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Knowledge of Osteoporosis in Patients with Type 2 Diabetes in Mongolia: Web-based Cross-sectional Study During COVID-19 Pandemic

Moğolistan'da Tip 2 Diyabetli Hastalarda Osteoporoz Bilgisi: COVİD-19 Pandemisi Sırasında Web Tabanlı Kesitsel Çalışma

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Abstract

Objective: This study aimed to assess osteoporosis knowledge among individuals diagnosed with type 2 diabetes mellitus (T2DM) receiving care in Ulaanbaatar hospitals.

Materials and Methods: Conducted as a cross-sectional survey, the study included 644 participants, both male and female, aged between 20 and 65, all diagnosed with T2DM. Participants completed an online questionnaire evaluating their understanding of international osteoporosis within a 20-30-minute timeframe, amid the coronavirus disease-2019 pandemic in 2021. Knowledge levels were categorized using an Osteoporosis Knowledge Assessment Tool (OKAT), defining a good score as ≥20, a moderate score as 14-19, and a poor score as ≤1-13. Multivariate logistic regression analyses were employed to discern predictors of OKAT scores.

Results: Among the participants, 90.2% were married, 3.6% were unmarried, and 6.2% were divorced. Osteoporosis knowledge varied, with 1.08% demonstrating good knowledge, 25.62% having intermediate knowledge, and 73.3% possessing poor knowledge. Participants were stratified by T2DM duration, revealing that 47.5% had been diagnosed for 0-5 years, 26.86% for 6-10 years, and 25.62% for more than 11 years. Smoking was reported by 25% of participants, with 78.5% of males and 69.4% of females exhibiting poor osteoporosis knowledge. Among smokers, 0.6% had good knowledge, 24.2% had moderate knowledge, and 75.2% had poor knowledge. After adjusting for gender, odds ratios (OR) indicated that lower education was significantly linked to osteoporosis knowledge in T2DM (OR, 1.50; p=0.002). Additionally, OR for ophthalmic diseases and rheumatoid arthritis demonstrated a significant impact on osteoporosis knowledge in T2DM (OR, 1.01; p=0.001; OR, 1.20; p=0.001).

Conclusion: Patients aged 20-65 diagnosed with T2DM displayed insufficient knowledge about osteoporosis. The findings underscore the necessity for enhancing awareness and understanding of osteoporosis, particularly among individuals with diabetes.

Keywords: Osteoporosis, diabetes, knowledge

Öz

Amaç: Bu çalışmanın amacı, Ulan Batur hastanelerinde tedavi gören tip 2 diabetes mellitus (T2DM) tanılı bireyler arasında osteoporoz bilgisini değerlendirmektir.

Gereç ve Yöntem: Kesitsel bir anket olarak yürütülen çalışmaya, yaşları 20 ile 65 arasında değişen ve tümü T2DM tanısı almış kadın ve erkek 644 katılımcı dahil edilmiştir. Katılımcılar, 2021'deki koronavirüs hastalığı-2019 (COVİD-19) pandemisinin ortasında, 20-30 dakikalık bir zaman dilimi içinde uluslararası osteoporoz anlayışlarını değerlendiren çevrimiçi bir anket doldurmuştur. Bilgi düzeyleri, Osteoporoz Bilgi Değerlendirme Anketi (OKAT) kullanılarak kategorize edilmiş ve iyi puan ≥20, orta puan 14-19 ve kötü puan ≤1-13 olarak tanımlanmıştır. OKAT puanlarının prediktörlerini ayırt etmek için çok değişkenli lojistik regresyon analizleri kullanılmıştır.

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Bulgular: Katılımcıların %90,2'si evli, %3,6'sı bekar ve %6,2'si boşanmıştı. Osteoporoz bilgisi çeşitlilik göstermekte olup %1,08'i iyi, %25,62'si orta ve %73,3'ü zayıf bilgi düzeyine sahipti. Katılımcılar T2DM süresine göre sınıflandırıldı ve %47,5'inin 0-5 yıldır, %26,86'sının 6-10 yıldır ve %25,62'sinin 11 yıldan uzun süredir tanı almış olduğu ortaya çıkarıldı. Katılımcıların %25'i sigara içtiğini bildirmiş, erkeklerin %78,5'i ve kadınların %69,4'ü osteoporoz hakkında yetersiz bilgiye sahip olduğunu belirtmiştir. Sigara içenlerin %0,6'sı iyi derecede, %24,2'si orta derecede ve %75,2'si kötü derecede bilgi sahibiydi. Cinsiyete göre ayarlama yapıldıktan sonra, odds oranları (OR) düşük eğitimin T2DM'de osteoporoz bilgisi ile anlamlı derecede bağlantılı olduğunu göstermiştir (OR, 1,50; p=0,002). Ayrıca, göz hastalıkları ve romatoid artrit için OR, T2DM'de osteoporoz bilgisi üzerinde anlamlı bir etki göstermiştir (OR, 1,01; p=0,001; OR, 1,20; p=0,001).
Sonuç: T2DM tanısı almış 20-65 yaş arası hastalar osteoporoz hakkında yetersiz bilgiye sahipti. Bulgular, özellikle diyabetli bireyler arasında osteoporoz konusunda farkındalığın ve anlayışın artırılması gerekliliğinin altını çizmektedir.
Anahtar kelimeler: Osteoporoz, diyabet, bilgi

Introduction

According to the World Health Organization, the number of people diagnosed with diabetes increased from 108 million in 1980 to 422 million in 2014 (1). Also, according to the International Diabetes Association, the prevalence of diabetes in the age group of 20-80 years in 2019 was 9.3% (463 million people) and will increase to 10.2% (578 million) by 2030 and 10.9% (700 million) by 2045. The prevalence was higher in urban areas (10.8%) than in rural areas (7.2%), and higher in high-income countries (10.4%) and lower-income countries (4.0%). One in two people with diabetes (50.1%) is unaware that they have diabetes. In 2019, the prevalence of hypoglycemia decreased to 7.5% (374 million) and is expected to reach 8.0% (454 million) by 2030 and 8.6% (548 million) by 2045 (2).

Other serious complication of diabetes is osteoporosis (OP), decreased bone mineral density (BMD), and loss of bone integrity (3-5). Diabetic-induced osteopathy is associated with type 1 and type 2 diabetes and is usually associated with decreased BMD (6,7). A recent meta-analysis found that people with type 1 diabetes have a relative risk (RR) of developing a fracture of the middle bone marrow compared with non-diabetics, and people with type 2 diabetes have a RR of developing a bone marrow fracture compared to people without diabetes 1.34 (7). In addition to the Rotterdam study, inadequate self-monitoring of blood glucose was associated with a 47-62% increased risk of fractures, and adequate self-monitoring of glucose was associated with an increased risk of fractures [risk level: 0.91 (0.67-1.23)] (8). The clinical mechanism that leads to OP in diabetes is still controversial. Diabetes mellitus type 1 is a disorder in which autoimmune pancreatic beta cell damage results in acute insulin deficiency and adversely affects bone fractures and bone health (9-12). In patients with type 2 diabetes, reduced bone blood flow leads to OP, and fragility (9,13).

Awareness-raising studies on OP in patients with cancer, thalassemia, and HIV have shown that their knowledge of OP is insufficient (14-16). Previous epidemiological studies regarding insufficient to assess the level of knowledge about OP in patients with type 2 diabetes in Malaysia and Vietnam (17,18). In recent years, the prevalence of non-communicable diseases (NCDs) has been increasing among Mongolians due to lifestyle changes. The second national NCD survey in 2009 found that diabetes was 6.5% and fasting glucose was 9.5% (19). In addition, according to a survey conducted among the population aged 15-69, 17.4% have fasting blood glucose changes and 8.3% have diabetes. In the western region, the prevalence of diabetes is 4.2%, which is higher than the national average and in Ulaanbaatar city and other regions, 7.9% of men with diabetes are newly diagnosed. 28.3% of diabetic cases are treated with medication, 17.9% with insulin therapy, and 12.6% with conventional treatment.

According to the above studies, 60,000 to 80,000 people in Mongolia are likely to have diabetes, but according to official statistics, as of 2009, about 7,000 people have been diagnosed with diabetes by laboratory tests and are being treated by endocrinologist. In Mongolia, diabetes accounts for 42.9 percent of endocrine diseases and is 111.4 per 10,000 population, which has increased from (82.9) to (28.5) in 2018. In terms of gender, men are 104.6 per 10,000 population and women are 117.7 per 10,000 population. In terms of age group, the highest incidence is 22,360 (62.9%) or 378.5 per 10,000 population aged 45-65 years. In terms of location, it is the highest in the Central Region at 114.5 per 10,000 population. Among the images in the Central Region, Darkhan-Uul is 163.2, Tuv 141.2, Umnugovi 115.8, and Selenge 104.9 (20,21). Therefore, there is a need to improve the program for early detection of diabetes and prevention of other comorbidities. In Mongolian countries, despite the prevalence and clinical studies of NCDs, no research has been conducted to determine the knowledge of people diagnosed with diabetes with OP, which is the basis for this study. Thus, to determine the knowledge of OP in people diagnosed with diabetes in the central and suburban hospitals of Ulaanbaatar.

Materials and Methods

Study Design and Setting

Cross-sectional data were collected using an online survey questionnaire from January to April 2022 in Ulaanbaatar, Mongolia, due to coronavirus disease-2019 (COVID-19) pandemic restrictions.

Study Participants and Tools

A total of 644 type 2 diabetes mellitus (T2DM) patients aged 20-65 were randomly selected from two district units including the Chingeltei Health Unit controlled by an endocrinologist, and the Songinokhairkhan Health Unit located in Ulaanbaatar, Mongolia.

The sample size of the study was computed using a single proportion population formula as follows: $n=(Z2\alpha/2*P(1-P)/d2)$, where n is the sample size, p is an estimation of 53.3% prevalence of OP knowledge problems among study participants, d is a margin of error at 0.05, and Z is the value of standard normal distribution at the 95% confidence level, equal to 1.96. Thus, the sample size is 644 participants in total.

This study adopted a standardized questionnaire of Osteoporosis Knowledge Assessment Tool (22) and Osteoporosis Health Beliefs (23) which consisted of 32 questions.

All participants provided written informed consent before participating in the study. The study protocol was approved by the Ethics Committee of the Mongolian National University of Medical Sciences (MNUMS) – (No.: 2022/3-01-2022/D-04).

Measure of OP Knowledge

Knowledge of OP-related issues was assessed by 32 questions. Each correct response was assigned 1 point, and an incorrect response was assigned 0 points. According to Bloom's cut-off points (24), we categorized the scores of each question into three levels of knowledge:

Good knowledge: a score of 80-100% (above 20 points)
Moderate knowledge: a score of 50-79% (14-19 points)
Poor knowledge: a score <49% (0-13 points)

Statistical Analysis

This study employed descriptive methods to measure the level of OP-related knowledge according to the sociodemographic characteristics of the participants. The t-test for continuous variables and the chi-squared test for categorical variables were used to determine differences between the subject's gender and level of knowledge OP. The following logistic regression model was fitted to estimate putative determinants of participants' level of knowledge on OP:

KNOW= $\beta\_0+ \beta\_i \bar{}x\_i+e\_i$, where KNOW stands for the level of knowledge on OP, β_i is the intercept, β_i is the effect of determinants of OP knowledge, and e_i is the error term. All statistical analyses were performed with SPSS version 25.0 (SPSS Inc., Chicago, IL, USA).

Results

Table 1 shows a summary of the study participants according to sociodemographic characteristics. A total of 644 participants were recruited for the study, and all completed the questionnaire. Of the participants 90.2% were married, 3.6% were unmarried, and 6.2% were divorced. Approximately 22.4% of the participants lived in a suburban district, and 76.6% lived in a downtown district. Cardiovascular disease (CVD) and diabetic leg wound were significantly associated with gender. Also, smoking, alcohol, and salt food consumption were significantly associated with gender.

Table 2 shows the relationship between OP knowledge levels and other variables in patients with T2DM. The knowledge score of OP was statistically associated with gender and education, but the differences were not significant for age, and lifestyle factors in patients with T2DM.

Table 3 presents the relationship between OP knowledge scores and diabetes-related variables. The prevalence of gestational diabetes was significantly associated with OP knowledge level. Furthermore, ophthalmic diseases and rheumatoid arthritis were significantly associated with OP knowledge levels, but the diabetic duration and treatment of diabetes were not significant with OP knowledge levels in patients with T2DM.

Table 4 displays univariable and multivariable logistic regression results for factors associated with the level of knowledge regarding T2DM patients. After accounting for gender differences, there was a noteworthy correlation between lower educational levels and a heightened likelihood of possessing knowledge about OP in individuals with type 2 diabetes [odds ratio (OR), 1.50; p=0.002; 95% confidence interval (CI) (0.55-0.75)]. Additionally, the ORs for ophthalmic diseases and rheumatoid arthritis demonstrated a substantial impact on OP knowledge in individuals with type 2 diabetes [OR, 1.01; p=0.001; 95% CI (0.85-1.28), and OR, 1.20; p=0.001; 95% CI (0.93-1.02), respectively].

Discussion

The present study examined the level of OP knowledge among Mongolian patients with T2DM. To our best knowledge, this is the first study to examine this knowledge in Mongolian with T2DM patients in the context of a cross-sectional online survey. We found that the number and proportion of overweight with a body mass index (BMI) of 25.0 or higher was 297 (80.4%) for females and 207 (75.3%) for males. In this regard, Jayedi et al. (25) examine the association between anthropometric and obesity indices and the risk of type 2 diabetes in a systematic review and dose-response meta-analysis of cohort studies. They enrolled 216 cohort studies investigating the causal relationship between systemic obesity or central obesity and body fat mass and risk of type 2 diabetes in a general adult population of 26 million, including 2.3 million patients with type 2 diabetes (25). As a result, the risk ratios were 1.72 (95% CI 1.65 to 1.81; based on 182 studies) for a 5-unit increase in BMI, 1.61 (1.52 to 1.70; based on 78 studies) for a 10 cm larger waist circumference, 1.63 (1.50 to 1.78; based on 34 studies) for a 0.1-unit increase in waist-to-hip ratio, 1.73 (1.51 to 1.98; based on 25 studies) for a 0.1-unit increase in waist-to-height ratio, 1.42 (1.27 to 1.58; based on 9 studies) for a 1-unit increase in visceral adiposity index, 2.05 (1.41 to 2.98; based on 6 studies) for a 10% higher percentage body fat, 1.09 (1.05 to 1.13; based on 5 studies) for a 0.005-unit increase in body shape index, 2.55 (1.59 to 4.10; based on 4 studies) for a 10% higher body adiposity index, and 1.11 (0.98 to 1.27; based on 14 studies) for a 10 cm larger hip circumference (25). The relationship between BMI and the risk of type 2 diabetes exhibited a strong positive linear association (25). The number of smokers was 34 (9.2%) for females and 113 (41.0%) for males, and there was a significant difference

Table 1. Characteristics of participants

Variables	Total (n=644)	Gender		p-value
		Female (n=369)	Male (n=275)	
Age (years)				
<44	103	59 (16.0)	44 (16.0)	0.994
45-54	187	106 (28.5)	81 (29.5)	
55-64	231	134 (36.3)	97 (35.3)	
>65	123	70 (19.0)	53 (19.3)	
BMI (kg/m²)				
Normal (18.5-24.9)	140	72 (51.4)	68 (48.6)	0.003
Overweight (25.0-29.9)	255	142 (55.7)	113 (44.3)	
Grade 1 obesity (30.0-34.9)	169	93 (55)	76 (45)	
Grade 2 obesity (35.0-39.9)	63	49 (77.8)	14 (22.2)	
Grade 3 obesity (40<)	17	13 (76.5)	4 (23.5)	
Education				
Primary	140	77 (20.9)	63 (22.7)	0.358
Secondary	199	124 (33.6)	75 (27.3)	
College	111	59 (16.0)	52 (18.9)	
University	194	109 (29.5)	85 (30.9)	
Marital status				
Married	581	327 (88.6)	254 (92.4)	0.016
Not married	23	13 (3.5)	10 (3.6)	
Divorced, widowed	40	29 (7.8)	11 (4.0)	
Where do you live				
Suburban district	144	71 (19.2)	73 (26.5)	0.028
Downtown district	500	298 (80.8)	202 (73.5)	
Comorbidity				
Hypertension	221	120 (32.5)	101 (36.9)	0.252
Kidney disease	219	140 (37.9)	79 (28.7)	0.015
Cardiovascular disease	203	132 (35.8)	71 (25.8)	0.007
Ophthalmic disease	182	98 (26.6)	84 (30.5)	0.266
Diabetic leg wound	171	83 (22.5)	88 (32.0)	0.011
Rheumatoid arthritis	129	83 (22.5)	46 (16.7)	0.071
Chronic hepatitis	118	70 (19.0)	48 (17.5)	0.623
Drug use				
Anti-diabetic drugs	337	206 (55.8)	131 (47.6)	0.111
Insulin injection	253	133 (36.0)	120 (43.6)	
Combined treatment	54	30 (8.1)	24 (8.7)	
Lifestyle				
Smoking				
Yes	147	34 (0.7)	113 (0.7)	0.0001
No	497	335 (0.7)	162 (0.7)	
Alcohol				
Yes	129	33 (0.7)	96 (0.7)	0.0001
No	515	336 (0.7)	179 (0.7)	
Exercise				
I do it regularly	370	211 (0.7)	159 (0.7)	0.87
Not regularly	274	158 (0.7)	116 (0.7)	
Consumption of salt				
Salty food				
Eat	549	306 (0.7)	243 (0.7)	0.054
Do not eat	95	63 (0.7)	32 (0.7)	
Salty tea				
Drink	351	199 (0.7)	152 (0.7)	0.735
I don't drink	293	170 (0.7)	123 (0.7)	

P values were obtained by Student's t-test or chi-square test. BMI: Body mass index

Table 2. Relationship between osteoporosis knowledge levels and other variables

Variables	n	Osteoporosis knowledge level			p-value
		Good (>20 scores)	Moderate (14-19 score)	Poor (0-13 score)	
Sex					
Male	275	2 (0.7)	57 (20.7)	216 (78.5)	**0.032**
Female	369	59 (1.4)	108 (29.3)	256 (69.4)	
Age group					
<44	103	1 (1.0)	28 (27.2)	74 (71.8)	0.845
45-54	187	3 (1.6)	51 (27.3)	133 (71.1)	
55-64	231	1 (0.4)	58 (25.1)	172 (74.5)	
>65	123	2 (1.6)	28 (22.8)	93 (75.6)	
Education level					
Primary	339	1 (0.7)	22 (15.7)	117 (83.6)	**0.002**
Secondary	111	4 (2.0)	56 (28.1)	139 (69.8)	
College	194	1 (0.9)	25 (22.5)	85 (76.6)	
University	194	1 (0.5)	62 (32.0)	131 (67.5)	
Marital status					
Married	581	6 (1.0)	146 (25.1)	429 (73.8)	0.708
Single	23	0	8 (34.7)	15 (65.2)	
Divorced, widowed	40	1 (2.5)	11 (27.5)	28 (70.0)	
Lifestyle factors					
Smoking					
Yes	161	1 (0.6)	39 (24.2)	121 (75.2)	0.509
No	403	5 (1.2)	113 (28.0)	285 (70.7)	
Alcohol					
Yes	118	1 (0.8)	35 (29.7)	82 (69.5)	0.725
No	456	5 (1.1)	119 (26.1)	332 (72.8)	
Regular exercise					
Yes	350	4 (1.1)	91 (26.0)	255 (72.9)	0.909
No	254	2 (0.8)	66 (26.0)	186 (73.2)	

P values were obtained by Student's t-test or chi-square test

between males and females. Many studies have shown that smoking makes them more susceptible to diabetes. As per a previous investigation, among the 25 studies selected (26-50), all except one (48) identified a connection between active smoking and a heightened risk of diabetes, though not all reached statistical significance. Out of these, three studies presented unadjusted RRs, and the combined crude RR estimate from these studies stood at 1.89 (95% CI, 1.58-2.27) (38,47,48). Across all 25 studies, adjusted risks were reported in terms of RRs, hazard ratios (26-50), incidence density ratios, or ORs, and the fully adjusted RRs derived from these ranged from 0.82 to 3.74. Active smokers demonstrated an elevated risk of developing type 2 diabetes compared to nonsmokers, with a combined RR of 1.44 (95% CI, 1.31-1.58) (51). In addition, the more cigarettes they smoke, the more likely they are to develop diabetes, and people who quit smoking are at lower risk. It is thought that smoking is associated with two actions that make people more likely to develop diabetes: "stimulating the sympathetic nerves to raise blood sugar" and "interfering with the action of insulin in the body". Smoking cessation reduces the risk of developing diabetes compared to smokers, but it has been reported that weight gain associated with smoking cessation increases blood sugar. However, smoking cessation improves overall health far more than the problem of increased blood sugar due to weight gain. It has also been shown that the risk of myocardial infarction and stroke is halved even if weight gain is achieved after quitting weight for CVDs whose risk is likely to increase due to weight gain. For these reasons, it is important to quit smoking as soon as possible.

There was a significant difference between males and females, with 33 females (8.9%) and 96 males (34.9%) drinking alcohol. Ingesting the right amount of alcohol with proper drinking

Table 3. Relationship between osteoporosis knowledge levels and diabetes-related variables

Variables	n	Osteoporosis knowledge level			p-value
		Good (>20 score)	Moderate (14-19 score)	Poor (0-13 score)	
Diabetic duration					
0-5 years	306	3 (1.0)	79 (25.8)	224 (73.2)	0.848
6-10 years	173	3 (1.7)	46 (26.6)	124 (71.7)	
11 years	165	1 (0.6)	40 (24.2)	124 (75.2)	
BMI					
Normal	140	2 (1.4)	29 (20.7)	109 (77.9)	0.742
Overweight	255	1 (0.4)	66 (25.9)	188 (73.7)	
Obese					
Obese class 1	169	3 (1.8)	44 (26.0)	122 (72.2)	
Obese class 2	63	1 (1.6)	20 (31.7)	42 (66.7)	
Obese class 3	17	0	6 (35.3)	11 (64.7)	
Hypertension					
Yes	221	2 (0.9)	57 (25.8)	162 (73.3)	0.948
No	422	5 (1.2)	108 (25.6)	309 (73.2)	
Gestational diabetes					
Yes	24	2 (8.3)	5 (20.8)	17 (70.9)	0.002
No	620	5	160	455	
Treatment of diabetes					
Anti-diabetic drugs	337	0	76 (22.5)	261 (77.5)	0.462
Insulin injection	253	1 (0.4)	47 (0.4)	205 (81)	
Combined treatment	54	0	14 (26)	40 (74)	
Comorbidity					
Ophthalmic disease					
Yes	182	4 (2.2)	61 (33.5)	117	0.003
No	462	3	104	355	
Diabetic leg wound					
Yes	171	0	35 (20.4)	136 (79.6)	0.795
No	473	1 (0.2)	102 (21.6)	370 (78.2)	
Rheumatoid arthritis					
Yes	129	4 (3.1)	46 (35.7)	79 (61.2)	0.0001
No	515	3 (0.6)	119 (23.1)	393(76.3)	

P values were obtained by Student's t-test or chi-square test. BMI: Body mass index

reduces the development of diabetes. Specifically, it is said that about 20 to 25 g of alcohol per day suppresses the occurrence of diabetes. However, if you drink more than that, it is thought that it may raise the blood sugar level due to the effect on the fat accumulated in the liver and the effect of suppressing insulin secretion from the pancreas. In addition, excessive calories caused by drinking too much and eating too much are the biggest and most important causes of raising blood sugar levels. Continued excessive alcohol intake can eventually lead to alcoholic cirrhosis and alcoholic pancreatitis. Alcoholic cirrhosis causes hyperglycemia, and the liver does not release the necessary glucose, which can cause life-threatening hypoglycemia. Alcoholic pancreatitis can also lead to hyperglycemia and hypoglycemia by destroying both cells that lower and raise blood sugar levels. Blood sugar levels become unstable in both conditions, especially in those who are using insulin preparations or insulin secretory drugs for treatment.

There was also a significant difference between males and females in CVD and chronic kidney disease. Alcohol intake and smoking may be involved. However, this survey did not ask about the quantity of alcohol intake or smoking.

Table 4. Unadjusted and gender-adjusted odds ratios of osteoporosis knowledge of good to moderate and poor for diabetic mellitus and other covariates

			Unadjusted		Sex-adjusted		
Variables	**Unit/category**	**OR**	**95% CI**	**p-value**	**OR**	**95% CI**	**p-value**
Age							
<44	Reference group						
45-54		0.97	0.57-1.65	0.895	0.96	0.56-1.65	0.888
55-64		1.14	0.68-1.92	0.617	1.14	0.68-1.94	0.606
>65		1.22	0.67-2.20	0.521	1.22	0.67-2.20	0.523
Sex	Female/male	0.70	0.43-1.89	0.010	-	-	-
Education							
Primary	Reference group						
Secondary		1.00	0.48-0.75	0.002	1.50	0.50-0.75	0.002
College		0.50	0.27-0.78	0.004	0.46	0.27-0.81	0.006
University		0.64	0.34-1.20	0.167	0.63	0.34-1.20	0.157
Comorbidity							
Hypertension	Yes/No	1.00	0.69-1.43	0.983	1.02	0.70-1.47	0.924
Ophthalmic disease	Yes/No	1.50	0.37-0.79	0.001	1.01	0.85-1.28	0.001
Rheumatoid arthritis	Yes/No	0.51	0.34-0.75	0.001	1.02	0.93-1.02	0.001

OR: Odds ratio, CI: Confidence interval

According to their knowledge of OP, 1.08% had good knowledge, 25.62% had intermediate knowledge, and 73.3% had poor knowledge (Table 2). The lack of knowledge of OP indicates that the subjects of this study will suffer from OP in the future. There was a significant difference in knowledge of OP due to the difference in education level (Table 3). Especially when the education category is low, the knowledge of OP is low. OP prevention education in Junior High school is needed to reduce the prevalence of OP in the future. In this survey, the educational background of the parents was more significantly associated with the knowledge of OP than the educational background of the subjects themselves (Table 4). This may be related to lifestyle as well as education. The need for home education was also suggested.

This study reveals how much knowledge about OP is in patients with type 2 diabetes. However, it is necessary to mention the limitations of research. The questionnaire was conducted on the Web under COVID-19. Therefore, it is indistinguishable whether the answer is based on the knowledge of the person or whether they are searching and answering by themselves. Since BMD has not been measured, the relationship between the knowledge of OP and the actual BMD is unclear. These are future issues.

Conclusion

Patients with T2DM had inadequate knowledge of OP. Therefore, there is a need to improve knowledge and understanding of OP, among diabetic patients. Also, it is believed that there is a need to study the knowledge of people with diabetes about OP in relation to blood glucose control and OP prevention behavior.

Ethics

Ethics Committee Approval: The study protocol was approved by the Ethics Committee of the Mongolian National University of Medical Sciences (MNUMS) - (No.: 2022/3-01-2022/D-04).

Informed Consent: All participants provided written informed consent before participating in the study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: M.J., A.D., Design: M.J., A.D., Data Collection or Processing: M.J., A.D., B.B-O., T.J., B.B., Analysis or Interpretation: M.J., B.B-O., B.B., Y.I., Literature Search: M.J., B.B-O., T.J., Y.I., Writing: M.J., Y.I.

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