



## ORIGINAL ARTICLE

# Osteoporosis Knowledge, Physical Activity Level, and Calcium Intake in Students of Physical Therapy and Rehabilitation and Nutrition and Dietetics Departments

*Fizik Tedavi ve Rehabilitasyon ile Beslenme ve Diyetetik Bölümleri Öğrencilerinin Osteoporoz Bilgisi, Fiziksel Aktivite Düzeyleri ve Kalsiyum Alımları*

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## Abstract

**Introduction:** The aim of this study was to compare the osteoporosis knowledge, calcium intake, and physical activity level of the students of physical therapy and rehabilitation and nutrition and dietetics departments, which are among the occupational groups that play an important role in the prevention and management of osteoporosis.

**Methods:** This study was carried out with second-, third-, and fourth-grade female students of physical therapy and rehabilitation and nutrition and dietetics departments. Osteoporosis knowledge was evaluated using Osteoporosis Knowledge Test, physical activity level was evaluated using the Sedentary Behavior Questionnaire, and daily calcium intake was evaluated using the Food Consumption Frequency Form.

**Results:** The mean age of 209 female participants was  $21.50 \pm 1.36$  years. There was no significant difference between the students of the two departments in terms of osteoporosis knowledge, physical activity level, and calcium intake ( $p > 0.05$ ). There was no significant difference among students of different grades in terms of evaluated parameters ( $p > 0.05$ ).

**Discussion and Conclusion:** The osteoporosis knowledge, physical activity level, and calcium intake of the students studying in two different departments involved in osteoporosis management and at different grade levels were similar. Although osteoporosis knowledge of the students of both departments was high, their physical activity level and daily calcium intake were low. It is important for these students, who will be practitioners of professional groups that play a primary role in health promotion, to reflect their knowledge on their own attitudes and habits and to be the right role models for their clients and the development of social health.

**Keywords:** Calcium intake; Knowledge; Osteoporosis; Physical activity

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Osteoporosis, a skeletal system disorder characterized by decreased bone mineral density, occurs as a result of changes in bone microstructure due to the deterioration of the balance between bone formation and resorption.<sup>[1]</sup> The incidence of osteoporosis is known to be more than 200 million worldwide and increases with age. It is predicted that 1 out of every 3 women and 5 men over the age of 50 years will have an osteoporotic fracture. In addition, the annual cost is stated to be higher for osteoporotic fractures than for myocardial infarction, cerebrovascular events, and breast cancer care. For this reason, osteoporosis has become an important social problem due to the increasing incidence and economic burden on individuals and the health system. Due to the high cost of treatment and the high mortality rate, prevention of osteoporosis rather than treatment has gained importance in recent years.<sup>[2]</sup>

Physiotherapists and dietitians are among the occupational groups that play an important role in the prevention and management of osteoporosis. Physiotherapists take an active role in reducing the risk of falls and fractures by maintaining muscle strength, increasing bone mineral density, and improving balance. Dietitians, on the other hand, are professionals who ensure the protection of bone metabolism by supporting proper/balanced nutrition and recommending diet programs that support calcium intake. Members of these two professions also work on osteoporosis prevention, treatment, reduction of secondary problems, public health studies, and development of social policies.<sup>[3]</sup>

According to the recommendations of the World Confederation for Physical Therapy, the European Network of Physiotherapy in Higher Education, and the National Core Education Program of Physiotherapy, subjects such as body structure and functions, bone structure, the effect of movement and exercise on bone mineral density, osteoporosis, primary and secondary effects of osteoporosis, and prevention and treatment are included in the physical therapy and rehabilitation undergraduate education curriculum.<sup>[4]</sup> In addition, they can find the opportunity to apply their theoretical knowledge in areas such as postmenopausal osteoporosis and age-related decrease in bone density in women's health and geriatric rehabilitation clinics. In this regard, physical therapy and rehabilitation undergraduate institutions are also obliged to guarantee the educational outputs and achievements of their graduates. The preventive and therapeutic methods used by physiotherapists who graduated with these competencies increase the strength of the bone by increasing bone density. In addition, these interventions reduce the fall risk and minimize the risk of osteoporotic fractures.<sup>[3]</sup>

According to the Core Education Program prepared for undergraduate education in Nutrition and Dietetics, dietitians take an active role in the prevention and treatment of diseases by interpreting the interaction of the symptoms and complications with nutrition.<sup>[5]</sup> Adequate protein, calcium, vitamin D, fruit, and vegetable consumption provided by proper nutrition determined by dietitians who are competent and experienced in their fields creates positive effects on bone health. Malnutrition and insufficient calcium intake have been shown as risk factors for osteoporosis.<sup>[2]</sup> It has been stated that calcium intake in daily recommended amounts is very important in the management of osteoporosis.<sup>[6]</sup>

Members of both occupational groups have important duties and responsibilities in terms of prevention, management, treatment of osteoporosis, and protection of public health. However, to complete these responsibilities, they must first have a high level of knowledge and self-awareness about osteoporosis during their student life, and as a result, they must be physically active individuals who pay attention to adequate calcium intake. Therefore, the primary aim of our study was to compare the osteoporosis knowledge, physical activity level, and calcium intake of physical therapy and rehabilitation students (PTS) and nutrition and dietetics students (NDS). A secondary aim was to compare the results of different grade students within the departments in terms of the measured parameters.

## Materials and Methods

### Ethical Approval

This study was approved by the Non-Interventional Clinical Research Ethics Committee of Lokman Hekim University (March 29, 2022, decision no: 2020/052) and was conducted in accordance with the Declaration of Helsinki. All participants were informed about the study, and a signed consent form was obtained from each participant.

### Participants

This was a cross-sectional study conducted in the Health Science Faculty of Lokman Hekim University. The population of the study was female students studying in the second, third, and fourth grades of the physical therapy and rehabilitation and nutrition and dietetics departments of Lokman Hekim University in the 2021–2022 academic year. The exclusion criteria were any health disability in physical activity or consumption of milk and dairy products and any disease that could adversely affect bone

development. It was aimed to reach the entire population without selecting a sample, but the data of 227 students were obtained due to the students who could not be reached or did not want to participate in the study. Due to missing data ( $n=17$ ) and exclusion criteria ( $n=1$ ), 18 students were excluded from the study, and the study was completed with 209 students.

## Outcome Measurements

The data were collected by face-to-face interview method in the classrooms of the students. The sociodemographic characteristics of the participants were evaluated with the Personal Information Form, their knowledge about osteoporosis were evaluated with the Osteoporosis Knowledge Test (OKT), and their physical activity levels were evaluated with the Sedentary Behavior Questionnaire (SBQ). In addition, the calcium intake of the students was determined by the Food Consumption Frequency Form created by the researchers. It took an average of 30 min for a participant to complete the scales.

## Personal Information Form

In the Personal Information Form, age, body weight, height, department, grade level, any disease or drug use, and the presence of osteoporosis in the family/close environment were questioned. The body mass index (BMI) of the participants was calculated with the data obtained from the information form. In addition, participants were grouped according to BMI classification.

## Osteoporosis Knowledge Test

Developed by Kim et al.<sup>[7]</sup> in 1991, OKT is a 24-item scale that evaluates the level of knowledge about calcium intake, exercise, activity level, and osteoporosis risk factors in the prevention of osteoporosis. The Turkish version of the scale was developed by Kılıç and Erci<sup>[8]</sup> in 2004. OKT consists of two subdimensions, Exercise Knowledge Test and Calcium Knowledge Test. Items 1–9 of the Exercise Information and Calcium Information Test are common. In these items, the probability of developing osteoporosis is marked on one of the options “more likely,” “less likely,” “neutral,” and “don't know.” For items 1–9, “neutral” and “don't know” are incorrect answers. Incorrect answers are scored “0” and correct answers “1.” For items 10–24 in OKT, the “don't know” option is incorrect. The exercise subscale is scored between 0 and 16, the calcium subscale is scored between 0 and 17, and the OKT total score ranges from 0 to 24. The higher total score obtained from the scale indicates better knowledge of osteoporosis.<sup>[8]</sup>

## Sedentary Behavior Questionnaire

The physical activity levels of the participants were evaluated using the SBQ developed by Rosenberg et al.<sup>[9]</sup> in 2010. The Turkish version of the scale was developed by Bakar et al.<sup>[10]</sup> in 2018. The SBQ is a questionnaire developed to assess the time spent performing 9 sedentary behaviors on an ordinary weekday and weekend. Participants are asked to mark the time spent on each behavior. For the total score, the durations of the behaviors in hours are added separately as weekdays and weekends. To obtain the average sedentary behavior times for weekdays and weekends, the total duration of the weekday is multiplied by 5, and the total duration of the weekend is multiplied by 2.<sup>[10]</sup>

## Food Consumption Frequency

In the study, the amount of calcium intake of the individuals was determined by the Food Consumption Frequency Form created by the dietitian researcher. Calcium intakes of individuals were calculated using the Nutrition Information System (BeBis) program.<sup>[11]</sup> The adequacy of the dietary calcium intake of the individuals was determined according to the Dietary Reference Intake (DRI). According to the DRI, the recommended daily calcium intake for men and women in the 19–30 age group is 1000 mg.<sup>[12]</sup> In addition, the daily portion consumption of milk and dairy products was calculated by taking into account the Türkiye Dietary Guidelines (TUBER)-2015. According to TUBER, the recommended daily consumption of milk and dairy products for men and women in the 18–49 age group is three servings.<sup>[13]</sup>

## Statistical Analysis

Statistical analyses were performed using the IBM SPSS Statistics 26.0 (SPSS, Inc., Chicago, IL, USA) package program. The significance level was set to  $p<0.05$ . Normality tests (visual and analytical) were conducted for numerical data. The Mann–Whitney U test was used as a nonparametric test and Independent Samples t test was used as a parametric test in comparison of numerical variables between pairs. The Chi-squared test was used to compare categorical variables between independent groups. The Kruskal–Wallis H test was used as a nonparametric test for the comparison of three or more independent groups.

## Results

The study was completed with a total of 209 female university students, 97 (46.4%) of them were PTS, and 112 (53.6%) were NDS. The mean age of the participants was  $21.50\pm 1.36$  years, and the mean BMI was  $21.19\pm 3.18$  kg/m<sup>2</sup>. There were

**Table 1.** Demographic and anthropometric characteristics of the participants

	Total (n=209)		PTS (n=97)		NDS (n=112)		p
	n	%	n	%	n	%	
Age (years), Mean±SD	21.50±1.36		21.34±1.26		21.64±1.43		0.109
BMI (kg/m <sup>2</sup> ), Mean±SD	21.19±3.18		21.63±3.66		20.80±2.66		0.150
BMI classification							0.447
Underweight (<18.50 kg/m <sup>2</sup> )	29	13.9	12	12.4	17	15.2	
Normal (18.50–24.99 kg/m <sup>2</sup> )	159	76.1	73	75.3	86	76.8	
Overweight (25.00–29.99 kg/m <sup>2</sup> )	16	7.6	8	8.2	8	7.1	
Obese (≥30 kg/m <sup>2</sup> )	5	2.4	4	4.1	1	0.9	
Grade level							0.252
II	67	32	36	37.1	31	27.7	
III	76	36.4	35	36.1	41	36.6	
IV	66	31.6	26	26.8	40	35.7	
Presence of chronic disease (yes)	25	12	9	9.3	16	14.3	0.218
Presence of osteoporosis in the family (yes)	41	19.6	18	18.6	23	20.5	0.719

PTS: Physical therapy and rehabilitation students; NDS: Nutrition and dietetics students; BMI: Body mass index; SD: Standard deviation.

**Table 2.** OKT and SBQ sub- and total scores

	Total (n=209) Mean±SD	PTS (n=97) Mean±SD	NDS (n=112) Mean±SD	p
Exercise Knowledge Test (score)	13.17±1.95	13.45±1.77	12.92±2.06	0.080
Calcium Knowledge Test (score)	13.54±2.33	13.65±2.13	13.44±2.49	0.734
OKT (total score)	20.14±2.66	20.44±2.34	19.88±2.89	0.221
SBQ – weekday (h)	46.34±23.47	47.94±21.90	44.95±24.77	0.205
SBQ – weekend (h)	18.33±8.94	19.04±8.73	17.72±9.12	0.319
SBQ – total (h)	64.72±31.19	67.15±29.52	62.62±32.55	0.201

PTS: Physical therapy and rehabilitation students; NDS: Nutrition and dietetics students; OKT: Osteoporosis Knowledge Test; SBQ: Sedentary Behavior Questionnaire; SD: Standard deviation.

**Table 3.** Daily calcium intake of the participants, the rate of meeting the recommended calcium intake, and the daily consumption of milk and dairy products

	Total (n=209) Mean±SD	PTS (n=97) Mean±SD	NDS (n=112) Mean±SD	p
Calcium intake (mg/day)	533.06±346.05	561.08±324.24	508.78±363.59	0.160
DRI (%)	53.31±34.61	56.11±32.42	50.88±36.36	0.160
Milk and dairy products consumption amount (serving)	2.17±1.42	2.28±1.33	2.07±1.50	0.161
DRI <50%, n (%)	121 (57.9%)	53 (54.6%)	68 (60.7%)	0.375

PTS: Physical therapy and rehabilitation students; NDS: Nutrition and dietetics students; DRI: Dietary reference intake; SD: Standard deviation.

67 (32%) students in the second grade, 76 (36.4%) students in the third grade, and 66 (31.6%) students in the fourth grade. There was no significant difference between the students of the two departments in terms of age, BMI, BMI classification, grade level distribution, presence of chronic disease, and family history of osteoporosis (Table 1).

The total OKT score was 20.44±2.34 for PTS and 19.88±2.89 for NDS. According to the results of SBQ, the weekly sed-

entary time was 67.15±29.52 h for PTS and 62.62±32.55 h for NDS. There was no significant difference between PTS and NDS in terms of OKT and SBQ total and subdimension scores ( $p>0.05$ ) (Table 2).

Daily calcium intake was 561.08±324.24 mg for PTS and 508.78±363.59 mg for NDS. According to the DRI recommendation, PTS met 56.11±32.42%, and NDS met 50.88±36.36% of the recommended calcium intake. The average daily con-

sumption of milk and dairy products was  $2.28 \pm 1.33$  servings for PTS and  $2.07 \pm 1.50$  servings for NDS. Calcium intake of 54.6% for PTS and 60.7% for NDS were below 50% of the DRI recommendation. There was no significant difference between the groups in terms of daily calcium intake, rates of meeting the recommended calcium intake, and daily consumption of milk and dairy products ( $p > 0.05$ ) (Table 3).

When the students were compared among the grades within their departments, there were no significant differences in terms of OKT and SBQ scores, calcium intake, DRI percentages, and milk and dairy products consumption amount ( $p > 0.05$ ) (Table 4).

## Discussion

This study was conducted to compare the osteoporosis knowledge and related osteoporosis preventive attitudes and behaviors of PTS and NDS, who will be among the important professionals in the prevention and treatment of osteoporosis. Our results indicated that osteoporosis knowledge, physical activity level, and daily calcium intake of students from both departments were similar.

Osteoporosis is a disease that can be prevented or delayed. Therefore, there is a need to raise awareness about osteoporosis and its complications in every period of life. Raising awareness about osteoporosis at a young age, especially before peak bone mass is reached, will contribute more to the preservation of bone health and the prevention of the disease.<sup>[14]</sup> In this respect, our study is important in terms of determining osteoporosis knowledge and raising awareness in students who have not yet reached peak bone mineral density.

In the literature, there are notable studies dealing with osteoporosis knowledge of young adults. In a review, Chan et al.<sup>[15]</sup> stated that adolescents and young adults had insufficient knowledge about osteoporosis and the reason was the belief of the younger generation that osteoporosis was a disease that only affects older adults. Eyigör et al.<sup>[16]</sup> indicated that although medical students know the definition of osteoporosis, their knowledge about complications and prevention is insufficient. In a study conducted with 353 nursing students, it was reported that the osteoporosis knowledge level was at a dramatic level of 39.6% of the maximum score.<sup>[17]</sup> Erçalik et al.<sup>[18]</sup> reported that there was no difference between PTS and NDS in terms of total osteoporosis knowledge measured by OKT, but PTS had a higher score in the exercise subdimension, and there was a correlation between the grade level and osteoporosis knowledge in both departments. Elnaem et al.<sup>[19]</sup> evaluated the osteoporosis knowledge of senior medical, pharmacy, physical therapy and rehabilitation, and nutrition and di-

**Table 4.** Comparison of students among the grades within their departments

	PTS		NDS		P
	Second grade (n=36) Mean±SD	Third grade (n=35) Mean±SD	Third grade (n=41) Mean±SD	Fourth grade (n=40) Mean±SD	
Exercise Knowledge Test (score)	13.31±1.58	13.86±1.52	12.82±2.05	13.08±1.82	0.332
Calcium Knowledge Test (score)	13.81±1.45	14.11±1.94	13.36±2.10	13.68±2.33	0.366
OKT (total score)	20.50±1.75	21.03±2.12	19.69±2.57	20.16±2.54	0.207
SBQ – weekday (h)	49.06±21.64	46.29±19.46	44.52±21.53	40.20±17.80	0.749
SBQ – weekend (h)	19.46±8.55	19.76±8.63	17.13±7.40	15.85±7.56	0.511
SBQ – total (h)	68.52±29.13	66.22±26.52	61.65±27.42	55.77±23.84	0.603
Calcium intake (mg/day)	562.34±363.99	557.20±254.60	457.69±220.15	493.71±253.57	0.840
DRI (%)	56.23±36.40	55.72±25.46	45.77±22.02	49.37±25.36	0.840
Milk and dairy products consumption amount (serving)	2.28±1.51	2.28±1.03	1.86±0.91	2.01±1.02	0.815

PTS: Physical therapy and rehabilitation students; NDS: Nutrition and dietetics students; OKT: Osteoporosis Knowledge Test; SBQ: Sedentary Behavior Questionnaire; DRI: Dietary reference intake; SD: Standard deviation.

etics department students with OKT and stated that total and nutrition subdimension scores were higher in PTS and NDS. In our study, it was determined that osteoporosis knowledge of PTS and NDS was similar and high, and there was no significant difference between different grade levels in terms of osteoporosis knowledge. The similar knowledge level of the students of these two departments may be because the courses in their curricula contain information about osteoporosis disease and preventive measures. Besides, these two groups may have similar characteristics in terms of the presence of a family history of osteoporosis. As stated in the literature, information about osteoporosis can be easily accessed through social media today.<sup>[15]</sup> This may also explain the knowledge level similarity of the students of both departments at different grade levels. In addition, our results may differ from the studies in the literature in terms of osteoporosis knowledge levels because only female students were included.

Lifestyle is one of the most important factors affecting bone density. According to the literature, good nutrition plays an important role in preventing osteoporosis and increasing bone density. Especially, insufficient calcium and vitamin D intake are important risk factors for osteoporosis.<sup>[20]</sup> As these are modifiable risk factors of osteoporosis, they have a wide place in the literature. In a study examining the lifestyles of high school female students in terms of preventing osteoporosis, it was revealed that 69.2% of the participants had malnutrition.<sup>[21]</sup> Park et al.<sup>[22]</sup> reported that many students had vitamin D (65%) and calcium deficiencies (52.5%) according to the results of their study with 160 nursing students. Khired et al.<sup>[23]</sup> investigated the osteoporosis knowledge, attitudes, and behaviors of female university students and stated that only 32% of the students aged 17–20 years and 27% of those aged 21–25 years consumed sufficient dairy products. In their study with 239 female university students, Mostafa et al.<sup>[20]</sup> reported that the average daily calcium intake was approximately 946 mg. The results of the current study indicated that the daily calcium intake level of female PTS and NDS was well below the recommended amount according to the DRI, similar to the literature.

Ford et al.<sup>[24]</sup> stated that osteoporosis and calcium knowledge of university students did not significantly affect dairy product intake. Similarly, in the current study, although the PTS and NDS had high knowledge of calcium and osteoporosis, consumption of calcium and dairy products was found to be insufficient. This result may be due to the negative attitude of the students toward calcium-rich foods, especially dairy products, because of their reluctance or lack of motivation to taste dairy products.

Another risk factor for osteoporosis is insufficient physical activity. It has been reported that regular moderate-to-vigorous physical activity improves bone health, increases bone mineral density, and prevents the development of osteoporosis in the young population.<sup>[25,26]</sup> Mujammi et al.<sup>[27]</sup> investigated the level of knowledge, attitude, and behavior related to osteoporosis in young adults and stated that although 87.6% of the participants knew that exercise could reduce the risk of osteoporosis, only 17.6% exercised more than 90 min a week. A study of 186 female medical students in Sri Lanka indicated that although the majority of the students had moderate knowledge of osteoporosis, only 13.6% of them performed the recommended level of physical activity.<sup>[28]</sup> Park et al.<sup>[22]</sup> reported that most of the nursing students performed insufficient level of exercise despite their adequate level of knowledge in the field of health. Our results indicating insufficient physical activity levels despite the high exercise knowledge of students of both departments were found to be compatible with the literature. This situation may be due to the lack of interest of the current participants in physical activity and exercise. Studies emphasized that regular physical activity combined with high calcium intake is beneficial for bone health in the young population.<sup>[29,30]</sup> For this reason, it is more important for PTS and NDS to adopt an osteoporosis-preventive lifestyle compared to students of other departments.

### Limitations

One of the limitations of our study is that the results cannot be generalized to all PTS and NDS because the sample group of our study included a single university sample and only female gender. In addition, parent education level and household income level, which may have significant effects on osteoporosis attitudes and behaviors, were not examined.

### Conclusion

The current study indicated that the osteoporosis knowledge, physical activity level, and daily calcium intake of PTS and NDS were similar, besides although the osteoporosis knowledge of the students from both departments was high, their osteoporosis preventive calcium intake and physical activity levels were insufficient. This situation shows that students cannot reflect the knowledge they have acquired to their own attitudes and behaviors. Creating awareness programs that encourage calcium intake and physical activity for young students who have not yet reached their peak bone mineral density and including osteoporosis risk factors in the course curriculum in more detail may be beneficial in terms of developing

the right attitude and behavior. In addition, identifying and eliminating the barriers to calcium intake and physical activity can have a positive impact on lifestyle. It is also important for PTS and NDS, who are among the practitioners of the professional groups that play a primary role in health promotion, to reflect their knowledge on their own attitudes and habits to be the right role models for their clients and society.

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