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The Comparison of Osteoporosis Knowledge and Awareness Levels of Patients with Hypothyroidism and Hyperthyroidism

Hipotiroidi ve Hipertirodisi Olan Hastaların Osteoporoz Bilgi ve Farkındalık Düzeylerinin Karşılaştırılması

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Abstract

Objective: Osteoporosis can be followed secondary to hypothyroidism and hyperthyroidism. In this study, we evaluated the awareness and knowledge of osteoporosis in patients with hypothyroidism and hyperthyroidism.
Materials and Methods: A total of 148 patients and 148 volunteers, 80 of whom were diagnosed with hypothyroidism and 68 with hyperthyroidism, were included in the study. Demographic information and socioeconomic status of all patients and volunteers were recorded. Participants were evaluated using the osteoporosis knowledge test and osteoporosis awareness scale. For the osteoporosis knowledge questionnaire, correct answers of 13 and above were considered sufficient and answers below 13 were considered insufficient. First, the patient and volunteer groups were compared, and then the patient group was divided into two groups as hypothyroidism and hyperthyroidism. Questionnaires measuring osteoporosis awareness and osteoporosis knowledge levels of hypothyroid and hyperthyroid patients were compared.
Results: There was no difference between the patient and control groups in terms of age, gender, education level, and income level ($p>0.05$). Both the patient and control groups had osteoporosis awareness, but there was no significant difference between the groups ($p>0.05$). The awareness of osteoporosis was high in the hypothyroid-hyperthyroid patient and control groups. When the osteoporosis knowledge levels of the patient and control groups were compared, a statistically significant difference was found in favor of the control group ($p<0.05$). No statistically significant difference was found regarding the osteoporosis awareness levels of hyperthyroid and hypothyroid patients ($p>0.05$). The osteoporosis knowledge level was low in patients with hypothyroidism and hyperthyroidism.
Conclusion: Osteoporosis awareness was high in the hypothyroid and hyperthyroid patient and control groups. Considering the osteoporosis knowledge levels of the patient and control groups, although the knowledge level was insufficient in both groups, the decrease in the patient group was significant.
Keywords: Hypothyroidism, hyperthyroidism, osteoporosis awareness, level of knowledge

Öz

Amaç: Osteoporoz, hipotiroidi ve hipertiroidiye ikincil olarak izlenebilmektedir. Biz bu çalışmada hipotiroidi ve hipertiroidisi olan hastalarda osteoporoz farkındalık ve bilgi düzeyini değerlendirmeyi amaçladık.
Gereç ve Yöntem: Çalışmaya 80 hipotiroidi ve 68 hipertiroidi tanılı toplam 148 hasta ve 148 gönüllü dahil edildi. Tüm hastaların ve gönüllülerin demografik bilgileri ve sosyoekonomik durumu kaydedildi. Katılımcılar osteoporoz bilgi testi ve osteoporoz farkındalık skalası ile değerlendirildi. Osteoporoz bilgi anket skorları için 13 ve üzeri doğru cevaplar yeterli, 13 altı yetersiz olarak kabul edildi. İlk olarak hasta ve gönüllü grubu karşılaştırıldı ve sonra hasta grubu kendi içinde hipotirodi ve hipertiroidi olarak iki gruba ayrıldı. Hipotirodi ve hipertiroidi hastalarının osteoporoz farkındalıklarını ve osteoporoz bilgi düzeylerini ölçen anketleri karşılaştırıldı.
Bulgular: Hasta ve kontrol grupları arasında yaş, cinsiyet, eğitim düzeyi ve gelir düzeyi açısından fark yoktu ($p>0,05$). Hem hasta hem de kontrol grubu osteoporoz farkındalığına sahipti ancak gruplar arasında anlamlı fark yoktu ($p>0,05$). Hipotiroid-hipertiroid hasta grubu ve kontrol grubunda osteoporoz farkındalığı yüksekti. Hasta grubu ile kontrol grubunun osteoporoz bilgi düzeyleri karşılaştırıldığında, kontrol grubu lehine istatistiksel olarak anlamlı fark bulundu ($p<0,05$). Hipertiroidi ve hipotiroidi hastalarının osteoporoz farkındalık düzeyleri açısından istatistiksel olarak anlamlı fark bulunmadı ($p>0,05$). Hipotiroidi ve hipertiroidisi olan hastalarda osteoporoz bilgi düzeyi düşüktü.

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Sonuç: Hipotiroidi ve hipertiroidi hasta grubu ve kontrol grubunda osteoporoz farkındalığı yüksekti. Hasta ve kontrol gruplarının osteoporoz bilgi düzeylerine bakıldığında her iki grupta da bilgi düzeyi yetersiz olmasına rağmen hasta grubundaki azalma anlamlıydı.
Anahtar kelimeler: Hipotiroidi, hipertiroidi, osteoporoz farkındalık, bilgi düzeyi

Introduction

The thyroid gland is the largest organ in the human body that is specialized for endocrine functions. Hormones secreted from the thyroid gland are necessary for growth and development, as well as for the optimal functioning of most tissues and organs (1). Metabolic changes due to thyroid hormones affect bone turnover (2,3).

Secondary osteoporosis (OP) defines the presence of OP due to causes other than the underlying postmenopausal condition or aging. It occurs not only in postmenopausal women but also in men and premenopausal women (4). Thyroid dysfunction is also one of the main causes of secondary OP. Thyroid hormones stimulate bone formation and increase the bone remodeling process. Thyroid dysfunctions are clinically divided into three as hypothyroidism, euthyroidism, and hyperthyroidism (2,5). Exogenous or endogenous suppression of thyroid stimulating hormone secreted from the pituitary causes bone loss and thus OP (2,3). Overt hyperthyroidism and hypothyroidism are important thyroid dysfunctions that have been associated with OP in both men and women. Hyperthyroidism accelerates bone turnover, shortens the normal bone turnover cycle, and reduces bone mineral density, thus causing OP and increased fracture risk (6). It has been reported that bone mineral densities of hyperthyroid patients are between 7-12% lower than euthyroid healthy controls (6,7). In hyperthyroidism, both vertebral and non-vertebral bone mineral density decreases. Although it did not reach normal values after approximately 2 years of hyperthyroidism treatment, a significant increase in bone mineral density was also observed (8). Information on the effect of hypothyroidism on adult bone is conflicting. The basic view is that the most important factor that increases the risk of OP in hypothyroidism is that long-term and high-level use of thyroid hormone replacement therapy reduces bone density with its cumulative effect and increases the risk of fracture (9,10).

Raising awareness of OP in patients with thyroid dysfunction is a very important public health problem. These patients need to have OP knowledge and awareness levels at the expected level in terms of OP prevention and treatment management of OP. There are studies on multiple sclerosis, chronic obstructive pulmonary disease, postmenopausal, and risk group patients living in rural areas, but there is no study examining OP awareness and knowledge levels of hyperthyroid and hypothyroid patients (11-14). In this way, it can be aimed to create informational brochures and raise awareness with media tools. For this purpose, we aimed to investigate OP knowledge and awareness levels in patients diagnosed with thyroid dysfunction in this study. Thus, it will be possible to obtain information about OP knowledge and awareness of patients with hypothyroidism and hyperthyroidism, which are the causes of secondary OP.

Materials and Methods

Our study is a cross-sectional survey study. The study protocol was approved by the Acıbadem Mehmet Ali Aydınlar University Ethics Committee (date: 02.09.2022). The registration number for the study is 2022-14/09. The study was conducted following the principles of the Declaration of Helsinki.

Study Design and Data Collection

The study was designed as a prospective cross-sectional study and was carried out at Acıbadem Hospital Physical Therapy and Rehabilitation Clinic between September 2021 and June 2022. Patients between the ages of 18-50 who were diagnosed with hyperthyroidism and hypothyroidism and agreed to participate in the study were included in the study. Exclusion criteria of the study; to have other secondary OP-causing disease (rheumatoid arthritis, ankylosing spondylitis, hyperparathyroidism, etc.), to have a previous malignancy history or to have an active malignancy, to have an active chronic infection, to be diagnosed with OP. A total of 155 patients were evaluated in the preliminary evaluation. Four of the patients refused to participate in the study and 3 patients were not included in the study because they met the exclusion criteria. As a result, 80 hypothyroid and 68 hyperthyroid patients were included in the study. The control group consisted of healthy volunteers of the same age and gender. Socio-demographic characteristics such as age, height, weight, body mass index (BMI) (kg/m^2), marital status, education level, occupation, and place of residence were recorded. The study was initiated after the approval of the ethics committee. Verbal and written consent was obtained from the patients and the control group. Our work was carried out in two stages. In the first stage, two groups were taken as patient and control. Patient and control group demographic data, OP awareness level, and OP knowledge level questionnaires were evaluated. In the second stage, the patient group was divided into hypothyroidism and hyperthyroidism, and OP awareness and OP knowledge levels were evaluated.

Osteoporosis Knowledge Test (OKT)

The OKT was first performed in 1991 by Kim et al. (15) as a multiple-choice questionnaire containing 24 questions aimed at measuring the level of knowledge about OP. The questionnaire includes questions about exercise and activity level, and the diet applied to prevent OP. Turkish validity and reliability study was conducted by Kılıç and Erci (16). The OKT was revised in 2011 and the number of questions increased to 32 (17). The Turkish validity and reliability of the revised form were performed by Atalay et al. (18). Items 1 to 11 question the risk factors for OP and the answers are given by ticking one of the options "It is highly likely to have OP", "It is unlikely to have OP", "It has nothing to do with the development of OP", and "I do not know". The

answers "It has nothing to do with the development of OP" and "I do not know" are evaluated as wrong and given 0 points. The answers "There is a high probability of OP" or "There is a low probability of OP" are considered correct and 1 point is given. Other questions contain 4 optional answers and 1 point is given when the correct answer is marked. There are two subgroups of Revised OCT: The nutrition subgroup includes 26 questions (1-11 and 18-32), Exercise subgroup includes 20 questions (1-17 and 30-32). Fourteen questions of these two subgroups are common (1-11 and 30-32). This situation is taken into account in the total score and the total score is between 0-32. An increase in the total score obtained from the scale means that the individual's knowledge of OP is at a good level (15). If the total score was below 15, it was considered as insufficient, and if it was above 15, it was considered as sufficient knowledge level.

Osteoporosis Awareness Scale (OAS)

The OAS developed by Choi et al. (19) in 2008 consists of 31 items and five sub-dimensions in English. The Turkish validity and reliability study of the scale was carried out by Ocak Aktürk et al. (20). Responses to the OAS items are rated on a 4-point Likert-type scale from 1 to 4 [(4= I know very well, 3= I know, 2= I know a little, 1= I do not know) none]. The minimum and maximum possible scores from the OAS are 31 and 124, respectively. The higher the average score obtained from the scale, the higher the OP awareness level. There are no reverse-scored items and cut-off points in the scale. The Cronbach's alpha (α) reliability coefficient of the scale is 0.948.

Statistical Analysis

Statistical analysis of the data was done with the Windows SPSS (20.0) program. Data are given as mean ± standard deviation and percentage. The conformity of the data to the normal distribution was analyzed. Chi-square was used for categorical data, the t-test was used for those with normal distribution for group comparisons, and the Pearson test was used for those who did not. Statistical significance was accepted as $p<0.05$. The minimum sample size was calculated as individuals (8 individuals in each group) using the G-Power (ver. 3.1) software (95% confidence interval, 80% power, and 0.72 effect size).

Results

The mean age of patients with hypothyroidism (48 female, 32 male) was 41.89±1.0 years, patients with hyperthyroidism (38 female, 30 male) were 42.75±1.2 years, and the control group (76 female, 72 male) was 39.83±1.73 years. There was no difference between the patient and control groups in terms of age, gender, education level, and income level ($p>0.05$). There was no statistically significant difference between hypothyroid and hyperthyroid patients when age, gender, education level, and income level were compared ($p>0.05$). Demographic data of the patients are shown in Table 1.

The OP risk factors of hypothyroid, hyperthyroid patients and the control group are presented in Table 2. A total of 52.9% of patients with hyperthyroidism had a family history of OP and it was found to be statistically significantly higher when compared to patients with hypothyroidism (28.75%) ($p<0.05$). No statistically significant difference was found between the patient group and the control group in terms of fracture history, family history, consumption of milk/dairy products, coffee, cigarette and alcohol consumption, menopause status, and BMI ($p>0.05$). Both the patient and control groups had OP awareness, but there was no significant difference between the groups (Table 3) ($p>0.05$). The awareness of OP was high in the hypothyroid-hyperthyroid patient group and control group. When the OP knowledge levels of the patient group and the control group were compared, a statistically significant difference was found in favor of the control group ($p<0.05$). In the evaluation of the questionnaire measuring the OP knowledge level, the mean score of the questionnaire in the patient group was 9.26±6.98; 14.25±8.38 in the control group. No statistically significant difference was found regarding the OP awareness levels of hyperthyroid and hypothyroid patients (Table 4) ($p>0.05$). OP knowledge level was low in patients with hypothyroidism and hyperthyroidism. The mean OP knowledge questionnaire scores were 9.39±6.52 in the hypothyroid group and 11.20±8.20 in the hyperthyroid group. No significant difference was found between them ($p>0.05$). In both groups, they heard about OP most frequently from the doctor. 53.7% of hypothyroid patients and 45.5% of hyperthyroid patients heard about OP from the doctor; 21.2% of hypothyroid patients and 22.1% of hyperthyroid patients heard about OP from radio and television.

Discussion

OP is a chronic disease that progresses silently without showing symptoms and results in fracture, requires long-term follow-up, and has become a public health problem by becoming more and more common nowadays. Prevention from OP and the development of a healthy life can be achieved by reaching the groups at risk and gaining preventive health behaviors from OP. Having knowledge about the disease and taking preventive measures by being aware of the risk factors will reduce the incidence of the disease (21). However, studies have shown that OP information is lacking in society, and most of the information is obtained from written and visual media such as television, newspapers, and the internet. It was stated that the contents of this news were insufficient to raise awareness in society and that sufficient information was not given about protection measures and little-known risk factors (22).

In the present study, we found that although the awareness of OP was higher in hyperthyroid and hypothyroid patients compared to the control group, the level of OP knowledge was lower. We found OP awareness at 87.1% in all patients, 86.2% in hypothyroid patients, and 89.7% in hyperthyroid patients. In the literature, there are studies evaluating OP knowledge levels and OP awareness in various parts of society and various patient populations. In different studies conducted in different groups in

Table 1. The sociodemographic data of patients

	Patients with hypothyroidism (n=80) Mean ± SD	Patients with hyperthyroidism (n=68) Mean ± SD	p	Control group (n=148) Mean ± SD	p (all patients-control group)
Age (years)	41.89±1.0	42.75±1.2	0.238	39.83±2.4	0.136
Gender n (%)					
Female	48 (60%)	38 (55.8%)	0.357	76 (51.3%)	0.126
Male	32 (40%)	30 (44.1%)		72 (48.6%)	
Marital status (%)					
Married	45 (56.2%)	36 (52.9%)	0.435	68 (45.9%)	0.344
Single	35 (43.7%)	32 (47.1%)		80 (54.1%)	
Occupation (%)					
Housewife	12 (5%)	11 (16.2%)	0.412	24 (16.2%)	0.541
Office worker	35 (43.7%)	28 (41.2%)		64 (43.2%)	
Retired	22 (27.5%)	14 (20.5%)		35 (23.7%)	
Manuel labor	11 (13.8%)	15 (22.1%)		25 (16.9%)	
Educational status (%)					
Primary school	15 (18.7%)	13 (19.2%)	0.378	27 (18.3%)	0.156
Middle school	18 (22.5%)	17 (25%)		34 (22.9%)	
High school	23 (28.8%)	19 (27.9%)		43 (29.1%)	
University	24 (30%)	19 (27.9%)		44 (29.7%)	
Place of residence (%)					
Urban area	15 (18.75%)	14 (20.5%)	0.243	31 (20.9%)	0.332
Rural area	65 (81.25%)	54 (79.5%)		117 (79.1%)	

SD: Standard deviation, n: Patient number. Group comparisons of baseline characteristics were perfomed with independent samles t-test or x^2 test. P<0.05 is statistically significant

the literature, it is striking that the levels of OP awareness vary in a wide range (23-25). In a multicenter study conducted in Turkey, which included 540 women and 36 men with OP, Kutsal et al. (23) found OP awareness to be 54%. In another study involving 768 Turkish women living in rural areas, OP awareness was found to be 60.8% (24). In another study by Özişler et al. (25) in which 250 cases aged 65 and over were included, the awareness of OP was found to be 88%. It is thought that the wide range in rates is due to population differences and the way awareness is examined. A study examining OP knowledge and awareness levels in patients with thyroid dysfunction, which is one of the causes of secondary OP, has not been found in the literature.

The four important steps to prevent OP are: Nutrition rich in calcium and vitamin D, increasing physical activity, not smoking and alcohol use, early diagnosis, and treatment stages are very important (21). To know and apply these stages, increasing the knowledge of OP and increasing the belief in health against OP gains importance in protection against the disease. To achieve success in the prevention of OP, the effect of cognitive processes should be increased, and preventive practices should gain meaning for people and provide permanent behavioral change (22). It is emphasized that raising awareness and knowledge about OP in individuals with diseases that predispose them to secondary OP is an important step in the prevention of OP. It is seen that studies on knowledge and awareness levels about OP are mostly carried out on health workers and individuals with OP risk factors (11-14). The aim here is to aim to increase the awareness of health professionals about OP, enlighten society, and try to take preventive measures to prevent OP in patients with risk factors. However, it is very important to inform patients with risk factors in terms of OP, as well as healthcare professionals. In our study, we found low OP knowledge levels in hyperthyroid and hypothyroid patients. With the OP knowledge test we used in this study, it is aimed to measure the knowledge level of people by questioning the nutrition and exercise knowledge that will prevent or reduce the development of OP. Despite their awareness, the low level of OP knowledge shows us that sufficient information will not be given to the patient during the short polyclinic examination. For this purpose, we think that meetings and brochures to be organized for the education of risky individuals may be important. There is a need to raise awareness about OP in every period of life. Raising awareness, especially in patients with secondary OP, will contribute more to the preservation of bone health and the prevention of disease development.

Table 2. Osteoporosis risk factors of hypothyroid, hyperthyroid patients and control group

	Patients with hypothyroidism (n=80) Mean ± SD	Patients with hyperthyroidism (n=68) Mean ± SD	p	Control group (n=148) Mean ± SD	p (all patients-control group)
Milk/dairy product consumption					
0/day	4 (5%)	2 (2.9%)	0.467	5 (3.4%)	0.552
1-3 portion/day	68 (85%)	51 (75%)		121 (81.8%)	
More than 3 portion	8 (10%)	15 (22.1%)		22 (14.8%)	
Coffee consumption					
0 cups/day	37 (46.25%)	31 (45.6%)	0.120	68 (45.9%)	0.235
1-3 cups/day	40 (50%)	36 (52.9%)		76 (51.3%)	
More than 4 cups/day	3 (3.75%)	1 (1.5%)		4 (2.8%)	
Alcohol consumption					
0 times/week	63 (78.75%)	51 (75%)	0.455	116 (78.4%)	0.356
1-3 times/week	13 (16.25%)	10 (14.7%)		21 (14.2%)	
More than 4 times/week	4 (5%)	7 (10.3%)		11 (7.4%)	
Physical activity					
None	16 (20%)	14 (20.6%)	0.345	32 (21.6%)	0.236
Rarely (less than once a week)	18 (22.5%)	16 (23.5%)		33 (22.3%)	
Minor (1 or 2 per week)	28 (35%)	27 (39.7%)		55 (37.2%)	
Regular (3 days a week)	12 (15%)	8 (11.8%)		19 (12.8%)	
Every day of the week	6 (7.5%)	3 (4.4%)		9 (6.1%)	
History of osteoporosis in the family (%)					
Yes	23 (28.75%)	36 (52.9%)	0.002	61 (41.2%)	0.438
No	57 (71.25%)	32 (47.1%)		87 (57.8%)	
Menopause (%)					
Yes	10 (20.8%)	9 (23.7%)	0.118	16 (21.1%)	0.239
No	38 (79.1%)	29 (76.3%)		60 (78.9%)	
BMI (kg/m^2)	25.762±3.316	24.126±3.402	0.398	26.112±4.234	0.145
Disease duration (month)	50.35±68.71	48.32±47.56	0.345	-	-
History of fracture (%)					
Yes	9 (11.25%)	6 (8.8%)	0.479	16 (10.8%)	0.347
No	71 (88.75%)	62 (91.2%)		132 (89.2%)	

SD: Standard deviation, n: Patient number, BMI: Body mass index. Group comparisons of baseline characteristics were perfomed with independent samles t-test or x^2 test. P<0.05 is statistically significant

Table 3. Patient and control group osteoporosis knowledge questionnaire score

	Patient (n=148) Mean ± SD	Control (n=148) Mean ± SD	p
Osteoporosis knowledge test			
Insufficient (15<)	113 (76.3%)	81 (54.7%)	0.004
Sufficient (15 and above)	35 (23.6%)	67 (45.2%)	
Osteoporosis knowledge level			
Mean ± SD	9.26±6.98	14.25±8.38	0.001
Osteoporosis awareness scale			
Mean ± SD	112.45±8.54	116.76±9.78	0.736
Osteoporosis awareness (%)			
Yes	129 (87.1%)	131 (88.5%)	0.826
No	19 (12.8%)	17 (11.4%)	

SD: Standard deviation, n: Patient number. Chi-square was used for categorical data, the t-test was used for those with normal distribution for group comparisons and the Pearson test was used for those who did not. P<0.05 is statistically significant

When the information sources about OP were questioned, 53.7% of hypothyroid patients and 45.5% of hyperthyroid patients were asked by a doctor; It was reported that 21.2% of hypothyroid patients and 22.1% of hyperthyroid patients learned about OP from radio and television. Our patients with hyperthyroidism and hypothyroidism have a high awareness of OP because they are under regular doctor follow-up. Contrary to literature data (22), the fact that they mostly hear about OP from doctors supports this data.

Study Limitations

Our study has some limitations. Being a cross-sectional study, planned with a relatively small number of patients, it is not appropriate to interpret the OP knowledge and awareness level for the general population. Better results can be achieved with multicenter studies with more participants. In previous studies (26-28), the correct answers given by individuals to the questioning of the definition of OP and risk factors were evaluated with questionnaire forms mostly structured by researchers, and the

Table 4. Comparison of patients with hypothyroidism and hyperthyroidism			
	Hypothyroidism (n=80) Mean ± SD	**Hyperthyroidism (n=68) Mean ± SD**	**p**
Osteoporosis knowledge test			
Insufficient (15<)	62 (77.5%)	51 (75%)	0.812
Sufficient (15 and above)	18 (22.5%)	17 (25%)	
Osteoporosis knowledge level			
Mean ± SD	9.39±6.52	11.20±8.20	0.298
Osteoporosis awareness scale			
Mean ± SD	110.89±9.86	114.78±7.98	0.756
Osteoporosis awareness			
Yes	69 (86.2%)	61 (89.7%)	0.103
No	11 (13.8%)	7 (10.3%)	
From whom did you hear about osteoporosis?			
Doctor	43 (53.7%)	31 (45.5%)	0.447
Radio tv	17 (21.2%)	15 (22.1%)	
Friend	4 (0.05%)	3 (0.04%)	
Internet	2 (0.02%)	2 (0.02%)	
Other healthcare personnel	2 (0.02%)	0 (0%)	
Other	1 (0.01%)	0 (0%)	

SD: Standard deviation, n: Patient number. Chi-square was used for categorical data, the t-test was used for those with normal distribution for group comparisons, and the Pearson test was used for those who did not. P<0.05 is statistically significant

relationship between socio-demographic characteristics and OP knowledge and awareness level was investigated. Unlike previous studies, we evaluated the level of OP knowledge and awareness with scales such as OCT and OAS, which have international validity and are valid and reliable in our country.

Conclusion

OP awareness was high in the hypothyroid and hyperthyroid patient group and control group. Considering the OP knowledge levels of the patient and control groups, although the knowledge level was insufficient in both groups, the decrease in the patient group was significant. OP knowledge level was low in patients with hypothyroidism and hyperthyroidism. No significant difference was found between them. Providing training to those with hypothyroidism and hyperthyroidism to increase their knowledge of OP is important in terms of preventing OP and reducing the risk of fracture.

Ethics

Ethics Committee Approval: The study protocol was approved by the Acıbadem Mehmet Ali Aydınlar University Ethics Committee (decision no: 2022-14/09, date: 02.09.2022).

Informed Consent: Verbal and written consent was obtained from the patients and the control group.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: S.K., Concept: S.K., I.F.K., Design: S.K., I.F.K., Data Collection or Processing: S.K., I.F.K., Analysis or Interpretation: S.K., I.F.K., Literature Search: S.K., I.F.K., Writing: S.K.

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References

1. Schwarz C, Leichtle AB, Arampatzis S, Fiedler GM, Zimmermann H, Exadaktylos AK, et al. Thyroid function and serum electrolytes: does an association really exist? Swiss Med Wkly 2012;142:w13669.
2. Williams GR, Bassett JHD. Thyroid diseases and bone health. J Endocrinol Invest 2018;41:99-109.
3. Bassett JH, Williams GR. Role of Thyroid Hormones in Skeletal Development and Bone Maintenance. Endocr Rev 2016;37:135-87.
4. Ganesan K, Jandu JS, Anastasopoulou C, Ahsun S, Roane D. Secondary Osteoporosis. 2023.
5. Tsevis K, Trakakis E, Pergialiotis V, Alhazidou E, Peppa M, Chrelias C, et al. The influence of thyroid disorders on bone density and biochemical markers of bone metabolism. Horm Mol Biol Clin Investig 2018;35.
6. Ross DS. Hyperthyroidism, thyroid hormone therapy, and bone. Thyroid 1994;4:319-26.
7. Auwerx J, Bouillon R. Mineral and bone metabolism in thyroid disease: a review. Q J Med 1986;60:737-52.
8. Bauer DC, Ettinger B, Nevitt MC, Stone KL; Study of Osteoporotic Fractures Research Group. Risk for fracture in women with low

serum levels of thyroid-stimulating hormone. Ann Intern Med 2001;134:561-8.

9. Abrahamsen B, Jørgensen HL, Laulund AS, Nybo M, Bauer DC, Brix TH, et al. The excess risk of major osteoporotic fractures in hypothyroidism is driven by cumulative hyperthyroid as opposed to hypothyroid time: an observational register-based time-resolved cohort analysis. J Bone Miner Res 2015;30:898-905.
10. Simonelli C. Diagnosis and Treatment of Osteoporosis, 5th edition, ICSI Health Care Guideline (PDF). Institute for Clinical Systems Improvement. 2008.
11. Karakaş A, Erdinç Gündüz N, Özçelik S, Limoncu H, Dilek B, Gülbahar S, et al. Awareness and Knowledge Levels of Osteoporosis in Patients with Multiple Sclerosis. Turk J Osteoporos 2022;28:131-6.
12. Yazıcı O, Taş Gülen Ş, Demir Yazıcı Ş. Evaluation of Osteoporosis Awareness in Chronic Obstructive Pulmonary Disease Patients. Turk J Osteoporos 2019;25:93-8.
13. Akyol Y, Ulus Y, Bilgici A, Kuru Ö. The Comparison of Knowledge Level and Awareness of Osteoporosis between Premenopausal and Postmenopausal Women. Turk J Osteoporos 2020;26:10-8.
14. Kurt EE, Koçak FA, Tuncay F, Erdem HR, Kıranatlıoğlu F. Knowledge Level and Awareness about Osteoporosis among Risk Group of Rural Women. Turk J Osteoporos 2015;21:63-8.
15. Kim KK, Horan ML, Gendler P. Osteoporosis Knowledge Test, Osteoporosis Health Belief Scale, and Osteoporosis Self-Efficacy Scale. Allendale, MI: 1991.
16. Kılıç D, Erci B. Osteoporoz sağlık inanç ölçeği, osteoporoz öz-etkililik/yeterlilik ölçeği ve osteoporoz bilgi testinin geçerlilik ve güvenilirliği. Atatürk Üniv Hemşirelik Yüksekokulu Dergisi 2004;7:89-102.
17. Gendler PE, Coviak CP, Martin JT, Kim KK, Dankers JK, Barclay JM, et al. Revision of the Osteoporosis Knowledge Test: Reliability and Validity. West J Nurs Res 2015;37:1623-43.
18. Atalay NŞ, Akkaya N, Şahin F. The Psychometric Properties of the Turkish Version of Revised 2011-Osteoporosis Knowledge Test. Turk J Osteoporos 2015;21:127-31.
19. Choi E, Kim J, Chung M, Hwang K. Development of an osteoporosis awareness scale for women. Journal of Korean Academy of Nursing 2008;328:813-21.
20. Ocak Aktürk S, Meseri R, Özentürk MG. The Psychometric Property Evaluation of the Turkish Version of the Osteoporosis Awareness Scale. Turk J Osteoporos 2021;27:151-8.
21. Yurdagül Y, Şahin NH. Osteoporozun önlenmesi ve sağlığın geliştirilmesi. İstanbul Üniversitesi FNHYO Dergisi 2006;14:115-23.
22. Janiszewska M, Firlej E, Dziedzic M, Żołnierczuk-Kieliszek D. Health beliefs and sense of one's own efficacy and prophylaxis of osteoporosis in peri- and post-menopausal women. Ann Agric Environ Med 2016;23:167-73.
23. Kutsal YG, Atalay A, Arslan S, Başaran A, Cantürk F, Cindaş A, et al. Awareness of osteoporotic patients. Osteoporos Int 2005;16:128-33.
24. Gemalmaz A, Oge A. Knowledge and awareness about osteoporosis and its related factors among rural Turkish women. Clin Rheumatol 2008;27:723-8.
25. Özişler Z, Ünsal Delialioğlu S, Özel S, Şahin Onat Ş, Yılmaz Şahin Ş, Dolmuş M. The Awareness of Elderly about Osteoporosis: What about Our Elderly? Turk J Osteoporos 2015;21:69-72.
26. D'Silva F, Pinto CA. Knowledge Level of Pre and Post Menopausal Women on Osteoporosis: A Cross-Sectional Study. IOSR Journal of Nursing and Health Science 2017;6:70-5.
27. Çıtıl R, Özdemir M, Poyrazoğlu S, Balcı E, Aykut M, Öztürk Y. Women's Knowledge And Attitude About Osteoporosis At Kayseri Melikgazi Health Group Headship's. Turk J Osteoporos 2007;13:60-6.
28. Selçuk EB, Tetik BK, Sönmez B, Tekindal MA. Assesment of the Knowledge, Attitudes and Behaviours of Postmenopausal Women About Osteoporosis. Ankara Med J 2015;15:114-9.