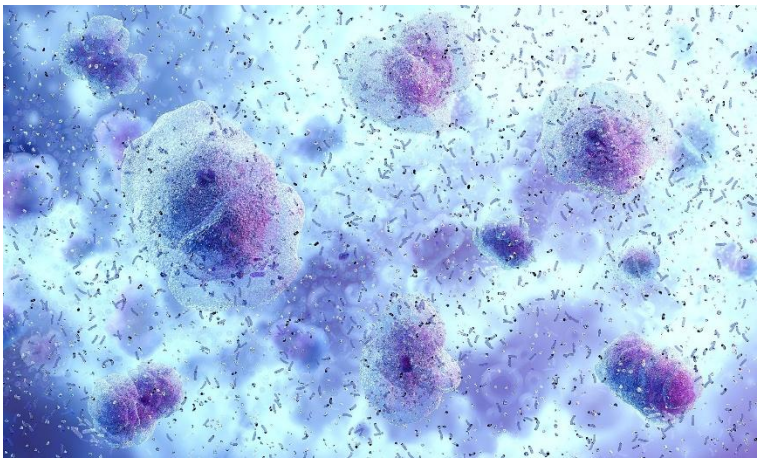
Between Vaginal Microbiota Composition and Psychological Profiles Integrated Microbiome and Metabolomic Analysis Reveals Associations

A recent cross-sectional study published suggests that the vaginal microbiome may be linked to selected psychological traits and local metabolic patterns. Distinct vaginal community-state types (CSTs) were associated with reward responsiveness, motivational drive, and behavioral inhibition. Exploratory analyses suggested that metabolites may statistically account for some of these associations. Larger longitudinal studies of women are needed to determine whether these patterns hold and to better understand how the vaginal microbiome may relate to psychological health.

The vaginal microbiome plays an important role in women's health, but its composition can shift for several reasons. These include hormonal changes, smoking, sexual behavior, urogenital infections, and the use of antibiotics or topical products. How psychological factors interact with these changes is still not fully understood.



Study

In this study, researchers in Italy combined microbiome profiling with metabolomic assessment to investigate links between the vaginal microbiome and psychological characteristics in 105 women of reproductive age.

From November 2023 to April 2024, researchers enrolled Caucasian women aged at least 18 years who were sexually active with men and volunteered while attending degree programs at the University of Bologna. Participants had not used vaginal douches or topical agents during the preceding two weeks, or antibiotics or antifungals during the preceding month. None of them had been diagnosed with chronic medical conditions such as diabetes, human immunodeficiency virus (HIV) infection, autoimmune diseases, or cancer. The researchers also excluded pregnant women, women menstruating at sampling, those who smoked more than 15 cigarettes a day, those with sexually transmitted urogenital infections, and women with a history of mental health disorders or systemic or topical probiotic use.

Participants provided two self-collected vaginal swab samples for analysis. One was used to assess vaginal pH, bacterial vaginosis, and sexually transmitted infections. The other sample underwent 16S ribosomal ribonucleic acid (rRNA) gene sequencing to classify microbial communities into community-state types (CSTs). The researchers also performed nuclear

magnetic resonance (NMR) spectroscopy to identify the metabolites present in the second swab sample.

Exploratory mediation analyses examined whether metabolites could statistically account for associations between CSTs and behavioral activation and inhibition dimensions. For each participant, the researchers collected information on age, body mass index (BMI), educational attainment, employment, contraceptive use, smoking habits, and vaginal symptoms.

Participants also completed established self-report questionnaires that explored various aspects of psychological health, including motivation, emotional regulation, responses to rewards, perceived stress, anxiety, depression, and somatization. These included the Behavioral Activation System (BAS), Behavioral Inhibition System (BIS), State-Trait Anxiety Inventory (STAI-Y2), Difficulties in Emotion Regulation Scale (DERS), Beck Depression Inventory (BDI), Perceived Stress Scale (PSS), and Psychosomatic Problem Scale (PSP). The investigators used linear regression adjusted for demographic and health-related factors to examine how CST profiles related to psychological outcomes. Structural equation modeling (SEM) was then used to estimate direct and indirect statistical associations involving CSTs, metabolites, and psychological scores.

Findings

The participants were 22 years old on average, with a mean body mass index (BMI) of 21.5 kg/m^2 and vaginal pH of 4.33. Around 40% reported vaginal symptoms, while 57% had taken at least one antibiotic course in the preceding year; 24.8% reported two courses. CST I, II, and V were the most common profiles, together accounting for 52.4% of participants. CST III was found in 30.5% of women, while CST IV was identified in the remaining 17%. Only 18 participants had CST IV, and 93% of the cohort were students.

Women in the CST IV group had significantly lower scores for reward responsiveness and goal-directed motivation. Participants in the CST III group, dominated by Lactobacillus iners, scored lower on the BIS scale, indicating a weaker tendency to inhibit behavior in response to uncertainty or potential threats. No significant CST associations were identified for trait anxiety, depression, perceived stress, overall emotion-regulation difficulties, or somatization. Exploratory models linked CST IV to lower aminobutyrate (GABA) and valine levels. Across the cohort, these metabolites were statistically associated with lower BAS-Reward Responsiveness and BAS-Drive scores, respectively. For phenylalanine, the model showed an indirect association with BIS that pointed in the opposite direction to the direct association; CST IV had no significant overall association with BIS.

CST IV showed lower lactate levels and higher levels of short-chain fatty acids (SCFAs), sugars, and biogenic amine-related metabolites. Several amino acids were depleted, while glucose, choline, and other metabolites were elevated. Succinate levels were higher in the combined CST I, II, and V group than in CST III.

Higher phenylalanine levels tended to occur alongside higher BIS scores, whereas benzoate levels showed the opposite pattern. In participants with greater BAS-Reward Responsiveness, valine, threonine, lactate, and GABA levels were also higher. BAS-Drive correlated positively with valine, while BAS-Fun Seeking was associated with amino acids and cadaverine. The psychological correlation and regression analyses were exploratory and were not corrected for multiple comparisons, increasing the possibility of chance findings.

Conclusion

The findings link CST IV, a polymicrobial vaginal community with reduced Lactobacillus dominance, to lower reward responsiveness and motivational drive scores. CST III was also associated with lower behavioral inhibition scores. The results support a biopsychosocial perspective on vaginal health, but future research with diverse populations is required to establish whether microbiome changes influence psychological functioning or vice versa. The cross-sectional design cannot determine causality, and vaginal metabolite measurements do not establish effects on circulating metabolites or brain signaling.

Future longitudinal studies should investigate the potential roles of GABA, valine, and phenylalanine alongside plasma and vaginal metabolomic profiles, inflammatory and endocrine markers, and neurobiological assessments. This could help clarify whether local metabolic changes contribute to the broader relationship between vaginal microbiome composition and psychological health.

Source:

https://www.news-medical.net/news/20261026/The-vaginal-microbiome-may-relate-to-more-than-reproductive-health.aspx