


EFFECT OF OBESITY AND DIETARY FACTORS....

10.1177/00220345010800101701. [PubMed] [Cross Ref]


**Rosen CJ et al. (2004):** Congenic mice with low serum IGF-I have increased body fat, reduced bone mineral density, and an altered osteoblast differentiation program. *J. Bone* 35: 1046–58.

**Rozman C et al. (1989):** Age-related variations of fat tissue fraction in normal human bone marrow depend both on size and number of adipocytes: a stereological study. *J. Exp Hematol* 17: 34–7


الخلفية العلمية: التغذية من أهم العوامل التي تؤثر على الصحة وتلعب دوراً كسبب لمرض ترقق العظام. هذا المرض هو أخطر الاضطرابات الأيضية في العظام التي غالباً ما تؤدي إلى كسور في عظام الفخذ ولا يكون له أعراض في مراحله الأولية.

الهدف: دراسة تأثير السمنة والعوامل الغذائية على مستوى كثافة العظام بين طالبات جامعة أم القرى.


النتائج: ترقق العظام قد أصاب 7% من الحالات بينما كانت نسبة المصابات بوهن العظام حوالي 32.3% ونسبة الدهون في الجسم وكتلة العظام. وسجلت الدراسة أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات الجامعة. كما أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات الجامعة. كما أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات الجامعة. كما أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات الجامعة. كما أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات الجامعة. كما أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات الجامعة. كما أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات الجامعة. كما أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات الجامعة. كما أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات الجامعة. كما أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات الجامعة. كما أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات الجامعة. كما أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات الجامعة. كما أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات الجامعة. كما أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات الجامعة. كما أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات الجامعة. كما أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات الجامعة. كما أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات الجامعة. كما أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات الجامعة. كما أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات الجامعة. كما أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات الجامعة. كما أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات الجامعة. كما أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات الجامعة. كما أن نسبة الدهون في الجسم وتعرض للهشاشة العظمية بين طالبات جامعة أم القرى.