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ORIGINAL ARTICLE

SARS-CoV-2 IgG Antibody Seroprevalence in Children from the Amritsar District of Punjab

Amandeep Kaur[1], Narinder Singh[2], Kanwardeep Singh[3], Shailpreet Kaur Sidhu[3], Harleen Kaur[1], Poonam Jain[1], Manmeet Kaur[2], Mohan Jairath[1]

[1]The Viral Research and Diagnostic Laboratory, Government Medical College, Amritsar, India
[2]Department of Pediatrics, Government Medical College, Amritsar, India
[3]Department of Microbiology, Government Medical College, Amritsar, India

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ABSTRACT

The majority of the children experience milder coronavirus disease 2019 (COVID-19) symptoms. Children represent a significant source of community transmission. Children under 18 years of age account for an estimated 4.8% of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections globally. However, no conclusive statements pertaining to the multi-fold aspects of the virus in children could be drawn due to the lower prevalence of pediatric cases. The present study was conducted to identify the indirect impact of SARS-CoV-2 infections on developing herd immunity among children in the age group 3 to 18 years by investigating their antibody levels. In the study, 240 children aged 3~18 years were recruited by the Department of Pediatrics, Government Medical College and Hospital, Amritsar, India, and quantification of the antibodies was performed at the Viral Research and Diagnostic Laboratory (VRDL), Government Medical College (GMC), Amritsar, India. Out of the 240 serum samples, 197 (82.08%) showed seropositivity, while 43 (17.92%) were seronegative. When stratified, it was observed that in the age group 3~6 years, 22.33% of children were found to have anti-SARS-CoV-2 antibodies while in the age groups 7~10 years, 11~14 years, and 15~18 years, respectively, 37.06%, 30.46%, and 10.15% were seropositive. Although there was seroconversion among children which was useful for predicting the next wave, no differences in seropositivity were observed between adults and children.

INTRODUCTION

Since, the first outbreak in China, it's been two years the SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) pandemic is still giving hard time to the health systems around the globe. Numerous seroprevalence surveys have been conducted globally, however children remain largely glossed over [1-3]. Children under 18 years of age accounts for an estimated 4.8% of SARS-CoV-2 infection globally [4]. No conclusive statements pertaining to multi-fold aspects of the virus could be drawn owing to lesser prevalence of paediatric cases, thus the reported cases are the underestimation of the true number of paediatric case load as most of the children are mild or asymptomatic [5]. Majority of the children experiences very less severe symptoms of COVID-19 [6, 7] as they are contemplated to be virus shedders both through respiratory and oral-fecal routes as they are a paramount source of community-acquired transmission. Also, both adults and children have been shown to produce virus neutralizing antibodies in response to infection [8, 9]. SARS-CoV-2 IgG antibodies were detected in 99% of infected people after onset of the symptoms [10]. Presuming that presence of anti-viral antibodies renders some level of post infection immunity,

Corresponding author: Kanwardeep Singh
Department of Microbiology, Government Medical College, Amritsar 143001, India
E-mail: projects.vrdlamritsar@gmail.com
ORCID: https://orcid.org/0000-0003-3912-4847

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precise estimation of childhood seroprevalence aids in the modelling of epidemiological predictions and usher in appropriate anti epidemic measures such as home stay or school shut down [11-13]. The study was conducted to identify the indirect impact of SARS-CoV-2 infection on developing the herd immunity among the children with age group between 3 years to 18 years by investigating the amount of Ab percentage.

MATERIALS AND METHODS

The study was designed by keeping in mind the most commercial, cultural, and transportation centre of Punjab region (North-Western part of India). 240 healthy children with age from 3 to 18 years (without vaccination), who were examined for various paediatric reasons in the Department of Paediatrics, Government Medical College and Hospital, Amritsar, India. The quantification of the Ab levels was performed at Viral Research and Diagnostic Laboratory (VRDL), Government Medical College (GMC), Amritsar, India. Before commencement of the study, ethical permission and approval was obtained from the Ethics Commission at Government Medical College (GMC), Amritsar, India (GMC/IEC/21/KD/14; DATED 20/4/2021). In September 2021, venous blood (2~3 mL) was withdrawn from the children who were undergoing blood sampling regardless of this study, after taking informed consent from their parents/guardians. The children with known deficiency of antibodies were excluded from the study. Further, the children were stratified into four age groups (3~6, 7~10, 11~14, 15~18) and was analysed for demographic parameters such as age, sex, medical conditions, previous/current contact with COVID-19 infected patient. The semi-quantitative detection of anti-SARS-CoV-2 IgG Ab in the samples was detected using recommended kit ErbaLisa® COVID-19 IgG indirect ELISA kit (Erba Corporate Services, London, UK) using standard protocol as described by manufacture. Ab percentage was evaluated on the basis of cut off values following comparison between negative control and sample. The sample was evaluated negative if its value was similar to the negative control whereas if the value obtained was at-least 2 times higher than cut off value of negative control it was considered as positive. Since the samples were not randomly selected, so there was no provision to perform statistical analysis, thus, only descriptive analysis was performed using SPSS 20 (SPSS Inc., Chicago, IL, USA).

RESULTS

The present study was conducted on 240 children who have attended Department of Paediatrics, Government Medical College and Hospital, Amritsar, India due to various medical conditions. Out of the 240 children, 197 (82.08%) showed seropositivity while 43 (17.92%) were seronegative. Among both genders, males 111 (56.34%) outnumbered females 86 (43.65%) in sero-positivity (Figure 1).

Amid 240 children, only 2 (0.83%) children (siblings) were found to had symptoms for COVID-19 and upon testing was RT-PCR SARS-CoV-2 positive due to their

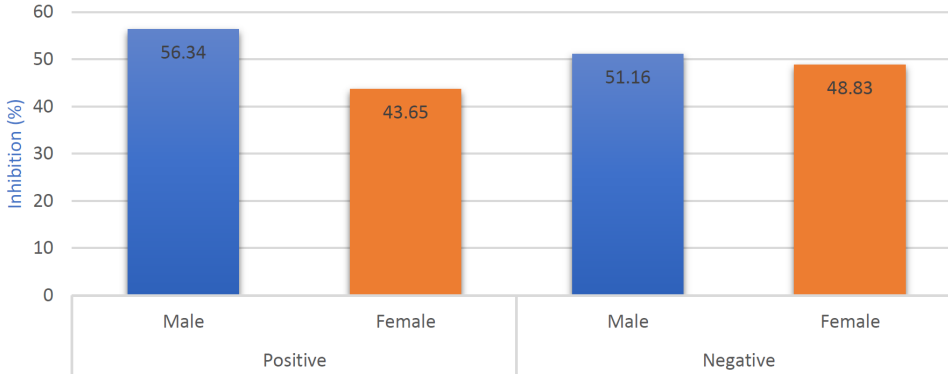

Figure 1. Prevalence of the gender specific seropositive and seronegative Ab inhibition.

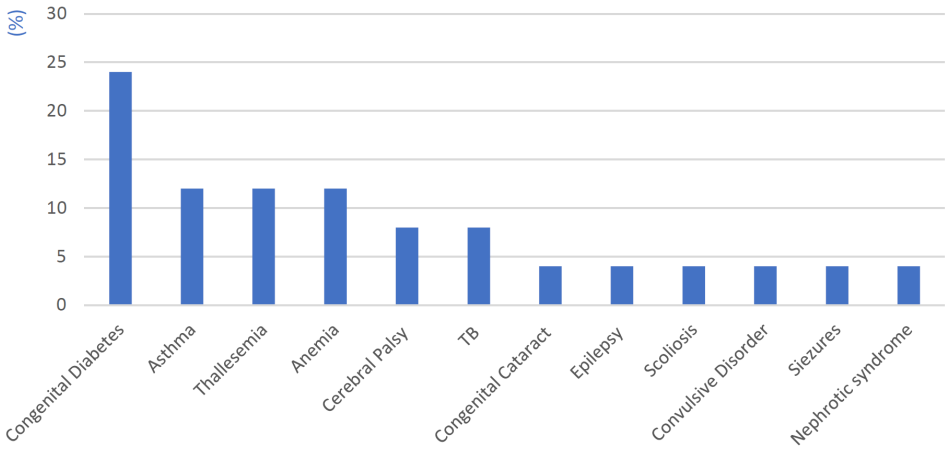

Figure 2. Distribution of various pre-edical conditions among children with Anti-SARS-CoV-2 Abs.

Table 1. Age-wise distribution of antibody percentage among males and females

Age group (years)	Antibody levels (N)		Antibody levels (%)
	Male	Female	
3~6	24	20	22.33
7~10	45	28	37.06
11~14	30	30	30.46
15~18	12	8	10.15

exposure to their SARS-CoV-2 positive parents while rest of the children were asymptomatic. Only 25 (10.37%) children were found to have pre-medical conditions such as congenital diabetes, asthma, anaemia, thalassemia, convulsive disorders, seizures, TB, scoliosis, epilepsy, cerebral palsy (Figure 2). Out of these 25 children, 17 were seropositive and 8 were seronegative for Ab percentage. When stratified, it was observed that in the age group 3~6 years, 22.33% were found to be having anti SARS-CoV-2 antibodies while in age groups 7~10 years, 11~14 years and 15~18 years, 37.06%, 30.46% and 10.15% were seropositive, respectively (Table 1, Figure 3).

DISCUSSION

The baseline results of our study bestowed with significant insights into the proportion of youngsters who have detectable levels of SARS-CoV-2 antibodies during second wave of COVID-19 pandemic.

In the present study, seroprevalence among children was higher (82.08%) as compared to the reported trends in Columbian cities where highest seropositivity seen was 60.8% in Guapi, 58.7% in Barranquilla, 50.7% in Leticia and lowest was 28.8% in Cali, 27.2% in Bogota and 25.8% in Medellin [14]. A study from Quebec revealed that it contributes only 19% to the total incidence in the second wave [15] whereas, study from Canada reported the seroprevalence in children from first and second wave was quite low ranging from 0.3%~1.6% [16, 17]. Other studies revealed that seroprevalence rate in children and youth varies such that 0.6% in Germany [18], 4.3% in France [19], 22.3% in Switzerland [20, 21] and 11.2% in UK [22]. In US, seroprevalence rate among children was 1.71% [23]. Bloomfield and co-workers [24] found not even a single case of seropositivity among their population (Czech Republic) and suggested that large scale studies are required to render methodologically firm estimates regarding paediatric population. This huge disparity in seroprevalence might be owing to difference in geographical region, ethnicity, race and also the result of immunogenicity acquired during childhood.

Reports from India observed higher seropositivity as compared to western world. A second nation-wide seroprevalence study showed 9% seropositivity among children from 10~17 years of age [25] while it was 19.6% in Chennai in teenagers up to 17 years [26]. An ongoing multi-centric study revealed higher prevalence in youngsters (60.3%) below 17 years of age

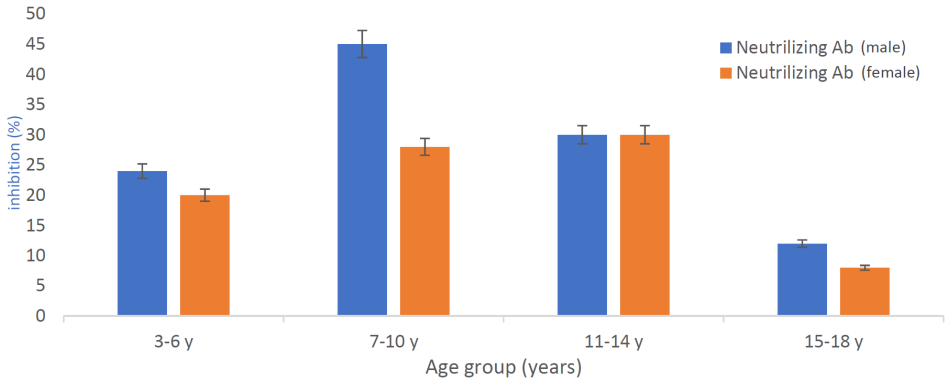

Figure 3. Distribution of Ab levels among males and females according to age.

as compared to adults which might be because of their high mobility and liberty in comparison to much younger children [27].

In the present report, only 0.83% were found to be RT-PCR positive when exposed to previously positive patients. This is in contrast to the study which documented that 18% of seropositive participants were positive for RT-PCR [28]. Also, in this study, no significant difference was observed between age groups for development of antibodies, which is consistent to the other investigations [18, 22, 29].

We assumed that children with pre-medical conditions were at higher risk from COVID-19 compared to their healthy peers, however, studies with detailed clinical information is lacking. In the present study, only 10.37% of the children were found to have co-morbidities and most common was congenital diabetes followed by asthma, thalassemia, anaemia and so on (Figure 2). However, none of these children showed any severe symptoms with COVID-19 and needed to be hospitalized. Various studies have reported diabetes as a risk factor for in-house death and severe COVID-19 illness among children [30-32]. A recent report suggested asthma is most frequently occurring health condition associated with risk of hospitalization but do not jeopardize the patient to COVID-19 illness [33]. On the other hand, evidences suggested that children with epilepsy were at higher risk of hospitalization and fatality when suffering from COVID-19 [34]. Other medical conditions that poses risk to children for COVID-19 was cardiac disease, neurological and developmental disorders [35], obesity [36], anxiety, depression and attention deficit hyperactivity disorder (ADHD) [37].

The study provide evidence of seroprevalence status of children in Punjab and spotlight the advantages of serological testing amid children for SARS-CoV-2. Higher seroprevalence among children in the present study could be due to their exposure to SARS-CoV-2 during the first and second wave of infection. Since, the number of test for SARS-CoV-2 among children were comparatively less among both waves in comparison to other age groups as reported by Sidhu et al. [38]. This could be due to absence of any symptoms for the infection and also due to low severity. Low paediatric seropositivity in other studies might be owing to reduced ability to elicit the antibody response because of seroconversion post infection [8]. The disparity in incidence rate is related to lower childhood susceptibility to the virus, is perhaps due to immune protection from other SARS-CoV-2 viruses often acquired by children [39, 40] or it may be on account of decreased expression of angiotensin-converting enzyme 2 receptor in nasal epithelia, which is the cellular entry point for SARS-CoV-2 [41]. No study till now has reported higher seropositivity, thus, pursuing monitoring the serological status of youngsters helps to estimate exact prevalence rate. From the above findings, it was also concluded that serology is a valuable tool for SARS-CoV-2 surveillance, albeit, RT-PCR and antigen tests are requisite for acute infection detection but precise comprehension of earlier infections pave the way to better acknowledge and govern community transmission.

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Conflict of interest: None

Author's information (Position): Kaur A[1], Research Scientist; Singh N[2], Associate Professor; Singh K[3], Professor; Sidhu SK[3], Associate Professor; Kaur H[1], Research Assistant; Jain P[1], Research Assistant; Kaur M[2], Professor; Jairath M[1], Research Scientist.

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