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Research Article

OSTEOPOROSIS KNOWLEDGE, OSTEOPOROSIS PREVENTING BEHAVIORS AND EATING HABITS AMONG HIGHLY EDUCATED YOUNG PREMENOPAUSAL TURKISH WOMEN

***Neşe KAYA*[1]** ***Emine KURTBEYOĞLU*[2]**

[1]Nuh Naci Yazgan University, Faculty of Health Science, Dep. of Nutrition and Dietetics, Kayseri, Turkey
[2]Erciyes University Faculty of Health Science, Department of Nutrition and Dietetics, Kayseri, Turkey
Corresponding author: dyt_nese@hotmail.com

Abstract: *The purpose of this study was to determine osteoporosis knowledge, osteoporosis-preventing behaviors, and eating habits among highly educated young premenopausal women under the age of bone mineralization termination. This cross-sectional study was conducted on 189 academic and administrative staff of Erciyes University, aged 18-35 years. The knowledge level of osteoporosis was evaluated with the Turkish version of the Osteoporosis Knowledge Test (OKT). Osteoporosis-preventing behaviors and eating habits of participants were assessed. Despite the high educational level of women, they had poor levels of knowledge about osteoporosis. The mean total score for knowledge achieved by all women, out of a possible score of 24, was 14.08±3.69 or 58.6%. The mean nutrition subscale score was 9.63±3.07 and the exercise subscale score was 9.19±2.85. The total osteoporosis knowledge score and nutrition subscale scores were higher among women who have adequate consumption (≥3 servings/day) of dairy products ($p<0.001$) and have less frequent coffee consumption ($p<0.05$). No association was found between the osteoporosis knowledge score and other osteoporosis preventive behaviors. This study showed that the osteoporosis knowledge score and nutrition subscale score was higher among women who have adequate consumption of dairy products. It is a promising result in transferring knowledge to practice. However, for the dissemination of osteoporosis preventive behaviors, awareness is required to be adopted protective measures such as nutrition and exercise as a lifestyle in the prevention of osteoporosis, which is a preventable and manageable major public health problem.*

Keywords: *Osteoporosis, Osteoporosis knowledge, Calcium, Nutrition*

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1. Introduction

Osteoporosis is a progressive systemic skeletal disease, which affects more than 200 million people worldwide, resulting in reduced bone mass and increased fracture risk and is also called the epidemic of the 21st century [1]. It is often referred to as a 'silent disease because there are no apparent early symptoms. It is not possible to feel that bones getting weaker. Mostly it is not even known by a person, that having osteoporosis until after breaking a bone. Osteoporosis is serious, even deadly. It was reported that 24% of hip fracture patients aged 50 and over die in the year following the fracture and one-quarter end up in nursing homes and half never regain the previous function [2].

This serious global health problem osteoporosis is preventable and manageable. About 85-90% of adult bone mass is acquired by the age of 18-20 years. Building strong bones during childhood and

adolescence can help prevent osteoporosis later in life [2]. The Health Belief Model has been widely used to predict the adoption of preventive behaviors associated with osteoporosis risk factors [3]. Adopting preventive behaviors such as adequate calcium and vitamin D intake and regular exercise is critical in delaying the onset and progression of this disease [3]. Bone mineralization is significantly affected by calcium and phosphorus metabolism which is controlled by vitamin D, parathormone, and calcitonin. Calcium and vitamin D form part of the bone mineral matrix as calcium phosphate and are required for bone strength. The best way to achieve adequate calcium intake is by adhering to a healthy diet. Major dietary factors which increase the risk of osteoporosis include a deficiency of calcium and vitamin D. Other contributing factors include smoking, excessive consumption of coffee, and long periods of immobilization. A daily intake of at least 1000 mg/day of calcium and 400-800 IU/day of vitamin D is recommended for the prevention of the deterioration of musculoskeletal health [4,5]. Due to the termination of bone mineralization at the beginning of the thirties, the inability to achieve peak bone mass under the age of the thirties increases osteoporosis risk in later life. Studies should also focus on young adults since the key factor in preventing osteoporosis is optimizing the peak bone mass during the early years. Moreover, this is particularly important in young adult individuals who are capable of making behavioral choices affecting modifiable lifestyle changes [6,7]. The lack of osteoporosis knowledge may be one of the reasons for insufficient calcium intake. However, knowledge does not guarantee the practical implementation of positive behavioral changes. Transferring knowledge into positive behavior changes is necessary. Education level is also an effective factor in nutritional knowledge level. There are studies comparing osteoporosis knowledge depending on the education level but fewer studies on women with highly educated. The study was conducted with highly educated women, to evaluate if high education level leads to a high osteoporosis knowledge level and leads to positive behavioral changes in nutrition. Therefore, this study aimed to determine osteoporosis knowledge, osteoporosis-preventing behaviors, and eating habits among highly educated young premenopausal women under the age of bone mineralization termination.

2. Materials and Methods

2.1. Design of the Study

This cross-sectional study was conducted on 189 academic and administrative staff working at Erciyes University (Kayseri/Turkey) between December 2017-March 2018 to evaluate the knowledge levels of osteoporosis in young adult women with a high level of education. The sample size was calculated (G*Power Version 3.1.9.4 Universität Düsseldorf, Germany) power of 80% with 0.05 significance, using of scale mean of a previous study [8] and generating a sample of 178 individuals. Considering the drop-out rate, 189 participants were reached. The study was completed with 189 participants. This study was conducted according to the guidelines laid down in the Declaration of Helsinki. Ethical approval was taken from the Clinical Research Ethics Committee of Erciyes University, Faculty of Medicine (Protocol number 2017/401; Date: 21/7/2017)). Written informed consent was obtained from all participants included in the study.

The data were collected by face-to-face interview method. The questionnaire was filled out by the participants and the researchers were controlled that all of the questions were filled. The exclusion criteria included: participants were (i) < 18 years old and > 35 years old, (ii) suffered from lactose intolerance or milk allergy which may alter dairy products consumption and daily calcium intake, (iii) had any medication on calcium metabolism.

2.2. Osteoporosis Knowledge

The knowledge level of osteoporosis was evaluated with the Turkish version of the Osteoporosis Knowledge Test (OKT) [9]. The OKT was developed to determine the knowledge of osteoporosis by Kim et al. [10], and the Turkish adaptation, validity, and reliability of the OKT were performed by Kılıç and Erci (2004) [9]. Kim et al. (1991) found the reliability of a Kuder-Richardson reliability co-efficiency (KR-20) of the OKT between 0.69 and 0.72 [10]. Kılıç and Erci (2004) found the (KR-20) as 0.79 [9]. The Turkish version of the OKT aims to assess osteoporosis knowledge in relation to various issues such as calcium intake, exercise, and activity levels to prevent osteoporosis. The OKT has 24 items and the answers of all 24 items were coded as 0=incorrect and 1=correct, with a possible range of scores from 0 to 24. The knowledge score was computed by adding all correct answers. Higher scores indicate more knowledge of osteoporosis. The knowledge scores were converted to a percentage, derived from the total knowledge score of 24. By the reason of the absence of a cut-off point for the tool, the knowledge of osteoporosis was considered good knowledge if the percentage was 60% or more, and poor knowledge if it was less than 60%. The OKT has 2 subscales; the OKT Nutrition (Calcium) subscale has 26 items (items 1 to 9 and 17 to 24) and the OKT Exercise subscale has 16 items (items 1 to 16). The Cronbach's Alpha co-efficiency was found 0.609 for OKT total score.

2.3. Osteoporosis Preventing Behaviors and Eating Habits

A questionnaire was used to assess the osteoporosis preventing behaviors and eating habits of participants. Osteoporosis preventive behaviors included physical exercise, daily exposure to sunlight (for ≥10 min) without sunscreen, vitamin D supplementation, and dietary consumption of calcium from dairy products (milk, cheese, yogurt), caffeine-containing drinks, and soft drinks prevention. The eating habits for dairy products caffeine-containing drinks, and soft drinks were evaluated by food frequency and consumption records questionary.

The adequate consumption of dairy products was defined based on the Dietary Guidelines of Turkey recommendations [11]. It's recommended that three servings of milk and dairy products daily for adults. A medium-sized cup of milk of 240 mL or yogurt of 200-240 mL or cheese in the size of two matchboxes (40-60 g) constitutes a serving. Three servings and above were interpreted as having adequate intake and less than three servings as inadequate intake. Anthropometric measurements, weight, and height scores were recorded based on the self-reports of participants. Body mass index (BMI; kg/m^2) was calculated was obtained by dividing the body weight by the square of the height in meters researchers and recorded.

Statistical Analysis

All statistical analyses were performed using the IBM SPSS Statistics 22.0 package program. Continuous variables were expressed as the mean and standard deviation. The regularity of distribution of all parameters was evaluated using the Shapiro–Wilk test. Statistical differences between groups were assessed using the Chi-Square test for categorical variables, while the Student's t-test was used for continuous variables. Comparisons between groups were performed using the one-way repeated analysis of variance (ANOVA) test. A statistically significant difference was assumed with the level of $p<0.05$ for each test.

3. Results

Participants' baseline characteristics were presented in Table 1. The mean age of participants was 29.22±4.09, 56.7% of them have a postgraduate education level, and the mean BMI was 23.08±3.48.

Table 1. Participants' baseline characteristics (n=189)

Variable		n	(%)
Age (year)			
Mean ± SD	29.22±4.09		
Marital status			
Single		98	51.9
Married		90	47.6
Educational level			
Bachelor degree		82	43.3
Postgraduate		107	56.7
BMI (kg/m²)			
Mean ± SD	23.08±3.48		
Underweight	(<18.5)	3	1.6
Normal	(18.5-24.9)	139	73.5
Overweight	(25.0-29.9)	31	16.4
Obese	(≥30.0)	11	5.8

The mean osteoporosis knowledge score was 14.08±3.69. Among the subscales, the mean exercise knowledge score was 9.19±2.85, and the mean nutrition knowledge score was 9.63±3.07. The correct answer rate of OKT questions on nutrition was found 62.6%, and on other questions associated with osteoporosis was found 55.8% (Table 2).

Table 2. Osteoporosis knowledge subscale scores (n=189)

Variable	Mean ± SD
Osteoporosis knowledge score	
Total score	14.08±3.69
Exercise subscale score	9.19 ±2.85
Nutrition (calcium) subscale score	9.63 ±3.07
Correct answer (%)	
Exercise subscale	55.8 %
Nutrition (calcium) subscale	62.6%

Among osteoporosis preventive behaviors, 24.3% of the participants reported having vitamin D supplementation, 88.9 % not smoking, 23.8% do exercise, and 10.1% daily exposure to sunlight (Table 3). There was no association between the osteoporosis knowledge score and exercise, smoking, vitamin D supplement, and sun exposure. When a comparative assessment of participants with good versus poor knowledge was performed, 42.3% (n=80) of participants were found to have good knowledge (score ≥ 60%). Nevertheless, the osteoporosis preventive behaviors were similar among participants who have a good or poor knowledge level (p>0.05) (Table 3).

Table 3. Osteoporosis preventive behaviors and osteoporosis knowledge level (n=189)

Variable	n (%)	Osteoporosis knowledge scores (Mean±SD)	*p*	Osteoporosis knowledge scores		*p*
				Good knowledge (score ≥ 60%) (n = 80)	Poor knowledge (score < 60%) (n = 109)	
Smoking						
Yes	21 (11.1)	13.81 ± 3.61	0.718	8	13	0.677
No	168 (88.9)	14.12 ± 3.71		72	96	
Exercise						
≥3 day/week	14 (7.4)	13.64 ± 3.48		5	9	
1-2 times/week	31 (16.4)	14.58 ± 3.24	0.470	12	19	0.765
None	144 (76.1)	14.02 ± 3.81		63	81	

Table 3. Continued.

Variable	n (%)	Osteoporosis knowledge scores (Mean±SD)	*p*	Osteoporosis knowledge scores		*p*
				Good knowledge (score ≥ 60%) (n = 80)	Poor knowledge (score < 60%) (n = 109)	
Vitamin D suplement						
Yes	46 (24.3)	14.24 ± 3.50	0.745	18	28	0.614
No	143 (75.7)	14.04 ± 3.76		62	81	
Sunlight exposure						
Daily	19 (10.1)	14.90 ± 3.28		8	11	
1-3 times /week	60 (31.7)	14.16 ± 3.63	0.750	27	34	0.931
None	110 (58.2)	13.89 ± 3.79		45	64	
Duration of sunlight exposure						
≥10 min	79 (41.8)	14.24 ± 3.58	0.624	34	45	0.867
< 10 min	110 (58.2)	13.97 ± 3.78		46	64	

In food consumption records only 14.3% (n=27) of participants have adequate consumption (≥3 servings/day) of dairy products/day and 4.2% (n=8) of participants have no consumption of dairy products. The total osteoporosis knowledge score and nutrition subscale scores were higher among women who have adequate consumption (≥3 servings/day) of dairy products ($p<0.001$) and who have less frequent (4-5 times/week) coffee consumption ($p<0.05$) (Table 4).

Table 4. Dairy products, coffee, tea, and soft drinks consumption and osteoporosis knowledge score **(n=189)**

Food item	Consumption	n	%	Osteoporosis knowledge score (n=189)			
				Total		Nutrition subscale	
				Mean ± SD	*p*	Mean ± SD	*p*
Dairy products	≥ 3 servings /day	27	14.3	14.88 ± 4.15[a]	<0.001*	10.33±3.46[a]	0.026*
	< 3 servings /day	154	81.4	14.13 ± 3.48[b]		9.64 ±2.97[b]	
	None	8	4.2	10.37 ± 4.24[bc]		7.00±2.67[bc]	
Milk	≥ 1 serving/day	40	21.1	14.70 ± 3.87[a]	0.017*	10.35±3.26[a]	0.024*
	≤4-5 servings/week	102	53.9	14.06 ± 3.66[a]		9.52±3.02[a]	
	None	47	24.8	13.59 ± 3.60[b]		7.25±3.00[b]	
Yogurt	≥ 1 serving/day	64	33.8	14.20 ± 3.67[a]	<0.001*	9.78 3.24[a]	0.031*
	≤4-5 servings/week	113	59.7	14.18 ± 3.56[a]		9.64 2.95[a]	
	None	12	6.34	12.50 ± 4.83[b]		7.75 3.38[b]	
Cheese	≥ 1 serving/day	102	53.9	14.23 ± 3.51[a]	0.005*	9.86 3.18[a]	0.033*
	≤4-5 servings/week	74	39.1	14.01 ± 3.82[a]		9.56 2.98[a]	
	None	13	6.87	12.23 ± 3.78[b]		8.23 2.55[b]	
Coffee consumption	≥3 servings/day	26	13.7	13.03 ± 3.50[a]	0.041*	8.92 ±3.07[a]	0.038*
	1 serving/day	80	42.3	13.73 ±3.90[a]		9.52 ±3.13[a]	
	4-5 servings/week	24	12.7	15.79 ±3.88[b]		11.2 ±3.12[b]	
	≤1-2 servings/week	59	31.2	14.32 ±3.19[a]		9.44 ±2.83[a]	
Tea consumption	≥3 servings/day	49	25.9	13.46 ± 3.51	0.280	9.40 ±3.06	0.903
	1 serving/day	106	56.1	14.43 ± 3.40		9.78 ±2.88	
	4-5 servings/week	15	7.9	14.20 ±v4.61		9.44 ±3.79	
	≤1-2 servings/week	19	10.0	13.63 ± 4.82		9.52 ±3.68	
Soft drink consumption	≥3 servings/day	3	1.6	13.66 ± 3.78	0.788	9.66 ±1.52	0.981
	1 serving/day	5	2.6	15.00 ± 5.04		10.02±3.70	
	4-5 servings/week	10	5.3	14.40 ±1.77		9.70 ±2.21	
	≤1-2 servings/week	171	90.4	14.88 ±3.75		9.63 ±3.07	

[abc] *Statistically significant difference between groups*

**p<0.05*

4. Discussion

This study showed that despite the high educational level of women, they had poor levels (<60%) of knowledge about osteoporosis. The total osteoporosis knowledge score (14.08±3.69 or 58.6%) was lower than expected in this group of highly educated women.

Measuring knowledge about osteoporosis is inherently difficult, and this may be probably the main reason why observed results from previous studies differ. Studies evaluating the level of osteoporosis knowledge in the literature are in a wide range in terms of methods and cohort characteristics. We mainly discussed the studies that have been conducted on highly educated women. Studies utilizing the OKT or similar instruments have also reported poor to moderate levels of knowledge, with mean total scores between 42% and 74% [12-14]. Peng et al. (2020) studied with orthopedic nurses and found overall knowledge of osteoporosis was moderate-to-low (11.4±2.5, out of 17 or 58%) similar to the present study results [12]. Malak and Toama (2015), studied female teachers and found the mean OKT scores 18.17±5.55 or 46.6% [13]. Hurst et al. (2007), found the mean OKT total score 63% (16.4, out of 26) in highly-educated women aged 20–49 years [14]. Sava et al. (2020), stated that the cohort received a moderately-high average OKT total score (17.36±2.3, out of 32), with a lower exercise knowledge score, and a higher calcium knowledge score in highly-educated women [3]. Ishtaya et al. (2018), found the mean OKT total score was 13.5±4.2 nutrition knowledge score was 11±3.6, and the exercise knowledge score was 8.8±2.8, indicating poor osteoporosis knowledge [15]. In the literature, studies conducted on women have reported poor to moderate osteoporosis knowledge, although most of them reported moderate knowledge levels [12-15]. In the study by Ishtaya el. (2018) the potential reasons for poor knowledge among participants were most probably the study population of diabetic women and the poor educational level and poor awareness of dietary approaches.

Studies conducted in Turkey give different results on osteoporosis knowledge levels. Similar to the present study results, Ungan and Tümer (2001), found the knowledge score on osteoporosis was 63.1% in Turkish women [8]. In the other two studies in Turkey, the osteoporosis knowledge scores were found to be low. In a study by Gemalmaz and Oge (2008), the mean osteoporosis knowledge score was found 5.52, out of 20, in the whole study population, and for rural women with a higher level of education was 9.26 [16]. Aslan and Kilic (2017), found the mean osteoporosis knowledge score was 9.86±4.36, out of 24, in women [17]. In a study by Gezer and Ocak (2019), the total OKT scores of the women with bachelor's degrees (13.3±4.56) were higher than those of unschooled literate women (8.9±4.76) ($p<0.05$). Additionally, the OKT total, OKT-exercise, and OKT-nutrition scores of the women in the high school group were found 10.4, 5.3, and 4.8 times higher than those of the unschooled literate women, respectively [18]. The difference is probably due to the different characteristics of the study populations.

In the present study, when a comparative assessment of women with good versus poor knowledge about osteoporosis was performed, 42.3% of the women were found to have good knowledge (score ≥ 60%). But the osteoporosis preventive behaviors were similar among women who have a good or poor knowledge level ($p>0.05$) (Table 3). In a study by Vadivelan et al. (2020), results showed that 62% of women have a good knowledge level about osteoporosis [19]. Similarly, Mortada et al. (2020), demonstrated that 59% of the participants showed an inadequate knowledge level about osteoporosis [20]. Hallit et al. (2020), (demonstrated that 40% of the women had adequate/good knowledge (score ≥13; above the median) [6].

The knowledge level of osteoporosis is important in the prevention of osteoporosis, but this may not be sufficient. The knowledge needs to be transferred to the practice. Exercise, daily exposure to sunlight, vitamin D supplementation, dairy product consumption, caffeine-containing drinks, soft drinks prevention, and avoiding smoking are qualified as osteoporosis preventive behaviors [15].

Mortada et al. (2020), had examined osteoporosis preventive behaviors among women of reproductive age and showed that only 38.0% of the participants reported that they were exposed to sunlight daily and 27.9% reported vitamin D supplementation [20]. When the overall osteoporosis preventive behavior of the participants was dichotomized into adequate and inadequate levels, the majority of participants (70.7%) had shown inadequate osteoporosis preventive behavior. Koç et al. (2016), studied osteoporosis knowledge among young premenauposal women and showed that of the participants 15.1% reported having vitamin D supplementation, 83.5% not smoking, 12% exercise regularly, 89% exposure to sunlight daily [21]. Women with a high knowledge score (score ≥ 40%; above the median) had higher rates of regular exercise, exposure to sunlight, no smoking, and adequate amounts of dairy product consumption than women with low knowledge scores. In the current study, 24.3% of the women reported having vitamin D supplementation, 88.9 % not smoking, 23.8% do exercise, and 10.1% exposure to sunlight daily. But no association was found between osteoporosis knowledge level and osteoporosis preventive behaviors. Studies investigating osteoporosis knowledge and osteoporosis preventive behaviors reported different results on the effect of osteoporosis knowledge on behaviors. It was reported that positive effects of osteoporosis knowledge on behaviors in some studies [22,23], although there were no significant differences between intervention and control groups in other studies [24,25]. Osteoporosis knowledge and its associated risk factors may play a role in revealing behavioral change, but factors underlying behavior affect osteoporosis knowledge. These results support that knowledge does not guarantee the practical implementation of behavioral changes.

In eating habits, although most of the women (95.7%) consume dairy products, the rate of adequate consumption (≥3 servings/day) of dairy products (14.3%) was not high as expected. Most of the studies evaluating osteoporosis knowledge focus on the knowledge level and health beliefs about osteoporosis, the knowledge of the importance of calcium intake, and the importance of exercise [12-20]. But there are few studies evaluating the association between knowledge level and dietary habits, dairy products, and calcium-rich food consumption [26-27]. High knowledge of osteoporosis is important but it is not enough to achieve effective prevention of osteoporosis. Awareness and transferring knowledge to practice are required to be adopted protective measures such as nutrition and exercise as a lifestyle in the prevention of osteoporosis. Food consumption and knowledge level about osteoporosis were also examined in this study. The results of the present study showed that the osteoporosis knowledge score and nutrition subscale score was higher among women who have adequate consumption of dairy products ($p<0.001$). The knowledge scores were also higher in women who consume coffee 4-5 times/week than those who consumed it more often ($p<0.05$). Ramli et al. (2018), investigated the knowledge, attitude, and practice regarding osteoporosis among 106 health sciences students [26]. They indicated that the osteoporosis knowledge levels of female participants were at moderate levels. When the practice of participants regarding osteoporosis was examined, they found that the score of practice was at a poor level. Among the participants, only 12.3% drank milk, 38.7% took vitamin D supplements and 6.6% practiced a well-balanced diet according to the food pyramid. Only 12.3% of the participants reported that they spent 15 min/day in the sunlight and only 8.5% of them exercised at least 20 min/day. Similarly, Jalili et al. (2007), showed the practice score was lower than that of knowledge and attitude [27]. The average score for knowledge, attitude, and practice were 9.3 out of 21, 2.6 out of 5, and 1.5 out of 6, respectively. Adequate osteo-protective exercise and sufficient calcium intake were found only in 3.8% and 5.5% of participants, respectively. This was again supported by previous findings that knowledge does not always ensure preventive behaviors.

5. Limitations

This study has also several limitations. First, it aimed to examine the effect of knowledge of osteoporosis on protective behaviors and food consumption in premenopausal women (<35 years old before the termination of bone mineralization) with high education levels. The sampling method used in the present study limits the comparisons and also a generalization of the results to the population. Similar studies compared the knowledge level according to education level, age group, and gender; but since the study sample has similar features these characteristics couldn't be compared. Second, food frequency and consumption amounts were recorded but, to determine the correlation between the knowledge level and dairy products and calcium intake complete food consumption records should be recorded. A causal inference couldn't be made between the outcome and independent variables in the present study.

6. Conclusion

This study showed that the osteoporosis knowledge score and nutrition subscale score was higher among women who have adequate consumption of dairy products. But no association was found between osteoporosis knowledge level and other osteoporosis preventive behaviors including exercise, sunlight exposure, and vitamin D supplementation. It is a promising result in transferring knowledge to a practice that women who consume adequate dairy products have high osteoporosis knowledge scores. However, for the dissemination of osteoporosis preventive behaviors, awareness is required to be adopted protective measures such as nutrition and exercise as a lifestyle in the prevention of osteoporosis, which is a major public health problem. Comprehensive effective programs on the importance of nutrition, calcium and vitamin D intake, and exercise in the prevention of osteoporosis can be implemented for the general public.

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Ethical approval

Ethical approval was taken from the Clinical Research Ethics Committee of Erciyes University, Faculty of Medicine (Protocol number 2017/401; Date: 21/7/2017).

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Conflict of interests

The authors declare that they have no conflicts of interest.

Author contributions

NK designed and conducted the study and EK contributed to the study conception and design. NK provided essential constructs and databases necessary for this study. NK wrote the first draft of the manuscript and all authors read and approved the final manuscript. NK had primary responsibility for the final content.

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