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DISSERTATION

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Epidemiological study of toxoplasmosis among pregnant women in the region of Setif, with analysis of serological prevalence and risk factors

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الملخص :

هدفت هذه الدراسة إلى تحديد الانتشار المصلي لعدوى المقوسة الغوندية *(Toxoplasma gondii)* وتحديد عوامل الخطر المرتبطة بها لدى النساء الحوامل في ولاية سطيف، الجزائر.أُجريت دراسة مقطعية خلال الفترة الممتدة من جانفي 2025 إلى مارس 2026 بالاعتماد على بيانات جُمعت من مخبرين وشملت 684 امرأة حامل، بالإضافة إلى استبيان وُزّع على 50 مشاركة. بلغت النسبة المصلية للأجسام المضادة IgG و IgMعلى التوالي 34.06٪ و0.73٪، في حين كانت 64.91٪ من النساء سلبيات المصل، وبالتالي عرضة للإصابة الأولية أثناء الحمل. وقد تمثلت عوامل الخطر المهمة في وجود سوابق للإجهاض التلقائي، واستهلاك اللحوم غير المطهية جيدًا، واستعمال المياه المعبأة خلال فصل الصيف.كما دمج هذا العمل نموذجًا للشبكات العصبية الاصطناعية (ANN) للتنبؤ بخطر داء المقوسات الخلقي اعتمادًا على المعطيات المصلية والديموغرافية والوبائية. وأظهر النموذج أداءً تنبؤيًا ممتازًا، مما يبرز الإمكانات الكبيرة للذكاء الاصطناعي في دعم التقييم المبكر للمخاطر وتعزيز استراتيجيات الوقاية والرعاية الصحية.

الكلمات المفتاحية داء المقوسات؛ الانتشار المصلي؛ الحمل؛ عوامل الخطر؛ الشبكات العصبية الاصطناعية

Abstract:

This study aimed to determine the seroprevalence of *Toxoplasma gondii* infection and identify associated risk factors among pregnant women in the Wilaya of Sétif, Algeria.

A cross-sectional study was conducted between January 2025 and March 2026 using data collected from two laboratories involving 684 pregnant women, in addition to a questionnaire administered to 50 participants. The overall IgG and IgM seroprevalence rates were 34.06% and 0.73%, respectively, while 64.91% of women were seronegative and therefore susceptible to primary infection during pregnancy. Significant risk factors included a history of spontaneous abortion, consumption of undercooked meat, and the use of bottled water during summer. This work also integrated an Artificial Neural Network (ANN) model to predict the risk of congenital toxoplasmosis using serological, demographic, and epidemiological data. The ANN showed excellent predictive performance, highlighting the potential of artificial intelligence in supporting early risk assessment and preventive healthcare strategies.

Key words: Toxoplasmosis , Seroprevalence, Pregnancy, Risk factors, Artificial Neural Network

Résumé:

Cette étude avait pour objectif de déterminer la séroprévalence de l'infection à *Toxoplasma gondii* et d'identifier les facteurs de risque associés chez les femmes enceintes de la wilaya de Sétif, en Algérie. Une étude transversale a été réalisée entre janvier 2025 et mars 2026 à partir des données recueillies dans deux laboratoires, incluant 684 femmes enceintes, ainsi qu'un questionnaire administré à 50 participantes. Les taux globaux de séroprévalence des IgG et des IgM étaient respectivement de 34,06 % et 0,73 %, tandis que 64,91 % des femmes étaient séronégatives et donc susceptibles de contracter une infection primaire durant la grossesse. Les principaux facteurs de risque identifiés étaient les antécédents d'avortement spontané, la consommation régulière de viande insuffisamment cuite et l'utilisation d'eau en bouteille pendant l'été. Ce travail a également intégré un modèle de réseau de neurones artificiels (Artificial Neural Network, ANN) afin de prédire le risque de toxoplasmose congénitale à partir de données sérologiques, démographiques et épidémiologiques. Le modèle ANN a montré d'excellentes performances prédictives, soulignant le potentiel de l'intelligence artificielle dans l'évaluation précoce du risque et le renforcement des stratégies préventives en santé maternelle.

Mots clés : Toxoplasmose, Séroprévalence, Grossesse, Les facteurs de risque,Réseau de Neurones Artificiels

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Introduction

Introduction

Toxoplasmosis is one of the most widespread parasitic zoonoses worldwide and is caused by the obligate intracellular protozoan parasite *Toxoplasma gondii.* The parasite is capable of infecting a broad range of warm-blooded animals, including humans, and is characterized by a complex life cycle involving felines as definitive hosts and numerous intermediate hosts such as birds, livestock, and humans. Human infection occurs mainly through the ingestion of tissue cysts present in undercooked or raw meat, consumption of food or water contaminated with oocysts shed in cat feces, or through vertical transmission from mother to fetus during pregnancy.

Although toxoplasmosis is generally asymptomatic or mild in immunocompetent individuals, it represents a major public health concern in pregnant women and immunocompromised patients. Primary maternal infection acquired during pregnancy may lead to transplacental transmission of the parasite to the fetus, resulting in congenital toxoplasmosis. The severity of fetal infection depends largely on the gestational age at which maternal infection occurs. While the risk of fetal transmission increases progressively throughout pregnancy, infections acquired during the first trimester are usually associated with the most severe fetal outcomes, including spontaneous abortion, stillbirth, hydrocephalus, chorioretinitis, and severe neurological impairment. Infections occurring later in pregnancy may present fewer immediate symptoms at birth but can lead to delayed ocular, auditory, motor, or cognitive complications during childhood. (Robert *et al*., 2011).

Because congenital toxoplasmosis may result in irreversible fetal damage, early serological diagnosis during pregnancy is essential. The detection of IgG and IgM antibodies allows differentiation between past exposure and recent infection, thereby helping clinicians establish appropriate therapeutic and preventive strategies. Early

identification of acute maternal infection enables timely treatment, which may reduce the risk of maternal–fetal transmission and minimize fetal complications. Consequently, regular prenatal screening programs play a crucial role in monitoring susceptible pregnant women and improving maternal and neonatal health outcomes.

The epidemiology of *Toxoplasma gondii* infection varies considerably between regions depending on climatic conditions, cultural habits, dietary behavior, socioeconomic status, hygiene practices, and environmental exposure. In Algeria, and particularly in the Setif region, several environmental and sociocultural factors may favor the persistence and transmission of the parasite. Climatic conditions that support oocyst survival in soil, frequent contact with stray or domestic cats, agricultural activities, consumption of raw vegetables, untreated water, and insufficient cooking of meat may all contribute to increased exposure among pregnant women. Despite the potential importance of these factors, epidemiological data concerning toxoplasmosis in Setif remain limited, especially regarding the dominant local risk factors associated with infection during pregnancy.

In this context, the present study was conducted to evaluate the seroprevalence of *Toxoplasma gondii* infection among pregnant women in Setif through the detection of IgG and IgM antibodies collected from two participating medical laboratories between January 2025 and March 2026.

In addition to serological analysis, an epidemiological questionnaire was administered to pregnant women in order to identify the major risk factors associated with toxoplasmosis in this region. Particular attention was given to dietary habits, environmental exposure, contact with cats, soil exposure, hygienic practices, socioeconomic conditions, and lifestyle related behaviors.

Furthermore, this study aims to assess pregnant women's knowledge and awareness regarding toxoplasmosis, including its modes of transmission, preventive measures, consequences during pregnancy, and the importance of prenatal screening. Evaluating the level of awareness is essential for identifying gaps in public health education and improving preventive strategies among vulnerable populations.

Finally, this work incorporates a predictive approach through the development of an Artificial Neural Network (ANN) model designed to predict the risk of congenital toxoplasmosis based on serological, demographic, and epidemiological data. The integration of artificial intelligence techniques into epidemiological research may provide deeper insight into the complex interactions between multiple risk factors and maternal–fetal transmission, while also contributing to the development of predictive tools that could support clinical decision-making and preventive healthcare strategies in the future.