

MICROBIOLOGICAL CHARACTERISTICS OF VAGINAL FLORA IN WOMEN IN LABOR DEPENDING ON THE CLIMATO-GEOGRAPHICAL ZONE OF RESIDENCE

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ABSTRACT

The study was conducted in the southern region of the Kyrgyz Republic — Osh Province. The research subjects were women of reproductive age (19 to 36 years) who were permanent residents of the region. A total of 34 women were examined. The identification of isolated microorganisms was carried out based on their morphological, staining, cultural, and biochemical properties. All procedures were performed in accordance with the official methodological guidelines issued by the Ministry of Health of the Kyrgyz Republic: Order No. 274 of May 25, 2010; Order No. 139 of February 25, 2016; and Order No. 104 of March 15, 2011. The vaginal microbiota is a complex microbial ecosystem dominated by obligate anaerobes, primarily *Lactobacillus* species, which play a central role in maintaining a stable vaginal environment. Disturbance of this microbial balance — known as dysbiosis or bacterial vaginosis — is associated with a reduction in lactobacilli and an overgrowth of facultative and anaerobic pathogens such as *Gardnerella vaginalis*, *Mobiluncus* spp., *Candida* spp., *Staphylococcus* spp., and *Escherichia coli*. Several studies have shown that the composition of the vaginal microbiome may vary significantly depending on environmental and geographic factors, such as climate, altitude, diet, ethnicity, and lifestyle. Microbiological analysis revealed that in parturient women living in lowland areas, *Staphylococcus epidermidis* was detected in 19.4% of cases, *Staphylococcus aureus* in 25%, and *Lactobacillus* spp. in 20% of samples. In high-altitude residents, *Staphylococcus epidermidis* was found in 12.9% of cases, *Staphylococcus aureus* in 9.6%, and *Lactobacilli* in 37% of women. Yeast infections were represented by *Candida albicans* in 22% and *Candida crusei* in 41.9% of cases. These findings suggest that the vaginal micro ecosystem in parturient women is a highly labile environment, sensitive to various environmental and lifestyle influences.

Keywords: Vaginal Microbiota, *Lactobacillus*, *Candida*, Altitude, Parturient Women, Kyrgyz Republic.

I. INTRODUCTION

The study was conducted in the southern region of the Kyrgyz Republic — Osh Province. The research subjects were women of reproductive age (19 to 36 years) who were permanent residents of the region. The vaginal microbiota is a complex microbial ecosystem dominated by obligate anaerobes, primarily *Lactobacillus* species, which play a central role in maintaining a stable vaginal environment. These bacteria produce lactic acid, hydrogen peroxide, and other antimicrobial compounds, maintaining an acidic vaginal pH (3.8–4.4) that inhibits the growth of pathogenic and opportunistic microorganisms [1, 2]. Disturbance of this microbial balance — known as dysbiosis or bacterial vaginosis — is associated with a reduction in lactobacilli and an overgrowth of facultative and anaerobic pathogens such as *Gardnerella vaginalis*, *Mobiluncus* spp., *Candida* spp., *Staphylococcus* spp., and *Escherichia coli* [3, 4]. Vaginal dysbiosis has been linked to adverse gynecological and obstetric outcomes, including preterm labor, chorioamnionitis, postpartum infections, and infertility [5].

Several studies have shown that the composition of the vaginal microbiome may vary significantly depending on environmental and geographic factors, such as climate, altitude, diet, ethnicity, and lifestyle [6, 7]. It has been reported that living in high-altitude regions may reduce the prevalence of fungal and anaerobic infections while supporting the dominance of beneficial *Lactobacillus* species [8]. Pregnancy and childbirth introduce physiological and immunological changes that alter the host's microbial resistance, making the vaginal

microbiota particularly important during this period. The integrity of the local microbial ecosystem contributes to colonization resistance and plays a crucial role in protecting maternal and neonatal health [9].

Despite growing interest in the vaginal microbiome, there remains a lack of comparative research evaluating the influence of altitude and environmental conditions on the vaginal microbiota in parturient women. This knowledge gap underscores the relevance of the present study.

II. MATERIALS AND METHODS

The study was conducted in the southern region of the Kyrgyz Republic — Osh Province. The research subjects were women of reproductive age (19 to 36 years) who were permanent residents of the region. A total of 34 women were examined.

The identification of isolated microorganisms was carried out based on their morphological, staining, cultural, and biochemical properties. All procedures were performed in accordance with the official methodological guidelines issued by the Ministry of Health of the Kyrgyz Republic:

- Order No. 274 of May 25, 2010: "On the approval of methodological instructions for the storage, preparation, quality control, and calculation of nutrient media usage in bacteriological laboratories";
- Order No. 139 of February 25, 2016: "Methodological recommendations for the identification and antimicrobial susceptibility testing of microorganisms";
- Order No. 104 of March 15, 2011: "On the approval of methodological guidelines for ensuring biological safety in laboratories working with microorganisms of pathogenicity groups I–IV".

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Disturbance of this microbial balance — known as dysbiosis or bacterial vaginosis — is associated with a reduction in lactobacilli and an overgrowth of facultative and anaerobic pathogens such as *Gardnerella vaginalis*, *Mobiluncus* spp., *Candida* spp., *Staphylococcus* spp., and *Escherichia coli* [3, 4]. Vaginal dysbiosis has been linked to adverse gynecological and obstetric outcomes, including preterm labor, chorioamnionitis, postpartum infections, and infertility [5].

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Pregnancy and childbirth introduce physiological and immunological changes that alter the host's microbial resistance, making the vaginal microbiota particularly important during this period. The integrity of the local microbial ecosystem contributes to colonization resistance and plays a crucial role in protecting maternal and neonatal health [9].

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The obligate microflora of the vagina in women of reproductive age is dominated by lactobacilli, mainly *Lactobacillus crispatus*, *L. jensenii*, *L. iners*, and *L. gasseri*. They play a key role in maintaining microbiological homeostasis by competing for nutrient substrates, producing antibacterial metabolites (including lactic acid, hydrogen peroxide and bacteriocins) and exerting an immunomodulatory effect [1, 2, 3].

Lactobacilli break down glycogen deposited in the vaginal epithelium under the influence of oestrogens into glucose and then into lactic acid, forming an acidic environment (pH 3.8–4.4) that prevents colonisation by pathogenic and conditionally pathogenic microflora [4, 5]. According to recent meta-analyses, the presence of dominant lactobacillary flora is associated with a lower risk of bacterial vaginosis, yeast infection, premature birth, and postpartum complications [6, 7].

Microbiological characteristics in parturient women depending on their place of residence. An analysis of the vaginal microflora in parturient women living in lowland areas revealed the following distribution of microorganisms: *Staphylococcus epidermidis* was detected in 19.4% of cases; CFU — 33.6 ± 4.1 , number of microbial bodies — 1682.3 ± 233.5 ; *Staphylococcus aureus* — in 25% of cases; CFU — 39.1 ± 3.0 , microbial density — 1966.6 ± 198.0 ; *Lactobacillus* spp. — in 20% of samples; CFU — 21.8 ± 2.3 , number of microbial bodies — 1093.3 ± 117.2 ;

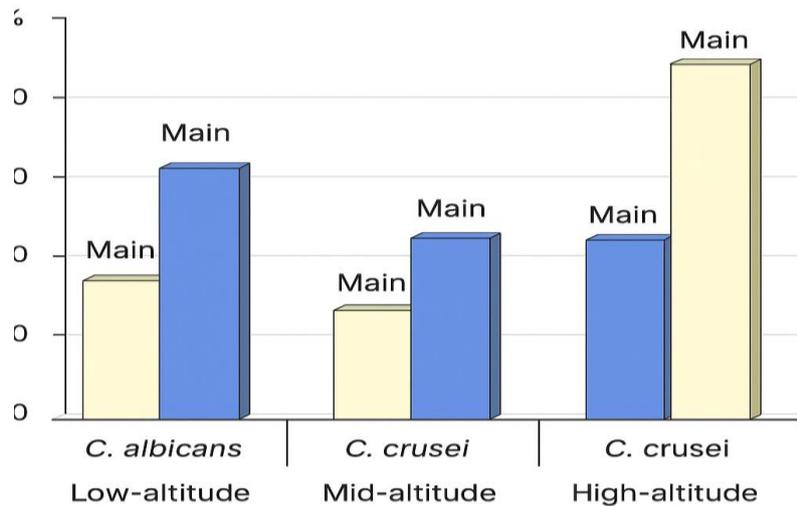


Fig. Frequency of vaginal isolation of staphylococci in parturient women living in low-, mid-, and high-altitude regions.

Note: * - $p < 0.05$ compared to the low-altitude group (statistically significant).

In parturient women residing in high-altitude regions the following microbial distribution was observed: *Staphylococcus epidermidis* — in 12.9 % of cases; CFU (colony-forming units) - 31.4 ± 5.0 ; microbial counts - 1587.2 ± 271.0 . *Staphylococcus aureus* was isolated much less frequently — 9.6 % of cases; CFU - 24.0 ± 10.3 ; microbial counts - 1233.3 ± 536.0 . *Lactobacilli* were isolated in 37 % of women; CFU - 34.0 ± 3.7 ; microbial counts - 1616.6 ± 135.0 . Yeast infections: *Candida albicans* - 22.0 %; *Candida crusei* - 41.9 %; CFU - 23.3 ± 3.8 and 26.7 ± 4.4 respectively; fungal counts - 1192.8 ± 167.9 and 1353.8 ± 228.4 accordingly.

These findings suggest that the vaginal micro-ecosystem in parturient women is a highly labile environment, sensitive to various environmental and lifestyle influences. A complicated obstetric history and the use of specific contraceptive methods prior to pregnancy (e.g., hormonal contraceptives or intrauterine devices) are associated with shifts in the vaginal flora composition: hormonal contraceptives are linked with increased colonization by *Candida* and *Gardnerella*, while intrauterine devices are correlated with a higher number of women colonised by *Staphylococcus aureus* and *Gardnerella*. The mechanism of bacterial colonisation of mucosal surfaces involves two principal stages: adhesion to epithelial cells and survival under altered environmental conditions. Even under physiological labor stress, living in mid- or high-altitude settings introduces additional stressors (hypoxia, arid air, diminished host immunity) that also affect the microorganisms attempting colonisation of a new biotope.

III. CONCLUSION

1. The composition of the vaginal microbiome in parturient women appears to be significantly influenced by the altitude and ecological conditions of their residential region.
2. A higher prevalence of *Lactobacillus* spp. and a lower occurrence of opportunistic pathogens in mid- and high-altitude populations suggest potential microbiological adaptation to environmental stressors.
3. The unexpectedly high detection rate of *Candida crusei* in high-altitude subjects warrants further investigation regarding its epidemiological patterns and antifungal susceptibility.
4. Prior contraceptive use and adverse obstetric history were found to correlate with altered microbial colonization, which may be relevant for prenatal and postpartum management.

5. These findings support the need for geographically tailored maternal care strategies aimed at reducing the risk of vaginal dysbiosis and related complications during childbirth.

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