

Article

The Role of D Vitamin and Microelements Deficiency in Menstrual Function Disorders in Adolescent Girls and Their Correction Methods

Ashurova Nigora Gafurovna*¹

1. Abu Ali ibn Sino Bukhara State Medical Institute, Department of "Obstetrics and Gynecology in Family Medicine"

* Correspondence: ashurovanigora.1972@gmail.com

ORCID 0009-0002-8378-1334

Abstract: This article presents the results of research on the role of microelement and vitamin D deficiency in the occurrence of menstrual cycle disorders and their relationship with the hormonal function of the ovaries. 272 adolescent girls aged 11-17 were involved in the prospective examination. The study results showed that the estradiol content decreased by 11.6% compared to the normal concentration of vitamin D. The increase in the risk of menstrual cycle disorders in the form of hypomenstrual syndrome with vitamin D and microelement deficiency was determined using ROC analysis.

Keywords: Adolescent Girls, Menstrual Cycle Disorders, Vitamin D, Microelements

1. Introduction

The female reproductive system has regular cyclical changes, which are teleologically important as periodic preparation for pregnancy and fertilization. Due to the variability of menstrual frequency, regularity, duration of the menstrual cycle, and menstrual blood loss in women, research on these factors is being conducted in various large populations [1].

Currently, caring for the reproductive health of adolescent girls, restoring their general somatic health, improving generative potential through predicting, early detection, and timely correction of reproductive pathologies is one of the priority areas of the country's healthcare system. The increase in the proportion of gynecological diseases (menstrual cycle disorders, inflammation of the genitals, etc.) among adolescent girls worldwide over the past decade is reflected in statistical reports [2][3][4].

Zinc is a necessary factor for the female body, as it is part of estrogen receptors and thereby regulates all estrogen-dependent processes. It has been established that zinc deficiency in a girl's body leads to the development of signs of hypogonadism, disruption of menstrual cycle stages, and in women, to postpartum hypogalactia [5][6][7]. Most essential MEs are catalytic centers of the most important enzymes [8][9][7].

Iron, which is a component of more than 70 enzymes that differ in their functions, plays an invaluable role in the body. Iron deficiency disrupts endogenous metal metabolism, lipid peroxidation, nitrogen oxide synthesis, cytokine production, and intracellular transport processes [10][11].

According to WHO data, more than 1 billion people on the planet suffer from iodine-iron deficiency[12].

Vitamin D maintains the balance of androgens and estrogens by increasing the expression of the aromatase enzyme in the ovaries. It plays an important role in

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balancing the biological effects of FSH and LH by enhancing FSH receptor excretion [13][14]. Despite the fact that these problems seem to have been studied quite comprehensively, the role of human heredity and predisposing factors, microelements and vitamin D deficiency in the occurrence of menstrual cycle disorders and their relationship with the hormonal function of the ovaries have not been sufficiently studied, which requires additional research to predict the development of menstrual dysfunction in adolescent girls of the Uzbek population [15].

Purpose of the research

By studying the pathogenetic mechanisms of menstrual cycle disorders in adolescent girls, it is necessary to substantiate the role of vitamin D and microelement deficiency in its occurrence and to develop prognostic criteria.

2. Materials and Methods

In accordance with the goals and objectives of the work, 272 adolescent girls (11-17 years old) from among schoolchildren of the city of Bukhara and Bukhara region were involved in prospective examinations. The main group consisted of 192 girls with menstrual cycle disorders, and the control group consisted of 80 healthy adolescent girls of the same age with regular menstruation. According to the predominant clinical signs, the main contingent of the examined was divided into 2 groups: the 1st group consisted of 105 girls with short-term (1-2 days), sporadic (36-52 days) and low-volume (10-40 ml) menstruation, as well as a 6-month absence of menstruation. The 2nd group included 87 adolescent girls with prolonged menstruation (more than 7 days), frequent recurrences (less than 20 days), and significant blood loss (more than 80 ml).

The study used general visual, anthropometric, clinical-laboratory, functional-instrumental, hormonal, molecular-genetic, and statistical research methods.

3. Results and Discussion

Changes in the menstrual cycle, in particular, the duration of menstrual days and the age of menarche, were compared with the main and control groups, and when the patients of the main group were rearranged depending on the type of menstrual disorder, compared with the control group, and also compared with each other, it was found that the duration of menstrual days in patients with hypomenstrual disorders was statistically significantly less compared to the control group, and in patients with hypermenstrual disorders, it was statistically significantly increased. On the other hand, no differences were found between the patient and control groups in terms of menarche age. When examining the difference in biochemical changes in the indicator of vitamin D at an adequate concentration and a deficiency, a statistically significant change was revealed only in the estradiol indicator in adolescent girls with frequent and frequent menstruation (in the case of vitamin D deficiency, the amount of E2 decreased by 11.6% ($p < 0.05$) compared to the indicator determined at an adequate concentration of vitamin D) (Table 1). On the other hand, in the case of vitamin D deficiency in adolescent girls with low menstruation + amenorrhea, compared to its adequate concentration, among the compared biochemical indicators, FSH decreased by 27.3% ($p < 0.05$), the LH/FSH ratio increased by 57% ($p < 0.05$), the E2 level decreased by 26.2% ($p < 0.05$), and the DGEAS level decreased by 19.6% ($p < 0.05$).

Table 1. Characteristics of changes in biochemical markers in patients with varying concentrations of 25-hydroxycalciferol

Indicators	Adolescent girls with frequent menstruation		Adolescent girls with low menstruation + amenorrhea		The control group
	D<30 H ₁₇ /M ₁ n=71	30<D H ₁₇ /M ₁ n=16	D <30 H ₁₇ /M ₁ n=93	30< D H ₁₇ /M ₁ n=12	
FSG (mEd/ml)	11.55±0.71 ^c	12.0±1.93 ^c	4.99±0.41 ^{ab}	6.86±0.95 ^a	10.85±0.58
LG (mEd/ml)	10.1±0.77	11.9±2.2	13.1±2.52	12.4±1.03	10.84±2.2
LG/ FSG	0.91±0.27 ^c	1.01±0.97 ^c	3.63±0.23 ^{ab}	2.31±0.44 ^a	1.33±0.38
Testosterone (nmol\l)	3.2±0.35 ^a	2.75±0.58	3.59±1.22 ^a	2.10±0.25 ^a	0.98±0.05
Estradiol (pg/ml)	91.3±2.85 ^{abc}	103.3±3.26 ^{ac}	23.1±2.37 ^{ab}	31.3±3.31 ^a	46±2.16
DGEAS (mg/dl)	386.1±17.6 ^a	358±38.5 ^a	366.4±17.5 ^{ab}	456±31.3 ^a	217.7±10.8
Progesterone (nmol/L)	5.26±0.37 ^{ac}	5.46±0.90 ^{ac}	11.0±1.82 ^a	12.62±0.6 ^a	2.74±0.38
TTG (mEd/ml)	2.51±0.14	2.14±0.38 ^c	3.64±1.29	3.75±0.31 ^a	2.69±0.11
T4 free (ng\ml)	10.8±0.38	11.81±0.38	12.74±1.3	12.9±0.55	13.2±0.29
Prolactin (mE/ml)	281.4±14.3 ^a	313.3±27.5	328.15±25.0	351.2±14.8	329.9±9.7

Comments: a - compared to the control group $p<0.05$ up to; b – 25(oh)d as compared with patients in group having exactly kontsentriyaga index adekvat – $p<0.05$ up to; s – 25(oh)d less exactly as the coming of menstruation kontsentriyadagi+amenoreya available compared to patients – $p<0.05$ up to.

Induced biochemical changes associated kontsentriyasiga results identified vitamin d include vitamin d in relation to menstruation and menstrual less frequent many of the coming of the coming defisiti+amenoreya forecasting shows that the importance of development. This **ROCK** analysis also proved (table 2).

Table 2. Prognostic significance of vitamin D deficiency in the development of various menstrual disorders

Indicators	SE	SP	AUC	OR	95%CI	P
Adolescent girls with frequent menstruation	0.62	0.837	0.72	8.43	4.04-17.59	<0.001
Adolescent girls with low menstruation + amenorrhea	0.69	0.837	0.75	12.36	5.90-25.89	<0.001

Note: AUC –indicator the role of forecasting the development of disease;

OR - odds ratio

As can be seen from Table 2, 25 (OH) D deficiency increases the likelihood of frequent and frequent menstruation by 8.43 (95%CI: 4.04-17.59; $p<0.001$) times, and the likelihood of menstrual cycle disorders of the hypomenstrual type increases by 12.36 (95%CI: 5.90-25.89; $p<0.001$) times (Fig. 1).

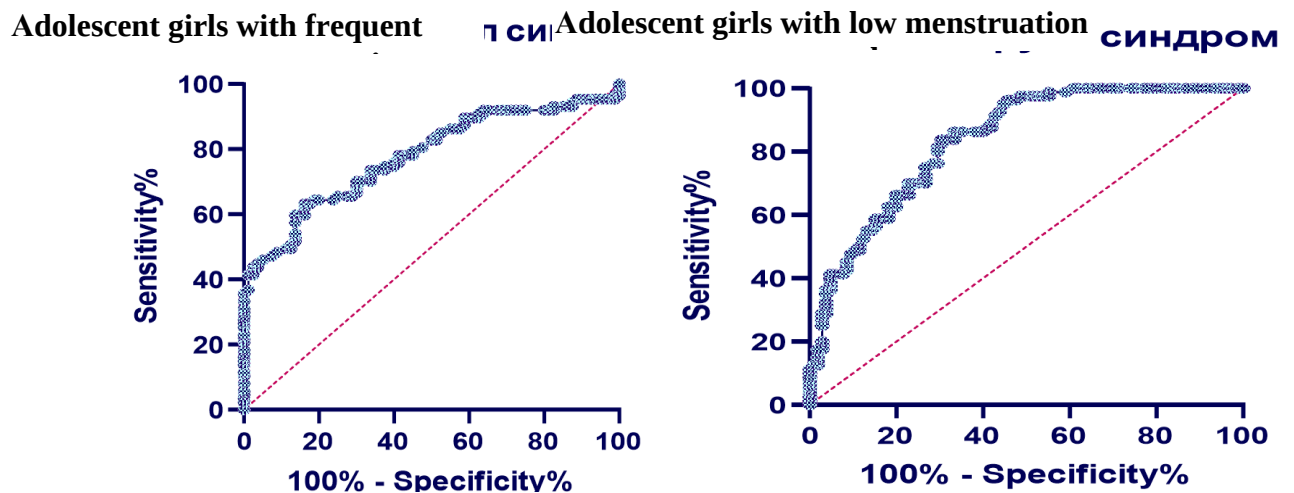


Figure 1. Prognostic effectiveness of 25 (OH) D deficiency in the development of irregular menstruation (ROC curve).

In our study, the concentration of some trace elements in the blood was checked in all adolescent girls. The incomparable importance of zinc for adolescent development and sexual maturity is that it is part of estrogen receptors and thereby regulates all estrogen-dependent processes. In our study, the results of numerous studies are consistent with the fact that in girls suffering from menstrual disorders, characterized by low, sporadic, short-term, and low blood loss, zinc decreased by 1.34 times compared to the control group and by 1.22 times compared to girls with frequent and frequent menstruation. It is noteworthy that, considering that in this group, delayed sexual characteristics, amenorrhea, and delayed sexual development occurred in 31.4%, 28.5%, and 23.8%, respectively, zinc is embodied in the adolescent's body not only as a microelement responsible for sexual, but also for physical development (Table 3).

Table 3. Ofcourse indicators in the group of micronutrients

	Adolescent girls with low menstruation + amenorrhea	Adolescent girls with frequent menstruation	The control group	Reference indicator
Calcium	2,36±0,114*	2,24±0,131**	2,82±0,142	(2,5-3,0 μmol/l)
Iron	10,41±0,95*	8,60±0,89***	13,19±0,56	(4,7-19,5 mkm/l)
Magnesium	0,722±0,081	0,61±0,056**	0,798±0,026	(0.7-0.91 μmol/l)
Zinc	12,91±1,03***	15,86±0,96*	17,28±0,471	(11,4-22,0 mkm/l)

Comments: * - differences control the data statistically significant (*P<0.05 up to, ** - P<0,01)

Therefore, the development of character hypogonadism the body of the girl child, the phase of the menstrual cycle disorder is likely to be one of the factors of the failure of zinc direct.

As can be seen from the table, the iron is too low a figure comparable in both groups concentration is showing less and less frequent in the group of teenage girls seeing a lot of her menstrual menstrual compared to 1.2 times of seeing this girl, almost 1.6 times lower as compared to the example have shown that healthy girls. This is probably the difference with your own functions, which is a component of more than 70 enzymes due to chronic blood loss within the cell substance of iron transport out of the process associated with stability. In conditions of iron deficiency in the body to grow and the process of coming lations, considering all the calcium and magnesium in the amount of interest we have with teenage girls. As seen, the amount of calcium and magnesium in

the serum and the menstrual going to be a lot less show up with that in girls, respectively, in comparison with the control group and increase of 1.1 and 1.3 times less than 1.25 times of 1,19 and motions. Considering that it is essential to take the metabolic processes and in the metabolism of the one is not for me, but complex also plays an important role micronutrients and their balance (3-table).

An increase in the effectiveness of treatment was achieved by including vitamin D in the traditional treatment program (for deficiency: 50,000 IU once a week for 2 months, followed by a maintenance dose of 3000 IU daily continuously for at least 3 months; for deficiency: 3000-4000 IU daily continuously for at least 2 months, followed by a maintenance dose of 2000 IU daily for at least 3 months) and medications containing the necessary trace elements (magnesium, zinc, iron, calcium) and conducting a consultative interview with the adolescent girl and her parents. In particular, the prescription of magnesium preparations (48 mg 2-3 times a day continuously for at least 2-3 months, depending on the degree of deficiency) to adolescent girls of both groups who complained of painful menstruation made it possible to improve the quality of life of girls. It should be noted that in both groups of adolescent girls with painful menstruation, positive results were obtained not only in terms of the number of indicators, but also in terms of pain intensity.

Table 4. Changes in vitamin D levels in the dynamics of treatment of menstrual cycle disorders

cycle disorders				
Figure	Adolescent girls with low menstruation + amenorrhea			The control group
	before treatment	after treatment		
		after 3 months	after 6 months	
	20.77±0.56***	32.6±0.52*^^^	35.2±0.72***^^^	29.71±0.85
25 (ON)D (ng\ml)	Adolescent girls with frequent menstruation			
		after treatment		
	before treatment	after 3 months	after 6 months	
	22.87±1.0***	29.14±1.04	31.907±1.15	29.71±0.85

Note: * - compared to the control group $p < 0.05$ up to; ** - $p < 0.001$; *** $p < 0.0001$, ^ - from the treatment compared to the previous figure $p < 0.05$ up to; ^^ - $p < 0.01$; ^^ - $p < 0.001$.

In this case, girls with vitamin D deficiency (blood concentration of 20-30 ng/ml) were prescribed a daily dose of 3000-4000 IU, while those with severe deficiency received a weekly dose of 50,000 IU of vitamin D. Both groups showed positive results over time. The concentration of vitamin D increased by 1.4 and 1.3 times after 3 months, respectively, and by 1.69 and 1.71 times after 6 months compared to the baseline (Table 4). Considering that vitamin D deficiency was statistically significantly lower in both groups, treatment was prescribed according to the degree of vitamin D deficiency and insufficiency. When observing the dynamics of microelements, in girls with oligomenorrhea + amenorrhea, after 3 months, calcium levels increased by 1.3 times, iron by 1.7 times, magnesium by 1.1 times, and zinc by 1.6 times compared to the initial microelement indicators, reaching the lower limit of the normal range. After 6 months, a significant change was observed only in zinc levels, which increased by 2.2 times.

Table 5. Indicators of microelements in the dynamics of treatment in adolescent girls with low menstruation + amenorrhea

Indicators	Adolescent girls with low menstruation + amenorrhea			The control group
	Initial	3 months after	6 months after	
Calcium (2,5-3,0 $\mu\text{mol/l}$)	2,36±0,114*	2,52±0,11	2,79±0.12^	2,82±0,142
Iron (4,7-19,5 mkm/l)	10,41±0,95*	11,50±0,76	12,47±1,27	13,19±0,56

Magnesium (0.7-0.91 $\mu\text{mol/l}$)	0,722 $\pm$ 0,081	0.745 $\pm$ 0,08	0,797 $\pm$ 0,067	0,798 $\pm$ 0,026
Zinc (11,4-24,0 mkml/l)	12,91 $\pm$ 1,03***	14,81 $\pm$ 0,48**	16,64 $\pm$ 1,22^	17,28 $\pm$ 0,471

Note: * - compared to the control group – $p < 0.05$; ** $p < 0.01$; *** - $p < 0.001$, ^ - from the treatment compared to the previous figure $p < 0.05$ up to; ^^ - $p < 0.01$; ^^ - $p < 0.001$.

Table 6. Indicators of microelements in the dynamics of therapy in adolescent girls with frequent menstruation.

Indicators	Adolescent girls with frequent menstruation			The control group
	Initial	3 months after	6 months after	
Calcium (2,5-3,0 $\mu\text{mol/l}$)	2,24 $\pm$ 0.131**	2,36 $\pm$ 0,11*	2,81 $\pm$ 0,057^^^	2,82 $\pm$ 0,142
Iron (4,7-19,5 mkml/l)	8,60 $\pm$ 0,89***	10,30 $\pm$ 0,72**	12,47 $\pm$ 0,534^^^	13,19 $\pm$ 0,56
Magnesium (0.7-0.91 $\mu\text{mol/l}$)	0,61 $\pm$ 0,056**	0,71 $\pm$ 0,022*	0,79 $\pm$ 0,074	0,798 $\pm$ 0,026
Zinc (11,4-24,0 mkml/l)	15,86 $\pm$ 0,96	16,92 $\pm$ 0,174	17,76 $\pm$ 0,27	17,28 $\pm$ 0,471

Note: * - compared to the control group – $p < 0.05$; ** $p < 0.01$; *** - $p < 0.001$, ^ - from the treatment compared to the previous figure $p < 0.05$ up to; ^^ - $p < 0.01$; ^^ - $p < 0.001$.

Similar changes were observed in girls with heavy and frequent menstruation. The most significant indicators were manifested in iron and zinc levels. After 3 months, these indicators increased by 1.2 and 1.1 times respectively, while after 6 months, they increased by 2.2 and 1.3 times respectively (Table 6). Interestingly, in girls suffering from heavy and frequent menstruation, a 2.2-fold increase in iron levels was achieved only after 6 months. This extended period is explained by the fact that in an organism that has lost a large amount of blood over a long time, it takes longer to replenish iron reserves in the depot.

4. Conclusion

Under conditions of vitamin D deficiency, an increase in FSH by 27.3% ($p < 0.05$), an increase in the ratio of LH/FSH and UT/E2 by 57% ($p < 0.05$) and 75.8% ($p < 0.05$) increases the risk of menstrual irregularity + amenorrhea by 12.36 (95%CI: 5.90-25.89; $p < 0.001$) times. Similarly, the estradiol content decreased by 11.6% ($p < 0.05$) compared to the normal concentration of vitamin D. The prognostic significance of vitamin D and micronutrient deficiency in the development of menstrual disorders, although good for both groups of patients (AUC=0.72 and AUC=0.75, respectively), showed that its deficiency relatively more often increases the risk of menstrual disorders of the hypomenstrual type.

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