



Vitamin D Deficiency in Postmenopausal Women with Pelvic Organ Prolapse

Dr. Zhuma Rani Paul^{1*}, Dr. Nurun Nahar Khanam², Dr. Shyamal Chandra Barai³, Dr. Ashik Ahmed Chowdhury⁴, Dr. Shashawta Golder Krishna⁵, Dr. Rafia Masud⁶, Dr. Khurshid⁷, Dr. Tahura Akter⁸, Dr. Selina Akter⁹, Dr. Dilshad Rifaha¹⁰, Dr. Maliha Parvin¹¹, Dr. Meherun Nessa¹², Dr. Champa Chowdhury¹³

¹Medical officer Obstetrics and Gynaecology, 250 Beded General Hospital, Gopalganj, Bangladesh

²Associate Professor, Department of Obstetrics and Gynaecology, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh

³Medical Officer Surgery, 250 Beded General Hospital, Gopalganj, Bangladesh

⁴CA, General Internal Medicine, University of Alberta Hospital, Canada

⁵Resident, Department of Obstetrics and Gynaecology, Chattogram Medical College Hospital, Chattogram, Bangladesh

⁶Resident, Department of Obstetrics and Gynaecology, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh

⁷Specialist Obstetrics and Gynaecology, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh

⁸Registrar, Department of Obstetrics and Gynaecology, Sher E Bangla Medical College Hospital, Barishal, Bangladesh

⁹Medical Officer Obstetrics and Gynaecology, Narsingdi Sadar Hospital, Narsingdi, Bangladesh

¹⁰Medical Officer Obstetrics and Gynaecology, Khialgoan Urban Dispensary, Bangladesh

¹¹Medical Officer Obstetrics and Gynaecology, Upazila Health Complex, Dohar, Dhaka

¹²Senior Medical Officer, Obstetrics and Gynaecology, Nova IVF Fertility, Bangladesh

¹³Assistant Surgeon, Sikdoir Union Health Centre, Raozan, Chattogram, Bangladesh

*Corresponding Author

Dr. Zhuma Rani Paul

Medical officer Obstetrics and Gynaecology, 250 Beded General Hospital, Gopalganj, Bangladesh

Article History

Received: 19.03.2023

Accepted: 25.04.2023

Published: 29.04.2023

Abstract: Background: Pelvic organ prolapse refers to protrusion of the pelvic organ into or out of the vaginal canal. In Bangladesh, 15.6% women suffered from pelvic organ prolapse and more than 11% of women require surgical correction of prolapse in their lifetimes. The pelvic floor is a unique part of the body and the function of which is dependent on interrelationship between muscle, nerve, connective tissue and bone. Pelvic organ prolapses results when these relationships are disrupted or there is weakness. **Objective:** The aim of the study was to evaluate the Vitamin D deficiency in postmenopausal women with pelvic organ prolapse. **Methods:** It was a cross sectional comparative study, done in the Department of Obstetrics and Gynecology of Bangabandhu Sheikh Mujib Medical University (BSMMU) to investigate the level of vitamin D in patients with and without pelvic organ prolapse to explore the association of vitamin D with pelvic organ prolapse. After taking informed written consent the serum vitamin D level of all participants was measured by CMIA technology with flexible assay protocols at Biochemistry and Molecular Biology department of the same institute. Statistical analysis of the results was obtained by using window-based computer software devised with Statistical Packages for Social Sciences (SPSS-24). **Results:** The study population was divided into two groups, a case group (n=74) consisting of patients with pelvic organ prolapse and a control group (n=74) comprising of women without pelvic organ prolapse. A total 148 participants of 52 years or older attending the out or inpatient department were enrolled in the study. Mean±SD level of Vitamin D in the case group was 13.96±5.18 ng/ml and in the control, group was

Citation: Zhuma Rani Paul *et al* (2023). Vitamin D Deficiency in Postmenopausal Women with Pelvic Organ Prolapse. *Glob Acad J Med Sci*; Vol-5, Iss-2 pp- 119-125.

21.08±5.77 ng/ml respectively. The difference was statistically significant ($p<0.05$). Moreover, the vitamin D levels were inversely proportionate with the severity of pelvic organ prolapse. **Conclusion:** It can be concluded that women having low level of vitamin D have more chance of developing pelvic organ prolapse.

Keywords: Low vitamin D level, Pelvic organ prolapse.

Copyright © 2023 The Author(s): This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY-NC 4.0) which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

INTRODUCTION

Pelvic organ prolapse is the descent of one or more aspects of the vagina and uterus: the anterior vaginal wall, posterior vaginal wall, the uterus (cervix), or the apex of the vagina (vaginal vault or cuff scar after hysterectomy) [1]. Genital prolapse is a common gynecological condition globally; it is most prevalent in low and middle-income countries ranging from 3.4% to 56.4%. Almost 24% of women in the USA have pelvic floor disorders like pelvic organ prolapse, urinary incontinence, and fecal incontinence [2]. In South Asia, 22% of Nepalese women and 15.6% Bangladeshi women are suffering from symptomatic pelvic organ prolapse. The female pelvic floor is a unique part and complex component of the body; it is composed of smooth muscle, skeletal muscle (levatorani and coccygeus muscles), pelvic bones and ligaments [3]. Normal pelvic organ support is provided by the interaction between the pelvic floor, muscle, ligament and connective tissue that attach the uterus, vagina to the pelvic sidewalls (bony pelvis). Uterus maintains her normal position by 3 levels of pelvic floor support. Level I have cardinal and uterosacral ligament, level II has more direct paravaginal support and level III has a direct fusion of the vagina with the levatorani muscles, perineal membrane, and perineal body [4].

Connective tissues undergo constant turnover and remodeling in response to stress and strain and are also affected by hormonal changes during pregnancy, parturition as well as ageing [5]. Pelvic floor disorders have a long latency and may go through periods of remission, so cause is difficult to confirm [6]. The etiology of pelvic organ prolapse is likely to be multifactorial such as pregnancy, menopause, age, high BMI, estrogen deficiency, previous pelvic surgery, vaginal delivery, malnutrition, etc. among them malnutrition is likely to be the most common risk factor for pelvic organ prolapse [7]. Moreover, up to date no effective measures have been found to prevent progression of pelvic organ prolapse. Health cost of pelvic floor disorder projects is an economic burden, which will be increasing exponentially by 2030 [7].

Vitamin D is an oldest hormone, micronutrient and fat-soluble vitamin, which,

needed in calcium homeostasis and musculoskeletal tasks of individual organ systems. It can be found from sunlight, food such as oily fish, cod liver oil, dairy products, etc. but need to be activated before functioning. There are two forms of vitamin D – vitamin D2 or Ergocalciferol and vitamin D3 or Cholecalciferol [8]. However, the main source of vitamin D is sun exposure. Vitamin D3 [1,25(OH)2D3] is the biologically active form of vitamin D. Vitamin D3 is produced predominantly from precursors within the skin through the action of ultraviolet B (UVB) radiation on 7-dehydrocholesterol through a non-enzymatic thermal isomerization [9]. Synthesized or dietary vitamin D3, from the skin and the gut are hydroxylated in the liver to form 25-hydroxyvitamin D [25(OH)D] through the action of cytochrome P450 enzyme. Twenty-five hydroxy vitamin D [25(OH)D] is the major circulating form of vitamin D and serum levels are measured as being indicative of an individual's vitamin D status. Twenty-five hydroxy vitamin D [25(OH)D] then hydroxylated in the kidneys, to form the active form of 1,25-dihydroxyvitamin D3 [1,25(OH)2D3]. This activation is finely regulated by the parathyroid hormone (PTH) concentration, estrogen, glucocorticoids, calcitonin and somatotropin [10]. In addition, the serum level of this vitamin D3 is also affected by UVB radiation, radiation, skin type (melanin decrease conversion of pro to pre-vitamin D3), outdoor staying, use of sunscreen (block UVB radiation), and age (elderly has thinner skin).

As the prevalence of pelvic floor disorder is very high, various studies are going on to find out the etiology of these disorders. Up to this time a unifying theory explaining the cause of these problems does not exist but findings of some study claim low vitamin D is an independent factor for pelvic organ prolapse [11]. Few studies have found that hypovitaminosis D may influence the success rate of pelvic organ prolapse by pelvic floor muscle training (PFMT). Different studies found association between low vitamin D levels with pelvic organ prolapse; thus, vitamin D can be used as a biochemical marker for women at risk of developing pelvic organ prolapse. Vitamin D is well tolerated and hypovitaminosis D are mostly reversible with proper replacement, a high-risk group of people can

be started vitamin D therapy, which might prevent pelvic organ prolapse.

Therefore, this study has been designed to see whether there is an association of low vitamin D concentration with pelvic organ prolapse in Bangladeshi postmenopausal women and to assess whether low vitamin D is a risk factor for pelvic organ prolapse or not. The result of this study may give us a better idea about the situation of Bangladeshi women and may contribute to make guideline for prevention of genital prolapse.

METHODS

It was a cross sectional comparative study, done in the department of obstetrics and gynecology

of Bangabandhu Sheikh Mujib Medical University (BSMMU) of the same institute from September 2019 to August 2020. Ethical clearance was taken from the Institutional Review Board of BSMMU before conducting the research. After obtaining a written informed consent a total of 148 participants attending the outpatient and inpatient department were enrolled in the study. The study population was divided into case group (n=74) and a control group (n=74). Statistical analysis of the results was obtained by using window-based computer software devised with Statistical Packages for Social Sciences (SPSS-24).

RESULTS

Table 1: Socio demographic characteristics of study population (N=148)

Characteristics	Group I (n=74)		Group II (n=74)		p value
	n	%	n	%	
Age (in years)					
53-60	39	52.7	40	54.1	
61-65	35	47.3	34	45.9	
Mean±SD	59.95	±3.8	59.54	±3.55	^a 0.498 ^{ns}
Range (min-max)	53	-65	53	-65	
Educational status					
Illiterate	38	51.4	30	40.5	^b 0.222 ^{ns}
Primary	21	28.4	31	41.9	
SSC and above	15	20.2	13	17.6	
Occupation					
Housewife	65	87.8	65	87.8	^b 0.325 ^{ns}
Service holder	2	2.7	0	0.0	
Day labour and others	7	9.5	9	12.2	
Monthly income (Taka)					
<10,000	11	14.9	15	20.3	^b 0.151 ^{ns}
(10,000-20,000)	39	52.7	28	37.8	
(20,000-40,000)	19	25.7	19	25.7	
>40,000	5	6.7	12	16.2	

s=significant, ns=not significant, ^ap value reached from Unpaired t-test, ^bp value reached from Chi-square test

Group I: women with pelvic organ prolapse
Group II: women without pelvic organ prolapse

that, there is no significant difference between two groups in terms of age, marital status, educational status, occupation and monthly income.

Table 1 shows socio demographic characteristics of study population. It is observed

Table 2: Distribution of the study populations by BMI (N=148)

BMI (Kg/m ²)	Group I (n=74)		Group II (n=74)		p value
	n	%	n	%	
<18.5 (underweight)	7	9.5	7	9.5	
18.5-24.9 (normal)	46	62.1	45	60.8	
25-29.9 (Overweight)	21	28.4	22	29.7	
Mean±SD	23.21	±2.74	23.28	±2.77	0.877 ^{ns}
Range (min-max)	18	-26.7	18	-28	

ns=not significant, p value reached from Unpaired t-test

Table 2 shows that one fourth (28.4%) of patients belonged to BMI 25-29.9 kg/m² Overweight in group I and 21(29.7%) in group II. The mean BMI

is 23.21±2.74 kg/m² in group I and 23.28±2.77 kg/m² in group II. The difference is statistically not significant (*p*>0.05) between two groups.

Table 3: Distribution of the study populations by medical diseases (N=148)

Medical diseases	Group I (n=74)		Group II (n=74)		p value
	n	%	n	%	
Chronic cough	2	2.7	4	5.4	0.405 ^{ns}
Chronic constipation	3	4.1	6	8.1	0.302 ^{ns}
Abdominal tumour	0	0.0	0	0.0	-

ns=not significant, *p* value will be reached from Chi-square test

Table 3 shows that 2(2.7%) patients have chronic cough in group I and 4(5.4%) in group II. Three (4.1%) patients had chronic constipation in

group I and 6(8.1%) in group II. The difference is statistically not significant (*p*>0.05) between two groups.

Table 4: Distribution of the study populations by vitamin D (N=148)

Vitamin D (ng/ml)	Group I (n=74)		Group II (n=74)		p value
	n	%	n	%	
>30 normal	2	2.7	10	13.5	
21-29 vitamin D insufficiency	9	12.2	45	60.8	^a 0.001 ^s
<20 vitamin D deficiency	64	85.1	19	25.7	
Mean±SD	13.96±5.18		21.08±5.77		^b 0.001 ^s
Range(min-max)	8.8-30.5		10.5-35.5		

s= significant, ^a*p* value reached from Chi-square test, ^b*p* value reached from Unpaired t-test

Table 4 shows that the majority (85.1%) of patients have vitamin D deficiency in group I and 19(25.7%) in group II. The mean vitamin D level is

13.96±5.18 ng/ml in group I and 21.08±5.77 ng/ml in group II. The difference is statistically significant (*p*<0.05) between two groups.

Table 5: Comparison of pelvic organ prolapse with vitamin D level (n=74)

Types of Prolapse	n	Vitamin D level		p value
		Mean±SD	Range (min-max)	
Stage- I	15	17.45±7.39	8.9-30.5	0.001 ^s
Stage- II	35	14.26±4.11	8.8-21.0	
Stage- III	8	13.61±3.74	8.9-21.0	
Stage- IV	11	11.94±4.82	8.8-21.0	
Associated symptom like stress incontinence	5	13.94±1.43	12.3-15.2	

s=significant, *p* value will be reached from ANOVA test

Table 5 The mean vitamin D level is 17.45±7.39 (ng/ml) in stage- I types of prolapse, 14.26±4.11 (ng/ml) in stage-II, 13.61±3.74 (ng/ml) in stage- III, and 11.94±4.82 (ng/ml) in stage- IV and 13.94±1.43 (ng/ml) in associated symptom like

stress incontinence. The difference is statistically significant (*p*<0.05) between pelvic organ prolapse with vitamin D level. Low vitamin D level is associated with pelvic organ prolapse.

Table 6: Multiple logistic regression tables showing the effect of independent variables on dependent variable

	β(regression coefficient)	S.E.	Wald statistic	df	P value	OR	95% C.I	
							Lower	Upper
Vitamin D level	0.40	0.06	41.59	1	0.001 ^s	2.70	1.32	1.69
Parity	0.99	0.33	9.05	1	0.135 ^{ns}	0.82	0.91	2.16
Age	-0.30	0.32	0.87	1	0.351 ^{ns}	0.74	0.39	1.39
Educational status	0.30	0.27	1.20	1	0.273 ^{ns}	1.35	0.79	2.32
Occupation	-0.45	0.38	1.45	1	0.228 ^{ns}	0.63	0.30	1.33
Monthly income (Tk.)	-0.35	0.30	1.41	1	0.236 ^{ns}	0.70	0.39	1.26
Duration of postmenopausal age	0.08	0.20	0.17	1	0.684 ^{ns}	1.08	0.74	1.59

Chronic Cough	-0.94	1.84	0.26	1	0.607 ^{ns}	0.39	0.01	14.27
Chronic Constipation	-0.82	1.63	0.25	1	0.616 ^{ns}	0.44	0.02	10.75
BMI (kg/m ²)	-0.10	0.14	0.55	1	0.457 ^{ns}	0.90	0.69	1.18

s=significant, ns= not significant

The table shows the multiple logistic regression analysis done to see the effect of independent variables (vitamin D, Parity, age, educational status, occupation, monthly income, duration of postmenopausal age, chronic cough, chronic constipation, BMI,) on dependent variable (pelvic organ prolapse). The decrease in serum vitamin D level increases the risk of developing pelvic organ prolapse by 2.70-fold. Other variables were not significantly associated to develop pelvic organ prolapse.

DISCUSSION

Pelvic Organ Prolapse (POP) is a common benign gynecological condition in women resulting from pelvic floor dysfunction. It is an important postmenopausal health problem, which is likely to become a great challenge to public health [12]. Pelvic floor is a musculoskeletal organ and its function depends on the strength of muscle and ligaments; it supports the abdominal and pelvic viscera [13]. Bischoff *et al*, found that vitamin D receptors (VDR) locate in skeletal muscle cells, immunohistochemical staining also proves it. Pelvic floor musculature weakness can contribute to pelvic floor disorders like pelvic organ prolapse and the pelvic floor muscles are thought to be weakened when women have low vitamin D level. This case control study was carried out with an aim to measure vitamin D level in patients with and without pelvic organ prolapse to analyze the possible association between vitamin D levels with pelvic organ prolapse. The present study findings are discussed and compared here with previously published relevant studies.

In this present study, it has been observed that the mean age for case was 59.95±3.8 years and for control was 59.95±3.8 years, there was no significant difference of age between two groups (P>0.05). In a cohort study by Aytan *et al*, found a positive association between older age and presence of pelvic organ prolapse, an observation that was not confirmed in the present study as in this study age was matched between two groups. In this present study, it was observed that only 2(2.7%) patients had chronic cough in case and 4 (5.4%) in control. Three (4.1%) patients had chronic constipation in case and 6 (8.1%) in control. There is no other aggravating medical disorder in both groups. Navaneethan *et al*, [16] found that only 3.9% patients had chronic cough in the case group and

1.4% patients had cough in the control group. They also did not find any aggravating factor.

The current study found that vitamin D was deficient (≤20 ng/ml) in 85.1 % patients of case and only 25.7 % patients of control, and mean vitamin D level was 13.96±5.18 ng/ml and 21.08±5.77 ng/ml in case and control respectively. The difference between two groups was statistically significant (p<0.001). Similarly, in a study, Gupta [17] *et al*, revealed that vitamin D level was significantly lower in women with pelvic organ prolapse variety of pelvic floor disorder than in without pelvic floor disorder (12.81± 7.67 in cases and 21.6 ± 16.21 in control); the result is consistent with the present study. Unexpectedly, in another study [18] Barat *et al*, found that the mean serum vitamin D level in case group was 24.58 ± 20.75ng/ml and in control group 15.53±13.11ng/ml; the finding was reverse of the present study, there might be any strong confounding variable for the cause of POP among those study subjects. However, Ghanbari [19] *et al*, did a meta-analysis on seven observational studies; the findings revealed that the mean serum vitamin D level was significantly lower in women with pelvic floor disease including pelvic organ prolapse in comparison to women without pelvic floor disorder. In addition, Ahn *et al*, showed though the mean vitamin D concentration in patients with pelvic floor disorder and control group was not statistically significant, but number of vitamin D insufficient and deficient people in case group was significantly higher than the control group (p<0.05). Their study also observed that vitamin D receptor (VDR) polymorphisms were significantly associated with pelvic floor disease. Furthermore, many other investigators observed serum vitamin D levels significantly reduced in pelvic floor disorder group in comparison to control group [20].

This study has been observed that women with low vitamin D had 5.63 times more chance of developing POP in compares to women having normal level of vitamin D. Likewise, in a recent study [21] Can *et al*, investigated the lack of vitamin D in patients with uterine prolapse. They evaluated diagnosed cases of stage 3 and 4 uterine prolapses based on vaginal examination. Vitamin D deficiency (<20 ng/mL) was found in 95.0% of the patient group and 77.5% of the control group (p<0.05). A vitamin D level of (<20 ng/mL) was found to be the independent risk factor for uterine prolapse

(OR=5.8, 95% CI=1,0 – 33,3). That study findings were similar with the present study.

Current study was also observed that the mean vitamin D level was 17.45±7.39 (ng/ml) in stage- I types of prolapse, 14.26±4.11 (ng/ml) in stage-II, 14.41±2.87 (ng/ml) in stage- III, and 13.61±3.74 (ng/ml) in stage- IV and 13.94±1.43 (ng/ml) in associated symptom like stress incontinence. The differences of vitamin D level between stage I and other stages were statistically significant ($p<0.05$). The levels of vitamin D were inversely proportionate with the stages of pelvic organ prolapse, $r = - 0.277$ and it was statistically significant ($p<0.5$). In their study [17] Gupta *et al.*, found that severity of vitamin D deficiency in different stages of prolapse was statistically significant; the mean vitamin D level in stage I, II, III, and IV were 14.81±7.67, 10.97±5.98, 9.88±5.07, 11.36±5.88 ng/ml respectively. The findings were comparable with the present study.

CONCLUSION

This case control study found significantly lower vitamin D level in patient with pelvic organ prolapse, the levels were inversely proportionate with the severity of prolapse, and decrease in serum vitamin D level increases the risk of developing pelvic organ prolapse by 5.63-fold. Thus, it can be concluded that women having low level of vitamin D have more chance of developing pelvic organ prolapse.

REFERENCES

- American College of Obstetricians and Gynecologists. (2019). Pelvic organ prolapse: ACOG practice bulletin, number 214. *Obstetrics and Gynecology*, 134(5), 126-42.
- Nygaard, I., Barber, M. D., Burgio, K. L., Kenton, K., Meikle, S., Schaffer, J., ... & Pelvic Floor Disorders Network. (2008). Prevalence of symptomatic pelvic floor disorders in US women. *Jama*, 300(11), 1311-1316.
- Parker-Autry, C. Y., Burgio, K. L., & Richter, H. E. (2012). Vitamin D status: a review with implications for the pelvic floor. *International urogynecology journal*, 23, 1517-1526.
- Huebner, M., & DeLancey, J. O. (2019). Levels of pelvic floor support: what do they look like on magnetic resonance imaging? *International Urogynecology Journal*, (9), 1593-5.
- Sharma, S., Goel, N., Madhu, S. V., Rajaram, S., & Sharma, S. (2013). Serum elastin and 25 hydroxyvitamin D levels in women with pelvic organ prolapse. *J Indian Acad Clin Med*, 14, 204-8.
- Bazi, T., Takahashi, S., Ismail, S., Bø, K., Ruiz-Zapata, A. M., Duckett, J., & Kammerer-Doak, D. (2016). Prevention of pelvic floor disorders: international urogynecological association research and development committee opinion. *International urogynecology journal*, 27, 1785-1795.
- Bodner-Adler, B., Shrivastava, C., & Bodner, K. (2007). Risk factors for uterine prolapse in Nepal. *International Urogynecology Journal*, 18(11), 1343-1346.
- Dabrowski, F. A., Grzechocinska, B., & Wielgos, M. (2015). The role of vitamin D in reproductive health—a Trojan Horse or the Golden Fleece?. *Nutrients*, 7(6), 4139-4153.
- Holick, M. F. (2006). High prevalence of vitamin D inadequacy and implications for health. In *Mayo Clinic Proceedings*, 81(3), 353-73.
- Engelsen, O. (2010). The relationship between ultraviolet radiation exposure and vitamin D status. *Nutrients*, 2(5), 482-95.
- Holick, M. F., Binkley, N. C., Bischoff-Ferrari, H. A., Gordon, C. M., Hanley, D. A., Heaney, R. P., Murad, M. H., & Weaver, C. M. (2011). Evaluation, treatment, and prevention of vitamin D deficiency: an Endocrine Society clinical practice guideline. *The Journal of Clinical Endocrinology & Metabolism*, 96(7), 1911-30.
- Aytan, H., Ertunç, D., Tok, E. C., Yaşa, O., & Nazik, H. (2014). Prevalence of pelvic organ prolapse and related factors in a general female population. *Turkish journal of obstetrics and gynecology*, 11(3), 176-80.
- Parker-Autry, C. Y., Burgio, K. L., & Richter, H. E. (2012). Vitamin D status: a review with implications for the pelvic floor. *International urogynecology journal*, 23, 1517-1526.
- Kudish, B. I., Iglesia, C. B., Gutman, R. E., Sokol, A. I., Rodgers, A. K., Gass, M., ... & Howard, B. V. (2011). Risk factors for prolapse development in white, black, and Hispanic women. *Female pelvic medicine & reconstructive surgery*, 17(2), 80-90.
- Rortveit, G., Daltveit, A. K., Hannestad, Y. S., & Hunskaar, S. (2003). Urinary incontinence after vaginal delivery or cesarean section. *New England Journal of Medicine*, 348(10), 900-7.
- Navaneethan, P. R., Kekre, A., Jacob, K. S., & Varghese, L. (2015). Vitamin D deficiency in postmenopausal women with pelvic floor disorders. *Journal of mid-life health*, 6(2), 66-9.
- Gupta, M., Aggarwal, K., Jain, S., Saini, V., & Gupta, S. K. (2016). Pelvic Floor Disorders are Associated with Vitamin D Deficiency. *Indian Obstetrics and Gynaecology*, 6(4), 25-30.
- Barat, S., Bouzari, Z., Mehdiinia, S., Hajian-Tilaki, K., & Rad, M. N. (2019). The serum level of vitamin D in women with urinary incontinence due to pelvic floor disorder and prolapse: a regional case-control study on Iranian

- population. *Int J Women's Health Reproduct Sci*, 7(1), 67-73.
19. Ghanbari, Z., Karamali, M., Mirhosseini, N., Akbari, M., Tabrizi, R., Lankarani, K. B., ... & Asemi, Z. (2019). Vitamin D status in women with pelvic floor disorders: a meta-analysis of observational studies. *Journal of Mid-life Health*, 10(2), 57-62.
 20. Badalian, S. S., & Rosenbaum, P. F. (2010). Vitamin D and pelvic floor disorders in women: results from the National Health and Nutrition Examination Survey. *Obstetrics & Gynecology*, 115(4), 795-803.
 21. Can, A. T. A., Ileri, A., Gulseren, V., Kocaer, M., & Taner, C. E. (2020). The association between vitamin d and uterine prolapse. *Bozok Tıp Dergisi. Bozok Med Journal*, 10(2), 23-7.