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ORIGINAL ARTICLE

The Impact of Covid-19 Pandemic on the Clinical Course of Pediatric Skin Disorders: A Cross-Sectional Study

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ABSTRACT

Objectives: As Covid-19 infection continues to affect both the pediatric and adult populations, new-onset and pre-existing skin diseases in addition to the skin diseases with exacerbation, are frequently being reported as the cutaneous manifestations of the pandemic. In the present study, the aim was to investigate the impact of Covid-19 pandemic on the clinical course of the skin diseases observed in the pediatric population.

Materials and Methods: A web-based survey related to the cutaneous disorders seen in the pediatric population (0-18 years) prior to the pandemic and during the pandemic, was formed. The survey was spread using snowball sampling method. The questionnaire was asked to be filled by the parents. Demographical data, Covid-19 related questions, the presence of the new-onset skin disorders and the clinical course of the pre-existing cutaneous diseases during the pandemic were questioned.

Results: Two hundred ninety one children aged between 0-18 years, were included in the study. The mean age was 11.3 ± 4.6 years. One hundred sixty four respondents were female; whereas 127 were male. Ninety seven cases were tested for SARS-CoV-2, 41 had positive RT-PCR result. During the pandemic, 65 children had at least one new-onset cutaneous disease: the most common ones were pruritus (n=23, 35.4%), xerosis (n=17,26.2%), acne vulgaris (n=11, 16.9%) and seborrheic dermatitis (n=11, 16.9%). There was no statistically significant relationship between the presence of any new-onset skin disease during the pandemic and being diagnosed with Covid-19 (p=0.73). However, there was a statistically significant relationship between the number of new-onset acne vulgaris cases and median duration of mask wearing during the pandemic (p=0.025).

Conclusion: The present study shows that the era of the Coronavirus disease, has led to the emergence of new-onset skin problems in the pediatric population due to the use of personal protective equipment. Psychosocial burden of the pandemic also seems to have an impact on the pediatric skin disorders.

Keywords: Covid-19, pediatrics, skin disease

INTRODUCTION

From the start of Covid-19 pandemic in 31 December 2019, a wide range of systemic manifestations such as fever, dry cough, muscle pain, gustatory and olfactory dysfunction have been associated with the infection. As the outbreak of SARS-CoV-2 infection has continued to spread worldwide, cutaneous manifestations of the disease such as urticaria, morbilliform rash, livedo reticularis, papular or vesicular exanthem, have been associated with the infection [1]. It has also been shown that children tend to exhibit milder symptoms of Covid-19 compared to the adults and deaths are extremely rare in pediatric patients [2]. Just like the clinical course, cutaneous manifestations of the infection also differ between adults and children [3]. Erythema multiforme, Kawasaki disease-like inflammatory multisystemic syndrome, chilblain-like lesions, purpuric/livedoid rash and pityriasis-rosea like eruption are among the most frequently reported cutaneous manifestations of Covid-19 in the pediatric population [3-5]. Thrombosis, coagulopathy, immune complex vasculitis and SARS-CoV-2-induced type 1 interferonopathy have all been implicated in the pathogenesis of these cutaneous manifestations [3-5].

Besides the cutaneous illnesses observed in the individuals with Covid-19, skin problems arising from protective personal equipment (PPE) use and frequent hand washing including irritant/allergic contact dermatitis and acne vulgaris, have also increased significantly among the young adults [6,7]. Social isolation, the extension of the pandemic period, the loss of the beloved ones due to Covid-19 and being separated from the school might have overall had a negative psychosocial influence upon the children which have been associated with the development of new-onset trichotillomania, telogen effluvium (TE) and alopecia areata (AA) cases.

In the present study, the aim was to investigate the influence of Covid-19 pandemic on the clinical course of the skin diseases observed in the pediatric population.

METHODS

The present study was approved by the local ethics committee (the date and decision number: November 19 2021, 2021/029). Additionally, the approval of the Ministry of Health Ethics committee was also obtained (date: October 22 2021; application number: 2021-10-18T21_23_48.) Informed consent was taken from the participants. A web-based questionnaire which composed of 22 questions (Supplementary file 1) was formed using Google forms. The survey was divided into four sections: (I) demographical data of the child (age, number of the siblings/household members, jobs of the parents, the chronic systemic diseases, current medications); (II) questions related to Covid-19 infection [Covid-19 real time polymerase chain reaction (RT-PCR) result, the presence of any Covid-19 associated symptoms, history of close contact to a person with a diagnosis of Covid-19, treatment taken for Covid-19, requirement of hospitalization, use of face masks, duration during which face masks are used in a day); (III) skin problems observed prior to the beginning of Covid-19 pandemic (type of the skin disease, presence of consultation with a physician, treatment used for the disease); (IV) skin illnesses observed during Covid-19 pandemic (types of both new-onset and pre-existing/ongoing skin diseases, presence of referral to a specialist, given treatment, the clinical course of the pre-existing skin diseases during pandemic, the role of stress in the emergence or aggravation of the diseases). The online survey was sent to the individuals who had at least one child between the ages of 0 to 18 years, via e-mail or instant messaging in Turkey. The virtual snowball sampling method was used. The survey was asked to be filled by the parents and children (if the child was able to comprehend and answer the questions). The online survey was filled again for each child.

IBM SPSS for Windows Version 20.0 was used for the statistical analysis. The variables were investigated using visual (histograms, probability plots) and analytical methods (Kolomogorov-Smirnov/ Shapiro-Wilk test) to determine whether or not they

are normally distributed. Descriptive analyses were presented using means and standard deviations for normally distributed and medians and interquartile range (IQR) for the non-normally distributed and ordinal variables. Median scores of all groups were compared with the non parametric Mann-Whitney U test. Fisher's exact test or Chi-Square test were utilized for the statistical analysis of categorical variables. P-values below 0.05 were accepted as statistically significant.

RESULTS

Two hundred ninety one children aged between 0-18 years, were included in the study. The mean age was 11.3 ± 4.6 years (range: 1-18). One hundred sixty four (56.4%) respondents were female whereas 127 (43.6%) were male. Sixty four (22%) children had one or more systemic accompanying illness.The mean number of household members living in the same house with the children, were 4.5± 1.5 (range:2-15). Thirty three (11.3%) children was living with one or more household member employed in the healthcare sector. Ninety seven (33.3%) cases were tested for Covid-19, 41 (42.3%) had positive RT-PCR result whereas 56 (57.7%) tested negative. Additionally, 129 (44.3%) cases had close contact to someone with a confirmed diagnosis of Covid-19 whereas 117 (40.2%) children exhibited Covid-19 related symptoms. Hospitalization was not required for any child. In general, non-steroidal anti-inflammatory drugs, vitamin supplements, oral hydration and resting were the most commonly suggested treatment modalities for pediatric patients with Covid-19.

In the online questionnaire, participants were asked if they had any other contributing factors during Covid-19 pandemic which might be associated with the progression of the skin disease. Only five (1.7%) children had lost >5% of his/her own weight in a period of 6 months, 95 (32.6 %) felt stressed or overwhelmed which had a major impact on her/his daily functioning whereas 7 (2.4%) were on an extreme diet during Covid-19 pandemic. Prior to the pandemic, 159 (54.6%) respondents had at least one skin disorder. The most commonly reported cutaneous diseases were acne vulgaris (n=57, 35.8%), xerosis (n=43, 27%) and seborrheic dermatitis (SD) (n=43, 27%). The distribution of different skin diseases is shown in Table 1. Prior to the pandemic, 50 (31.4) out of 159 cases with a skin disease, were diagnosed by a physician and only 83 (52.2%) had used at least one treatment modality for their skin diseases. Forty three (51.8%) used cosmetics/personal care products, 38 (45.8%) used medical treatments prescribed by a physician, 15 (18%) used vitamin supplements and/or herbal medications.

During the era of Covid-19, 213 (73.2%) had one or more skin disease. The most common skin diseases were acne vulgaris (n=75, 35.2%), xerosis (n=62, 29.1%) and SD (n=57, 28.8%). The distribution of the skin diseases observed in the era of Covid-19

Table 1. The distribution of the skin diseases prior to the pandemic and during the pandemic

Disease Type	Prior to the Pandemic n (%)	During the Pandemic n (%)
Acne vulgaris	57 (35.8)	75 (35.2)
Xerosis	43 (27)	62 (29.1)
Seborrheic dermatitis	43 (27)	57 (28.8)
Pruritus	34 (21.4)	66 (31)
Telogen effluvium	24 (15.1)	39 (18.3)
Herpes simplex	18 (11.3)	23 (10.8)
Atopic dermatitis	14 (8.8)	16 (7.5)
Verruca vulgaris	10 (6.3)	16 (7.5)
Psoriasis	10 (6.3)	10 (4.7)
Insect bite	9 (5.7)	4 (1.9)
Viral maculopapular rash	4 (2.5)	2 (0.9)
Trichotillomania	3 (1.9)	3 (1.4)
Acral and oral vesicular eruption	3 (1.9)	14 (6.6)
Alopecia areata	2 (1.3)	5 (2.3)
Acral peeling and onychomadesis	2 (1.3)	2 (0.9)
Early hair greying	2 (1.3)	-
Vitiligo	1 (0.6)	2 (0.9)
Rosacea	1 (0.6)	3 (1.4)
Scabies	1 (0.6)	8 (3.8)
Irritant/allergic contact dermatitis	-	24 (11.3)
Impetigo	-	2 (0.9)

are shown in Table 1 and clinical pictures belonging to different diseases are shown in Figure 1 and 2. One hundred ninety one (89.7%) out of 213 children with a skin disease during Covid-19 pandemic, were diagnosed by a physician and 198 (93%) had used at least one treatment for their skin disease. Fifty seven (28.8%) used cosmetics/personal care products, 187 (94.4%) used medical treatments prescribed by a physician or underwent medical procedures (cryotherapy, platelet-rich plasma etc.) performed by a physician, 9 (4.5%) used vitamin supplements and/or herbal medications. On the other hand, 65 (22.3%) children developed new-onset skin disorders during Covid-19 pandemic (Table 2). The most common skin diseases are pruritus (n=23, 35.4%), xerosis (n=17,26.2%), acne vulgaris (n=11, 16.9%), SD (n=11, 16.9%) and irritant/allergic contact dermatitis (n=9, 13.8%). The average time between the emergence of any new-onset skin disease and Covid-19 diagnosis was 4.7± 3.9 months (range: 1-12). Prior to the pandemic, out of 159 children with at least one preceding cutaneous disease, 92 (57.9%) showed increase in the symptoms of the disease (Table 2). Out of 41 patients with a confirmed diagnosis of Covid-19, 26 (63.4%) had at least one skin disease during Covid-19 pandemic. The most prevalent diseases were TE (n=8, 30.8%), acne vulgaris (n=8, 30.8%) followed by pruritus (n=7, 26.9%) and SD (n=6, 22%).

Table 2. The distribution of new-onset skin disorders and pre-existing skin disorders with exacerbation

Disease Type	New-onset skin disorders n (%)	Pre-existing skin disorders with exacerbation n (%)
Telogen effluvium	6 (9.2)	13 (14.1)
Vitiligo	1 (1.5)	1 (1.1)
Alopecia areata	3 (4.6)	1 (1.1)
Psoriasis	1 (1.5)	4 (4.4)
Seborrheic dermatitis	11 (16.9)	32 (34.8)
Pruritus	23 (35.4)	18 (19.6)
Atopic dermatitis	5 (7.7)	5 (5.4)
Scabies	5 (7.7)	1 (1.1)
Verruca vulgaris	6 (9.2)	9 (9.8)
Acne vulgaris	11 (16.9)	41 (44.6)
Irritant/allergic contact dermatitis	9 (13.8)	-
Insect bite	1 (1.5)	2 (2.2)
Xerosis	17 (26.2)	26 (28.3)
Impetigo	2 (3.1)	-
Acral peeling with onychomadesis	1 (1.5)	-
Rosacea	2 (3.1)	-
Herpes simplex	6 (9.2)	7 (7.6)
Acral vesicular eruption	9 (13.8)	1 (1.1)
Maculopapular rash	-	2 (2.2)
Trichotillomania	-	2 (2.2)

Figure 1. Some clinical pictures of the skin diseases observed in pediatric patients during Covid-19 pandemic: a case of trichotillomania (A), irritant contact dermatitis due to frequent hand washing (B), retroauricular dermatitis due to face mask use (C).

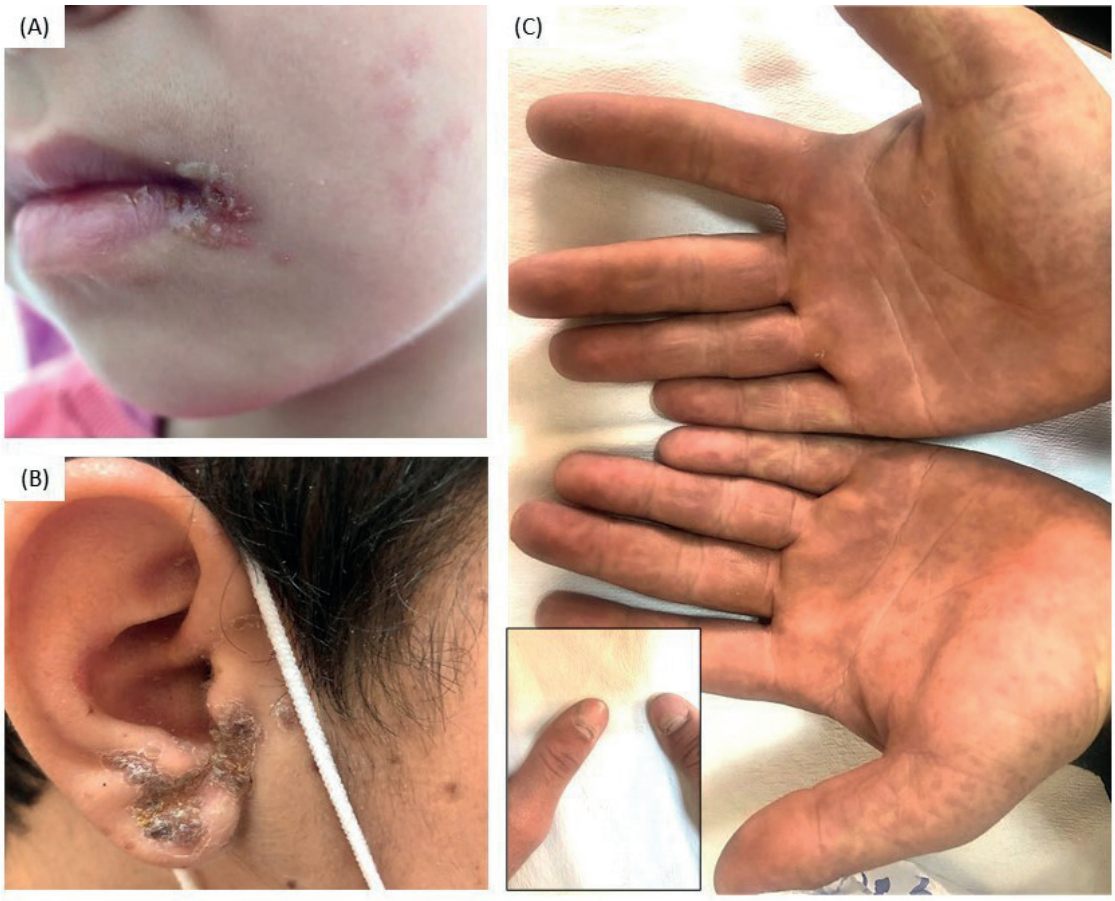

Figure 2. Some clinical pictures of the skin diseases observed in pediatric patients during Covid-19 pandemic: labial herpes simplex (A), vesicular/crusted acral eruption on the ear lobes (B), palmar dusky plaques (C) and onychomadesis (inset) belonging to the same patient.

The parents and children were also asked to compare the clinical course of the pre-existing skin diseases between the pre-pandemic and pandemic eras. In 56 (35.2%) individuals, the clinical course of the cutaneous disease was not reported to have any change, in 92 (57.9%) children the severity of the skin disease increased during Covid-19 pandemic whereas 11 (6.9%) showed decrease in the severity of the symptoms during Covid-19 pandemic. Of 157 children who developed either a new-onset skin disorder or showed increase in the severity of a pre-existing skin disease, 84 (53.5%) thought that stress played a significant role in the development of the new-onset skin disease or exacerbation of the pre-existing skin disease.

There was no statistically significant relationship between the presence of any new-onset skin disease during Covid-19 pandemic and being diagnosed with Covid-19 (p=0.73) (Table 3). Again, we were not able to find any significant difference between the presence of Covid-19 related symptoms and presence of any new-onset skin disorder (p=0.054) (Table 4). No statistically significant difference was found between Covid-19 RT-PCR positivity and the clinical course of the pre-existing skin disease (p=0.058) (Table 5). Lastly, 256 (88 %) out of 291 children were using masks regularly in daytime. The mean duration of mask-wearing in a day, was found to be 6.3±2.4 hours (range: 0.5-12). Statistically significant relationship was found between the presence acne vulgaris (both new-onset and pre-existing cases) among children

Table 3. There was no statistically significant relationship between the presence of any new-onset skin disease during Covid-19 pandemic and being diagnosed with Covid-19 (p=0.73)

	Presence of any new-onset skin disease during Covid-19 pandemic		
Covid-19 RT-PCR Results	Not present n (%)	Present	Total n (%)
Negative	16 (57.1)	10 (62.5)	26 (59.1)
Positive	12 (42.9)	6 (37.5)	18 (40.9)
Total	28 (100)	16 (100)	44 (100)

Table 4. There was not any significant difference between the presence of Covid-19 related symptoms and presence of any new-onset skin disorder (p=0.054)

	Presence of any new-onset skin disorder		
Presence of any Covid-19 related symptoms	Not present n (%)	Present	Total n (%)
Negative	47 (70.1)	35 (53.8)	82 (62.1)
Positive	20 (29.9)	30 (46.2)	50 (37.9)
Total	67 (100)	65 (100)	132 (100)

Table 5. No statistically significant difference were found between Covid-19 RT-PCR positivity and the clinical course of the pre-existing skin disease (p=0.058)

	The Clinical Course of the Pre-existing Skin Disorder			
Covid-19 RT-PCR results	No change n (%)	Symptoms increased n (%)	Symptoms decreased n (%)	Total n (%)
Negative	10 (50.0)	20 (66.7)	0 (0)	30 (62.1)
Positive	10 (50.0)	10 (33.3)	3 (100)	23 (37.9)
Total	20 (100)	30 (100)	3(100)	53 (100)

and the median duration of mask wearing during Covid-19 pandemic (p=0.001). Again, we found a statistically significant relationship between the number of new-onset acne vulgaris cases and the median duration of mask wearing (p=0.025).

DISCUSSION

SARS-CoV-2 infection, since its first emergence keeps on having a substantial influence upon mankind's physical and mental health. In various studies, it has been shown that Covid-19's systemic manifestations differ significantly between adults and children [8]. Pediatric patients with Covid-19 tend to exhibit milder symptoms of the disease compared to the adults; the most common signs are fever and cough [8]. Furthermore, the characteristic laboratory finding of the adult patients with Covid-19, lymphopenia, is not frequently observed in the children and atypical clinical manifestations such as diarrhea is found to appear more commonly in pediatric patients [9]. Just like symptoms and laboratory findings, cutaneous manifestations of SARS-CoV-2 infection are also distinctive in the pediatric population [4].

In a review article by Khalili et al [10], it was reported that pseudochilblain lesions, dactylitis, acral erythema, erythema multiforme, acute urticaria, livedo-like lesions, morbilliform eruption, acro-ischemia, chicken-pox-like rash, petechia and purpura were among the skin manifestations of Covid-19. Most patients were asymptomatic or showed only a few mild symptoms, the duration between the emergence of the systemic symptoms and cutaneous findings ranged between 1 day and weeks [10]. In another review by Shah et al [11], acral erythematous and violaceous maculopapular lesions were found to be the most prevalent skin findings in children followed by erythema multiforme, Kawasaki-like disease and varicella-like exanthem. The induction of type 1 interferon release by the virus, activation of the JAK-STAT signalling pathway along with coagulation pathway, thrombotic vasculopathy and immune-complex deposition are all implicated in the etiopathogeneses of the various cutaneous manifestatons of Covid-19 infection [4,12,13].

In addition to these skin diseases observed in the individuals diagnosed with Covid-19, skin problems due to frequent hand washing and hand sanitiser use such us irritant contact dermatitis, have also risen among the children [6]. In an observational study by Borch et al [6], it was shown that school children had a higher relative risk of developing irritant contact dermatitis compared to preschool ones. Frequent hand washing was found to be a significant risk factor for the emergence of irritant contact dermatitis [6]. Furthermore, continuous use of hand sanitisers was blamed in the pathogenesis of contact dermatitis with atypical clinical presentations [14]. A case of contact urticaria mimicking allergic contact dematitis due to the use of disposable polypropylene surgical mask, in a 7-year old girl was also reported by Corazza et al [15]. In a retrospective study by Altun [7], the most common causes for admission to an outpatient dermatology clinic in Turkey between 30 March and 30 April 2020, were investigated. The most prevalent, new-onset diseases in the pediatric group, were found to be acne, scabies, diaper dermatitis, atopic dermatitis and other eczematous eruptions [7]. In both children and adult age groups, the most frequent reason for admission was acne vulgaris [7]. In the present study in which new-onset pediatric skin diseases were evaluated

from the start of the outbreak until February 2022, the most common new-onset cutaneous illnesses were pruritus (n=23, 35.4%), xerosis (n=17,26.2%), acne vulgaris (n=11, 16.9%), SD (n=11, 16.9%) and irritant/allergic contact dermatitis (n=9, 13.8%). Our results were partially similar with the results of Altun's study, in that face mask-induced acne and SD cases constitued a substantial part of the newly emerged skin problems. Distinctively, pruritus, xerosis and contact dermatitis were found to be the other most frequent new-onset skin problems in the present study. Both the methods of the two studies (single-center retrospective study, physician-diagnosed illnesses vs online survey, physician and/or parent-assessed illnesses) and different time intervals in which the studies were carried out, might be responsible for the different outcomes of the two studies. Additionally, in the present study, no statistically significant relationship was determined between the presence of any new-onset skin disorder during Covid-19 pandemic and being diagnosed with Covid-19 (p=0.73). We believe that small proportion of cases (n=41, 18.7%) with a confirmed diagnosis of Covid-19, might be accountable for this result. Low nasopharyngeal swab RT-PCR positivity in children [4,16], higher rate of asymptomatic pediatric patients [17] and the lower rate of hospital admission among the pediatric patients due to mild-to-moderate symptoms might have caused the real positive cases to be missed out.

In another case letter from Turkey, two different hair loss patterns (AA and TE) were described in two pediatric patients with Covid-19-associated multisystemic inflammatory syndrome [18]. Furthermore, Oner [19] reported three pediatric cases of new-onset trichotillomania which started during Covid-19 pandemic. It was proposed that stress, anxiety, social isolation and negative psychosocial impact of the pandemic upon children, might have all contributed to the development of these hair diseases [18,19]. Supporting this assumption, in the present study, stress and anxiety were thought to have a role in the development of the new-onset skin disease(s) or exacerbation of the pre-existing skin problems in 84 (53.5%) cases. The most common cutaneous disorders which showed deterioration, were acne vulgaris (n=41, 44.6%), SD (n=32, 34.8%) and xerosis (n=26, 28.3%). Higher temperature of the face resulting from uninterrupted mask use, causes an enhanced sebum excretion rate, proliferation of abnormal microbiota and increased permeability of the skin barrier which all contribute to the development or clinical aggravation of acne and SD [20,21]. In line with this observation, in the present research, a statistically significant relationship was determined between the number of new-onset acne vulgaris cases and the median duration of mask wearing in a day (p=0.025). In another study investigating the effects of Covid-19 pandemic upon dermatology-specific health-related quality of life (HRQoL) in pediatric patients aged between 0-4 years, it was revealed that patients with SD and allergic contact dermatitis had a comparable but lower influence of cutaneous diseases on their HRQoL when compared with children with atopic dermatitis [22]. Even though, HRQoL is not evaluated in our study, the exacerbation of the skin disease was observed in 32 patients with SD and 5 patients with atopic dermatitis.

In conclusion, we want to highlight once again that Covid-19 pandemic, has led to the development of new-onset skin problems in the pediatric population due to the infection's direct viral effects, pyschosocial burden of the outbreak and continual use of personal protective equipment.

The present study has some limitations since the results were dependent on the answers of the parents and children obtained through an online questionnaire. The severity of the skin disease(s) was not directly evaluated by a specialist using a score or scale. Prospective, randomized-controlled studies with larger sample size are needed to support our findings.

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Author contribution

Study conception and design: EB; data collection: EB; analysis and interpretation of results: EB; draft manuscript preparation: EB. The author reviewed the results and approved the final version of the manuscript.

Ethical approval

The study was approved by the Ministry of Health Ethics Committee (Protocol no. 2021/029/19.11.2021).

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Conflict of interest

The authors declare that there is no conflict of interest.

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