The Impact of Oral Microbes on Human Health

Abdulaziz J.Alzahrani[1], Abdulsalam M.Alruwaili[2], Abdullah M.Albalawi[3], Abdullah M.Bashiri[1], Fatimah J.Alsaleh[4], Abdulrhman M.Hazzazi[3], Ali M.Hazzazi[1], Emad A.Fallatah[5], Mohammad A.Alzahrani[1], Khaireyah S.Gray[4]

laboratoray specialist at regional laboratoray in Dammam[1]
laboratoray technician at forensic medical services in Dammam[2]
laboratoray specialist at forensic medical services in Dammam[3]
laboratoray technician at regional laboratoray in Dammam[4]
laboratoray technician at branch of the ministry of health in the eastern province[5]

Abstracts

The aim of the current study is the impact of oral microbes on humans. Microbes present in the mouth, to what extent do they affect the upper human area (mouth, teeth, upper and lower jaw)? The questionnaire was created electronically via the Google Drive program and then distributed via mobile phone in the social networking program (the targets are residents of the city of Dammam aged between 25-55 years). The social networking network WhatsApp was used to distribute 600 questionnaires, and responses from 590 people were received via mail. It is concluded that , Cleaning the mouth should not be neglected or underestimated, especially after meals, because lack of cleanliness brings many diseases, especially serious diseases such as cancer.

Keywords: the impact, oral microbes, on human health.

1. Introduction

In 1891, the first oral microbiologist Willoughby D. Miller put forward the theory of oral focal infections, suggesting that oral microbial infection can affect other parts of the body, related to a variety of systemic diseases.(1) Frank Billings speculated that the infection of teeth may be the cause of rheumatoid arthritis, nephritis, endocarditis, and other diseases.(2) Proponents of this theory believe that dental plaque and its metabolites can enter the blood circulatory system and cause a variety of systemic or degenerative changes. Therefore, the treatment of systemic diseases by extracting the affected tooth is not only popular in dentistry, but also entire medical field. However, the theory of oral focal infection has not received enough attention and theoretical support. With the advances of microbiome research, the association between oral microbes and a variety of human chronic diseases has been studied, including inflammatory bowel disease, (3) cancers, (4) cardiovascular diseases, (5) Alzheimer's disease, (6) diabetes, (7) rheumatoid arthritis, (8) and preterm birth (9). In addition, the changes of oral microbiota in the state of systemic diseases are gradual and repeatable. Therefore, oral microbes can reflect human

health and disease status in real-time and have important value in disease risk early warning and curative effect prediction. Over 700 kinds of microorganisms are colonized in the human oral cavity.(10) The oral microbiome is one of the most important and complex microbial communities in the human body and is also one of the five research priorities (oral cavity, nasal cavity, vagina, intestine, skin) of the human microbiome project (HMP).(11) With the consummation of the human microbiome project, the understanding of oral microbes has become more in-depth, and it is not limited to further understanding the role of oral microorganisms in caries, periodontal diseases, and other oral diseases. Evidence is increasingly inclined to believe in the oral lesion theory proposed by Miller. The inflammation of periodontitis leads to the loss of connective tissues and bones.(12) Extensive inflammatory cell infiltration appears in the connective tissue near the periodontal pocket epithelium.(13) It is generally believed that this low-grade inflammation will disturb the health of the whole body or worsen other systemic diseases.(14) Therefore, in the general population, chronic periodontitis may be an important source of invisible peripheral inflammation. Thus, periodontitis is also called "lowgrade systemic disease", affecting a variety of systemic diseases. Particularly, a large amount of evidence has proved that bacteria are closely related to tumor development in the past two decades.(15) For example, the role of human papillomavirus in oral cancer,(16) Helicobacter pylori in gastric cancer,(17) Chlamydia pneumoniae in lung cancer,(18) Salmonella typhi in gallbladder cancer,(19) Streptococcus bovis, (20) Bacteroides fragilis(21), and especially the periodontal pathogen Fusobacterium nucleatum in colon cancer.(22) These studies have led to the possible role of bacteria in the occurrence of tumors, and the subsequent research results do provide some evidence to support it. There is a lot of evidence that oral microorganisms can induce cancer through direct or indirect factors.(23) For example, oral microorganisms can secrete polysaccharides or use their flagella to accumulate on the surface of tumor cells in large numbers, induce chronic inflammation, and the secretion of cytokines directly promotes the growth of tumor cells. Increasing evidence supports the association between the oral microbiome and human systemic diseases. (24) This association may be attributed to the ability of many oral microbes to influence the inflammatory microenvironment. Excluding unfavorable factors such as physical activity, poor oral condition is closely related to unhealthy body index. Clinical and basic research on oral health the digestive system.(25) For example, the colonization of oral microbes affects the metabolism of butyrate of intestinal microbes(26); oral microbes, especially periodontitis pathogens, can enter the bloodstream through periodontal inflammation tissues and enter the systemic circulation, thereby acting on the whole body.(27) As mentioned in the study of colorectal cancer, F. nucleatum colonizes the intestine and acts through the blood pathway.(28) In addition, the metabolites of oral microorganisms enter the systemic circulation through the blood, which makes a low-grade inflammation in the human body, and promotes the occurrence and development of chronic inflammatory diseases in the digestive system.(29) This approach is gradually supported by the evidence of oral microbiome research, and it is widely recognized in the research of systemic diseases caused by the imbalance of the intestinal flora. Therefore, this approach may also be the main role of oral microbes in the digestive tract and an important way to affect systemic diseases. Oral microbes and inflammatory bowel disease. Adults produce more than 1000 mL of saliva every day, almost all of which enter the gastrointestinal tract. (30) Therefore, oral microbes, as an important reservoir of intestinal microbes, play an important role in maintaining the internal stability of the intestinal

microecosystem. The virulent strains in the oral cavity migrate to the intestine through the digestive tract or blood, which affects the process of many intestinal inflammatory diseases.(31) Inflammatory bowel disease (IBD) is a global disease, especially in developed countries, the prevalence in developing countries is also increasing year by year, the prevalence in China is about 3.44 per 100,000 persons.(32) Chronic non-specific intestinal inflammatory diseases, whose etiology is not well understood, are believed to be determined by genetic and environmental factors.(33) The intestinal microbiome also plays an important role during IBD.(34) At the same time, recent studies found a correlation between oral microbes and IBD.3Periodontal disease is considered to be a risk factor for a variety of systemic diseases.(35) Porphyromonas gingivalis and F. nucleatum are the main pathogens of periodontal disease.(36) The inflammation caused by P. gingivalis in the oral cavity can lead to the disorder of the intestinal microbial community structure, the destruction of the intestinal barrier, the induction of endotoxemia, and the systemic inflammatory response.(37) Under normal circumstances, F. nucleatum is almost impossible to detect in the intestine, but the bacteria can migrate to the intestine, inhibit the immune response mediated by T cells, thus promoting the progress of IBD.(38) In addition, Streptococcus salivarius is an early colonizer in the oral cavity, which also can colonize the intestinal tract, down-regulate the nuclear transcription factor NFκB of small intestinal epithelial cells and participate in the process of intestinal inflammation and homeostasis.(39) Through population surveys, it is found that poor oral care behaviors related to alteration of the oral flora, cause an imbalance of intestinal microbes, and lead to the occurrence of IBD.(40) Cariogenic bacteria can also participate in intestinal inflammation. Streptococcus mutans TW295 is a serologically κ type (distributed in less than 5% of the population). The bacteria can express the collagen binding protein (CBP), which is more common in patients with bacteremia after tooth extraction and infective endocarditis.(41) Animal experiments have found that jugular vein injection of Streptococcus mutans TW295 can aggravate the degree of inflammation in a mouse model of colitis.(42) According to clinical research, the detection rate of this strain in patients with colitis is also higher than that of healthy people Oral microbiome studies have found that the oral flora of IBD patients is significantly different from that of healthy people.(43,44) The number of oral dominant bacteria in patients with IBD has changed, including Streptococcus, Prevotella, Neisseria, Haemophilus, and Veillonella. (45) Oral bacteria, such as Campylobacter and diseases. Oral microbes affect the process of systemic diseases through the inflammatory response caused by oral infection or the ectopic colonization of oral microorganisms in other organs or tissues of the human body, such as tumor, gut, heart, blood, brain, joint, placenta. and systemic diseases.

2. Material and Methods:

The study started in (in the eastern province in Saudi Arabia), began writing the research and then recording the questionnaire, and ended with data collection in June 2024. The researcher used the descriptive analytical approach that uses a quantitative or qualitative description of the social phenomenon (the impact of oral microbes on human health), the independent variable (the percentage of microbes present in the mouth area as a whole) and the dependent variable (the percentage of harmful microbes present in the mouth). This kind of study is characterized by

analysis, reason, objectivity, and reality, as it is concerned with individuals and societies, as it studies the variables and their effects on the health of the individual, society, and consumer, the spread of diseases and their relationship to demographic variables such as age, gender, nationality, and marital status. Status, occupation (46), And use the excel 2010 Office suite histogram to arrange the results using frequency tables Percentages (47). A questionnaire is a remarkable and helpful tool for collecting a huge amount of data, however, researchers were not able to personally interview participants on the online survey, only answered the questionnaire electronically, it consisted of ten questions, all was opened.

3. Results and discussion:

The percentage of approval to participate in the questionnaire was 100%, and the percentage of participants' ages was as follows: 25-34 years old, 25%, 35-44 years old, 40%, and 45-55 years old, 35%. As for their gender, the percentage of males was 80%, and the percentage of females was 20%, and their nationalities were mostly Saudi men and women, 100%. As for their professions, they were as follows: 90% government employee, 5% private sector employee and freelancer (equal), housewife and self-employed. , freelance work 0% (equal). As for the educational status, it was as follows: holders of primary school certificates: 0%, middle school, doctorate, and master's degrees: 4.7%, secondary schools: 9.5%, university degree holders: 47.6%, and diplomas: 28.6%. When moving to the questionnaire questions, the responses were as follows: The first question: Is dental inflammation related to rheumatoid arthritis, kidney inflammation, etc.? Yes 57.1% and no 42.9%.The second question: Is there a relationship between the oral microbiome and a variety of chronic diseases in humans? Yes 85.7% and no 14.3%. The third question is: Can the oral microbiome reflect human health and disease status in real time? Yes 95.2% and no 4.8%. The fourth question: Does early warning of oral infections indicate the risks of diseases and predict the therapeutic effect? Yes 81% and no 19%. The fifth question: Is the oral microbe one of the most important elements in the complex microbial communities in the human body? Yes 95.2% and no 4.8%. The sixth question: Is the role of oral microbes limited to caries, gum disease, and other oral diseases? Yes 61.9% and no 38.1%. The seventh question: Gingivitis leads to the loss of the body's connective tissues and bones? Yes 81% and no 19%.The eighth question: Is there a relationship between oral disease and cancers and oral bacteria? Yes 66.7% and no 33.3%. The ninth question: Is poor oral health closely linked to unhealthy body index? Yes, 90.9% and No, 9.1%. The tenth question: The human oral microbiome leads to the following: disturbance in the environment of the intestinal microbial community, destruction of the intestinal barrier, induction of endotoxemia, systemic inflammatory response, etc.? Yes 86.4% and no 13.6%.(table.no.1)(figure No.10).

Table.no.1: percentage of males and females :

males	females
80%	20%

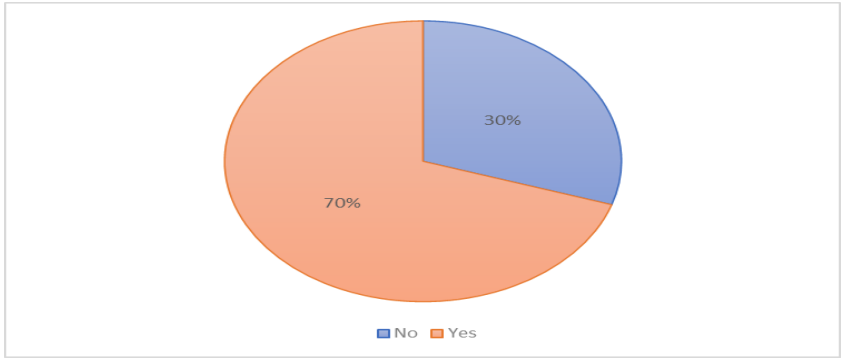

Figure No.1:the effect of oral microbes on human health

4. Conclusion:

Dental inflammation is related to rheumatoid arthritis, kidney inflammation, and others 57.1%, there is a relationship between the oral microbiome and a variety of chronic diseases in humans 85.7%, the oral microbiome can reflect a person's health and disease state in real time 95.2%.

Early warning of oral infections indicates the risks of diseases and predicts the therapeutic effect 81%, Is the oral microbiome one of the most important elements of complex microbial communities in the human body 95.2%, The role of oral microbes is limited to caries, gum disease and other oral diseases 61.9%. Gingivitis leads to loss of Connective tissues and bones in the body 81%. The relationship between oral diseases, cancers, and oral bacteria was 66.7%. Poor oral health is closely linked to the unhealthy body index (90.9%). It found that, the microbes in the human mouth should not be neglected or underestimated, as they can turn into a simple infection in the gums and teeth, and then spread to all parts of the body, leading to many diseases. They also transmit viruses, and thus the condition may develop. To serious diseases such as cancer.

Acknowledgment:

To start with, I would like to Praise God, and thank my friends (researchers) who make the project come to light.

WORKS CITED

1. Miller, W. D. The human mouth as a focus of infection. Lancet 138, 340–342 (1891).
2. Billings, F. Chronic focal infections and their etiologic relations to arthritis and nephritis. Arch. Intern. Med. IX, 484–498 (1912).
3. Read, E., Curtis, M. A. & Neves, J. F. The role of oral bacteria in inflammatorybowel disease. Nat. Rev. Gastroenterol. Hepatol. 18, 731–742 (2021).
4. Tuominen, H. & Rautava, J. Oral microbiota and cancer development. Pathobiology 88, 116–126 (2021).

5. Li, Y. et al. Oral, tongue-coating microbiota, and metabolic disorders: a novelarea of interactive research. Front. Cardiovasc. Med. 8, 730203 (2021).
6. Kamer, A. R. et al. Periodontal dysbiosis associates with reduced CSF Abeta42 incognitively normal elderly. Alzheimers Dement. (Amst.) 13, e12172 (2021).
7. Matsha, T. E. et al. Oral microbiome signatures in diabetes mellitus and periodontal disease. J. Dent. Res. 99, 658–665 (2020).
8. Huang, Z. et al. Faecal microbiota transplantation from metabolically compromised human donors accelerates osteoarthritis in mice. Ann. Rheum. Dis. 79, 646–656 (2020).
9. Gomez, L. A. et al. Porphyromonas gingivalis placental atopobiosis and inflammatory responses in women with adverse pregnancy outcomes. Front. Microbiol.11, 591626 (2020).
10. Xian, P. et al. The oral microbiome bank of China. Int J. Oral. Sci. 10, 16 (2018).
11. Turnbaugh, P. J. et al. The human microbiome project. Nature 449, 804–810 (2007).
12. Hathaway-Schrader, J. D. & Novince, C. M. Maintaining homeostatic control of periodontal bone tissue. Periodontology 86, 157–187 (2021).
13. Hajishengallis, G., Hasturk, H., Lambris, J. D. & Contributing authors C3-targeted therapy in periodontal disease: moving closer to the clinic. Trends Immunol. 42,856–864 (2021).
14. Zuza, E. C. et al. Evaluation of recurrence of periodontal disease after treatment
in obese and normal weight patients: two-year follow-up. J. Periodontol. 91, 1123–1131 (2020).
15. Nejman, D. et al. The human tumor microbiome is composed of tumor typespecific intracellular bacteria. Science 368, 973–980 (2020).
16. Yete, S., D'Souza, W. & Saranath, D. High-risk human papillomavirus in oral cancer: clinical implications. Oncology 94, 133–141 (2018).
17. Diaz, P., Valenzuela Valderrama, M., Bravo, J. & Quest, A. F. G. Helicobacter pylori and gastric cancer: adaptive cellular mechanisms involved in disease progression. Front. Microbiol. 9, 5 (2018).
18. Alshamsan, A., Khan, S., Imran, A., Aljuffali, I. A. & Alsaleh, K. Prediction of Chlamydia pneumoniae protein localization in host mitochondria and cytoplasm and possible involvements in lung cancer etiology: a computational approach. Saudi Pharm. J. 25, 1151–1157 (2017).
19. Shukla, S. K., Singh, G., Shahi, K. S., Bhuvan & Pant, P. Staging, treatment, and future approaches of gallbladder carcinoma. J. Gastrointest. Cancer 49, 9–15 (2018).
20. Jans, C. & Boleij, A. The road to infection: host-microbe interactions defining the pathogenicity of Streptococcus bovis/Streptococcus equinus complex members. Front. Microbiol. 9, 603 (2018).
21. Haghi, F., Goli, E., Mirzaei, B. & Zeighami, H. The association between fecal enterotoxigenic B. fragilis with colorectal cancer. BMC Cancer 19, 879 (2019).
22. Yu, T. et al. Fusobacterium nucleatum promotes chemoresistance to colorectal cancer by modulating autophagy. Cell 170, 548–563 e516 (2017).
23. Zhou, S., Gravekamp, C., Bermudes, D. & Liu, K. Tumour-targeting bacteria engineered to fight cancer. Nat. Rev. Cancer 18, 727–743 (2018).
24. Graves, D. T., Correa, J. D. & Silva, T. A. The oral microbiota is modified by systemic diseases. J. Dent. Res. 98, 148–156 (2019).
25. Gao, L. et al. Oral microbiomes: more and more importance in oral cavity and whole body. Protein Cell 9, 488–500 (2018).
26. Jia, X. et al. Berberine ameliorates periodontal bone loss by regulating gut microbiota. J. Dent. Res. 98, 107–116 (2019).
27. Bourgeois, D., Inquimbert, C., Ottolenghi, L. & Carrouel, F. Periodontal pathogens as risk factors of cardiovascular diseases, diabetes, rheumatoid arthritis, cancer, and chronic obstructive pulmonary disease-is there cause for consideration? Microorganisms 7, 424 (2019).
28. Engevik, M. A. et al. Fusobacterium nucleatum secretes outer membrane vesicles and promotes intestinal inflammation. mBio 12, e02706–e02720 (2021).
29. Hashioka, S. et al. Implications of systemic inflammation and periodontitis for major depression. Front. Neurosci. 12, 483 (2018).
30. Dawes, C. & Wong, D. T. W. Role of saliva and salivary diagnostics in the advancement of oral health. J. Dent. Res. 98, 133–141 (2019).
31. Li, B. et al. Oral bacteria colonize and compete with gut microbiota in gnotobiotic mice. Int. J. Oral. Sci. 11, 10 (2019).

32. Qiao, Y. & Ran, Z. Potential influential factors on incidence and prevalence of inflammatory bowel disease in mainland China. JGH Open 4, 11–15 (2020).
33. Cohen, L. J., Cho, J. H., Gevers, D. & Chu, H. Genetic factors and the intestinal microbiome guide development of microbe-based therapies for inflammatory bowel diseases. Gastroenterology 156, 2174–2189 (2019).
34. Glassner, K. L., Abraham, B. P. & Quigley, E. M. M. The microbiome and inflammatory bowel disease. J. Allergy Clin. Immunol. 145, 16–27 (2020).
35. Falcao, A. & Bullon, P. A review of the influence of periodontal treatment in systemic diseases. Periodontology 79, 117–128 (2019).
36. Zhang, Z. et al. Porphyromonas gingivalis outer membrane vesicles inhibit the invasion of Fusobacterium nucleatum into oral epithelial cells by downregulating FadA and FomA. J. Periodontol. https://doi.org/10.1002/JPER.21-0144 (2021).
37. Kato, T. et al. Oral administration of Porphyromonas gingivalis alters the gut microbiome and serum metabolome. mSphere 3, e00460–00418 (2018).
38. Liu, H. et al. Fusobacterium nucleatum exacerbates colitis by damaging epithelial barriers and inducing aberrant inflammation. J. Dig. Dis. 21, 385–398 (2020).
39. Li, Y., Shao, F., Zheng, S., Tan, Z. & He, Y. Alteration of Streptococcus salivarius in buccal mucosa of oral lichen planus and controlled clinical trial in OLP treatment. Probiot. Antimicrob. Proteins 12, 1340–1348 (2020).
40. Yin, W. et al. Inverse association between poor oral health and inflammatory bowel diseases. Clin. Gastroenterol. Hepatol. 15, 525–531 (2017).
41. Ito, S. et al. Specific strains of Streptococcus mutans, a pathogen of dental caries, in the tonsils, are associated with IgA nephropathy. Sci. Rep. 9, 20130 (2019).
42. Qi, Y. et al. New insights into the role of oral microbiota dysbiosis in the pathogenesis of inflammatory bowel disease. Digest. Dis. Sci. 67, 42–55 (2022).
43. Xiao, J., Fiscella, K. A. & Gill, S. R. Oral microbiome: possible harbinger for children's health. Int. J. Oral Sci. 12, 12 (2020).
44. Xun, Z., Zhang, Q., Xu, T., Chen, N. & Chen, F. Dysbiosis and ecotypes of the salivary microbiome associated with inflammatory bowel diseases and the assistance in diagnosis of diseases using oral bacterial profiles. Front. Microbiol. 9, 1136 (2018).
45 Goel, R. M. et al. Streptococcus salivarius: a potential salivary biomarker for orofacial granulomatosis and Crohn's disease? Inflamm. Bowel Dis. 25, 1367–1374 (2019
46-Alserahy, Hassan Awad, et al (2008), The thinking and scientific research, Scientific Publishing Center, King Abdul-Aziz University in Jeddah, the first edition
47-Al Zoghbi, Muhammad and AlTalvah, Abas (2000), Statistical system understanding and analysis of statistical data, first edition, Jordon- Amman