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ORIGINAL RESEARCH

Effect of Vitamin D Level on Female Vaginitis in Xi'an, China

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Background: Vaginitis is a common disease of the reproductive system in women, causing discomfort in daily life. Many reports indicate that the causes of vaginitis are related to vaginal microecological disturbances. Therefore, treatment strategies to restore microecological balance have shown promising results in both basic research and clinical settings. Recent studies have highlighted the potential adjuvant role of vitamin D in the treatment of vaginitis while illustrating its role in maintaining microecological balance. Therefore, this study focused on the therapeutic effects of vitamin D on vaginitis.

Methods: The study provided a statistical description of 5978 vaginitis patients who visited Shaanxi Provincial People's Hospital, presenting data in absolute numbers (%) and mean ± standard deviation (median quartiles were used for non-normally distributed variables). The chi-square test and analysis of variance were employed to analyze the distribution of vitamin D levels among patients, factors influencing vitamin D levels, and the association between recurrence rates and vitamin D levels.

Results: Vitamin D deficiency (57.74%) or insufficiency (22.20%) is prevalent among patients with vaginitis. Furthermore, vitamin D levels have an impact on the dominant bacterial species in the vagina, as well as catalase, acetylglucosaminidase, and the overall vaginal microecological status. Age and BMI have correlations with vitamin D levels. It is hypothesized that this relationship may be attributed to clinicians utilizing vitamin D as a supplementary treatment.

Conclusion: This study examined the statistical findings of vitamin D-related data from 5978 vaginitis patients, revealing a positive correlation between vitamin D deficiency and vaginitis occurrence. Patients with vitamin D deficiency/severe deficiency showed weakly positive levels of catalase and mostly weakly positive levels of acetylglucosaminidase, and most of these vaginitis are trichomonas vaginalis (TV). Furthermore, older individuals and those with higher BMI were found to be more susceptible to symptoms of vitamin D deficiency.

Keywords: Vitamin D, vaginal microecology, female reproductive system diseases

Introduction

Vitamin D, a fat-soluble sterol derivative, plays a crucial role in maintaining human health and regulating the immune response. It is involved in various physiological processes, including cell proliferation, differentiation, metabolism, immune regulation, and DNA repair.[1] Vitamin D deficiency has been linked to a range of diseases, such as kidney disease,[2] tumors, cardiovascular disease, autoimmune conditions, and rickets.[3] Recent research has also suggested a potential connection between female vaginal microecology and vitamin D levels, indicating that vitamin D deficiency may contribute to microbial imbalances in the female reproductive tract, such as bacterial vaginosis.

Bacterial vaginosis significantly impacts women of childbearing age, with a prevalence rate of approximately 23–29% and a recurrence rate as high as 80%.[4] It is the most common female reproductive system disease.[5] Among individuals

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with bacterial vaginosis, up to 50% experience symptoms, including vaginal itching, odor, and increased secretions. This imbalance in vaginal microecology can heighten the risk of HPV infection, potentially leading to cervical cancer, endometrial cancer, and other malignant diseases. Moreover, resistance to other sexually transmitted diseases may decrease.[6–8] In summary, bacterial vaginosis presents a significant challenge to women's physical and mental well-being.

Researchers often focus on various causative factors of bacterial vaginosis, such as the patient's race, education level, sexual partners, frequency of sexual intercourse, and vaginal douching.[7] While some recent studies have suggested a possible link between vitamin D and vaginitis, opinions vary. Some studies indicate that vitamin D deficiency in women may be a risk factor for bacterial vaginosis,[9,10] while others argue that no significant correlation exists.[11,12] As a result, this study analyzed data from 5978 vaginitis patients to investigate the relationship between vitamin D levels and vaginal microecology.

Materials and Methods

Study Population

A total of 5978 female patients, aged 18 to 90 years old, were selected as research subjects at Shaanxi Provincial People's Hospital from January 2018 to August 2023. Inclusion criteria included no history of cervical lesion treatment or radiotherapy, absence of serious immune system diseases, and no sexually transmitted diseases. Exclusion criteria comprised individuals who douched the vagina within 48 hours, used vaginal drugs or engaged in sexual intercourse within 3 days, or took oral antibiotics within 1 month. The study received approval from our hospital's ethics committee, and informed consent was not required for retrospective studies. Data collected for the statistical sample included age, height, weight, BMI, age at first sexual intercourse, Nugent score, marital status, number of pregnancies, education level, smoking status, vaginal douching status, contraceptive use, and vaginal ecological indicators.

Statistical Method

SPSS 26.0 was utilized for statistical analysis. Count data were described using absolute numbers and percentages. The Chi-square test was employed for statistical testing. Measurement data were presented as mean ± standard deviation (with median used for non-normally distributed data). Analysis of variance was used for statistical testing, with a significance level set at $\alpha=0.05$.

Results

Basic Information Analysis of Patients

A total of 5978 subjects were included in this study, with an average age of 30.15±3.98 years, an average BMI of 22.27 ±2.57, and an age of first sexual intercourse of 23.63±3.28 years. The Nugent score was 3.63±1.12. Among the participants, 5763 cases were mostly married (96.40%). The education level was predominantly college-educated, with 4121 cases (68.94%). The majority of participants had one pregnancy, totaling 4042 cases (67.61%). Leukocyte esterase was mostly weakly positive in 5798 cases (96.99%), while hydrogen peroxide was mainly positive in 5548 cases (55.48%). Sialidase was primarily negative in 5714 cases (95.58%), and β-glucuronidase was mainly negative in 5977 cases (99.98%). Acetamidase glucosidase was primarily negative in 5179 cases (86.63%). Gram-positive bacilli were the dominant bacteria in 5100 cases (85.31%), and abnormal flora dominated the microecology in 4498 cases (75.24%). Among the 5798 patients, non-smokers accounted for the majority (83.69%), 63.20% of the patients were taking oral contraceptives, and 58.53% reported no vaginal douching habits. Please refer to Table 1 for further details.

Distribution of Vitamin D

The 25(OH)D results of 5978 patients were statistically analyzed and categorized as normal (25(OH)D: 30.1–100), insufficient (25(OH)D: 20.1–30), deficient (25(OH)D: 10.1–20), and severely deficient (25(OH)D ≤10). The analysis revealed that only 20.06% were classified as normal, 22.20% as deficient, and 57.74% as deficient and severely deficient. These findings indicate a statistically significant association between decreased 25(OH)D levels and the occurrence of vaginitis. Refer to Table 2 for further details.

Table 1 Basic Situation Analysis of 5978 Patients

Variable	*n*	$\bar{X} \pm S$	Variable	*n*	%
Age	5978	30.15±3.98	Leucocyte esterase		
Height	5978	163.43±8.77	Negative	6	0.1
Weight	5978	59.33±7.03	Positive	174	2.91
BMI	5978	22.27±2.57	Weakly positive	5798	96.99
Age at first sexual Intercourse	5957	23.63±3.28	Catalase		
PH value	5978	4.9±0.39	Negative	20	0.33*
Nugent score	5978	3.63±1.12	Positive	5548	92.81
Marital status			Weakly positive	410	6.86
Unmarried	182	3.04	Sialic acid glycosidase		
Married	5763	96.40	Negative	5714	95.58
Divorce and Widow	33	0.55	Positive	86	1.44
Educational level			Weakly positive	178	2.98
Junior high school	10	0.17	Acetylaminoglucosidase		
High school	940	15.72	Negative	5179	86.63
Junior college	4121	68.94	Positive	542	9.07
Undergraduate course	907	15.17	Weakly positive	257	4.3
Pregnancy frequency			Dominant bacteria		
0	978	16.36	Gram-positive bacilli	5100	85.31
1	4042	67.61	Gram negative short bacilli	301	5.04
2	946	15.82	Gram positive cocci	274	4.58
3	12	0.20	Gram positive Streptococcus	15	0.25
Cigarette/Hookah Smoking			Nothing	288	4.82
No	5003	83.69	Microecology		
Yes	975	16.31	BV	177	2.96
Vaginal douching			VVC	716	11.98
No	3499	58.53	Abnormal microbial community	4498	75.24
Yes	2479	41.47	Microbial inhibition	413	6.91
Oral contraceptives			BV intermediate type	90	1.51
No	3778	63.20	TV	19	0.32
Yes	2200	36.80	Mixed nature	65	1.09
β Glucuronidase					
Negative	5977	99.98			
Positive	1	0.02			

Note: *percentage.

Table 2 Statistical Results of Total Hydroxyvitamin D

Classification	*n*	%
Normal	1199	20.06
Insufficient	1327	22.20
Lack	2356	39.41
Severe deficiency	1096	18.33
Total	5978	100.00

Analysis of Influencing Factors of Total Hydroxyvitamin D

The chi-square test revealed a statistically significant association between total hydroxyvitamin D levels and four indicators of vaginal dominant bacterial species, including catalase, acetylglucosaminidase, and vaginal microecological status. Subsequent analysis indicated that within the dominant bacterial group ($P<0.05$), the highest deficiency/severe ratio of total hydroxyvitamin D was observed in the Gram-positive bacilli group (62.44%); in the catalase group

(P=0.002), the weakly positive group had the highest percentage (59.02%); in the acetylglucosaminidase group (P=0.002), the weakly positive group also had the highest proportion; and in the microecological group (P<0.05), the TV group showed the highest percentage (68.42%). Furthermore, except Gram-positive streptococci as the dominant bacteria, Table 3 demonstrated that out of the 15 indicators analyzed (including marital status, education level, number of pregnancies, smoking, vaginal douching, oral contraceptives, dominant bacteria, Catalase, sialidase, leukocyte esterase, beta-glucuronidase, acetylglucosaminidase, microbiome, season, and age), the highest proportion of total hydroxyvitamin D deficiency/severe deficiency was observed. This underscores the relationship between vitamin D levels and vaginitis, with detailed information available in Table 3.

Table 3 Analysis of Influencing Factors of Total Hydroxyvitamin

Factor	Normal		Insufficient		Lack		Total		χ^2	P
	n	%	n	%	n	%	n	%		
Married Status										
Unmarried	42	23.08	40	21.98	100	54.95	182	100	1.601	0.809
Married	1151	19.97	1281	22.23	3331	57.80	5763	100		
Divorce and Widow	6	18.18	6	18.18	21	63.64	33	100		
Educational level										
Junior high school	3	30.00	2	20.00	5	50.00	10	100	3.848	0.697
High school	200	21.28	217	23.09	523	55.64	940	100		
Junior college	813	19.73	898	21.79	2410	58.48	4121	100		
Undergraduate course	183	20.18	210	23.15	514	56.67	907	100		
Pregnancy Frequency										
0	209	21.37	212	21.68	557	56.95	978	100	5.677	0.46
1	794	19.64	894	22.12	2354	58.24	4042	100		
2	191	20.19	219	23.15	536	56.66	946	100		
3	5	41.67	2	16.67	5	41.67	12	100		
Cigarette/Hookah Smoking										
No	1004	20.07	1105	22.09	2894	57.85	5003	100	0.226	0.893
Yes	195	20.00	222	22.77	558	57.23	975	100		
Vaginal Douching										
No	713	20.38	764	21.83	2022	57.79	3499	100	0.936	0.626
Yes	486	19.60	563	22.71	1430	57.68	2479	100		
Oral Contraceptives										
No	741	19.61	860	22.76	2177	57.62	3778	100	2.51	0.285
Yes	458	20.82	467	21.23	1275	57.95	2200	100		
Dominant Bacteria										
Gram-positive Bacilli	984	19.29	1106	21.69	3010	59.02	5100	100	47.532	0.000
Gram negative Short bacilli	53	17.61	75	24.92	173	57.48	301	100		
Gram positive Cocci	65	23.72	73	26.64	136	49.64	274	100		
Gram positive Streptococcus	7	46.67	2	13.33	6	40.00	15	100		
Nothing	90	31.25	71	24.65	127	44.10	288	100		
Catalase										
Negative	9	45.00	0	0.00	11	55.00	20	100	16.579	0.002
Positive	1126	20.30	1237	22.30	3185	57.41	5548	100		
Weakly positive	64	15.61	90	21.95	256	62.44	410	100		
Sialic acid glycosidase										
Negative	1161	20.32	1268	22.19	3285	57.49	5714	100	5.914	0.206
Positive	13	15.12	19	22.09	54	62.79	86	100		
Weakly positive	25	14.04	40	22.47	113	63.48	178	100		

(*Continued*)

Table 3 (Continued).

Factor	Normal		Insufficient		Lack		Total		χ²	P
	n	%	n	%	n	%	n	%		
Leucocyte Esterase										
Negative	2	33.33	1	16.67	3	50.00	6	100	7.347	0.119
Positive	26	14.94	31	17.82	117	67.24	174	100		
Weakly positive	1171	20.20	1295	22.34	3332	57.47	5798	100		
β Glucuronidase										
Negative	1199	20.06	1327	22.20	3451	57.74	5977	100	0.732	0.694
Positive	0	0.00	0	0.00	1	100.00	1	100		
Acetylaminoglucosidase										
Negative	1076	20.78	1157	22.34	2946	56.88	5179	100	16.549	0.002
Positive	89	16.42	112	20.66	341	62.92	542	100		
Weakly positive	34	13.23	58	22.57	165	64.20	257	100		
Microecology										
BV	26	14.69	39	22.03	112	63.28	177	100	52.822	0.000
VVC	109	15.22	152	21.23	455	63.55	716	100		
Abnormal Microbial Community	911	20.25	991	22.03	2596	57.71	4498	100		
Microbial Inhibition	124	30.02	104	25.18	185	44.79	413	100		
BV intermediate Type	15	16.67	23	25.56	52	57.78	90	100		
TV	3	15.79	3	15.79	13	68.42	19	100		
Mixed nature	11	16.92	15	23.08	39	60.00	65	100		
Season										
Spring	373	19.36	460	23.87	1094	56.77	1927	100	12.149	0.059
Summer	350	19.98	410	23.40	992	56.62	1752	100		
Autumn	267	20.43	258	19.74	782	59.83	1307	100		
Winter	209	21.07	199	20.06	584	58.87	992	100		
Age range										
18~20	5	22.73	4	18.18	13	59.09	22	100	4.953	0.550
20~30	723	20.69	781	22.35	1990	56.95	3494	100		
30~40	462	19.32	526	22.00	1403	58.68	2391	100		
≥40	9	12.68	16	22.54	46	64.79	71	100		

Influencing Factors of Vitamin D

Analysis of variance revealed that age, BMI, and pH values significantly impacted total hydroxyvitamin D levels. Subsequent pairwise comparisons using the LSD method revealed statistically significant differences between the normal and deficient vitamin D groups (P=0.001) in terms of age, between the normal and deficient groups (P=0.018) as well as between the normal and insufficient groups (P=0.035) in terms of BMI, and between the normal and deficient groups (P=0.024) as well as between the deficient and insufficient groups (P=0.001) in terms of pH values. The statistical analysis indicates that older individuals tend to have higher BMIs and that individuals with both high and low vaginal pH values are more likely to exhibit symptoms of vitamin D deficiency. Further details can be found in Table 4.

Analysis of Total Hydroxyvitamin D Deficiency in Patients with Different Microecological Recurrence

The study observed varying levels of hydroxyvitamin D deficiency among patients with different microbiota profiles and recurrence frequencies. Patients experiencing three or more recurrences had the highest percentage of normal levels, while those with no recurrences had the highest percentage of deficiency. Refer to Table 5 for specific data.

Table 4 Analysis of Influencing Factors of Vitamin D

Factor	Type	*n*	$\bar{x} \pm S$	*F*	*P*
Age	Normal	1199	29.83±3.78	6.36	0.002
	Insufficient	1327	30.07±4.02		
	Lack	3452	30.29±4.02		
Height	Normal	1199	163.51±8.76	1.048	0.351
	Insufficient	1327	163.12±8.61		
	Lack	3452	163.52±8.84		
Weight	Normal	1199	58.95±6.95	2.837	0.059
	Insufficient	1327	59.24±6.95		
	Lack	3452	59.50±7.09		
BMI	Normal	1199	22.11±2.52	3.118	0.044
	Insufficient	1327	22.32±2.58		
	Lack	3452	22.31±2.58		
Age at first sexual intercourse	Normal	1195	23.59±3.23	1.063	0.345
	Insufficient	1322	23.54±3.25		
	Lack	3440	23.68±3.3		
Nugent score	Normal	1199	3.63±1.06	0.379	0.684
	Insufficient	1326	3.65±1.12		
	Lack	3451	3.62±1.14		
PH value	Normal	1199	4.95±0.38	18.485	0.000
	Insufficient	1327	4.92±0.39		
	Lack	3452	4.88±0.39		

Table 5 Analysis of Total Hydroxyvitamin D Deficiency in Patients with Different Types of Vaginitis

Vaginal Microecology		Normal		Deficiency		Lack		Total		χ^2	*P*
		n	%	*n*	%	*n*	%	*n*	%		
BV	0	12	13.48	24	26.97	53	59.55	89	100	8.308	0.216
	1	11	15.07	12	16.44	50	68.49	73	100		
	2	8	24.24	7	21.21	18	54.55	33	100		
	≥3	8	25	3	9.38	21	65.63	32	100		
TV	0	3	23.08	2	15.38	8	61.54	13	100	3.280	0.773
	1	4	40	2	20	4	40	10	100		
	2	2	20	2	20	6	60	10	100		
	≥3	5	50	1	10	4	40	10	100		
VVC	0	58	15.8	81	22.07	228	62.13	367	100	3.901	0.69
	1	59	19.8	60	20.13	179	60.07	298	100		
	2	30	20.55	31	21.23	85	58.22	146	100		
	≥3	29	19.86	25	17.12	92	63.01	146	100		
BV intermediate type	0	10	25	10	25	20	50	40	100	6.863	0.334
	1	9	23.08	13	33.33	17	43.59	39	100		
	2	2	22.22	0	0	7	77.78	9	100		
	≥3	7	36.84	3	15.79	9	47.37	19	100		
Mixed vaginitis	0	9	30	8	26.67	13	43.33	30	100	6.091	0.413
	1	6	28.57	5	23.81	10	47.62	21	100		
	2	1	12.5	4	50	3	37.5	8	100		
	≥3	1	11.11	1	11.11	7	77.78	9	100		
Abnormal flora	0	357	21.77	361	22.01	922	56.22	1640	100	14.981	0.02
	1	343	21.12	393	24.2	888	54.68	1624	100		
	2	142	22.61	143	22.77	343	54.62	628	100		
	≥3	157	27.54	106	18.6	307	53.86	570	100		

(*Continued*)

Table 5 (Continued).

Vaginal Microecology		Normal		Deficiency		Lack		Total		χ^2	*P*
		n	%	*n*	%	*n*	%	*n*	%		
Flora inhibition	0	43	32.58	31	23.48	58	43.94	132	100	4.242	0.644
	1	67	27.57	61	25.1	115	47.33	243	100		
	2	22	28.21	23	29.49	33	42.31	78	100		
	≥3	22	33.85	20	30.77	23	35.38	65	100		

Table 6 Correlation Analysis Between Vitamin D and Vaginitis

	Normal		Deficiency		Lack/Serious Lack		Total	
	n	%	*n*	%	*n*	%	*n*	%
BV	26	14.69	39	22.03	112	63.28	177	100
VVC	109	15.22	152	21.23	455	63.55	716	100
TV	3	15.79	3	15.79	13	68.42	19	100
Control group	146	20.33	149	20.75	423	58.91	718	100

Correlation Analysis of Vitamin D and Vaginitis

The study included 718 patients with abnormal flora and a Nugent score of 2 in the control group. The research analyzed the correlation between vitamin D levels and different types of vaginitis. Results showed a statistically significant difference in the proportion of vitamin D levels between the severe deficiency group and the control group for BV ($\chi2$=119.733, *P* =0.000), VVC ($\chi2$=155.911, *P* =0.000), and TV ($\chi2$=116.580, *P* =0.000). This suggests that vitamin D may impact BV, VVC, and TV. Patients with BV, VVC, and TV had a higher proportion of vitamin D deficiency/severe deficiency compared to the control group. Refer to Table 6 and Figure 1 for more details.

Discussion

The primary role of vitamin D is to promote calcium and phosphorus metabolism and bone formation, thereby preventing the development of rickets. As women age, their vitamin D levels tend to decline. The latest vitamin D technology in the treatment of vaginitis includes local application, nanotechnology, immune regulation and smart drug delivery, and many

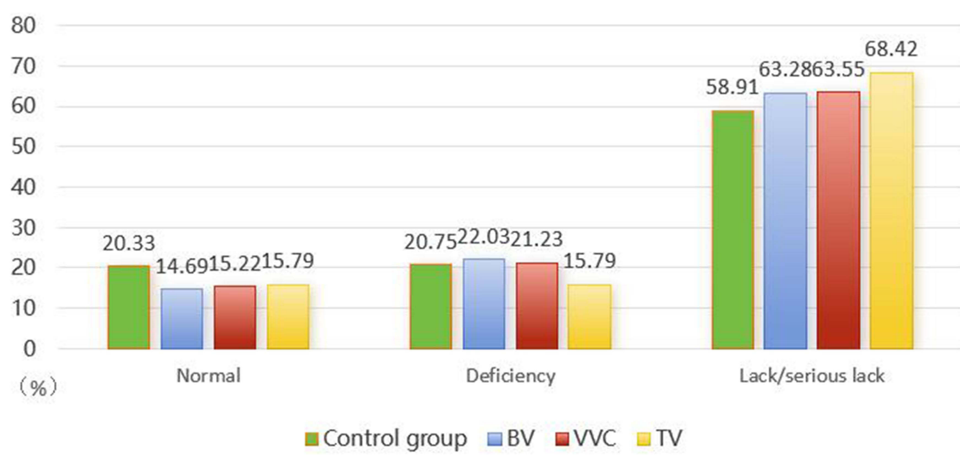

Figure 1 Analysis of vitamin D content in each group.

other aspects, and some studies are exploring vaginal suppositories made of vitamin D, which can directly act on the vaginal mucosa to increase local vitamin D concentration. This local application can reduce the potential side effects of systemic absorption and directly improve the immune environment in the vagina. From the medical treatment evidence, there is evidence that adequate vitamin D levels contribute to the reproduction of lactobacillus, thereby enhancing the vaginal defense mechanism and preventing pathogen colonization, so vitamin D treatment options are very promising. At the same time, our statistical findings indicate that older individuals are more prone to experiencing symptoms of vitamin D deficiency. Among menopausal women, vitamin D deficiency is prevalent, with rates ranging from 50% to 80%, aligning with the results of our study (showing that 64.79% of vaginitis patients aged ≥40 years have a deficiency or severe lack of vitamin D).[13] Some studies[14,15] suggest that vitamin D could serve as an alternative to estrogen therapy in alleviating vaginal atrophy.

The microecological balance within the human body is essential for overall health, with vitamin D playing a significant role in this delicate equilibrium. Research has demonstrated that vitamin D levels can impact the composition of both intestinal and respiratory microbiota. Furthermore, decreased levels of vitamin D have been linked to various reproductive system disorders in females, potentially influencing estrogen metabolism and reducing the risk of reproductive tract diseases.[8] Adequate levels of vitamin D can also stimulate the growth of vaginal epithelial cells, strengthening the protective barrier of the vaginal epithelium and safeguarding against pathogens. Optimal vitamin D levels can additionally lower vaginal pH, creating an environment unfavorable for pathogenic microorganisms. This pH regulation may be attributed to the presence of Lactobacilli, as sufficient vitamin D levels can enhance glycogen synthesis in the vagina. Studies have suggested a positive correlation between vaginal glycogen levels and Lactobacillus abundance, indicating that increased glycogen synthesis can further support Lactobacillus proliferation. As a dominant bacterial species, Lactobacillus plays a crucial role in suppressing the growth of other pathogens in the vagina, contributing to decreased pH levels.[16] The influence of vitamin D on vaginitis extends beyond these mechanisms, as research highlights that the primary form of vitamin D in the body, vitamin D3, and its derivative calcitriol can inhibit T cell proliferation and immunoglobulin production, potentially reducing inflammatory responses.[17,18]

This study examined the vaginal microecological test results and serum vitamin D levels of 5978 patients with vaginitis at Shaanxi Provincial People's Hospital. The findings revealed that a majority of vaginitis patients were deficient in vitamin D, with 57.74% having either a deficiency or severe deficiency. Vitamin D levels were found to impact catalase, acetaminophen, and glucosidase, as well as vaginal microecological status. Age and BMI were identified as statistically significant factors associated with total hydroxyvitamin D levels. Analysis of relapsed patients showed that in the abnormal flora group, higher recurrence of vaginitis was associated with normalized vitamin D levels. This suggests a potential role for vitamin D as an adjunct treatment for recurrent vaginitis. Among 1630 female patients with abnormal flora, it was observed that vitamin D deficiency and severe deficiency were most prevalent. Additionally, the severe vitamin D deficiency group had a higher proportion of BV, VVC, and TV patients compared to the control group.

Current research is investigating the efficacy of using vitamin D in the treatment of vaginitis, encompassing both oral medications and suppository treatments, all of which have shown promising results[14,19,20]. The statistical findings from this study offer a more comprehensive analysis of the relationship between vaginitis and vitamin D. Through this data analysis, we can explore the optimal administration method, dosage, timing, and potential combinations of vitamin D for vaginitis treatment. The medication protocol requires further investigation to enhance our understanding. Our goal is to offer robust support for the prevention and clinical management of vaginitis.

Conclusion

This study examined the statistical findings of vitamin D-related data from 5978 vaginitis patients and concluded that there is a positive correlation between vitamin D deficiency and the occurrence of vaginitis. Patients with vitamin D deficiency or severe deficiency tend to show weakly positive results in catalase and acetylglucosaminidase tests, with the majority of vaginitis cases being Trichomonas vaginalis (TV). Moreover, older individuals and those with higher BMI are more likely to exhibit symptoms of vitamin D deficiency. Among patients with abnormal vaginal flora, vitamin D deficiency and severe deficiency are notably common, with proportions exceeding twice that of the normal and insufficient vitamin D groups, respectively. Furthermore, patients with vaginitis-causing pathogens have higher rates of vitamin D deficiency compared to the normal control group.

Prospects and Deficiencies

Based on the results of this data analysis and related literature, it is evident that vitamin D plays a beneficial role in the treatment of vaginitis. In addition, we found that ospemifene can effectively improve the atrophic vaginal symptoms caused by estrogen deficiency in women,[21,22] forming a more favorable environment for the growth of lactic acid bacteria. A healthy level of lactic acid bacteria helps maintain a low pH in the vagina and inhibits the proliferation of pathogenic microorganisms, thereby indirectly reducing the risk of infection. However, further exploration is required to understand the specific mechanism of this treatment fully. We anticipate more research in this area and successful clinical cases in the future, which will ultimately offer valuable support for women's overall well-being.

Ethics Statements

This retrospective study was permitted to waive the informed consent of the patients in the study, as stipulated in Chapter 3, Article 32 of the Chinese law Measures for Ethical Review of Life Science and Medical Research Involving Human Subjects (National Health Science and Education Development [2023] No. 4). Our study complies with the Declaration of Helsinki.

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Disclosure

The authors report no conflicts of interest in this work.

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