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Epidemiological trends and risk factors of gastrointestinal parasitic infections among children: a five-year study in al jouf, saudi arabia

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Abstract

Background: Intestinal parasitic infections remain a major global public health concern, particularly among children in low- and middle-income countries, where they contribute significantly to morbidity. Despite lower prevalence in higher-income regions, these infections persist due to environmental and behavioral factors. This study aimed to evaluate the prevalence, temporal trends, and demographic distribution of intestinal parasitic infections among children in Sakaka, Saudi Arabia over a five-year period.

Methodology: A retrospective cross-sectional study was conducted on pediatric patients attending the Maternity and Children Hospital in Sakaka, Al Jouf region, between June 2020 and September 2024. Demographic characteristics and stool microscopy findings were collected and analyzed. Temporal variations and distribution patterns of parasitic infections were assessed.

Results: A total of 493 cases were examined, including 459 Saudi and 34 non-Saudi children. The detected parasites were *Entamoeba histolytica, Giardia lamblia, Hymenolepis nana*, and *Taenia spp*., with Taenia identified in only one case. Notably, *E. histolytica* was not detected in 2023, indicating possible environmental or diagnostic variations. An increase in parasite diversity was observed among males in 2024, including *H. nana*. Overall prevalence remained low, with no statistically significant differences observed between sexes.

Conclusion: The low prevalence and absence of significant demographic variation suggest limited transmission within the studied population. However, observed temporal fluctuations highlight the need for continuous surveillance. Strengthening public health education and preventive strategies remains essential to further reduce the burden of intestinal parasitic infections.

Introduction

The most prominent group of underestimated communicable diseases include parasitic infections of gastrointestinal (GI) tract affecting billions of people worldwide. They include helminthic and protozoan infections [1-5], mainly from low- and middle-income group countries. Children are the primary risk group for parasitic infections [4-7]. Enteroparasites are more prevalent among children as compared with the general population [8]. Intestinal parasitic infections are one of the most significant worldwide health challenges especially in preschool and school children in many developing countries [4]. A very high burden, 59.3% of parasites was detected in a 10-Year (between 2008 -2018) retrospective study on a group of adopted children from Africa and Latin America; Moreover 28.9% of these children tested positive for two or more parasites [5,6].

There are different factors in association with transmission of these enteroparasites. The multiple conditions that promote gastrointestinal infections include warm and humid climates, poor sanitation and hygiene, and the lack of clean drinking water [7]. One of the important factors may be poor living environments with no latrines and no access to clean water and lack of simple hygiene products like

soap for ablutions. Others may relate with child's practices; as hand washing practice after toilet, before and after eating and nail trimming [8], or family particularly mothers' practices and mother's educational status [9]. The primary route for transmission of intestinal parasites (Fig. 1) is the contamination of food or drinking water or personal contact via fecal-oral route

Endoparasitic infections are caused by different species of helminths and protozoa such as *Ascaris lumbricoides* (*A.lumbricoides*)*, Trichuris trichiura* (*T.trichiura*)*,* hookworm, *Schistosoma mansonai* (*S. mansoni*), *E. histolytica, Enterobius vermicularis* (*E. vermicularis)*, *cryptosporidium parvum* (*C.parvum*)*, H.nana and G.lamblia* which are the most prevalent and leading to a significant morbidity and mortality. Intestinal parasitic infections have multiple effects among children including physical and mental developments as they can cause symptoms like diarrhea, vomiting, loss of appetite and abdominal pain. Many of them cause severe complications such as fever, intestinal bleeding, malabsorption of nutrients, nutritional deficiency, destruction of cells and tissues [10-12] Most parasitic infection may lead to growth retardation, reduced mental development, absence from school, low academic performance and susceptible to infection. The symptoms detected were recurrent abdominal pains, abdominal distension, nausea, vomiting, diarrhea, anorexia, blood in stools [4]. Common symptoms of parasitic infections are summarized in Fig.2.

Most of the parasitic infections are centered in middle/low income or developing countries in Latin America, Sub-Saharan Africa [5] and Asia [13]. Albeit the rate of parasitic infections in developed countries is comparatively low [14-16]. But higher income countries also do report parasitic infections [11-12]. As a result, many studies about prevalence of intestinal parasitic infections in different regions of Saudi Arabia were done. A study in Al-Baha Area from 2009-2011 found out the rate of Parasitic infections were higher among Indonesian (41.42%) followed by Indian (22.89%), Bangladeshis 118 (10.93%), Philippines 96 (8.89%), Pakistani 94 (9.71%), Sri-Lankan 55 (5.09 %) Egyptian & Syrian 22 (2.03%) workers [13]. A recent study again emphasized the sign [15] finance of socio-economic factors and literacy when newly arrived expatriate laborers and drivers in Jeddah, Saudi Arabia demonstrated a rate of 18.61% and 11.7% soil transmitted helminth infections; the reported parasites were *A. lumbricoides, Necator americanus* (*N. americanus), T. trichiura, Strongyloides stercoralis* (*S. stercoralis*)*, A. duodenale* [16].

Parasitic infections are a serious problem (Fig. 3) because if neglected they multiply in great numbers causing lot of easily preventable diseases. Thus, the aim of this study was to detect any prevalence of intestinal parasitic infection among children in Sakaka, Saudi Arabia. Therefore, epidemiological surveys on the prevalence of intestinal parasitic infection are essential to develop appropriate intervention strategies. To our knowledge the prevalence of enteric parasites in-between children in Al-jouf area has not previously been reported. Therefore, this study aimed to assess the prevalence of intestinal parasitic infection among children attended Maternity and Children Hospital in Sakaka, Al jouf region.

This retrospective study was conducted between 2020-2024 on children who attended the Maternity and Children Hospital in Sakaka, Al Jouf region, Saudi Arabia. Sakaka city, the capital of Al Jouf Province, lies

in northwestern Saudi Arabia. It is located just to the north of the Annafud desert. It has an area of 100,212 km² and a population of 50, 8475 as of 2017 Census.

Material and Methods:

Data collection

Random samples of Saudi and non-Saudi children were included in this study. Patients' medical records were used to collect different sociodemographic and related data as age, sex, parent's occupation, nationality, time of stool analysis, any physical complaint, any history and microscopic examination data of stool analysis for parasite detection.

Stool samples were examined, at the laboratory of Maternity and Children Hospital, based on the direct wet mount (normal saline and lugol), formalin–ether concentration method, and Ziehl–Neelsen and trichrome stained slides.

Data Analysis Chi square test and Fisher's Exact test were conducted to test association between sex and the type of parasitic infection. Mann–Whitney U tests were conducted to assess age differences between infected males and females.

Ethical consideration

The study was conducted after having ethical Approval from Local committee of Bioethics (LCBE) at Jouf University and Ministry of Health.

Results

The prevalence of infection is summarized in Figure 4, the number of patients tested for intestinal parasitic infections across the study period (2020–2024) was predominantly composed of Saudi nationals, reflecting the population structure of the study setting in Saudi Arabia. Figure 5 presents the prevalence of parasitic infections among male and female patients over the five-year period. In all studied years (2020–2024), only a small proportion of the examined patients tested positive relative to the total number tested, indicating a generally low prevalence. Most positive cases were observed among Saudi nationals, with only a few exceptions, including one Bangladeshi female in 2021.

Gender-wise and temporal distribution of protozoan infections are shown in Figure 6. Overall, no consistent sex-related differences were observed across the study years. Notably, *Taenia* spp. was reported in only one female case in 2023. Figure 7 demonstrates the relationship between patient age and parasitic infections. In 2020–2023, infections were mainly limited to *Giardia lamblia* and *Entamoeba histolytica* across different age groups. In 2024, an additional parasite (*Hymenolepis nana*) was detected. The majority of infected cases across all years were Saudi nationals, with a few isolated cases among non-Saudi patients, including individuals from Bangladesh and Egypt.

Discussion

Figure 4, shows total number of children-patients in of different nationalaties tested for parasitic infections in year 2020,2021,2022, 2023,2024. Maximum number of patients tested were Saudi nationals. Out of total 493 patients tested in five years maximum patients, 459 tested patients were Saudi nationals, only 34 foreign nationals reported sick to the hospital for suspected parasitic protozoan infections [16–18].

Maximum patients tested positive were also Saudi nationals. In all five years only three foreign nationals were tested positive. Interestingly, all three patients tested positive for G. lamblia infection. One Bangladeshi female aged 5.3 years was tested positive for *G. lamblia* in 2021 [18]. In 2022 (Female,10.5 years) and 2023 (Female,6.2 years) an Egyptian each were tested positive for *G. lamblia*. The low prevalence of infection observed in expat population was since the study is based on children's population [16].

There is a high chance of a low expatriate child population in Sakaka Al Jouf. Prevalence of different protozaon parasitic infections in male and females in year 2020,2021,2022, 2023,2024 is shown in Figs. 5 and 6. According to Chi square test there is no statistically significant association between sex and the type of parasitic infection (*G. Lamblia* vs. *E. Histolytica*) at the 0.05 significance level. The observed variations in infection rates between males and females for different parasitic types are likely due to random chance rather than any biological or behavioral factors related to sex.2021 showed No significant sex or parasitic effects.

Although,2022 had Significant sex effect (males had lower infections), the infections peaked during summer. In Females, Giardia dominated 2023 infections (94.7% of all cases), Zero *E. histolytica* infections were detected in 2023.A rare case of *Taenia* sp. was observed in 2023 in a girl of 6.7 years [16].

In all five years tested, Fisher's Exact test showed no statistically significant association between gender or parasitic infection for either *G. lamblia* or *E. histolytica*. Although, females showed slightly higher positivity rates, low prevalence resulted in non-significant findings [19]. The small number of cases limit statistical power [16]. The occurrence of *T. solium* was very low, with only a single female case detected. The absence of E. histolytica in 2023 represents a significant change from previous years and calls for investigation into potential environmental or diagnostic factors [20]. In 2024, males show more diverse protozoal infections with additional representation of *H. nana* from a single male besides *E. histolytica* [21] and *G. lamblia*. Mann–Whitney U tests were conducted to assess age differences between males and females infected with *G. lamblia* and *E.histolytica* (Fig. 7). These results indicate that the age distribution of infections did not differ between sexes. The age comparison for *Taenia sp*. and *H. nana* was not conducted due to insufficient sample size (only one case each) [21–23].

CONCLUSION

Saudi Arabia is a country with high human development index. The low rate of protozoan infection in the studied population proved it. It is worth noting that the infection is low but not zero. Lack of hand hygiene and drinking water are prime factors in spread of protozoan diseases. The small size of protozoa shields some of them from treatment at drinking water facilities. Some patient families just returned from trips to less developed nations while some used normal filter water. Parasitic infections can be easily avoided through simple preventive measures, if ignored these infections can increase in number. Moreover, untreated /ignored infections can have devastating consequences on the health of children as listed. Therefore, it is pertinent to increase awareness in Saudi and expatriate population through health educational programs related to self-hygiene, sensitization, how to prevent transmission of intestinal parasitic infections.

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Declarations

Written informed consent was obtained from the parents or legal guardians of all participating children prior to their inclusion in the study."

"The study protocol was approved by the Research Ethics Committee of [Calluge of medicine Al-Jouf University 15-07/41], and all procedures were performed in accordance with relevant guidelines and regulations.

Conflict of interest

All the author certifies that the research was conducted without any commercial or financial relationships that could be seen as a potential conflict of interest.

Informed Consent

The local research ethics committee of the ministry of health in the Northern Borders region, registered with the National Bioethics Committee under number (H-09-A-51).

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Author Contribution

M.A.A.: Had supervision on all parts of the research work Methodology, Data curation, Morphological and Analysis of Data, Writing – Review and editing. H.S. A. and F.Z. Analysis and data curation, prepared figures, scientific writing and review; S.A.K. and F.S.A., writing and editing the strain identification part. A.E.S: The experiment, sampling, Data curation and Examination and reviewing.

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Figures



Figure 1

Identified causes for parasitic infections in developing countries

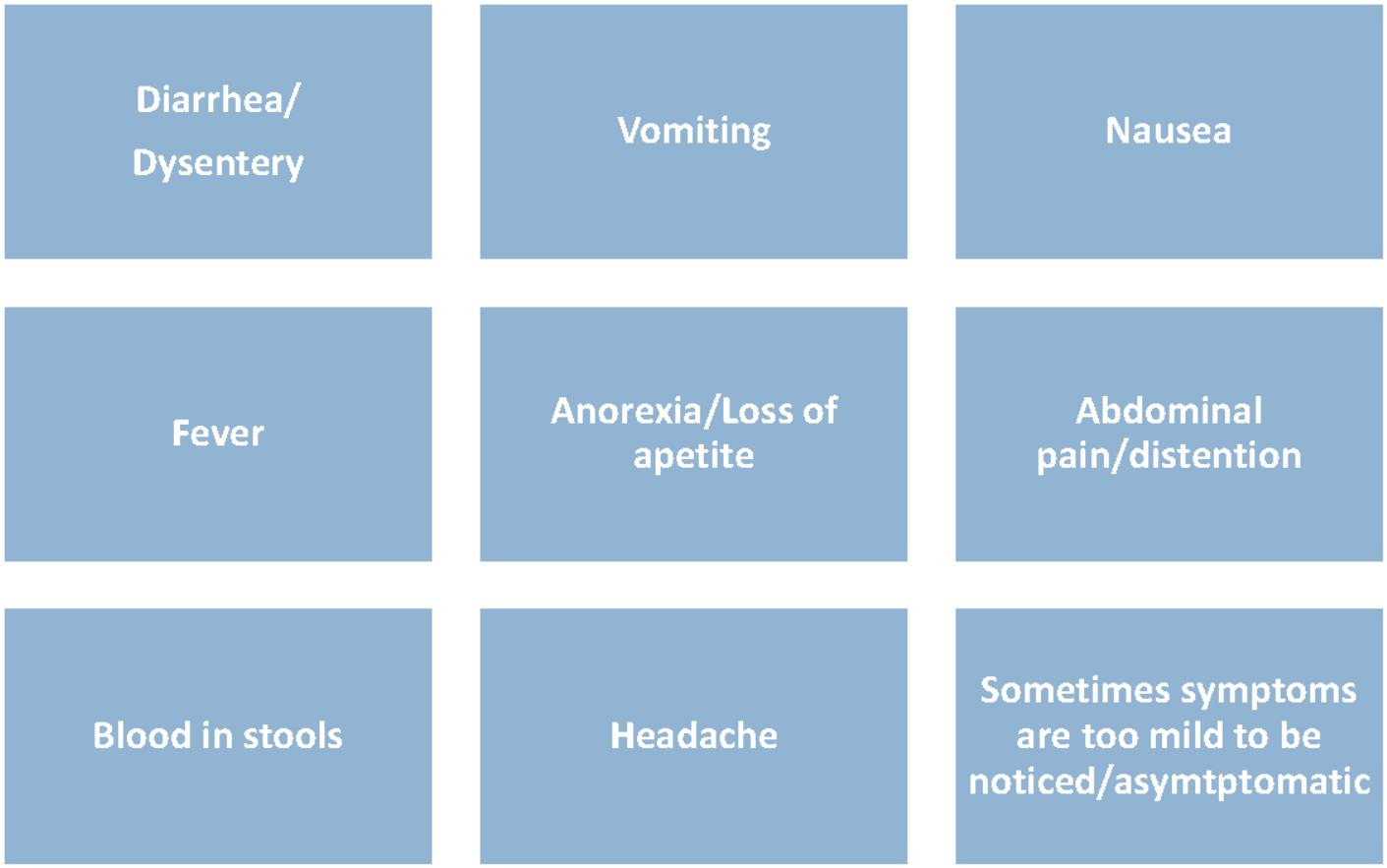


Figure 2

Common symptoms of parasitic infections

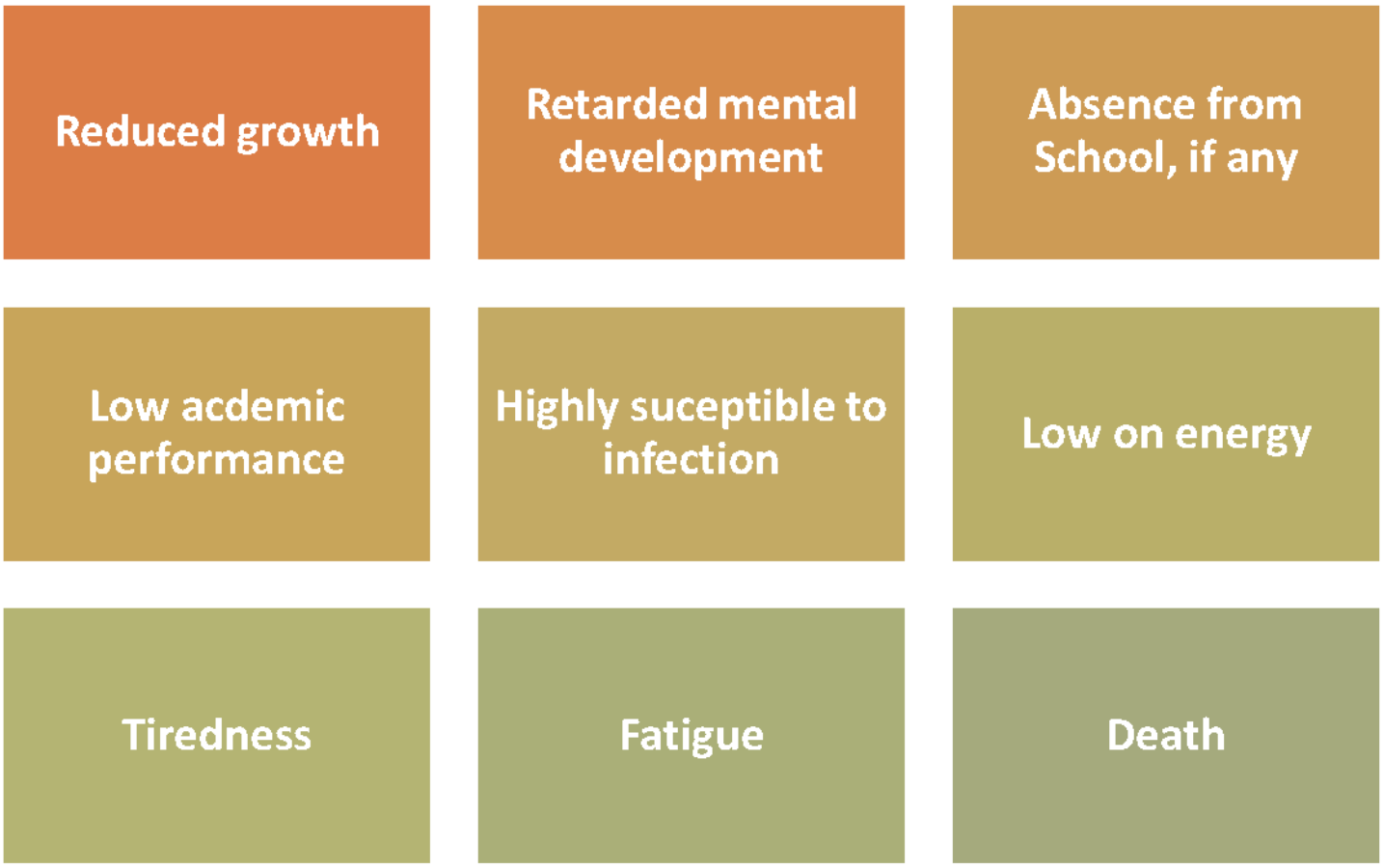


Figure 3

Long-term effects of parasitic infections

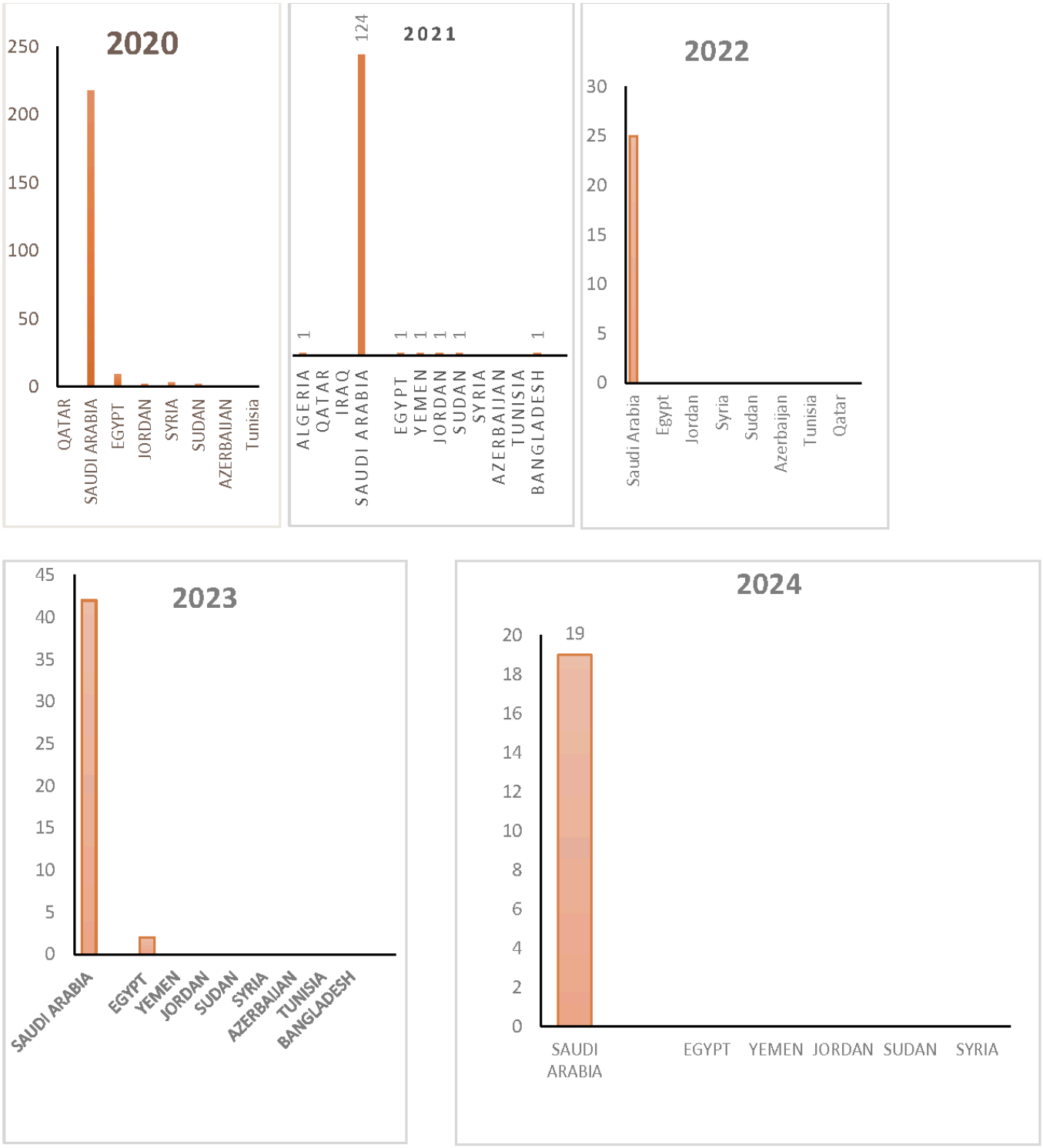


Figure 4

Total Number of patients in of different nationalaties tested for parasitic infections in year 2020,2021,2022, 2023,2024.Maximum number of patients tested were saudi Nationals.

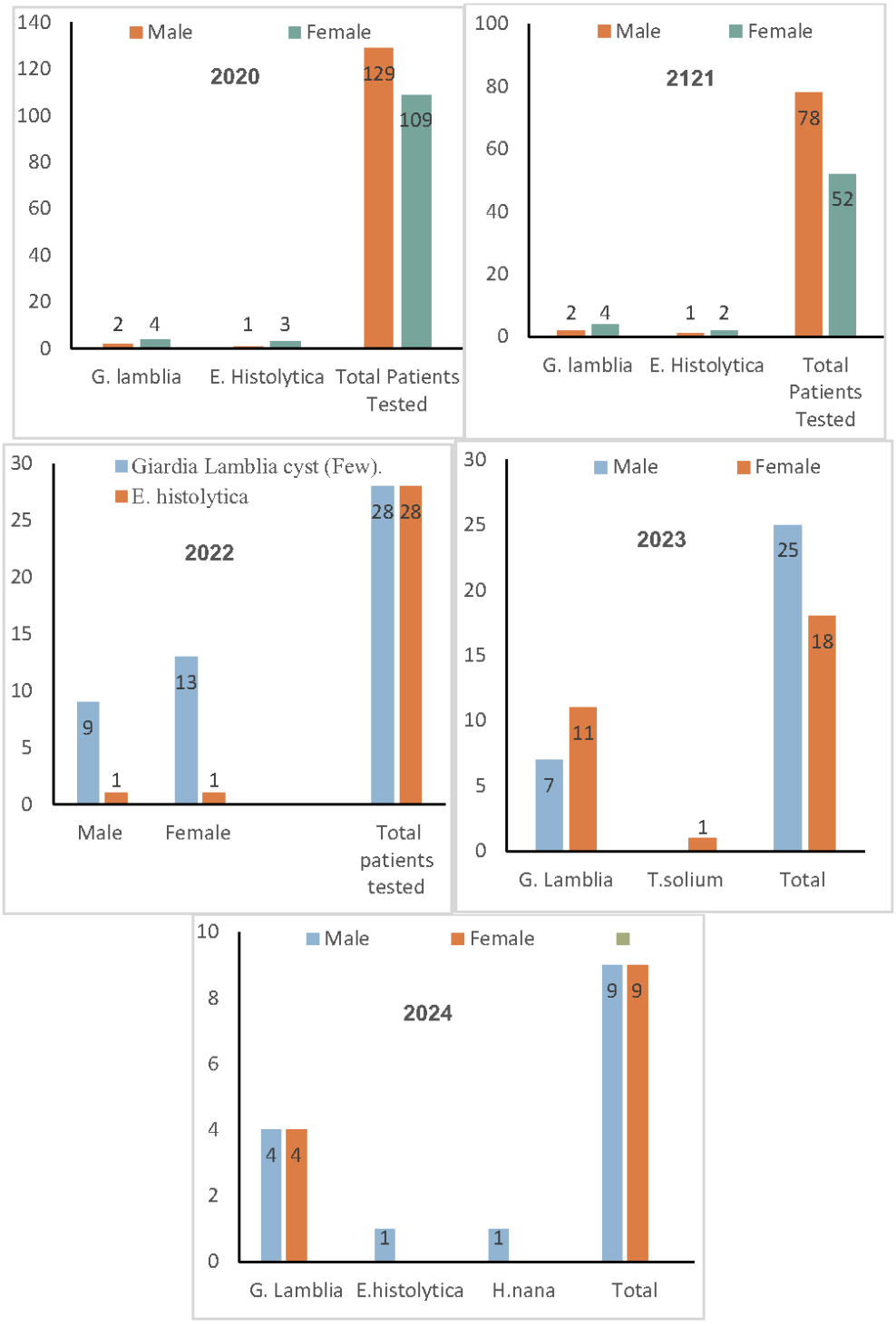


Figure 5

Prevalence of different parasitic infections in male and females in year 2020,2021,2022, 2023,2024

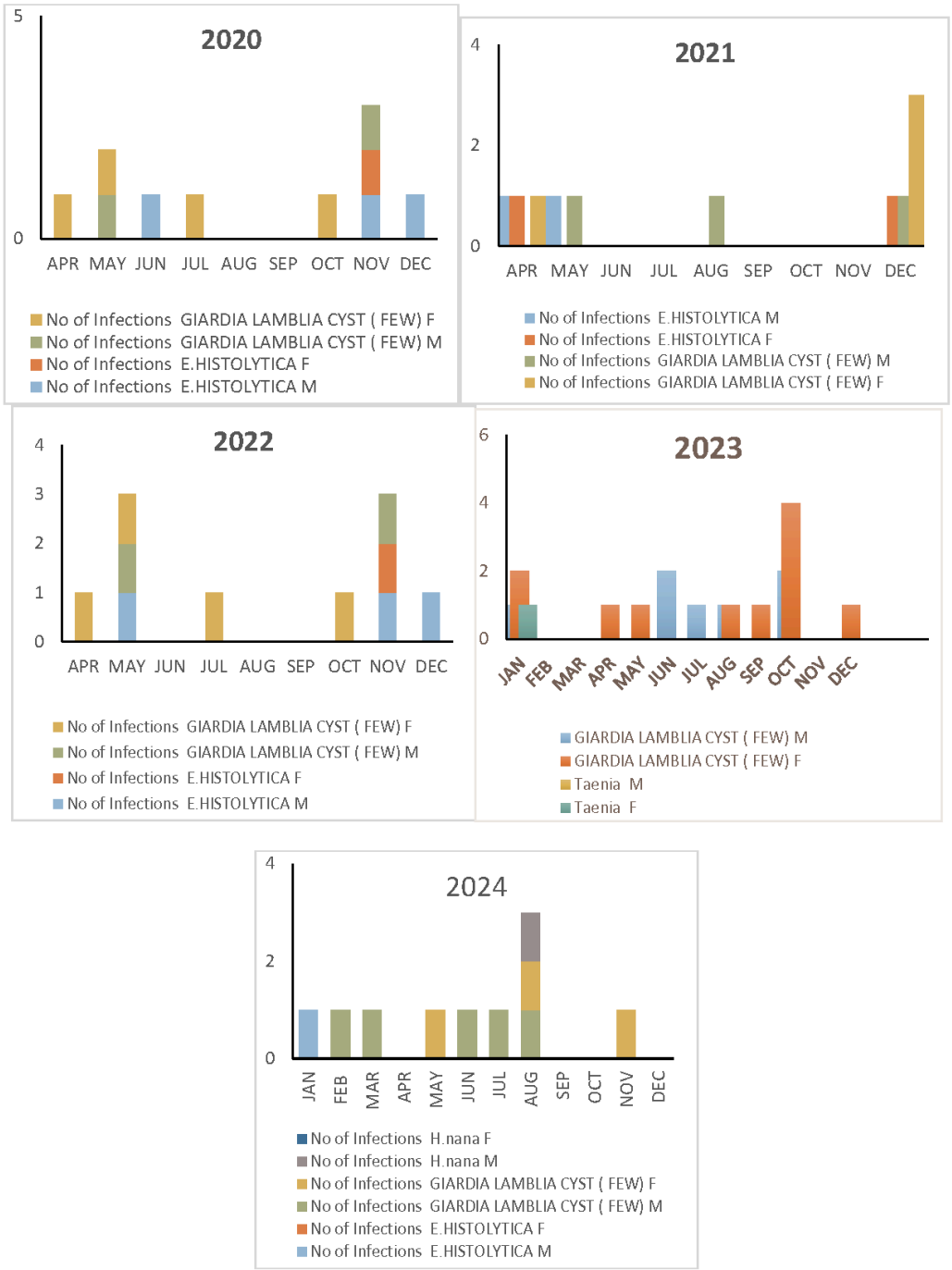


Figure 6

Gender Wise Stratification and Monthly Distribution of Protozoans, In Years 2020,2021,2022, 2023,2024. Taenia Species Was Exceptionally Reported In A Single Female In 2023.

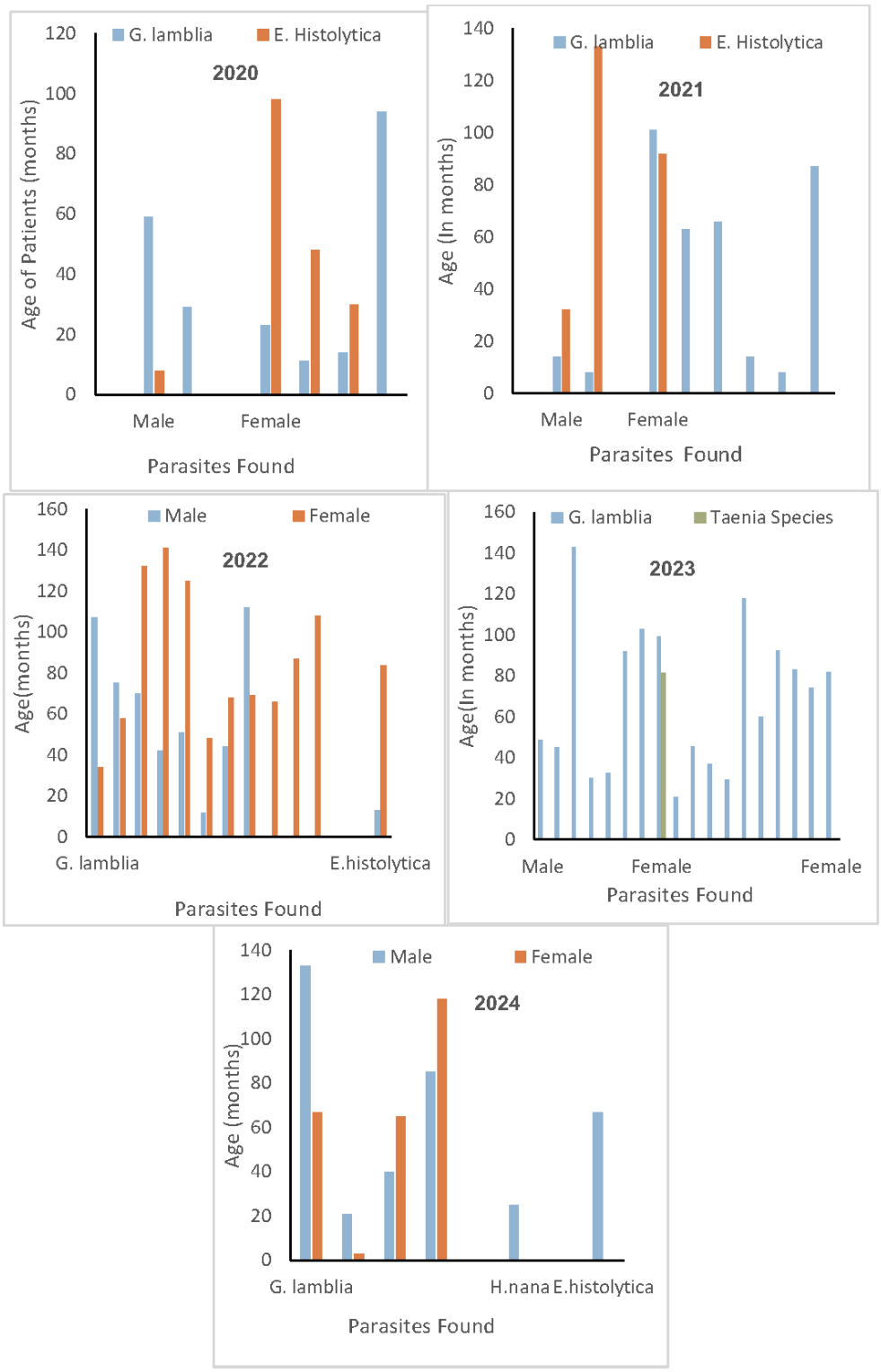


Figure 7

Age of patients (male and female) and different parasitic infections in year 2020,2021,2022, 2023,2024