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Assessment of Nutrition Habits as Related to Osteoporosis in Al Baha Region. Kingdom Saudi Arabia.

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Abstract: This study aims to find correlation between the dietary consumption pattern and osteoporosis disease affecting different individuals in the Al-Baha region in Saudi Arabia. The study included a number of 200 cases (105 students and 95 female employees). The nutritional status for the Participants included data about calcium (mmol/L), hemoglobin concentration (g/dl), glucose level, liver function , kidney function, lipid concentration and anthropometric measurements : height, weight , body mass index (BMI) wered measured questionnaire schedule was given to the students and employees to assess their demographic data, obtained diets and beverages, food and habits, nutritional knowledge as well as their acquaintance with diabetics and malnutrition . The results revealed the following: The percentage of ostopenia cases was high being (13.5% and 21%) for students and employees respectively, The intake of milk and milk products was low in ostopenia compared to normal so the calcium level in blood was low,The intake of phosphorus and vitamin D by students and employees was low compared to the normal level group, which were (29.7, 26.7 and 67.9, 78.3) & (40.6, 32.2 and 71.00,79.4) % of Recommended Dietary Allowance respectively,the intake of nutrients by inflicted group with ostopenia was below normal for (protein) and (vitamin A) while increased for carbohydrate than the RDA, intake of vitamin C was less than Recommended Dietary Allowance in case of ostopenia group which was 52.4 %, 41.4 % for students and employee respectively due to low fruits consumption,decrease of practice sport and exposure to sunrays daily was recorded for normal and ostopenia subjects. There was a prevalence of thyroid disorders and Helicobacter pylori infection, which led to an increased prevalence of osteoporosis.

Keywords: Osteoporosis - X-ray absorptiometry – vitamin D – Anthropometr – ostopenia.

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تقييم العادات الغذائية وارتباطها بمرض هشاشة العظام بمنطقة الباحة – المملكة العربية السعودية

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الملخص: تهدف هذه الدراسة إلى إيجاد العلاقة بين الحالة الغذائية ومرض هشاشة العظام الذي يصيب الأفراد المختلفين في منطقة الباحة بالمملكة العربية السعودية . تم اختيار مجموعة عشوائية من الطالبات كذلك مجموعة من الموظفات مما يعانوا من أعراض هشاشة العظام لتكون موضوع الدراسة لهذا البحث وقد شملت الدراسة على 200 حالة موزعة على التوالى (105) طالبة , 95 حالة من الموظفات من كلية العلوم والاداب بالجرشى ومن مستشفى الامير مشارى بالمملكة العربية السعودية على التوالي . تناولت الدراسة استبيان للحصول على البيانات الهامة مثل الدخل - الحالة الاقتصادية والاجتماعية – العادات والمعتقدات الغذائية والحالات المرضية من خلال مقابلة الحالات . كما تم تقييم الحالة الغذائية وارتباطها بهشاشة العظام للطالبات والموظفات موضع الدراسة بتقدير نسبة الكالسيوم فى الدم مع تقدير نسبة الهيموجلوبين ومجموعة من القيم مثل الجلوكوز وانزيمات الكبد والكلى ودهون الدم . بالاضافة الى عمل القياسات الجسمية المختلفة مثل الطول , والوزن ودليل كتلة الجسم كذلك قياس كثافة العظام بالجهاز الخاص بذلك فقد اوضحت النتائج ان الحالة الغذائية للطالبات موضع الدراسة كانت منخفضة على الرغم من ارتفاع المستوى الاقتصادى والاجتماعى ومستوى الدخل . كذلك ارتفاع النسبة المئوية لمن لديهن استعداد لهشاشة العظام حيث كانت على التوالى للطالبات والموظفات 13.5% و 21% . عدم تناول الالبان ومنتجاتها بكثرة وبالتالى نقص الكالسيوم فى الدم عن الطبيعى. نقص الفوسفور وفيتامين D عن الاحتياجات حيث بلغت النسبة فى الطالبات والموظفات على التوالى (29.7% و 26.7، 67.9% و 78.3%) و (40.6، 32.2 و 71، 794) % من التوصيات الغذائية. مأخوذ العناصر الغذائية من (البروتين وفيتامين A) كان أقل من الطبيعي بينما كان مأخوذ الكربوهيدرات أكبر من التوصيات للمجموعة المعرضة للاصابة بهشاشة العظام . نقص فيتامين Cعن الاحتياجات فى المجموعة المصابة حيث بلغت النسبة كالتالى 52.4 و 41.4% من التوصيات للطالبات والموظفات علي التوالي نتيجة لقلة استهلاك الفواكه والخضروات . قلة نسبة الهيموجلوبين فى الدم عن الطبيعى حيث كانت حيث كانت 10.1 و 10.7 - 11.50 و10.18 جم/ ديسيلتر للطالبات والموظفات المعرضات لهشاشة العظام . قلة ممارسة الرياضة وكذلك التعرض للشمس بين الطالبات والموظفات بنسبة 70% و77% للمجموعات المعرضة للهشاشة علي التوالي.

الكلمات المفتاحية: هشاشة العظام – جهاز قياس كثافة العظام – فيتامين د – المقاييس الجسمية.

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1. Introduction

The systemic bone disease known as osteoporosis can be somewhat avoided by being aware of its risk factors and adopting healthy lifestyle choices. While the majority of fracture prevention efforts have focused on slowing down the pace of age-related bone loss and lowering the frequency and intensity of trauma in the elderly, there is mounting evidence that peak bone mass plays a significant role in maintaining bone strength as people age **(Sulimani et al., 2016).** The main roles of vitamin D are to maintain bone and skeletal health and to prevent osteoporosis and rickets. It is also necessary for other non-skeletal body systems, such as developing immunity and lessening the severity of long-term illnesses including diabetes, hypertension, and heart disease **Gavriela et al ., (2023).** There are few natural sources of vitamin D, such as egg yolks, beef and animal products, and milk and dairy products **(Lips *et al.,* 2019).** In order to ascertain the sources, advantages, and deficiencies of vitamin D, numerous studies have been carried out globally in relation to the increasing prevalence of vitamin D insufficiency **(Alamoudi *et al*., 2019; Alshamsan & Bin-Abbas, 2016).** To avoid fracture, the skeleton needs to develop and maintain its integrity at its best throughout its life cycle. When weights are applied to bones that are greater than their capacity, the bones break. Calcium is essential for healthy bones. Reference calcium intakes in Western nations have been raised during the past 15 years in order to prevent osteoporotic fractures and maximize bone mass at skeletal maturity. Demonstrated that calcium plays a crucial role in both skeletal maintenance and proper growth. In addition, vitamin D is necessary for intestinal calcium absorption and is crucial for skeletal integrity and calcium homeostasis) **Fiamenghi and Mello, (2021).** The aim of this study was to collect information about knowledge and prevalence of osteoporosis in Al Baha region among women and describe the type of food habits, sociodemographic characteristics, and other osteoporosis- related health behavior.

2. Subjects and Methods

Subjects

Sample consisted of 105 female students from Faculty of Sciences and Arts (Buljurshi) Al-Baha University who were training in the nutrition unit and 95 employees from Prince Mashari Hospital in Baljurashi Kingdom of Saudi Arabia during the year January 2022 to 2023 were included in this study (all participated who were bone density measurements and blood analysis), all cases were divided in two groups :

A - Students (19 – 25) years old .

B – Employees (25 – 60) years old .

The sample was selected from those who suffer from symptoms of osteoporosis

Methods :

Data were collected by interview with participate using questionnaire containing the following: (name, occupation, age, total income , educational level, health status and food habits).

The questionnaire included some sheets (acts) as follows:

1- The first one was for health status .

2- The second one for food habits . It included : Food like and dislike .

3- The third one for data about different diseases of participants .

Analysis of dietary recall data :

All the subjects were interviewed To collect data. their food intake 24 hours recall for 7 days , food patterns and diet history were used. The energy and nutrient content of the 24 -hour were computed through the food composition table of the National Institute **RDA ,(1999).**

Anthropometric measurements :

The weight and height were measured and recorded without shoes for each participant , Subjects were weighed using a clinical balance wearing light clothing and without shoes to the nearest 0.1kg.The height was taken by using a wall stadiometer to the nearest 1mm. Since there are no local standard, for weight or height, for age considering Saudi people **(Garrow et.al.,1985).**

Body mass index (BMI) :

Body mass index was used as indication of the body status. It was calculated from dividing weight in kilograms by height in meters squared (kg/m^2) according to method reported by **Ostetriche *et al*., (2000)** .

Bone mineral densitometry (BMD):

Single-energy X-ray absorptiometry (SXY) is the most accurate (automatic, mecanical) way to measure BMD. It uses two different X-ray beams to estimate bone density in the spine and hip. Strong, dense bones allow less of the X-ray beam to pass through them. The amounts of each X-ray beam that are blocked by bone and soft tissue are compared to each other. SXY can measure as little as 2% of bone loss per year. It is a fast method and uses very low doses of radiation. Bone mineral densitometry was obtained by using a measured electronic SXY for students and employees .

Biochemical analyses:

All samples underwent blood analysis at Prince Mashari Hospital in Baljurashi, and the results were taken for the study. Determination of hemoglobin level was carried out by **King and Fauker (1973)** . Determination of blood glucose was carried out by **Siest *et al.*, (1981)** . Determination of AST and ALT was carried out according to the method of **Bergmeyer *et al.*, (1972)** . Serum total cholesterol (TC), high-density lipoprotein (HDL-c), and low-density lipoprotein (LDL-c) were determined according to Weichselbaum **(**1946**)** . Triglycerides (TG) was determined according to **Larsen , (1972)** .Creatinine concentration was determined according to **Carawy, (1955) and** uric acid was estimated by **Fossati *et al*., (1980).**

3. Statistical analysis :

Statistical analysis: Statistical package spreadsheet software (SPSS) version 16 was used for statistical analysis. Mean±SD and analysis of variance (ANOVA) test were used as appropriate. Qualitative data were expressed as percentages. For comparing the groups (SAS., 2004) .

4. Results

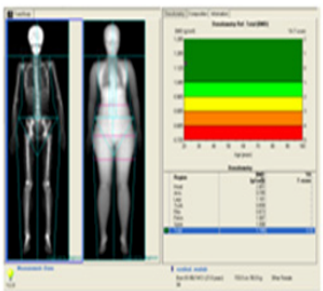
Distribution of studied subjects according to bone mass density is shown in Table 1 & Figure 1 , The sample consisted of 200 adult females (students and employees). The results indicated that (39 % and 26.5 %) of students and employees were normal ,while osteopenia was current in 13.5 % of students and 21% of employees as percent of total sample. The figure (1) displays the colors, where the green color shows that the samples are normal, the yellow color shows that the samples suffer from osteopenia, and the red color shows that the samples suffer from osteoporosis.

Table (1): Distribution of studied subjects according to bone mass density

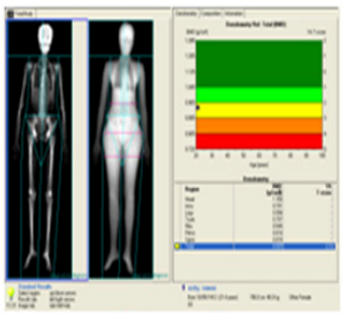
Categories / parameters	Student (No – 105)			Employee (N – 95)			Color dexa	Ready dexa
	No	No %	Mean ± SD	No	No %	Mean± SD		
Osteoporosis	-	-	-	-	-		Red	< 60
Osteopenia	27	13.5	25 ± . 28	42	21	41± .5	yellow	>61-<90
Normal	78	39	77 ± .13	53	26.5	52± .9	green	>90
Total	105	52.5	-	95	47.5	-	-	-
T. value	.023		-	2.454		-	-	-
P-value	.005**		-	.014*		-	-	-

*** P< 0.05** **** P<0.01 *** P<0.001** **NS: Not significant**

Figure (1): Samples from evaluated cases using DEXA scan



Normal



Osteopenia

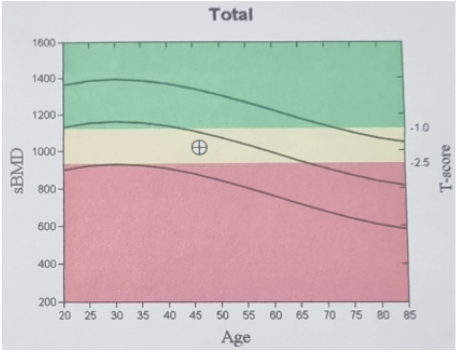


Fig. 1: Distribution of studied subjects according to bone mass density.

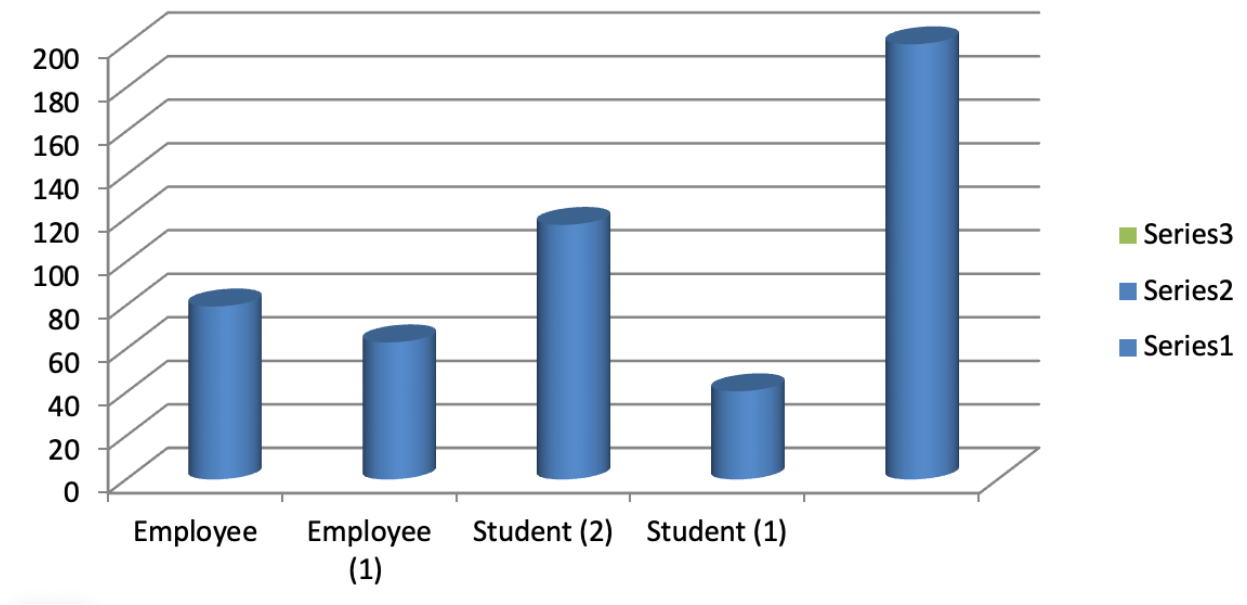


Table (2) : Mean ± SD of age, family income and anthropometric indices

Categories / Parameters	Student (No – 105)		Employee (N – 95)	
	Ostopenia	Non- ostopenia	Ostopenia	Non- ostopenia
	(no-27) Mean ± SD	(no-78) Mean ± SD	(no-42) Mean ± SD	(no-53) Mean ± SD
Age (years)	25±4.34	21.5±1.95	45.58 ± 4.99	37.85 ± 8.98
t-value	2.917		.845	
p-value	.008**		.405	
Family income (s.r)	954.6±314.5	872.7±3.542	1484.27± 347.3	1349.13± 308.57
t-value	1.077		1.003	
p-value	.284		.325	
Weight (kg)	42±11.32	51.9±9.63	65.67 ± 6.85	71.42 ± 12.28
t-value	1.245		2.565	
p-value	.214		.015*	
Height (cm)	162.3±6.54	161.1±9.2	161.33 ± 6.21	159.78 ± 5.400
t-value	1.414		.305	
p-value	.132		.763	
BMI (kg/cm2)	22.3±5.24	24.2±3.5	23.99 ± 2.97	29.07 ± 4.89
t-value	1.988		2.635	
p-value	.325		.013*	

*** P< 0.05** **** P<0.01 *** P<0.001** **NS: Not significant**

Data of table (2) show the age, family income and anthropometric measurement of students (19-25) years old and employees (25-60) years old . It could be noticed that the mean weight was normal for students and increase in the weight of female employees. But for ostopenia employee weight seems to be more weight than the non osteopenia. The height recorded for total sample was similar to normal . Moreover the mean of body mass index (BMI) was also similar to normal for groups except for ostopenia employee (over weight).

Table (3) : Mean ± SD Serum analysis for student and employee

Categories / Parameters	Student (No – 105)		Employee (N – 95)	
	Ostopenia	Non- Ostopenia	Ostopenia	Non- Ostopenia
	(no-27) Mean ± SD	(no-78) Mean ± SD	(no-42) Mean ± SD	(no-53) Mean ± SD
Glucose (mmol/L)	5.77± .718	5.1±.63	5.708± .687	6.33
t-value	.093		.156	
p-value	.926		.866	
Ca (mmol/L)	1.71± .25	1.99± .21	1.966± .14	2.07± .47
t-value	5.612		.793	
p-value	.000***		.433	
Hgb g/dL*	10.6±.17	11.3±. 23	11.65± .3205	12.54± .791
t-value	.651		.3068	
p-value	.50		..001**	
Urea (mmol/L)	2.06± .13	2.01± .83	2.633± .5821	2.59±. 013
t-value	.281		6.992	
p-value	.779		.000***	
Uric acid (umol)	275.3± .55	275.9± .50	289.5± .47	287.13± .73
t-value	.139		1.842	
p-value	.889		.075	

*** P< 0.05** **** P<0.01** *** In blood**

The results of table (3) show the mean ± SD blood analysis for samples cases). The highest means were recorded for non-ostopenia employees for calcium (2.07 ± 0.47) compared to ostopenia employees (1.966 ± 0.14) mmol. Also the results of the same table (3) indicated that most of students were suffering from decrease of (Hgb), while non- ostopenia employees it was high significantly ($p<0.01$) more compared with ostopenia group (12.54± 0.791 and 11.65± 0.3205) g/dl respectively .

Table (4) : Mean ± SD liver function for student and employee

Categories / Parameters	Student (No – 105)		Employee (N – 95)	
	Ostopenia	Non- Ostopenia	Ostopenia	Non- Ostopenia
	(no-27) Mean ± SD	(no-78) Mean ± SD	(no-42) Mean ± SD	(no-53) Mean ± SD
AST (u/L)	**33.52±6.78**	**35.4±5.86**	**40.25±2.562**	**39.43±5.50**
t-value	1.327		3.668	
p-value	.187		.001**	
ALP (u/L)	67.96±8.83	65.9±9.64	71.58±13.905	65.30±8.41
t-value	1.447		1.137	
p-value	.151		.264	
ALT (u/L)	25.09±4.14	29.96±3.97	34.50±5.838	30.13±2.24
t-value	1.253		3.199	
p-value	.213		.003**	

*** P< 0.05** **** P<0.01** ***** P<0.001** **NS: Not significant**

From results tables (4) it was found that level of Alp& AST were better for non- ostopenia than that of the ostopenia students & employees. Empolyees were higher than that of the students considering and ALT.

As indicated from results of table (5) triglycerides, LDL and were lower and HDL raostly higher for students compared with employee with different levels of significance, this may be affected by the less age in the first case. Difference due to inflicting with ostopenia was less evident.

Table (5) : Mean ± SD lipids fractions for student and employee

Categories / parameters	Student (No – 105)		Employee (N – 95)	
	Ostopenia	Non- Ostopenia	Ostopenia	Non- Ostopenia
	(no-27) Mean ± SD	(no-78) Mean ± SD	(no-42) Mean ± SD	(no-53) Mean ± SD
CHL (mmol/L)	3.73±.97	4.16±.93	3.455±.325	3.54±.57
t-value	2.069		.466	
p-value	.041*		.644	
TG (mmol/L)	.77±.42	.88±.49	3.05±.1730	2.51±.409
t-value	1.461		4.390	
p-value	.47		.000***	
HDL (mmol/L)	.90±.25	.85±.33	.8983±.1782	.95±.31
t-value	.617		.908	
p-value	.539		.370	
LDL (mmol/L)	1.71±.812	1.78±.58	2.85±.347	2.190±.708
t-value	.439		2.871	
p-value	.661		.007**	
VLDLl (mmol/L)	.14±.083	.45±.95	.3943±.7253	.33±.10
t-value	1.753		2.066	
p-value	.101		.048	

*** P< 0.05** **** P<0.01**

Data of table (6) show the nutrients intakes by student and employee . Protein intake was evidently low when compared with the recommend dietary intake (RDA,1989) , for ostopenia & non- ostopenia students it was (39.92±7.26, 45.52±5.50) of RDA while for the employee was (48.75±8.79,54.65±6.90) of RDA respectively; lowest limit was recorded for ostopenia subjects .Table (7) show the mean ± SD of vitamins intakes by students and employees, it was shown that the mean of vitamin A intake was (471 ± 166.6, 464.9 ± 177.1 and 579.3 ± 54.7 , 605 ± 133.1) for ostopemia and non- ostopemia student and employee respectively, also it was less than daily requirements (800 mg).

Moreover, from results of table (7) it was observed that intakes vitamin C and vitamin D were less than 100 % of RDA which was the case also for vitamin B_1 and vitamin B_2.

Table (6) : Mean ± SD of macronutrients intake

Categories / Parameters	Student (No – 105)		Employee (N – 95)	
	Ostopenia	Non- Ostopenia	Ostopenia	Non- Ostopenia
	(no-27) Mean ± SD	(no-78) Mean ± SD	(no-42) Mean ± SD	(no-53) Mean ± SD
Total protein (g)	39.92± 7.26	45.52± 5.50	48.75± 8.79	54.65± 6.90
t-value	2.688		2.185	
p-value	.008**		.036	
RDA %	86.78	94.6	84.2	96.6
Lipid	35.59± 6.2	38.36± 5.4	39.58± 6.22	34.39± 5.66
t-value	.154		.092	
p-value	.878		.927	
RDA %	54.9	54.6	54.9	54.6
CHO	190.3± 44.5	187± 39.12	220.58± 57.2	198.8± 52
t-value	3.671		.451	
p-value	.000***		.651	
RDA %	73.4	62.3	92.2	89.3
Energy	1371.1± 99	1240.326182.5	1516.2± 234.2	1576.316182.65
t-value	1.075		1.004	
p-value	.184		.324	
RDA %	68.5	62.46	75.86	78.9
Fiber	5.8± 3.9	3.8± 1.9	4.4± 2.3	3.9± 1.9

*** P< 0.05 ** P<0.01 *** P<0.001 NS: Not significant**

Table (7) : Mean ± SD of vitamins intake

Categories / Parameters	Student (No – 105)		Employee (N – 95)	
	Ostopenia	Non- Ostopenia	Ostopenia	Non- Ostopenia
	(no-27) Mean ± SD	(no-78) Mean ± SD	(no-42) Mean ± SD	(no-53) Mean ± SD
Thiamin (mg)	.70±.24	.66±.29	.70±.20	.756±.25
t-value	.626		.669	
p-value	.432		.500*	
RDA %	63.6	69.1	63.6	68.7
Riboflavin (mg)	.71±.14	.82±.13	.816±.307	.773±.14
t-value	1.811		.783	
p-value	.073		.439	
RDA %	64.5	74.5	74.2	70.3
Vitamin C (mg)	35.11±9.02	38.05±11.7	27.9±5.24	35.8±6.2
t-value	1.776		3.629	
p-value	.079		.001**	
RDA %	52.4	59.2	41.4	53.5
Vitamin A (mcg)	471±166.6	494.9±177.1	579.3±54.7	605±133.1
t-value	.264		6.798	
p-value	.792		.000***	
RDA %	59.4	61.75	72.3	75.6
Vitamin D	5.70±1.6	6.40±2.06	5.82±1.54	6.31±1.89
t-value	.448		2.407	
p-value	.485		.022*	
RDA %	67.9	71	78.3	79.4

*** P< 0.05 ** P<0.01 *** P<0.001 NS: Not significant**

Table (8) : Mean ± SD of Minerals intake

Categories / Parameters	Student (No – 105)		Employee (N – 95)	
	Ostopenia	Non- Ostopenia	Ostopenia	Non- Ostopenia
	(no-27) Mean ± SD	(no-78) Mean ± SD	(no-42) Mean ± SD	(no-53) Mean ± SD
Calcium (mg)	689.5±147.9	898.3±167.6	656.8±108.4	765.8±131.8
t-value	2.708		2.458	
p-value	.008**		.019*	
RDA %	51.54	74.8	54.6	63.7
Phosphorus (mg)	358.9±171.9	377.5±158.2	321.8±58.2	383.9±98.3
t-value	.459		.957	
p-value	.647		.346	
RDA %	29.7	40.6	26.7	32.2
Total iron (mg)	10.1±1.35	10.7±1.76	11.50±.1.03	10.18±1.92
t-value	1.147		.3568	
p-value	.254		.000***	
RDA %	67.6	75.3	76.7	81.2
Zinc (mg)	5.50±2.04	6.74±.93	5.49±2.38	5.98±1.55
t-value	1.726		.757	
p-value	.087		.454	
RDA %	62.5	64.5	54.08	58.2

*** P< 0.05 ** P<0.01 *** P<0.001 NS: Not significant**

Table (9) : Mean correlation between nutrient intake and anthropometric

	Age	Income	Weight	Height	BMI
Protein	-.071	-.102	-.044*	.056	-.014*
Lipid	.006	.219**	.076	-.087	.034*
Carbohydrate	.496**	.450**	.259**	.048*	.161
Calcium	-.299**	-.065	.087	.043	.026
Phosphorus	.198*	.163	.178**	.005	.176*
Iron	-.172*	-.380**	-.218**	.155	-.243**
Zinc	-.102	-.147	-.070	.102	-.211*
Vit . B1	.091	.061	.063	.000	.054
Vit . B2	.127	.038	-.47	-.231**	-.066
Vit . C	-.127	-.177*	.47	-.080	.035
Vit . D	-.030	.079	-.271**	.144	-.174*
Vit . A	.103	.041	-.243**	-.090	-.153

***p < 0.05 significant ** p < 0.01 high significant *** p < 0.001 very high significant**
-negative correlation coefficient BMI : Body mass index

Data present is table (8) show minerals intakes by ostopenin & non- ostopenin individuals groups . It could be noticed that the intake of calcium was respectively low (689.5±147.9, 898.3 ± 167.6 and 656.8 ± 108.4, 765.8 ±131.8) mg/dl by student and employee respectively, being less than of the RDA. Moreover, the intake of phosphorus, iron and zinc were less than 100% of the RDA .

Table (9) showed that show the correlation coefficients between anthropometric indices and nutrients intakes which revealed that: There was positive significant correlation between weight and carbolydrates, and phosphorus while it was negative with iron carbohydrate and phosphorus and vitamin D. Positive significant correlation was found between BMI and phosphorus (0.176) P<0.05. There are positive significant correlations between age and each of carbohydrate (P<0.01) calcium (p<0.01) and phosphorus (p<0.05).

Table (10) show the correlation coefficient between mineral intakes some blood analysis. Result indicated that: There are a positive significant correlations for calcium intake from one side and Hgb from the other side. There are positive high significant correlation between iron and Hgb ($p < 0.001$).

Table (10) : Mean correlation between minerals intake and some blood analysis

	Ca	Hgb	Glucose	Cholesterol
Calcium	.203*	.261**	.093	.154
Phosphorus	.075*	.092	.079	.296**
Iron	-.092	.283**	.133	.091
Zinc	.106*	.074	.056	.209*

*** p < 0.05 significant ** p < 0.01 high significant *** p<0.001 very high significant**

Table (11) Distribution of studied sample according to health status and food habits.

Categories / parameters	No - 27		No-78		No-42		No-53	
	osteopenia		Non-osteopenia		osteopenia		Non-osteopenia	
	No	No%	No	No%	No	No%	No	No%
Does anyone in your family suffer from osteoporosis?								
Yes	21	77.7	40	51.3	22	52.3	14	26.4
No	6	22.3	38	48.7	20	47.6	39	73.6
Are you exposed to sunlight daily?								
Yes	11	40.7	45	57.7	10	23.8	17	32.1
No	9	33.3	8	10.2	15	35.7	20	37.7
Sometimes	7	25.9	25	32.1	17	40.5	16	30.1
Do you suffer from any of Endocrine disorders ?								
Yes	1	3.7	2	2.6	10	23.8	15	28.3
No	26	96.3	76	97.4	32	76.19	38	71.7
Do you suffer from malabsorpation or digestion problem?								
Yes	17	62.9	15	19.2	12	28.5	11	20.8
No	5	18.2	35	44.9	11	26.2	12	22.6
Sometimes	5	18.9	28	35.9	19	45.23	30	56.60
Do you suffer from diabetes or gout ?								
Yes	2	7.5	1	1.3	13	30.9	20	37.7
No	25	92.5	77	98.7	29	69.1	33	62.3
Do you suffer from hypertension?								
Yes	1	3.7	2	2.5	10	23.8	10	18.9
No	26	96.3	66	84.6	32	76.2	43	81.1
Do you practice sport or exercise?								
Yes	16	59.2	25	32.1	10	23.8	10	18.9
No	8	29.6	30	38.4	11	26.2	22	41.5
Sometimes	3	11.2	23	29.5	21	50	21	39.62
Do you lose some teeth recent ?								
Yes	15	55.6	32	41.1	18	42.8	12	22.6
No	12	44.4	46	58.9	24	57.2	41	77.35
Do you have any drugs containing calcium ?								
Yes	2	7.4	--	--	14	33.3	16	30.18
no	25	92.6	78	100	28	66.6	37	69.8

Data present in Table (11) show the distribution of the studied sample according to health status and dietary habits. The results indicated that: (21) % of participants do not get sun exposure, which causes osteoporosis, (70) % of participants did not eat fatty fish (salmon and sardines), there was a prevalence of thyroid disorders and Helicobacter pylori infection. (77%) of participants had a family history of osteoporosis. They also did not consume sufficient amounts of vitamin D or vitamin C. Most participants also had malnutrition (74%) .

Categories / Parameters	Student (N – 105)				Employee (N – 95)			
	No - 27		No-78		No-42		No-53	
	osteopenia		Non- osteopenia		osteopenia		Non- osteopenia	
	No	NO%	No	NO%	No	NO%	No	NO%
Do you keep drinking tea after eating?								
Yes	16	59.2	20	25.6	25	59.5	15	28.3
No	4	14.8	35	44.9	13	30.95	10	18.86
Sometimes	7	26	23	29.5	4	9.5	28	52.8
Do you suffer from Helicobacter pylori?								
Yes	10	37.1	30	38.5	15	35.7	17	32.1
No	17	62.96	48	61.53	27	64.28	36	67.9
Do you have cola or Pepsi products with the meal ?								
Yes	20	74.1	50	64.1	10	23.8	19	35.8
No	4	14.8	15	19.2	32	76.2	10	18.8
Sometimes	3	11.1	13	16.7	--		24	45.2
Do you prefer salt foods ?								
Yes	12	44.4	20	25.6	16	38.1	9	16.9
No	7	26	45	57.7	14	33.3	10	18.8
Sometimes	8	29.6	13	16.8	2	4.9	34	64.2
Do you prefer caned food more than fresh ones ?								
Yes	15	55.5	41	52.7	15	35.7	18	33.9
No	5	18.5	6	7.6	13	30.95	10	18.8
Sometimes	7	26	31	39.7	14	33.3	25	47.2
Do you make sure to consume milk or dairy products daily?	5	18.5	26	33.3	10	23.8	19	35.8
Yes	15	55.5	30	38.5	16	38.1	12	22.64
No	7	26	21	28.2	16	38.1	22	41.50
Sometimes								
Did you have milk in your childhood ?								
Yes	20	74.1	50	64.1	14	33.3	15	28.30
No	2	7.4	5	6.4	17	40.47	9	16.98
Sometimes	5	18.5	23	29.5	11	26.1	29	54.7
Do your food contain animal fats (meat) ?								
Yes	9	33.3	20	25.6	17	40.4	13	24.52
No	10	37.1	18	23.1	10	23.8	2	22.6
Sometimes	8	29.6	40	51.3	15	35.7	8	52.8
Do you eat oranges or guava after eating?								
Yes	11	40.7	29	37.2	6	14.2	9	16.9
No	16	59.3	30	38.5	16	38.1	13	24.5
Sometimes	--	--	19	24.3	20	47.6	31	58.5
Do you eat fish?								
Yes	2	7.4	5	6.4	5	11.9	15	28.3
No	19	70.3	51	65.4	37	88.1	15	28.3
Sometimes	6	22.3	22	28.2	--		23	43.4
What kind of bread do you prefer ?								
White	11	40.7	35	44.9	18	42.8	19	35.8
Brown	16	59.3	43	55.1	24	57.1	24	64.1

5. Discussion

Globally, vitamin D insufficiency is a major health concern. In Saudi Arabia, it is very common in all age categories, but it is more common in women and children. vitamin D helped maintain teeth and bone, enhance immunity, and improve muscle strength . The current study aimed to find correlation between the dietary consumption pattern and osteoporosis disease affecting different individuals in Al Baha region–Saudi Arabian kingdom .The results from table (1) showed that the disease was more prevalence among female by 21% and was the highest.prevalence in the age group of 19 to 60 years. Our data show that Ostopenia is more frequent in employees than in students 13.5 % as percent of total sample. Table (2) demonstrates that ostopenia increases with weight gain, and this is more so in overweight female employees , also female in the age group 40-50 years have higher osteoporosis. This result agree with Sheu and diamond, (2022) showed that According to a Saudi Ministry of Health research, women over 50 are more likely to develop osteopenia and osteoporosis.

Data of table (3) shows low blood calcium in students and employees and high uric acid levels in the participants , This is due to the lack of consumption of foods containing calcium, also lack of exposure to the sun,It is commonly recognized that phosphorus and calcium serve as phenotypic indicators for the production of bones. This result agree with Bundy et al.,(2017) showed that the level of nutritional knowledge rose among middle-aged individuals and fell considerably among younger and older individuals, middle-aged individuals possess greater nutritional knowledge .

Our current study shows that table (5) triglycerides and LDL were higher and HDL raostly lower for employee compared with students with different levels of significance ($p<0.05$), This result agree with (Nejla and Erbe, 2020) showed that a lack of vitamin D lowers the risk of heart failure, protects against cardiovascular disease and its risk factors, and linked to an increased risk of cardiovascular disease.

Data of table (6) show the nutrients intakes by student and employee . Protein intake was evidently low when compared with the recommend dietary intake (RDA , 1999), for ostopenia & non- ostopenia it was lowest limit recorded , This led to vitamin D deficiency because vitamin D content was higher in meat than in vegetables and fruits.

This result agree with Bahrami,et al., (2021) showed that low energy and protein intake has been suggested to contribute to the increased incidence of ostopenia in the elderly. However, the impact of dietary protein on bone health is still a matter of debate, adequate dietary calcium intake, appropriate intakes of vegetables and fruit have a beneficial effect on bones in boys aged 8-20 y.

The current study demonstrates that the participants' decreased intake of foods containing vitamins, as they had a lower percentage of vitamins, especially vitamins A, D, and C, There are few natural sources of vitamin D, this led to a deficiency of vitamin D and led to the appearance of symptoms of osteoporosis. This result agree with (Alamoudi et al., 2019 ; Kaddam et al., 2017] and Al-Qahtani et al., 2022) showed that Saudi Arabia have unacceptably high degrees of vitamin D insufficiency and vitamin D insufficiency is high due to insufficient dietary vitamin D intake and lack of sun exposure.

Data present is table (8) shows the intake of calcium was being less than of the RDA. Moreover, the intake of phosphorus, iron and zinc were less than 100% of the RDA. It is well known that calcium and phosphorus are widely accepted as phenotype markers for bone formation . This led to a decrease in bone density in the participants, whether students or employees. This result agree with (Ministry of Education,2018) showed that vitamin D was essential in maintaining calcium and phosphate levels, and crucial for bone and teeth. our research has indicated that table (9 and 10) shows that there are correlation between nutrient intake and anthropometric ,as well as minerals intake and some blood analysis , There are positive significant correlations between weight and each of carbohydrate ($P<0.01$), calcium ($p<0.01$) and phosphorus ($p<0.05$) while it was negative with iron carbohydrate and phosphorus and vitamin D, there are positive high significant correlation between calcium intake and calcium in the serum ($p < 0.001$), There are positive high significant correlation between iron and Hgb ($p < 0.001$).

Data present is table (11) showed that (21) % of participants do not get sun exposure which causes osteoporosis, 72% were exposed to the common cold as a result of exposure to vitamin D deficiency . This result agree with (Martins et al., 2019; Zareef and Jackson 2021) showed that link between 25-hydroxy vitamin D levels in the serum and sunlight exposure is more significant than dietary intake and Vitamin D production in the skin could be impaired in some situations, such as darker skin and sunscreen use, according to premenopausal women in Jeddah, Saudi Arabia, roughly half of study participants disliked being in the sun, (70) % of participants did not eat fatty fish (salmon and sardines), dairy products and eggs per week, also showed that most sample of students and employees preferred cola and pepsi (74.1 to 83.3%) , Most of the weather in Al Baha is cloudy and cold. This result agree with (Ministry of Education, 2018) explain that residents who live in cloudy areas are more prone to vitamin D deficiency.

Most of the study participants take vitamin D tablets and yet have osteoporosis because they do not take calcium products, whether tablets or food, These findings support the findings of a study by Abuobaida, et al., (2021) , which demonstrated that consuming high-calcium skim milk helped postmenopausal women reduce the rate of bone loss at clinically significant lumbar spine and hip sites. Moreover, supplementing with milk improved the subjects' serum 25-hydroxy vitamin D status. or food, These findings support the findings of a study by Lips et al., (2019), which demonstrated that consuming high-calcium skim milk helped postmenopausal women reduce the rate of bone loss at clinically significant lumbar spine and hip sites. Moreover, supplementing with milk improved the subjects' serum 25-hydroxy vitamin D status.

In the present study, the results showed that hyperthyroidism developed bone this change similar to reported by (Ministry of Education, 2018) .

6. Conclusion

This study was evaluating nutritional habits and its association with the prevalence of osteoporosis in the Al-Baha region . The results indicate that Participants had limited understanding regarding of osteoporosis and its causes . Most participants had not adequate knowledge of vitamin D benefits and its effects on maintaining teeth and bone, enhancing immunity, improving muscle strength and heart disease. The majority were unaware of the nutritional sources of vitamin D and calcium. The number of employees participants diagnosed with osteopenia was higher than Student, mainly due to restricted sunlight exposure, lack of intake of milk and milk products , lack of fish consumption, stomach acid deficiency , consumption of canned Pepsi and cola and there was a prevalence of thyroid disorders and Helicobacter pylori infection, which led to an increased prevalence of osteoporosis, The study advises eating fresh vegetables , eating fish twice a week and increased sun exposure.

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