Open Journal of Medical Microbiology, 2020, 10, 162-169
https://www.scirp.org/journal/ojmm
ISSN Online: 2165-3380
ISSN Print: 2165-3372

Microflora Formation in Newborns Depending on the Mother Microbiological Profile and Locality Altitude

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How to cite this paper: Orunbaeva, B., Attokurov, K., Attokurova, G., Abdullaeva, Z., Aytieva, F. and Tuychieva, D. (2020) Microflora Formation in Newborns Depending on the Mother Microbiological Profile and Locality Altitude. *Open Journal of Medical Microbiology*, **10**, 162-169.
https://doi.org/10.4236/ojmm.2020.103014

Received: August 14, 2020
Accepted: September 15, 2020
Published: September 18, 2020

Abstract

Aims: This work is aimed to investigate microflora formation, quantitative and qualitative features of various bacteria colonization in the women in labor, and newborns depending on the microbiological profile and locality altitude. **Rationale:** Physiological and social adaptation of newborns in extreme climate of mountains, in particular the microflora formation in unusual conditions studied. **Findings:** In the study of nasal microflora, the *C. albicans* species in case of women in labor were 77.7%, while in the newborns *C. albicans* species were 2 times less. In lowlands, the *S. aureus* type was prevailed, while in case of midlands prevailed bacterium was *S. epidermidis*. In the newborns of highlands, *E. coli* was prevailed, as in the examined lowlands, it found as 75%. In the women in labor, *C. albicans* were detected as 56.6%, *C. krusei* was 36.6%, *S. aureus* was 23.3%, *S. epidermidis* was 60% and *E. coli* was 30%. In newborns, representatives of candida fungi found: *C. albicans* was 3.3%, *C. krusei* was 26.6%, *S. aureus* was 43.3%, *S. epidermidis* was 53.6% and *E. coli* was 36.6%. **Conclusions:** In this work, we determined bacterial microflora colonization in throat, nasal, vaginal, urinoculture and skin swab of women in labor and newborns in lowland, midland and highland conditions, respectively.

Keywords

Microflora, Woman in Labor, Newborns, Microbiological Profile, Bacteria

1. Introduction

Microflora formation in newborns has potential to influence and impact the physical and neurocognitive development; numerous species and strains of bacteria exist in the neonatal microbiota [1] [2]. According to the UN Commission on Sustainable Development, the well-being of half of humanity in the XXI century related to the quality of development and development of mountainous territories [3]. As it is known, the species composition of human microflora is constantly changing, and its stability is considered as a relative due to alterations caused by bacterial infections [4], pharmacodynamic and pharmacokinetic of selected antibiotics [5], lifestyle and the dietary alterations inducing temporary microbial shifts within one day [6] [7]. Newborns early life immune system is not stable. It is rapidly adapting to environmental conditions and interventions aimed to protect organism against various pathogens and disorders [8] as represented in **Figure 1**. Conditions for initial microbiota colonization in infants are resulting in a symbiotic relationship between the colonizing bacteria and intestinal epithelial with lymphoid tissues [9] as represented in **Table 1**.

2. Research Methods

Studies conducted in various heights in the southern region of Kyrgyzstan, under examination of 133 women in labor aged from 17 to 43 years old, and 133 newborns. Examined people divided into three groups according to the locality altitude in which they are living:

1) Residents of the lowlands, Kurshab at 1012 m above the sea level;

2) The inhabitants of the middle mountains, Zhalpak-Tash at 2000 - 2500 m above the sea level;

3) The inhabitants of the highlands Sary-Tash, at 3325 m above the sea level.

Table 1. Phases of intestinal colonization of the infant intestine.

Phase one	Intrauterine period The fetus becomes exposed to maternal microbiota through transplacenta passage into amniotic fluid
Phase two	1st week of life The newborn ingests maternal vaginal/colonic microbiota with passage through the birth canal (full term, vaginal delivery)
Phase three	Two weeks to four months Introduction of oral liquid feedings
Phase four	Four months to one year Period of weaning to solid foods
Phase five	One to three years Infant receives table food and intestinal microbiome resembles that of adult intestine (diversity of bacteria with greater than 1000 species)

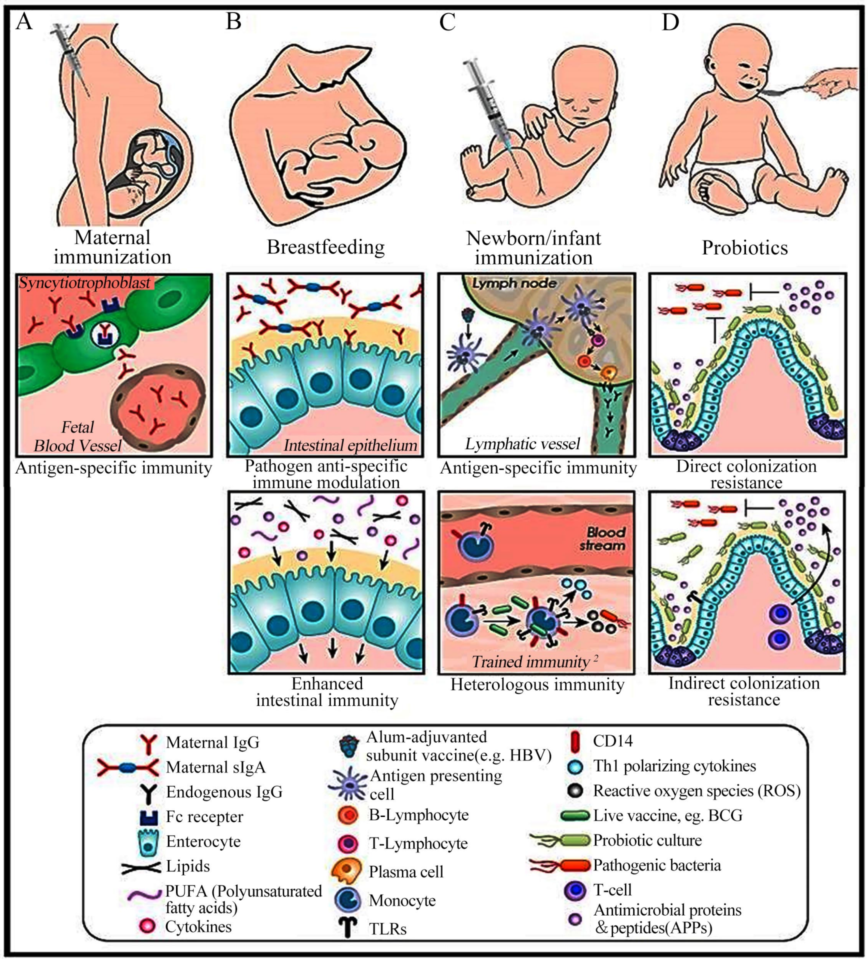

Figure 1. Interventions that Broadly Enhance Host Defense against Infectious Disease in Early Life There are key windows of opportunity during prenatal life and early postnatal life to enhance host resistance to specific infections via homologous *i.e.*, pathogen and thus classic antigen specific responses (top panels)-as well as broadly protective heterologous ("non-specific") responses (bottom panels). (A) Maternal immunization leverages passive transfer of maternal IgG antibodies across the placenta that can protect the fetus and newborn. The specificity of the maternal IgG reflects past maternal exposures thereby targeting specific pathogens. (B) Top panel shows that breastfeeding provides secretory IgA, with specificities reflecting maternal microbiota, transferred across the gut along with maternal IgG bound to antigen; whereas the bottom panel shows that breastmilk also contains soluble factors, including cytokines, lipids, and fatty acids, that broadly enhance mucosal resistance to infection. (C) Early life immunization of the newborn or young infant reduces risk for infection with (C-top) specifically-targeted pathogens; (C-bottom) live attenuated vaccines such as Bacille Calmette Gue'rin (BCG) provide broader heterologous ("non-specific") protection, possibly via "trained immunity" mediated by epigenetic reprograming of monocytes. (D) Probiotics reduce infection. Mechanisms underlying probiotic effects remain under study and may include, for example, (D-top panel) enhancement of colonization resistance wherein bacteriocin production by probiotic bacteria targets specific pathogens without affecting commensal flora, and (D-bottom) mucosal PRR signaling-mediated enhancement of immune development, including intestinal epithelial cell expression of antimicrobial protein and peptide (APPs) as well as innate lymphoid cells and mucosal Th17 and Treg development (reprinted with permission of Elsevier) [8].

Healthy women in labor and newborns considered according to the inclusion criteria. Studies conducted all year round. Our purpose was to determine quantitative and qualitative values of various bacterial growth and colonization in the healthy women in labor and newborns microscopically. Variables were excluded in this research. Bacteriological studies carried out in accordance with the Order of the Ministry of Health of the Kyrgyz Republic No. 4 from January 11.2010.11, "Methodological instructions for bacteriological methods of laboratory research of clinical material". Work carried out at the Laboratory of Microbiology, Immunology and Virology of the Institute of Medical Problems of the Southern Branch of the National Academy of Sciences of the Kyrgyz Republic.

Microbiological methods such as isolation of bacteria, method of culture and identification of microbiota applied in this study. Types of samples: throat and skin swabs, nasal mucus, urine culture tested for microflora content.

3. Results and Discussions

In this study the throat microflora of women in labor and newborns in lowland conditions examined, during which the *C. albicans* bacteria [10] [11] detected in 19.4% mothers and in 6.9% of newborns, respectively (**Figure 2**). In the midland and highland conditions, this microflora was not found in the pharynx. In pharynx microflora of women in labor and newborns, *C. krusei* [12] bacteria observed only in lowland conditions. In the midland and highland, *C. albicans* bacteria not detected. *S. aureus* [13] found in all three studied groups: in lowlands, it was 8.4% in women in labor and 5.5% in newborns. In midland conditions, the *S. aureus* bacteria found as 23.3% in women in labor, and in newborns, it was 20%, which is 17.3% and 26.6% higher than in the lowland group. In highlands of women in labor, *S. aureus* noted as 35.4% of cases and in 25.8% in newborns, which is almost 3 times more in comparison with the lowland group.

In the study of nasal microflora (**Figure 3**), we found the *C. albicans* species in case of women in labor were 77.7%, while in newborns *C. albicans* species were 2 times less. In women of the midlands, this indicator reduced and amounted to 53%, while in newborns it found only in 13% of cases, which was amounted to 34.6% in relation to the lowlandgroup. In women of the alpine group, this indicator was 45%, while in newborns the *C. albicans* bacteria not found. *C. krusei* bacteria found in the women in labor in low and middle mountain conditions noted as almost 40% of cases, in newborns two times less. **Figure 3** is showing microflora of nose in highland conditions, where *C. albicans* not detected in newborns. *S. aureus* bacteria in all groups were three times less in newborns comparing to the women in labor.

S. epidermidis bacteria dominated in the urine culture of women in labor at highlands, midlands and lowlands, as well as in newborns at lowland and highlands, at highest percentage (**Figure 4**). In newborns, urine culture at midlands contained dominated *S. aureus* bacteria. In the lowland conditions, in 72 women in labor *C. albicans* presented as 11%, *S. aureus* was 15%, and *S. epidermidis* was

25%. *E. coli* found 22%, *P. rettrgeri* was 22%, *P. mirabilis* was 31%, and *P. vulgaris* was 15%. In newborns urine culture *C. albicans* was detected 13%, *S. aureus-was* 12%, and *S. epidermidis* was 20%, microbe species of the *P. rettgeri*, *P. mirabilis*, *P. vulgaris* and *Klebsiella* observed too. In the midland conditions, 30 women in labor and 30 newborns examined where from the pathogenic microflora the following bacteria species detected:

S. aureus was 40%, *S. epidermidis* was 50%, *C. albicans* was 9% - 30%, and *E. coli* bacteria were 15%. In highlands, 31 women in labor and newborns examined where for women in labor the highest percentage of microflora dominated by *S. Epidermidis* species.

Skin swab microflora of women in labor and newborns analyzed for presence of bacteria. In lowlands, the *S. aureus* type was prevailed, while in case of midlands prevailed bacterium was *S. epidermidis* (**Figure 5**). In the newborns of highlands, *E. coli* was prevailed, as in the examined lowlands it found as 75%. All microflora representatives in the woman in labor and in newborns were 79%, in the woman in labor of midlands were 66%, and in newborns were 58%. In the highlands of the examined women in labor microflora bacteria were 31.1%, while in newborns were 22%.

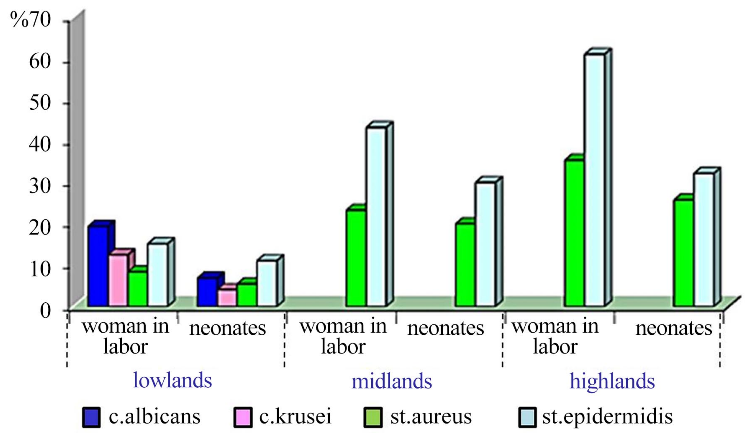

Figure 2. Microflora of the throat of women in labor and newborns.

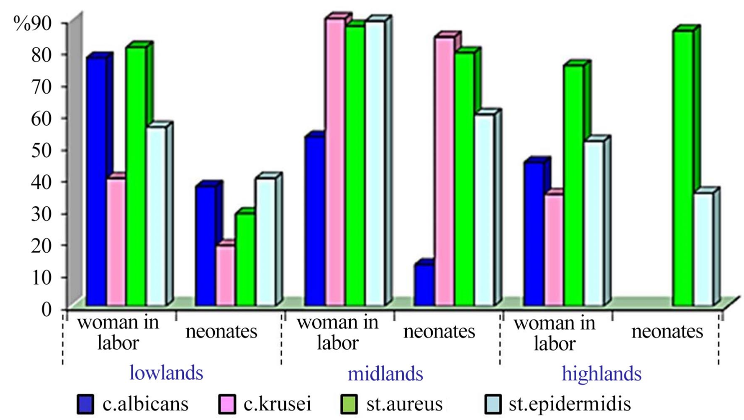

Figure 3. Microflora of the nose in women in labor and newborns.

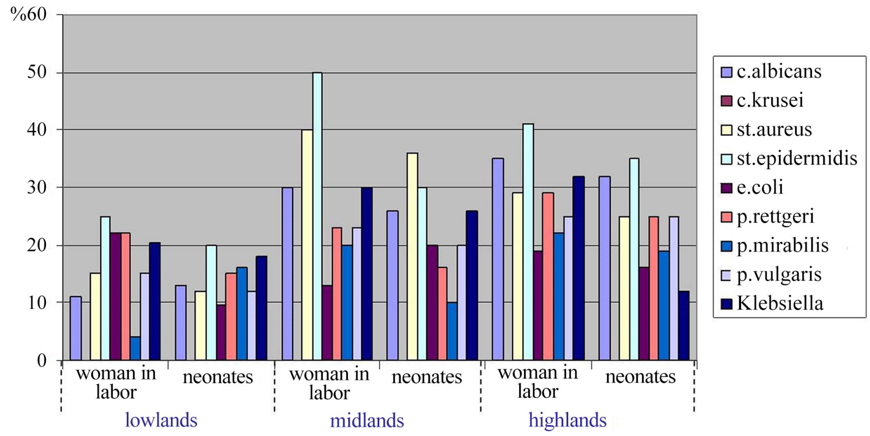

Figure 4. Microflora of the urine culture in various altitudes for woman in labor and newborns.

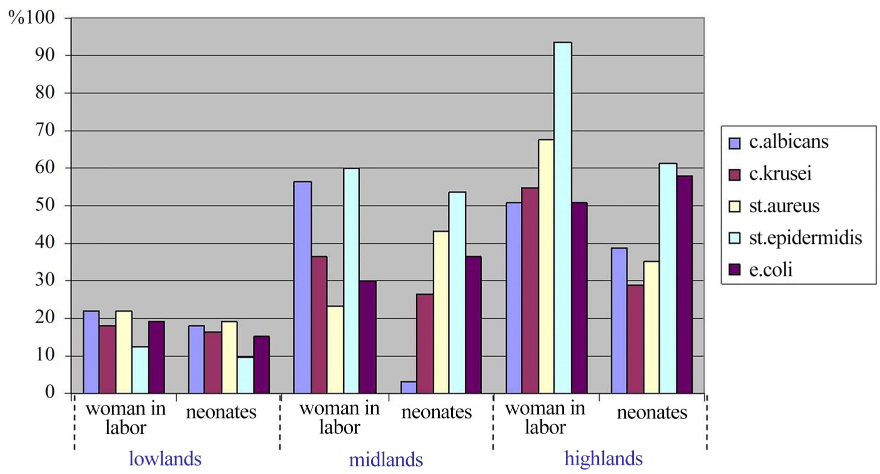

Figure 5. Skin swab microflora of woman in labor and newborns.

In the lowland conditions, skin swab microflora examination was performed for 72 women in labor, where *C. albicans* was 22.2%, *C. krusei* was 18%, *S. aureus* was 22%, *S. epidermidis* was 12.5%, *E. coli* was 19.4%. In newborns, *C. albicans* found as 18.0%, *C. krusei* was 16.6%, *S. aureus* was 19.4%, *S. epidermidis* was 9.7%, and *E. coli* was 11% - 15.2%. As can be seen from the table, a high percentage of *S. aureus* observed for women in labor and newborns.

In the midland conditions, 30 women in labor and newborns examined. In the women in labor *C. albicans* were detected as 56.6%, *C. krusei* was 36.6%, *S. aureus* was 23.3%, *S. epidermidis* was 60% and *E. coli* was 30%. In newborns, representatives of candida fungi found: *C. albicans* was 3.3%, and *C. krusei* was 26.6%, *S. aureus* was 43.3%, *S. epidermidis* was 53.6% and *E. coli* was 36.6%. In case of highlands 31 inhabitants including woman in labor and newborns examined, where microflora of woman in labor showed *C. albicans* as 51%, *C. krusei* was 54%, *S. aureus* was 67.7%, *S. epidermidis* was 93.5%, and *E. coli* was 51%. In the newborns *C. albicans* was 38.7%, *C. krusei* was 29%, *S. aureus* was 35.4%, *S. epidermidis* was 61%, and *E. coli* was 58%.

4. Conclusion

Throat examination of woman in labor and newborns in midlands and highlands showed no candida detected. In the low mountain conditions 1012 meters above sea level, a higher percentage of candida observed for women in labor, while in newborns epidermal staphylococcus dominated. Nose microflora in lowlands showed a high percentage of *C. albicans* and *S. aureus* bacteria in both mothers and newborns. In the midlands, the large number of *S. aureus* observed for women in labor, and in newborns, *S. epidermidis* found, while in the newborns of highlands, this yeast not detected. In newborns, urine culture at midlands contained dominated *S. aureus* bacteria. Skin swab microflora of women in labor and newborns analyzed for presence of bacteria. In lowlands, the *S. aureus* type was prevailed, while in case of midlands prevailed bacterium was *S. epidermidis*.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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