

CORRECTION OF HALITOSIS IN CHRONIC INFLAMMATORY DISEASES OF THE OROPHARYNX IN ADULTS

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Abstract:

Chronic pharyngitis, characterized by persistent oropharyngeal discomfort, halitosis, and mucosal hyperemia, significantly impairs quality of life. This study evaluates the efficacy and safety of *Streptococcus salivarius* K12, a probiotic strain included in the product BactoBLIS, in managing symptoms of chronic oropharyngeal inflammatory diseases. A prospective observational study involving 45 adult patients with chronic catarrhal pharyngitis was conducted from September 2019 to January 2020. Patients were administered *S. salivarius* K12 lozenges (1×10^9 CFU) nightly for 14 days. Clinical symptoms were assessed using a visual analogue scale (VAS) at baseline, day 7, and day 14. Statistically significant improvements were observed in pain during swallowing (from 5.69 ± 0.39 to 0.08 ± 0.05 points), foreign body sensation (from 6.88 ± 0.23 to 0.69 ± 0.12 points), and halitosis severity (from 6.16 ± 0.31 to 0.68 ± 0.29 points). No adverse effects were reported, and good adherence to therapy was noted. The findings demonstrate the probiotic's potential as a safe and effective treatment for halitosis and other symptoms associated with chronic pharyngitis.

Keywords: *Chronic pharyngitis, halitosis, Streptococcus salivarius K12, probiotics, oropharyngeal diseases, BactoBLIS, microbiota, visual analogue scale (VAS), therapy compliance.*

Recently, there has been an increase in the number of patients with complaints of pain when swallowing, soreness, a feeling of dryness and a foreign body in the oropharynx, dry cough and bad breath, which persist for a long time and significantly worsen the quality of life. When examined by an otorhinolaryngologist, hyperemia of varying intensity of the mucous membrane of the posterior wall of the pharynx, anterior palatine arches and the palatine tonsils is revealed. After conducting additional studies to exclude neoplasms of the pharynx and larynx, the main diagnosis in patients with these complaints is chronic pharyngitis.

It should be noted that a distinctive feature of chronic inflammatory diseases of the oropharynx is refractoriness to therapy with local antiseptics, which manifests itself in the long-term persistence of complaints.

Most often, this condition develops against the background of gastroesophageal reflux disease (GERD), chronic gastritis or other chronic pathology of the gastrointestinal tract, but it can also be an independent pathological process, and the main complaint in these patients is bad breath (halitosis).

Halitosis is an important medical and social problem, since bad breath negatively affects a person's quality of life, reducing his social activity, causing chronic psychological stress. Overall, halitosis occurs in approximately 25% of the population.

At the same time, as a result of the accumulation of bacteria on the root and dorsum of the tongue, as well as in the oral cavity, anaerobic putrefaction of trapped food particles and desquamated epithelial cells increases, which causes typical morning breath. Dry mouth, which occurs as a consequence of a decrease or complete cessation of salivation and leads to a decrease in the antimicrobial activity of saliva and a change in the composition of the microbial spectrum of the oral cavity from gram-positive bacteria to gram-negative species, is called xerostomia, a direct correlation between which and halitosis has been proven.

Hyposalivation can develop as a result of diabetes mellitus, thyroid dysfunction, Sjogren's syndrome, depression, stress, dehydration, taking a number of medications, nasal breathing disorders and alcohol abuse. Almost 25% of elderly people complain of dry mouth. Tonsilloliths are also a potential cause of bad breath.

When analyzing microbial profiles on the surface and inside tonsilloliths, a statistically significant difference in their qualitative composition was revealed. The interior was dominated by rod-shaped anaerobic microorganisms belonging to the genera *Eubacterium*, *Fusobacterium*, *Megasphaera*, *Porphyromonas*, *Prevotella*, *Selenomonas* and *Tannerella* and associated with the production of volatile sulfur compounds.

At the same time, coccus bacteria predominated on the surface of tonsilloliths. In addition, the accumulation of bacteria that produce volatile sulfur compounds in the crypts of the palatine tonsils can also cause halitosis. It should be noted that the microbial spectrum of the palatine tonsils, even in healthy people, is not a constant value. Its variability has been proven depending on the time of year.

Bad breath can also accompany diseases of the gastrointestinal tract, including GERD, gastric and duodenal ulcers, especially when contaminated with *Helicobacter pylori*.

Thus, despite the widespread prevalence of chronic inflammatory pathology of the oropharynx, the problem of therapeutic approaches to treatment remains relevant. In this regard, it was decided to conduct an observational study to evaluate the effect of the probiotic bacteria *Streptococcus salivarius* K12 on the regression of clinical signs in chronic inflammatory diseases of the oropharynx in adult patients.

Probiotic bacteria *S. salivarius* are a new line of probiotics aimed at supporting and restoring the microflora of the mouth and throat. This direction is promising from the point of view of preventing and reducing the frequency of relapses of chronic inflammatory infections in otorhinolaryngology, since these probiotic bacteria are capable of inhibiting key pathogens of infections of the oral cavity and throat and restoring local microbiocenosis, thereby playing an important role in preventing the development of inflammatory diseases.

The purpose of the study was to evaluate the effectiveness and safety of the probiotic strain *Streptococcus salivarius* K12 as part of the BactoBLIS product for chronic inflammatory diseases of the oropharynx accompanied by halitosis.

Material and methods

A prospective observational study was conducted in adult patients with chronic oropharyngeal diseases. 45 people were under observation in the outpatient departments of otorhinolaryngology of the Federal State Budgetary Institution "OBP" by the Administrative Department of the President of the Russian Federation and the Federal State Budgetary Institution "9th LDC" of the Ministry of Defense of Russia in the period from September 2019 to January 2020 - 16 men (age 42.93 ± 3.0 years) and 29 women (age 40.55 ± 2.62 years) with a diagnosis of chronic catarrhal pharyngitis.

Of these, 33 patients, along with hyperemia of the mucous membrane of the posterior pharyngeal wall, also had hyperemia of the mucous membrane of the palatine tonsils; 5 patients had a previous history of tonsillectomy. Confirmed GERD was registered in 33 patients of the general group, of which 30 patients were simultaneously diagnosed with inflammatory phenomena on both the posterior wall of the pharynx and the palatine tonsils.

We observed 3 patients with GERD after tonsillectomy and only with symptoms of chronic catarrhal pharyngitis. Patients were included in the study based on the clinical picture (bad breath, pain when swallowing, burning sensation, tingling or sensation of a foreign body in the oropharynx, coughing) and pharyngoscopy data (hyperemia of the mucous membrane of the posterior pharyngeal wall, palatine arches and tissue of the palatine tonsils, individual inflamed lymphoid granules in the absence of plaque on the palatine tonsils). Criteria for non-inclusion in the study: neoplasms of the nasopharynx, oropharynx, hypopharynx and larynx; treatment with antibacterial drugs for 1 month and local antiseptics for 14 days before the current visit to an otolaryngologist; age under 18 years; the presence of plaque on the mucous membrane of the oropharynx.

On the day of the patients' visit, samples were taken from the mucous membrane of the posterior pharyngeal wall, right and left palatine tonsils for microbiological examination of the microflora of the oropharynx to determine the qualitative and quantitative composition of the isolated microorganisms. The biological material was immediately delivered to the laboratory, after which the swab with a sample of the biological material was removed from the test tube with the transport medium and inoculated onto the surface of the nutrient medium in a 1/4 Petri dish, followed by sieving into sectors using a microbiological loop on nutrient media such as Columbia agar with sodium colistimethate and nalidixic acid, chocolate agar with multivitamin supplement and bacitracin, Sabouraud agar with chloramphenicol, MacConkey agar with crystal violet and selective salt medium. Immediately after seeding the biomaterial, the Petri dishes were placed in an electric dry-air thermostat TS-1/80 SPU ($t=37^{\circ}\text{C}$). After 48 hours of incubation, the Petri dishes were transferred to a laminar flow hood and the inoculated dishes were examined for the presence or absence of growth of colonies of microorganisms. Identification of microorganisms was carried out according to standard microbiological research schemes.

All patients received the probiotic strain *S. salivarius* K12 as monotherapy in the amount of 1×10^9 colony-forming units (CFU) in the form of lozenges, 1 tablet at night for 14 days.

The study was conducted in the entire cohort of patients with chronic pharyngitis, without dividing into groups based on etiology, to study the possibility of using a drug containing probiotic bacteria *S. salivarius* K12 when prescribed empirically.

The effectiveness of the probiotic was judged on the basis of medical examination data and the patient's subjective assessment of the severity of pain in the throat, a feeling of soreness or a lump in the oropharynx, and unpleasant odor from the oral cavity according to a 10-point visual analogue scale (VAS) before and at 5- th and 7th day of admission.

Statistical calculations were performed using the IBM SPSS Statistics 23.0 program. All indicators had a small coefficient of kurtosis and asymmetry, and therefore parametric statistics methods were used for their analysis. Data are presented as mean and standard deviation ($M \pm SD$). P values < 0.05 were considered statistically significant.

Results

Microbiological examination revealed the following microorganisms: *Staphylococcus aureus* in 60% of cases (from 102 to 105 CFU), *Candida albicans* in 15% of cases (from 103 to 105 CFU), *Pseudomonas aeruginosa* (103 CFU), *Streptococcus agalactiae* in 5% of cases (103 CFU), *Streptococcus viridans* in 15% of cases (from 103 to 105 CFU).

Microbiological examination did not reveal the presence of pathogenic flora with colonization of 105 CFU or higher in all patients; This is consistent with the data of our previous studies [10], and therefore repeated microbiological examination was not carried out in patients with clinical recovery.

When contacting an otorhinolaryngologist, the patient was asked to rate the severity of symptoms on a VAS scale. The following assessment results were obtained: severity of pain when swallowing - 5.69 ± 0.39 points, sensation of tickling or lump - 6.88 ± 0.23 points, severity of bad breath - 6.16 ± 0.31 points. As a result of taking the BactoBLIS product, a positive clinical effect was noted in all patients according to the three analyzed clinical signs with a statistically significant difference between the indicators on the 1st and 7th days, 7th and 14th days of observation (see table, see figure). The level of pain when swallowing on the 7th day of observation was 2.69 ± 0.34 points, on the 14th day - 0.08 ± 0.05 points. The feeling of soreness or a lump in the oropharynx on the 7th day was rated by patients as 3.54 ± 0.29 points, on the 14th day - 0.69 ± 0.12 points.

The greatest positive reaction was observed with regression of halitosis: its severity on the 7th day of taking the probiotic was 2.47 ± 0.44 points, on the 14th day - 0.68 ± 0.29 points. When examining the oropharynx, no hyperemia of the mucous membrane was observed in the patients on the 14th day of therapy. During the intake of the probiotic, good tolerability and absence of complaints were noted.

Table. Dynamics of the severity of symptoms of chronic pharyngitis depending on the duration of treatment

Discussion

Since patients with chronic pharyngitis account for up to 70% of visits in the outpatient practice of otorhinolaryngologists and often turn to therapists, general practitioners and other related specialists [13], the relevance of this problem is beyond doubt. The increase in incidence is associated with the deterioration of the environmental situation in the Russian Federation, smoking, and stressful situations. Changes in diet, active consumption of fast food products, or fast food, containing large amounts of preservatives, stabilizers, dyes and flavors, leads to chronic pathology of the gastrointestinal tract and indirectly to clinical manifestations of chronic diseases of the oropharynx. Bad breath, as one of the manifestations of chronic pharyngitis, can become a serious obstacle to interpersonal relationships, especially with the opposite sex, and affect the patient's social life and psychological health. According to psychologists, halitosis negatively affects such key components of

self-esteem and quality of life as self-esteem and self-confidence [16]. People with halitosis often try to hide or mask their problem by chewing gum, mints, flavored sprays, constant brushing of their teeth, or mouth rinses.

However, all these remedies cause a temporary effect, so the search for new methods to eliminate this unpleasant symptom is extremely important. In patients with halitosis, pharyngoscopy reveals nonspecific signs of chronic pharyngitis, regardless of the etiological cause that led to the exacerbation of the inflammatory process. Along with this, it is necessary to have a universal remedy that can eliminate an extremely unpleasant symptom (halitosis), which causes a sharp decrease in the quality of life in patients.

The state of local immunity of the mucous membrane of the oropharynx, which is part of the mucosal immune system, is an important factor in the prevention of acute respiratory diseases [19].

Please note that the study demonstrated the presence of obligate aerobic and facultative anaerobic microorganisms (*S. aureus*, *C. albicans*, *P. aeruginosa*, *S. agalactiae*, *S. viridans*) in patients with halitosis associated with chronic pharyngitis.

In our study, there were no unwanted side effects in all patients and their good adherence to treatment was noted. The safety of the K12 strain has previously been confirmed by a series of studies: the absence of known streptococcal virulence factors and antibiotic resistance determinants, as well as its low susceptibility to mutagenicity, have been shown.

Taking the probiotic BactoBLIS has been shown to reduce the frequency of episodes of streptococcal throat infections by approximately 80% in both adults and children. In our patients, a single dose of a probiotic at night facilitated compliance with the prescribed doctor's recommendations. Local use of the drug is also another positive factor in the action of the probiotic at the mucosal level.

Conclusion

The good effectiveness of topical application of a product containing the probiotic *Streptococcus salivarius* K12 has been confirmed for chronic inflammatory diseases of the oropharynx of various origins. There was a clinically significant regression of the main signs of the pathological process in the form of bad breath, pain when swallowing and the feeling of a foreign body in the oropharynx.

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