ABSTRACT

of the dissertation work of **Oralkhan Zhibek**

titled: **«Oral Health Status and Adverse Pregnancy Outcomes»**

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Relevance of the research

The health of society and the sustainability of future generations are fundamental indicators of civilization. Core measures of population health include physical development, birth rate, morbidity, and mortality. Accordingly, improving perinatal health requires in-depth research and the development of effective strategies to reduce perinatal morbidity and mortality while accounting for contemporary biological, social, and environmental risk factors. Investigating the association between oral health and adverse pregnancy outcomes is an important area of contemporary biomedical research and aligns with the Sustainable Development Goals, particularly SDG 3 "Good Health and Well-being" and SDG 10 "Reduced Inequalities." Adverse pregnancy outcomes (APOs), including preterm birth (PTB), low birth weight, and preeclampsia, remain major global public health challenges and contribute substantially to perinatal morbidity and mortality worldwide.

The World Health Organization and the United Nations identify preterm birth as a global scientific and public health priority. Despite advances in neonatal care, including antenatal corticosteroids, surfactant therapy, and kangaroo mother care, the global burden of preterm birth remains substantial, particularly in regions with limited access to high-quality perinatal services.Therefore, the development of effective and accessible strategies aimed at preventing preterm birth remains an important issue for Kazakhstan as well.

Current scientific evidence indicates that the development of preterm birth is influenced by a complex interaction of maternal, social, environmental, and biological factors. In recent years, oral health, particularly periodontal disease, has attracted increasing attention as a chronic source of systemic inflammation. Inflammatory mediators and oral pathogens, including Fusobacterium nucleatum, may affect the fetoplacental unit, potentially contributing to placental dysfunction and the initiation of spontaneous labor.

In Kazakhstan, the substantial contribution of preterm birth to infant mortality highlights the importance of identifying modifiable maternal risk factors. Maternal oral health may serve as a valuable non-invasive biomarker for early risk identification. Integrating oral health assessment into routine antenatal care could facilitate early detection of high-risk pregnancies, enable timely preventive interventions, and improve maternal and neonatal outcomes. Moreover, oral health promotion represents a cost-effective and scalable public health strategy that can be effectively integrated into preventive healthcare systems.

The purpose of the study is to investigate whether oral diseases contribute to the etiology of preterm birth by examining their interaction with socioeconomic and maternal factors, and to elucidate the underlying mechanisms through assessment of Fusobacterium nucleatum in saliva and placenta.

Objectives of the study include:

−To conduct a systematic review and meta-analysis of international and national research data to determine the strength and consistency of the association between oral diseases and preterm birth.

−To identify and analyze maternal risk factors contributing to preterm birth, including socioeconomic, behavioral, clinical determinants, and self-reported oral symptoms, based on data obtained from a prospective pregnancy cohort in the Republic of Kazakhstan.

−To determine the individual and combined effects of oral diseases and maternal risk factors on spontaneous preterm birth in a case–control sample, and to explore potential biological mechanisms by assessing periodontal status, behavioral determinants, and the presence of Fusobacterium nucleatum in placental tissue.

Scientific novelty of the study

This study is the first in Kazakhstan to comprehensively examine the association between maternal oral disease and preterm birth using integrated socioeconomic, clinical, and molecular data. The detection of Fusobacterium nucleatum in saliva and placental tissue provides new evidence of oral–placental interactions. The application of a stacking multiclass machine-learning model enables identification of early predictors of preterm birth within the regional population.

The practical significance of the study

The study provides evidence-based support for reducing preterm birth risk through improved maternal oral health management as part of a broader risk profile. Alongside well-established predictors of preterm birth, such as obstetric and socioeconomic factors, the identification of periodontal disease as a contributory and modifiable risk factor enables improved risk stratification and individualized prenatal care. The findings support the integration of routine oral health assessment into standard antenatal care within an interdisciplinary maternal health framework.

The main scientific provisions submitted for defense:

− A systematic review and meta-analysis demonstrated a significant association between maternal periodontitis and increased risk of preterm birth, based on both international and local datasets.

−In the cohort study, maternal periodontal status was identified as a significant predictor of spontaneous preterm birth, with stronger associations observed among women of lower socioeconomic status.

−Advanced analytical approaches, including machine learning models, were applied to integrate clinical, socioeconomic, and microbiological data, enabling accurate prediction of preterm birth risk. These models provide a framework for individualized risk stratification, supporting early identification of high-risk pregnancies and informing targeted intervention strategies.

−Based on these findings, practical, evidence-based recommendations were developed to integrate oral health assessment and management into routine prenatal care. These include structured oral health education programs for pregnant women, early periodontal screening, timely diagnosis, proper oral hygiene practices, and appropriate treatment during pregnancy. Enhancing awareness and knowledge can improve health-seeking behaviors, reduce the burden of maternal oral infections, and

consequently lower the incidence of preterm birth, thereby improving both maternal and neonatal health outcomes.

Relevance of the topic to the plans of research programs

The work was carried out within the framework of the project “Clinical, Genomic and Environmental Variable Approach to Preterm birth” by the Ministry of Science and Higher Education of the Republic of Kazakhstan. State registration number AP14869249. Scientific Supervisor: Zhurabekova G.A.

Approval of the work.

The main content of the dissertation has been published in international and local scientific journals and discussed at conferences. Three of which appeared in journals recommended by the Committee for Quality Assurance in Science and Higher Education of the Ministry of Science and Higher Education of the Republic of Kazakhstan, while three were published in foreign periodicals: one in a journal «BMC pregnancy and childbirth» indexed in the scopus database (Q1); one in journal «Iranian Journal of Medical Sciences» indexed in the scopus database (Q2); one in a journal Human ecology» indexed in the scopus database (Q3); Four abstracts in the proceedings of international conferences.

The doctoral candidate’s personal contributions included collecting data on the research topic, conducting the main theoretical and experimental studies—including analysis, interpretation, and presentation of results—preparing manuscripts for publication, and writing the dissertation.

Scope and structure of the dissertation

The dissertation comprises 129 pages and is organized into sections, including abbreviations and notations, introduction, literature review, materials and methods, results and discussion, conclusion, practical recommendations and a reference list.

The introduction substantiates the research's relevance, defines the object and subject of the study, formulates the purpose and objectives, describes the research methods, and presents the scientific novelty and practical significance of the work. It also outlines the scientific provisions submitted for defense and provides information on the approval of the research and related publications.

The first chapter presents a comprehensive review of the current scientific literature on adverse pregnancy outcomes, with a particular focus on preterm birth and its epidemiology, classification, and consequences. The chapter analyzes established maternal, socioeconomic, behavioral, and biological risk factors for preterm birth and reviews existing evidence on the association between maternal oral diseases and adverse pregnancy outcomes. Special attention is given to proposed biological mechanisms linking oral inflammation and periodontal pathogens to pregnancy complications.

The second chapter describes the study's materials and methods. It outlines the design of the systematic review and meta-analysis, the prospective cohort study, and the nested case–control study conducted in the Republic of Kazakhstan. The chapter details the characteristics of the study population, data collection procedures, clinical oral health assessment methods, and molecular detection of Fusobacterium nucleatum. Statistical methods, including multivariable regression and machine learning modeling, are also described.

The third chapter presents the results of the research and their discussion. It reports the findings of the systematic review and meta-analysis, cohort and case–control analyses and molecular investigations. The results of traditional statistical analyses and machine-learning models are presented, highlighting the contribution of oral health indicators within a broader risk factor framework for preterm birth. The findings are discussed in the context of existing international evidence.

The conclusion summarizes the main results of the dissertation, confirms the achievement of the research objectives, and substantiates the scientific novelty and practical significance of the study. Recommendations for clinical practice and future research directions are also provided.