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Comparative Analysis of Pregnancy Course, Delivery Outcomes and Neonatal Condition in Women from Namangan and Tashkent Depending on Vitamin D Status

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Abstract Over the past decade, numerous studies have accumulated in the literature linking vitamin D deficiency and insufficiency during pregnancy with a wide range of adverse outcomes for maternal, fetal, and neonatal health. **The aim of this study** was to evaluate the impact of vitamin D status on the course of pregnancy, delivery outcomes, and perinatal indicators among women in Namangan region and Tashkent city. **Materials and Methods.** Patients were divided into three groups: with deficiency, insufficiency, and adequate vitamin D levels. **Results.** Comparative analysis revealed no statistically significant differences between the regions in terms of delivery outcomes, anthropometric data, and Apgar scores ($p>0.05$). **Conclusion.** Adequate vitamin D levels in pregnant women contribute to a reduced risk of complications and improved perinatal outcomes, regardless of the region of residence.

Keywords Vitamin D, Pregnancy, Complications, Newborn, Apgar scale

1. Introduction

In recent years, the role of vitamin D in ensuring a normal course of pregnancy and fetal development has attracted increasing attention from researchers. According to modern data, more than 40–80% of women of reproductive age have insufficient serum 25(OH)D levels, which makes hypovitaminosis one of the most pressing problems in obstetrics [1,6]. Vitamin D insufficiency during pregnancy is associated with a higher incidence of complications such as preeclampsia, gestational diabetes, preterm birth, anemia, and infectious diseases [2,5]. For newborns, maternal vitamin D deficiency often leads to low birth weight, intrauterine growth restriction, increased risk of infections, and low Apgar scores [5].

One of the important factors influencing vitamin D sufficiency is the geographical location and place of residence. Studies show that vitamin D levels are directly related to latitude and solar radiation intensity: deficiency occurs significantly more often in northern than in southern regions [9]. In addition, ethnic and cultural factors, including dietary habits and clothing that limits ultraviolet exposure, also play a role [8]. Some studies have demonstrated differences between residents of urban and rural areas. Women in rural areas usually have higher vitamin D levels, which is associated with longer sun exposure and greater outdoor physical activity. In contrast, urban women more often present with deficiency due to a sedentary lifestyle, prolonged stay indoors, and sunscreen use [3,4]. Even under identical climatic conditions, vitamin D sufficiency can vary significantly within a single country. For example, Wang et al. (2016) demonstrated that serum 25(OH)D levels and bone mineral density depended not only on the season but also on the specific region of residence [7]. These findings emphasize the necessity of considering geographical factors when assessing vitamin D status.

For Uzbekistan, this problem is of particular importance. Despite high levels of insolation, vitamin D deficiency and insufficiency remain widespread among pregnant women. This is associated with cultural characteristics (wearing closed clothing), limited sun exposure, as well as dietary patterns.

Aim of the study. To assess the features of pregnancy course, delivery outcomes, and perinatal indicators in pregnant women from Namangan region and Tashkent city depending on vitamin D status.

2. Materials and Methods

A total of 166 pregnant women and their newborns were examined from January 2024 to September 2025. Among them, 100 were observed at the Republican Specialized Scientific and Practical Medical Center for Maternal and

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Child Health (Tashkent), and 66 at the Namangan branch of the same institution.

All pregnant women underwent a general clinical examination, which included complaints collection, medical history, general and special obstetric examination. Serum 25-hydroxycholecalciferol (25-OH-D) levels were determined in maternal venous blood using immunochemiluminescent assay (ELISA).

For the classification of vitamin D status in newborns, the reference ranges of the Russian Association of Endocrinologists were applied:

- Deficiency: <20 ng/mL
- Insufficiency: ≥20 and <30 ng/mL
- Optimal/adequate: ≥30 ng/mL

Statistical analysis was performed as absolute values and their percentage ratios using applied software packages.

3. Results and Discussion

Out of 100 patients included in the study in Tashkent, **Group 1** (n=41; 41%) consisted of pregnant women with vitamin D deficiency, **Group 2** (n=29; 29%) – with vitamin D insufficiency, and **Group 3** (n=30; 30%) – with optimal vitamin D levels (control group). Thus, vitamin D deficiency among pregnant women in Tashkent occurred 1.4 times more frequently compared to insufficiency and normal levels.

In Namangan, 66 pregnant women were examined. Among them, vitamin D deficiency was identified in 36.4% (n=24), insufficiency – in 45.5% (n=30), and optimal levels – only in 18.1% (n=12). Unlike Tashkent, vitamin D insufficiency predominated in Namangan, while the proportion of women with adequate vitamin D status was almost twice as low (18.1% vs. 30%).

Analysis of the mean vitamin D levels in pregnant women showed that values within the groups were comparable in both Namangan and Tashkent. In women with vitamin D deficiency, the mean level was 16.6 ±2.2 ng/mL in Namangan and about 15.0 ± 2.5 ng/mL in Tashkent. In cases of insufficiency, the values ranged from 23.2 ± 3.0 ng/mL to 23.0 ±3.0 ng/mL, respectively. Among women with normal vitamin D status, the mean values were 34.8 ± 1.3 ng/mL in Namangan and about 34.0 ±2.0 ng/mL in Tashkent. Thus, the distribution of patients across groups corresponded to generally accepted diagnostic criteria, and the differences between the two regions in absolute vitamin D levels were minimal, as shown in Table 1.

Table 1. Average vitamin D levels by group (ng/ml)

Groups	Namangan (n=66)	Tashkent (n=100)
1 group	16,6 ±2,2	15,0 ±2,5
2 group	23,2 ±3,0	23,0 ±3,0
3group	34,8 ±1,3	34,0 ±2,0

Table 2 presents the incidence of somatic diseases during pregnancy. In Namangan, among pregnant women with vitamin D deficiency, the most frequent complications were urinary tract infections — 18 cases (75.0%), as well as anemia — in 12 women (50.0%). Respiratory infections in this group were observed much less frequently: acute respiratory infections (ARIs) with and without fever were registered in only 3 women (12.5%). In Group 2, the rates were somewhat lower: anemia and UTIs were noted in 12 women each (40.0%), while ARIs with fever were recorded in 6 women (20.0%). In the control group with normal vitamin D levels, complications were almost absent: only one woman was diagnosed with a urinary tract infection, while anemia and respiratory infections were not detected.

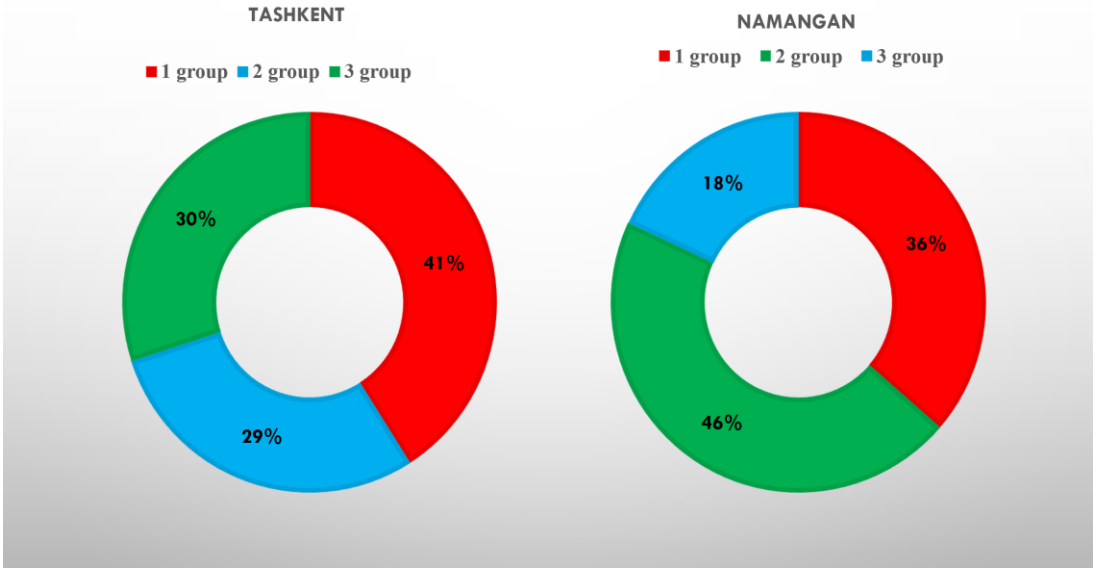

Figure 1. Structure of pregnant women, (%)

In Tashkent, respiratory infections predominated in cases of vitamin D deficiency. Thus, ARIs with fever occurred in every third pregnant woman, and without fever — in every fifth. The incidence of anemia was 57 cases (46.3%), while urinary tract infections were detected in 78 women (63.4%). In Group 2, the structure of complications was similar: anemia (62.0%) and UTIs (72.4%) prevailed, whereas respiratory infections were less common (12.7%). In the control group with normal vitamin D levels, complication rates were minimal: one-third of pregnant women had anemia and urinary tract infections, while ARIs were reported in every tenth case (33.3%, 33%, and 10%).

Thus, in Namangan region, vitamin D deficiency was more strongly associated with urinary tract infections and anemia, whereas in Tashkent it was accompanied by a higher frequency of respiratory infections.

Comparative analysis of the course of labor showed that in Namangan, preterm deliveries were recorded in 9 women (13.6%), whereas in Tashkent they were observed in 19 women (19.0%). Term deliveries accounted for 86.4% and 81.0%, respectively. The obtained differences were not statistically significant, indicating the absence of substantial regional variations in this parameter, as shown in Table 3.

Table 4 shows comparing the anthropometric parameters of newborns, a similar pattern was observed in both Namangan and Tashkent: with adequate maternal vitamin D status, neonatal weight and length were higher than in cases of deficiency or insufficiency. Under conditions of deficiency, the mean birth weight in Namangan was 3014.5 ± 278.5 g, which only slightly exceeded the corresponding value in Tashkent (2802.7 ± 353 g). In the insufficiency group, neonatal weight reached 3256.4 ± 163.3 g in Namangan versus 2993.3 ± 290 g in Tashkent. In the group with normal vitamin D levels, the values were very close — 3155.3 ± 130.4 g and 3240 ± 319 g, respectively.

Newborn length was also within comparable ranges: in Namangan — from 49.0 ± 0.98 cm to 50.3 ± 0.52 cm, and in Tashkent — from 49.1 ± 1.4 cm to 50.0 ± 1.25 cm. The differences between the regions did not reach statistical significance, which confirms the universal nature of the identified trend: adequate maternal vitamin D status is associated with more favorable neonatal anthropometric parameters, regardless of the region of residence.

Table 2. Somatic diseases during pregnancy (abs., %)

	Namangan (n=66)			**Tashkent (n=100)**		
Groups	**1group (abs, %)**	**2 group (abs, %)**	**3 group (abs, %)**	**1 group (abs, %)**	**2 group (abs, %)**	**3 group (abs, %)**
ARI with fever	3(12,5%)	6(20%)	0 (0%)	13(31,7%)	5(12,7%)	1(3,3%)*
ARI without fever	3(12,5%)	0 (0%)	0 (0%)	23(56,1%)	5(12,7%)	3(10%)*
Anemia	12 (50%)*	12(40%)*	0	19(46,3%)	18(62%)	10(33,3%)
Urinary tract infection	18(75%)*	12(40%)*	3(25%)	21(72,4%)*	21(72,4%)*	9(30%)*

Note: $p < 0.05$ – statistically significant differences

Table 3. Course of labor (abs., %)

	Namangan (n=66)			**Tashkent (n=100)**		
Groups	1group (abs, %)	2 group (abs, %)	3 group (abs, %)	1 group (abs, %)	2 group (abs, %)	3 group (abs, %)
Preterm deliveries	6(25%)	3(10%)	0 (0%)	13(31,7%)	5(17,3%)	1(3,3%)*
Term deliveries	18(75%)	27(90%)	12(100%)	28(68,3%)	24(82,7%)	29(96,7%)*

Note: *$p < 0.05$ – statistically significant differences (only in Tashkent)

Table 4. Anthropometric parameters of newborns after delivery (M ±m)

	Namangan (n=66)			**Tashkent (n=100)**		
Groups	1group	2 group	3 group	1 group	2 group	3 group
Weight, g	3014,5 ±278	3155,4 ±163	3256,3 ±130	2802,7 ±353	2993,3 ±290	3240 ±319
Length, sm	49,1 ±0.98	49,1 ±0.52	49,1 ±0.5	49,1 ±1.4	49,8 ±2,05	49,8 ±2,05

Note: $p > 0.05$ in all groups

Table 5. Apgar score of newborns (M ±m)

	Namangan (n=66)			**Tashkent (n=100)**		
Groups	1group	2 group	3 group	1 group	2 group	3 group
1minute	5,3 ±2,82	5,8 ±1,13	7,1 ±0,88	5,3 ±2,82	5,8 ±1,13	7,1 ±0,88
5 minutes	6,3 ±2,82	6,40 ±0,27	6,75 ±0,48	7,63 ±0,50	7,4 ±0,27	7,7 ±0,48

Note: $p > 0.05$ in all groups

Assessment of neonatal condition using the Apgar score **(Table 5)** demonstrated that mean Apgar values at the 1st and 5th minutes were higher in groups with adequate vitamin D levels in both Namangan and Tashkent. In Groups 1 and 2, the indicators in Namangan slightly exceeded those in Tashkent, whereas in Group 3, newborns in Tashkent showed higher mean scores (7.1 ±0.88 and 8.8 ±0.93 versus 6.75 ± 0.48 and 7.75 ± 0.48, respectively). Despite these differences, statistical significance between the regions was not confirmed. The overall trend remained consistent: with optimal maternal vitamin D levels, newborn Apgar scores were higher.

4. Conclusions

The present study revealed that vitamin D deficiency and insufficiency are widespread both in Namangan region and in Tashkent city, with differences in distribution: vitamin D deficiency was more frequently observed in Tashkent, whereas insufficiency predominated in Namangan. Pregnant women with vitamin D deficiency more often experienced pregnancy complications such as urinary tract infections, anemia, and respiratory infections. In Namangan, the association with urinary tract infections and anemia was more pronounced, while in Tashkent deficiency was accompanied by a higher frequency of respiratory diseases. Comparative analysis of the course of labor showed no statistically significant differences between the regions in the rates of preterm and term deliveries. Birth weight and length, as well as Apgar scores, were higher in newborns of mothers with adequate vitamin D levels; however, interregional differences were not statistically significant ($p > 0.05$).

Thus, the findings confirm the importance of maintaining optimal vitamin D sufficiency during pregnancy for favorable gestational course and neonatal outcomes. Regardless of the region of residence, adequate maternal vitamin D levels are associated with improved newborn health indicators.

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