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Assessing the Prevalence and Risk Factors Association of TORCH Infections among Pregnant Women in Lower Dir, KPK, Pakistan

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Abstract **Original Research Article**

TORCH infections caused by pathogens like Toxoplasma, Rubella virus, Cytomegalovirus (CMV), and Herpes simplex viruses (HSV-1 and HSV-2) are a major reason for neonatal and infant deaths worldwide. Sadly, these infections are becoming more common in developing countries. ***Objectives:*** The current study was designed to looked into how often TORCH infections occur and what risk factors are linked to them in pregnant women from District Lower Dir, Khyber Pakhtunkhwa. ***Method:*** A total of 300 blood serum samples were analysed through ELISA (enzyme linked immune sorbent assay). ***Results:*** Nearly half (48%) of the samples tested positive for at least one infection. Toxoplasma was the most common at 18%, followed by Rubella (14%), HSV-1 (8.33%), CMV (4%), and HSV-2 (2.6%). Co-infections showed up in 16% of cases, with Toxoplasma and CMV being the most frequent pair. Triple infections were less common (9.33%) but still concerning. Women aged 21–40 were the most affected. The study also identified several risk factors for these infections. Eating raw or undercooked meat, consuming unwashed fruits and veggies, exposure to animals, poor literacy, previous miscarriages, and a lack of awareness about TORCH infections all played a role. Notably, the Temargara region had the highest rates of Toxoplasma infection. ***Conclusion:*** In conclusion, the study shows that a lack of awareness, poor hygiene, and low vaccination coverage are increasing these high infection rates in pregnant women. The study suggests Education, better hygiene practices, and improved vaccination programs could make a big difference in reducing these infections and their devastating effects.

Keywords: TORCH infections, Toxoplasma gondii, Rubella virus, Cytomegalovirus, Herpes simplex virus, Pregnant women.

INTRODUCTION

The TORCH group of pathogens which includes Toxoplasma gondii, Rubella virus, Cytomegalovirus (CMV), and Herpes simplex viruses (HSV-1 and HSV-2), plays a significant role in causing illness and death in newborns across the globe. The prevalence of TORCH infection in Khyber Pakhtunkhwa is reported to be 6.99% and a 10-15% of abortion in pregnancy are caused by TORCH infection in pregnant women [1]. The consequences of these infections can be severe if the babies are immunocompromised [2]. At different gestational ages, the complications may be incudes abortions, fetal death, congenital malformations and growth restriction in the neonates[3].

Among the TORCH pathogens, a strict intracellular parasite *toxoplasma gondii*, was first discovered in the tissues of mammal and later found to be transmitted to humans beings through close contact [4]. *Toxoplasma gondii* can transferred to human beings through the ingestion of contaminated tissue, oocysts, organ transplantations, and blood transfusion containing bradyzoites [5].

Cytomegalovirus and rubella virus, both members of TORCH pathogens, cause severe congenital problems in fetuses. Rubella causes congenital rubella syndrome (CRS) in fetal during pregnancy (CRS)(6). The rubella and cytomegalic virus can be transmitted through close contact, breast milk, saliva urine and blood transfusion [7]. Pregnant women during the first and second trimester are more likely to transmit rubella and cytomegalic virus to their fetus, leading to complications like development delays, low IQ levels, and hearing loss [8].

Herpes simplex virus 1 and 2, also members of TORCH group, cause illness in fetus during pregnancy. In the northeastern United states, one in every 3,000 newborns is born with HSV infections. These viruses damage the neurological development of infants. An increasing numbers of children born with genital herpes due to HSV infections, a trend that has been rising in recent decades [2, 9].

Screening for TORCH infections is essential to identify pregnancies at risk and implement measures to prevent complications. The enzyme-linked immunosorbent assay (ELISA) is a trusted and effective tool for detecting TORCH-specific antibodies in pregnant women [9].

Unfortunately, limited region-specific data exists on how common TORCH infections are and what risk factors contribute to them in District Lower Dir, Khyber Pakhtunkhwa. This study aims to address this gap by examining the prevalence of TORCH infections and the related risk factors among pregnant women in the area. The findings aim to offer valuable insights for improving public health efforts.

METHODOLOGY

The study was designed as an observational study with the aim of establishing the burden of TORCH infections (Toxoplasma gondii, Rubella virus, Cytomegalovirus (CMV) and Herpes Simplex Virus (HSV1 and HSV2) and some risk factors among pregnant women in District Lower Dir, Khyber Pakhtunkhwa, Pakistan. A total of 300 blood samples were collected from pregnant women 15-40 years attending private gynecology clinics and government outpatient departments. Written consent was obtained from all participants before sample collection.

Specimen Collection and Processing

Blood samples (5 mL each) were collected aseptically using syringes and transferred into properly labeled sample collection tubes. Serum was separated by centrifugation at 3,000 rpm for 10 minutes, then stored at 4°C until testing. All samples were processed in the Department of Microbiology, Abasyn University, Peshawar.

Detection of TORCH infections

Serum were analyzed for IgG and IgM antibodies against *Toxoplasma gondii*, Rubella virus, CMV, and, HSV-1 / HSV-2 using ELISA kits (BioCheck, South San Francisco, USA). The kits demonstrated high accuracy during validation studies. All tests were conducted according to the manufacturer's guidelines.

Materials and reagents

The ELISA testing utilized antigen-coated plates, sample diluters, enzyme conjugates and standard control (0, 15, 100, and 200 IU/mL), along with wash buffers, chromogen substrates, and stop solutions. Additional materials included comprised of micropipettes, absorbent papers and distilled water and an ELISA reader equipped with 450 nm and 630 nm filters for optical density measurement.

Assessment of Risk Factors

A structured questionnaire was employed to collect data on risk factors including cats touching, animals contact, consumption of unwashed vegetables, history of abortion, and drinking water sources. Information on education level, employment status, and knowledge of TORCH infections was also gathered.

Statistical Analysis

Data analysis was performed by using IBM SPSS Statistics 20. Bar graphs were used to illustrate single, double and triple infections, while heat maps visualized association between risk factors and TORCH infections.

RESULTS

Prevalence of TORCH infections

The research aimed at establish the prevalence of TORCH infections among pregnant in Lower Dir, in Khyber Pakhtunkhwa, Pakistan. A total of 300 serum samples were analysed using the ELISA providing crucial insight into the distribution of these pathogens, patterns of infections, and associated risk factors of TORCH pathogens.

Total TORCH Infections

The seroprevalence of TORCH infection in this research project was notably high. Out of 300 analysed samples, 144 (48%) tested positive for single infections, 48(16%) for double infections, and 28(9.33%) for triple infections. The total combined infections, single, double and triple infections out of 220/300 (73.33) were positive for the infections.

Single Infections

Out of the different TORCH Agents infections, Toxoplasma was the most prevalent, 56 cases (18.66%). Of these, 62.5% were IgG positive indicating chronic infection, while 37.5% were IgM positive, signifying recent infection. Rubella virus was identified in 43 cases (14.33 %), with IgM antibodies, with 55.81% of cases

and IgG antibodies in having IgM 44.18%. CMV infections were detected in 12 cases, (4%), with IgG observed in 58.33% and IgM in 41.66%. HSV1 was present in 25 cases (8.33%), and HSV2 in 8 cases (2.66%).

Double TORCH Infection

Double infections were observed in 48 cases (16%), with the most common combination of toxoplasma gondii and CMV (56.26%). Other co-infection included toxoplasma gondii and rubella (12.5%), and HSV1 co-infection with HSV2 18.75%.

TORCH Agents Triple Infections

Triple infection were recorded in 28 cases (9.33%) with the combinations of toxoplasma gondii HSV1 and HSV2, was the most frequent cases (32.14%). Of these toxoplasma gondii, rubella and CMV was 25% respectively.

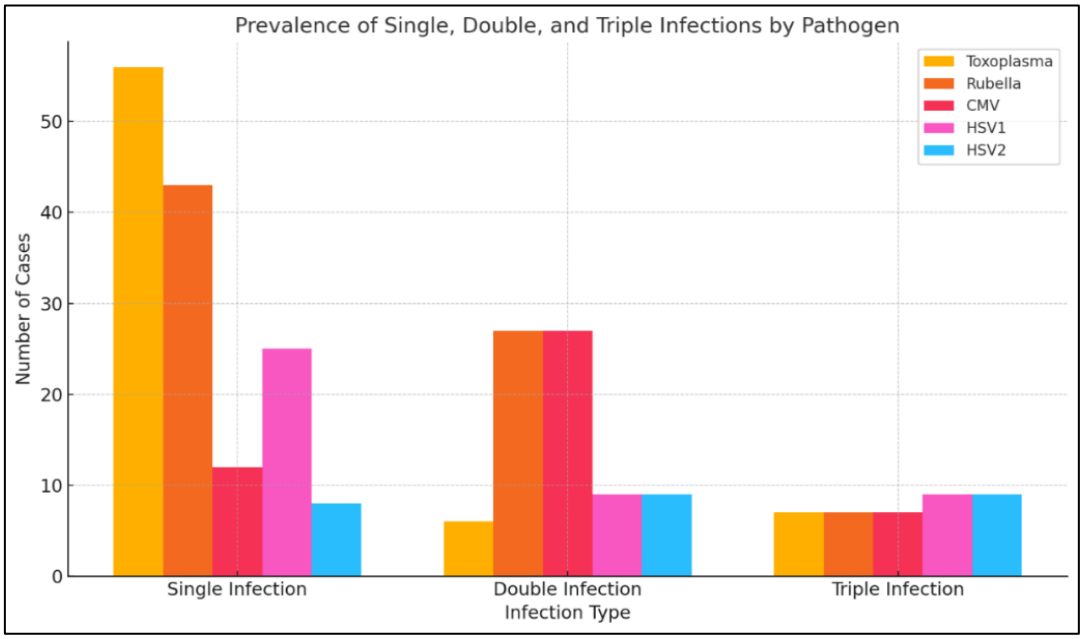

Figure 1. "The overall prevalence of single, double, and triple infections is depicted in Figure 1, highlighting the distribution of these infection categories across the study population."

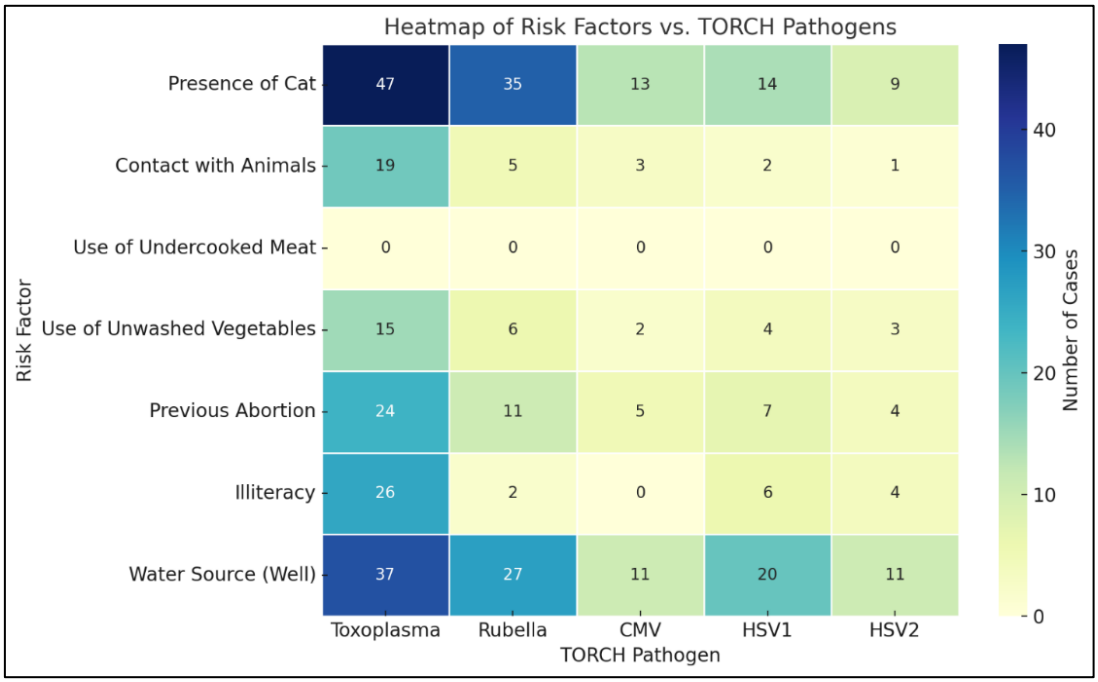

Figure 2. Several risk factors were identified as contributor to TORCH infections including the presence of cats, the consumption undercook meat and vegetables, and water sources are summarized in the heat map illustration

TORCH Infections Across Age Groups and Geographic Distribution

The study found that women aged 31-40 years had the highest rates of Toxoplasma and Rubella infections, with 52.63% positive for Ig M and 62.5% dual positives. Effects of CMV on women between the ages of 31 and 40 were quite high as 100% were IgG positive. The 31-40-year age group was also dominant in HSV1 and HSV2 infections. The study was collected samples from different regions, among which Temargara showed highest prevalence of toxoplasma gondii (5.66%), while the region Asbanr had the highest ratio of rubella 4% and HSV1 2%.

Risk factors of TORCH Infections

Toxoplasma infections had a strong correlation with the presence of cats at home 13 % followed by the risk factor using well water (12.66%), and eating unwashed vegetables (5%). Abortion history was strongly associated with infection, especially for Rubella (66%) and Toxoplasma gondii (80%). Higher infection rates were also associated with illiteracy. Similarly, water sources were another significant factor as well water consumption was linked to 12.66% of Toxoplasma cases, 9% of Rubella cases, and 6.66% of cases of HSV1. The illiteracy prevalence was also associated with higher rates of infection, more especially (Toxoplasma) 8.66% and HIV-1 (herpes simplex virus type 1) infection.

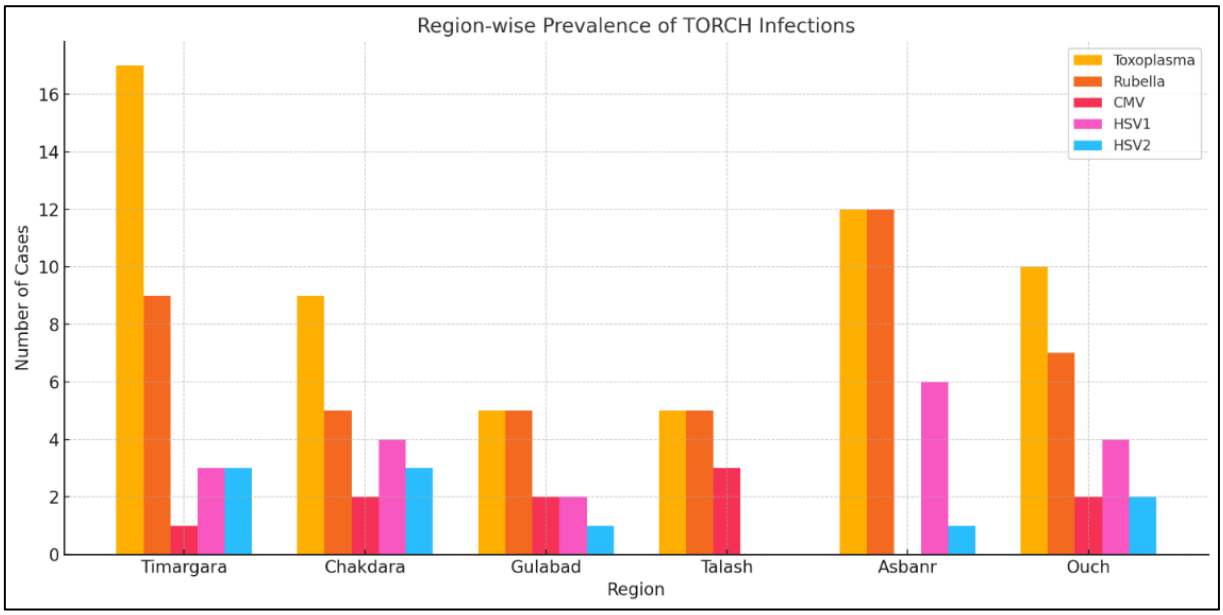

Figure 3."Regional variations in the prevalence of single, double, and triple infections are illustrated in Figure 2, providing a comparative view of infection rates across the six study locations."

Awareness and Protection Against TORCH Infections

Awareness of TORCH infections among the study participants alarmingly low, with 76% unaware of these infections and their associated risk factors. Only 24% of the participants had awareness of TORCH pathogen and their consequences. Among 300 participants only 6 were immunized against TORCH pathogens.

DISCUSSION

This study revealed a concerning rate of TORCH infections among pregnant women in District Lower Dir, Khyber Pakhtunkhwa, Pakistan, meaning these infections are an urgent public health concern [10]. This gap portrays large shortcomings in terms of preventative healthcare. If remaining unaddressed, this has the potential to be severely detrimental to both the mother as well as the neonate. The result obtained in this research is consistent with other low and mid-income countries like [11]. These similarities showcase the significant of socioeconomic factors on infection rates underlining the need for effective sanitations, immunization and awareness about TORCH infections.

Toxoplasma gondii has the highest prevalence (18.66) of single infection which is lower than the (12) America (32%) and [13] in Malaysia (42%). In this study the toxoplasma IgM prevalence was 37.5% and IgG was 62.5% while [14] in North America reported IgG 32.9% and 1.9% IgM. The co-infection in this study is 9.3% which is significantly lower than [15] 48% and Pereira 32%. The variation in the result may be due to difference in diagnostics methods, environmental exposure, and different healthcare interventions. The lower con-infection rate may reflect the differences in pathogen circulation in different regions.

The common rubella shows 58.1 IgG and 48.81% IgM positive compared to the study of [16] reported 89% IgG and 5.1% IgM seroprevalence. The study reported by of reported by [17] in the global survey reported 9.5% of seroprevalence. The CMV prevalence in the current study was (4%), with IgG observed in

58.33% and IgM in 41.66% contrastingly the result reported by Practice Bulletin. (2015) ranging from 0.7-4% in United states. The highest prevalence of CMV contrasted to our study reported by [18] 98.11% in china. The differences in the result across study may arise due to variation in coverage of vaccination and healthcare access. The higher IgM rates show ongoing transmission and risks. The significant contrast in CMV show differences of exposure to public health policies.

In the current study, HSV1 was present in (8.33%), and HSV2 was (2.66%) while the highest prevalence reported by Patton *et al.,* (2018) reported 59.3% of HSV1 and HSV2 21.1% respectively. The study reported by [19] reported nearly 100% prevalence of HSV1 and 2 viruses in the African black pregnant women. The lower sereprvelance of this virus compared to other studies might be due to genetically deference in populations, sexual health practice and treatment availability. The highest prevalence in Africa underscore endemicity may be due to sociecminc condition and disparities to healthcare programs. The result underscore the specific targeted screening, awareness and treatment strategies to control this infection in women.

The higher seroprevalence of TORCH infection aged 31-40 year align with past studies indicating rise exposure by time. The variation in age reported y [20] in younger women may be varies due to deference in infection pattern, immunity and life style of the patients. The association of cat presence with TORCH infection and unwashed vegetable reinforces by [21] and [22] underscoring the impact of environment and dietary on the transmission of TORCH infections. The lower rate of awareness about TORCH infection in the current and above studies alarming the critical gap in public health educations and nictitate the awareness and education in women regarding these infections.

The rate of high unavailabiuty of vaccine underscore the critical gap immunization system and healthcare infrastructure of Pakistan. The study by [23] confirmed the availability of vaccine in developed countries but the key factor such public willingness and regional disparities is still a big concerned. The non-avaiality of vaccine alarming the government to improve vaccine program, ensure avaiality and awareness campaign to eliminate the TORCH infection from our community.

RESEARCH LIMITATIONS

This study is subject to several limitations that need to be acknowledged. Primarily, the study was conducted in one geographical area, and therefore the results might not be representative of the District Lower Dir population. Furthermore, one of the limitations of this study was the reliance on self-reported data on risk factors as it may have caused response bias or recall bias. Third, although ELISA tests are considered to be of high sensitivity, in some instances they are not very good at distinguishing between acute and chronic infections, especially for CMV and HSV. Lastly, because the research was retrospective there were no follow up investigations on maternal and neonatal TORCH related infections outcomes over a specified period of time.

Future Perspective

The long-term effects associated with TORCH infections on both mothers and new-borns should be the focus of later studies in order to develop more suitable recommendations, as these TORCH infections and the significant components detected in this investigation emphasize the need of a better public health system. Enhanced diagnostic tools, appropriate hygiene practices and better immunization strategies are vital in decreasing the rates of these infections.

CONCLUSION

There was a high percentage of TORCH infections among pregnant women in Lower Dir region. However, there was a lot of variation in patterns of infection, age distribution and geographical distribution. Others such as lack of sanitation, consumption of unsafe water, lack of education further increase the infection burden. These results call for the initiation of concrete public health interventions that target the places where the disease is most. These measures can include improved epidemiologic capacities, vaccination programs, and education targeting TORCH infections in pregnant women and their new-borns.

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