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Review Article

Estimating the Prevalence of Parasitic Infections in Migrant Workers in The Middle East: A Systematic Review and Meta-Analysis

***Seyedeh Maryam Taheri** [1], **Hanieh Makipour** [2], **Saeed Bahadory** [3,4], **Ehsan Javanmard** [5], **Samaneh Dehbanipour** [5], **Ali Taghipur** [6], ***Gholamreza Hassanpour** [7], ***Elham Kazemirad** [5]*

1. *Department of Occupational Health, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran*
2. *Thalassemia & Hemoglobinopathy Research Center, Health Research Institute, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran*
3. *Vice-Chancellor of Treatment, Imam Hassan Hospital, Alborz University of Medical Sciences, Karaj, Iran*
4. *Department of Medical Parasitology, School of Medicine, Alborz University of Medical Sciences, Karaj, Iran*
5. *Department of Medical Parasitology and Mycology, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran*
6. *Department of Parasitology and Mycology, Jahrom University of Medical Sciences, Jahrom, Iran*
7. *Center for Research of Endemic Parasites of Iran, Tehran University of Medical Sciences, Tehran, Iran*

***Corresponding Authors:** Emails: Hassanpour@tums.ac.ir, ekazemirad@yahoo.com

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Abstract

Background: Parasitic diseases, including food-borne and vector-borne infections, remain a significant burden, especially with the increased migration from underdeveloped to developed regions. We aimed to estimate the prevalence of parasitic infections among migrant workers in the Middle East.

Methods: This systematic review and meta-analysis followed the PRISMA protocol. A search was conducted across major databases (Scopus, PubMed, Web of Science, Google Scholar) for studies on parasitic infections among migrant workers in the Middle East from April 1, 1993, to November 15, 2024. Data were analyzed using Comprehensive Meta-Analysis software (CMA), and 25 studies were included.

Results: The overall prevalence of parasitic infections in this study was estimated at 16.5%. (95% CI 2.7 to 58.5%). The prevalence based on microscopic diagnostic methods was 19.4% (95% CI 13.5% to 27.5%), and molecular diagnosis was 15.2% (95% CI 6.4% to 32.4%). The *P*-value in Egger's test was 0.5343, indicating no statistically significant evidence of publication bias. The pooled prevalence varied across countries: 34.7% in Iraq (n = 1 study), 19.6% in Saudi Arabia (n = 12 studies), 16.8% in the UAE (n = 4 studies), 13.2% in Qatar (n = 7 studies), and 4.2% in Kuwait (n = 1 study).

Conclusion: The prevalence of parasitic infections among migrant workers in the Middle East was estimated at 16.5%. Given this rate, routine mandatory screening is recommended along with targeted health education to reduce exposure risk and improve health. These findings highlight the public health concern that infected migrant workers may contribute to the spread of parasitic diseases in destination countries.

Keywords: Parasitic infections; Migrant workers; Middle East

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Introduction

Migration for employment purposes has become a defining feature of the modern, globalized world, with millions of individuals crossing national and international borders annually in search of economic opportunities (1). In the Middle East, migrant workers are mainly low or semi-skilled individuals originating from South and Southeast Asia, East Africa, and other Arab countries. They temporarily relocate on fixed-term visas to Gulf Cooperation Council states and regional economies to fill labor shortages in construction, domestic work, hospitality, and service sectors (2). Migrant workers face challenging journeys and settle in areas with poor health and sanitation conditions. Factors like unstable employment, limited healthcare access, language barriers, and social marginalization make them highly vulnerable to health issues, including parasitic infections (3, 4).

Parasitic infections caused by intestinal protozoa and helminths remain a major public health problem in resource-limited settings and are easily transmitted through contaminated food and water (5-9). Soil-transmitted helminths (STH) affect hundreds of millions globally, while *Giardia lamblia*, *Entamoeba histolytica*, and *Cryptosporidium* spp. are the most common protozoan pathogens in developing countries (10-15). Important parasitic infections transmitted by arthropod vectors in the Middle East include malaria and leishmaniasis. Despite disease control efforts over the past three decades, reports of malaria and indigenous leishmaniasis transmission persist (16, 17).

Migrant workers, especially those living in crowded or unsanitary conditions, are at increased risk of contracting and transmitting these infections. The transient lifestyles of migrant workers complicate the diagnosis, treatment, and follow-up care needed to control parasitic diseases (18). Many work in public health-related jobs, such as food preparation and hospitality, making it vital to assess the situation in regions with large migrant worker populations (19). However, the Middle East is developing rapidly today (20). This region has a population of over 500 million and, despite regional wars, has a dynamic and active economy (21). In 2019, the number of migrant workers in the Arab States reached 24.1 million, representing over 14% of the global migrant workforce. The oil, energy, and tourism industries are key drivers of this migration, significantly contributing to labor productivity in the Middle East (22). Overall, we aimed to assess parasitic infections among migrant workers in the Middle East. However, the primary focus of the current investigation was on intestinal parasitic infections.

Methods

Sources and Search Strategy

This meta-analysis and systematic review were conducted meticulously in accordance with the PRISMA guidelines to ensure comprehensive and transparent reporting of the research methodology and findings. A thorough search for relevant articles was performed, focusing on the period from April 1, 1993, to November 15, 2024. The search was conducted across major scientific databases, including Scopus, PubMed, Web of Science, and Google Scholar, to identify studies related to the following keywords: "Migrant worker" OR "Foreign worker" AND "Parasitic infection" AND "prevalence" OR "epidemiology" AND "Middle East" (Details of keywords are provided in the supplementary file). Additionally, articles containing any of these keywords in their titles were included. To ensure a thorough review, a manual search was conducted through the reference lists of selected articles and Google Scholar.

Criteria for Selection and Data Extraction

To determine article eligibility, two independent researchers reviewed all papers based on established inclusion criteria and resolved discrepancies through discussion. The inclusion criteria for this review were: (A) studies with migrant workers and parasitic infections in the title; (B) peer-reviewed original research or short reports; (C) cross-sectional studies on migrant worker prevalence; (D) use of fecal microscopy, immunoassays, and/or molecular diagnostics; (E) reports with total sample size and positive samples; (F) online publication between April 1993 and November 15, 2024; (G) full-texts published in English. Papers lacking full-text access or not meeting criteria were excluded, along with conference papers, reviews, and those with unclear or misleading data. Relevant data were extracted, including the first author, year of study, country, methods, sample size, positive samples, molecular methods, and identified parasitic infections.

Study quality assessment

Study quality was assessed using the Newcastle-Ottawa Scale (NOS); only moderate-to-high quality cross-sectional studies (score >3.5) were included (24).

Meta-analysis

Pooled prevalence estimates and 95% confidence intervals (CIs) were calculated using a random-effects model due to expected clinical and methodological diversity. Heterogeneity was assessed using the I^2 index and Q-value, with I^2 values of 25%, 50%, and 75% indicating low, moderate, and high heterogeneity, respectively. Subgroup analyses were performed by diagnostic method (ELISA, microscopy, molecular) and country in the Middle East. For single-study subgroups, heterogeneity was assumed to be zero. Prediction intervals were calculated for future study prevalence. Sensitivity analyses excluded studies with small sample sizes (<75) and moderate quality ratings. Publication bias was assessed using funnel plots and Egger's test; $p<0.05$ was considered significant (25). All analyses were performed using Comprehensive Meta-Analysis software version 3.0 (Biostat, Englewood, NJ, USA) (26).

Results

A total of 561 records were identified in the initial search of online databases (Fig. 1). After removing duplicates and articles unrelated to the topic, 25 articles were deemed eligible for inclusion in the data synthesis.

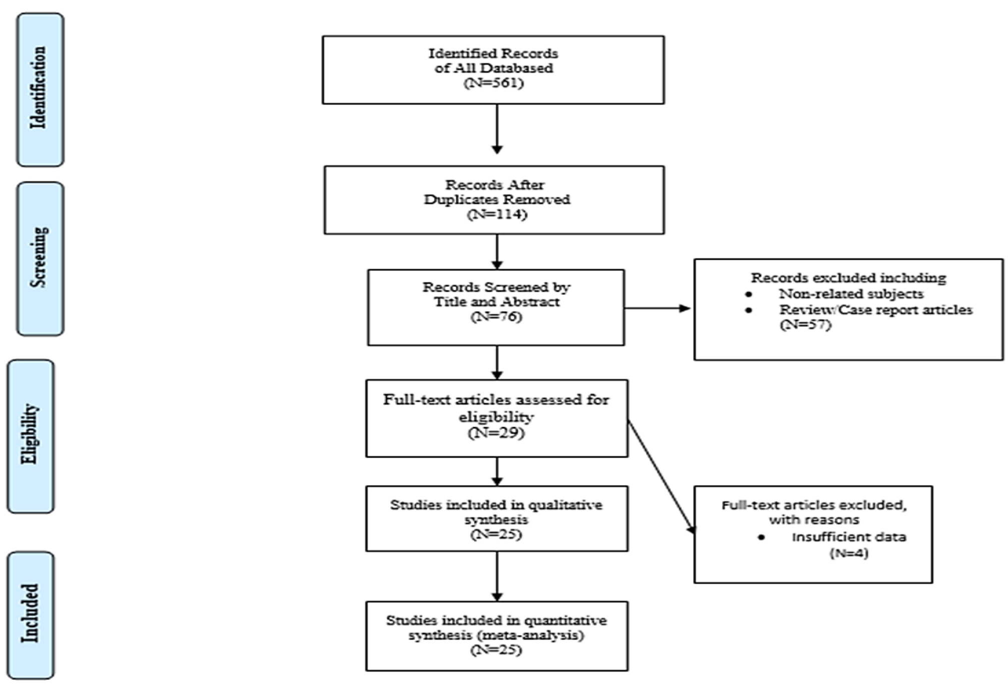

Fig. 1: PRISMA flow diagram of study inclusion/exclusion

Pooled Prevalence of Parasitic Infections in Middle Eastern Migrant Workers

The pooled prevalence in this study is 16.5% (95% CI 2.7-58.5%), based on 25 articles with 131,450 individuals, including 45,535 males and 23,501 females. Four studies did not specify gender but reported the total sample size and the number of positive cases. The largest sample size was reported by Ibrahim et al (27), with 60,268 participants, while the smallest was reported by Bi et al (28), with 75 participants. Additional data are provided in Tables 1-3 (Figs. 2–3). A sensitivity analysis excluding the earliest and highest-weighted study (Ibrahim et al.) showed a marginal change in the pooled prevalence, from 16.5% (95% CI: 2.7–57.7%; heterogeneity = 99.74%) to 16.2% (95% CI: 10.6–24%; heterogeneity = 99.742%), confirming that the overall estimate is robust and not influenced by Ibrahim et al (27).

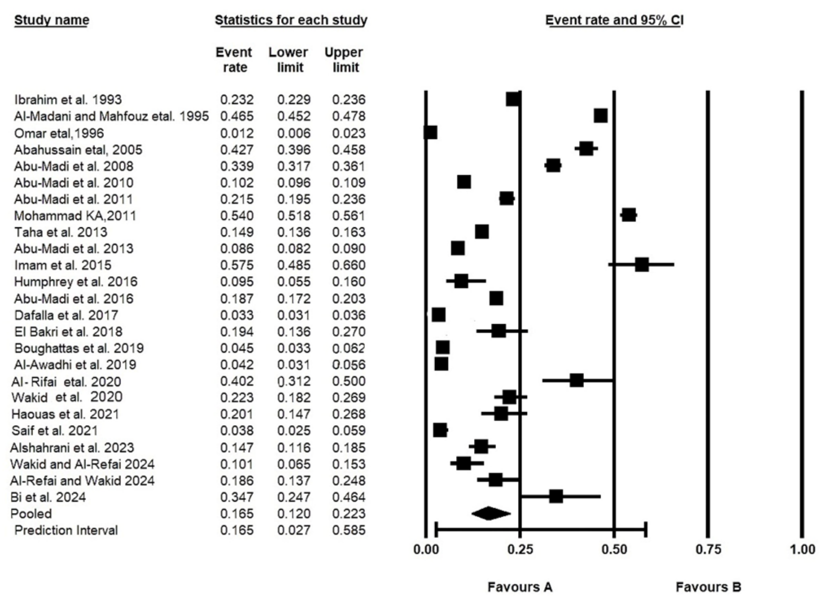

Fig. 2: Forest plot of parasitic infection prevalence in migrant workers

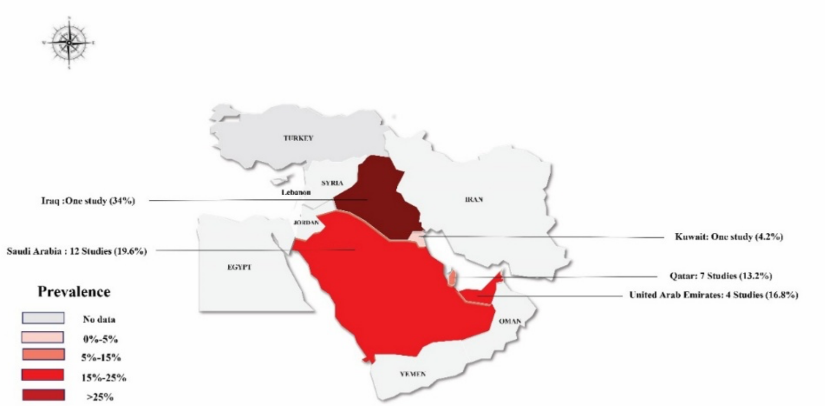

Fig. 3: Geographical distribution and prevalence of parasitic infections in Middle Eastern migrant workers

Table 1: Study characteristics on parasitic infections in Middle Eastern migrant workers

No	Country	Total sample	Positive	Diagnostic method	NOS*	Reference
1	United Arab Emirates	60268	14010	Microscopic	7	(27)
2	Saudi Arabia	5518	2566	Microscopic	7	(29)
3	Saudi Arabia	762	9	Microscopic	7	(30)
4	Saudi Arabia	994	424	Microscopic	7	(31)
5	Qatar	1737	588	Microscopic	6	(32)
6	Qatar	9208	943	Microscopic	8	(33)
7	Qatar	1538	331	Microscopic	8	(34)
8	Saudi Arabia	2000	1079	Microscopic	6	(35)
9	Saudi Arabia	2732	407	Microscopic	8	(36)
10	Qatar	18563	1593	Microscopic	8	(37)
11	Saudi Arabia	120	69	Microscopic	7.5	(38)
12	Qatar	126	12	Molecular	7	(39)
13	Qatar	2486	465	Microscopic	7.5	(40)
14	United Arab Emirates	21347	708	Microscopic	8.5	(41)
15	United Arab Emirates	134	26	Molecular	9	(42)
16	Qatar	839	38	Molecular	8	(43)
17	Kuwait	1000	42	ELISA	7	(44)
18	United Arab Emirates	102	41	Molecular	8	(45)
19	Saudi Arabia	355	79	Microscopic	7	(46)
20	Saudi Arabia	169	34	Microscopic	8	(47)
21	Saudi Arabia	497	19	ELISA	8	(48)
22	Saudi Arabia	407	60	Microscopic	7.5	(49)
23	Saudi Arabia	188	19	Microscopic	8.5	(7)
24	Saudi Arabia	188	35	Molecular	9	(4)
25	China*	72	15	Microscopic	7.5	(28)

* This study included Chinese workers working in Iraq.
*Newcastle-Ottawa Scale

Prevalence of parasitic infections by diagnosis method

Eighteen studies were analyzed using the microscopic method, which showed a prevalence of 19.4% (95% CI 13.5% to 27.5%); I^2 index heterogeneity (99.81); *Q-value* (89.31). Five studies were analyzed using the molecular method, which showed a prevalence of 15.2% (95% CI 6.4% to 32.4%); I^2 index heterogeneity (96.45); *Q-value* (112.93) (4, 39, 42, 43, 45). In addition, two studies conducted in Saudi Arabia and Kuwait used serological methods to diagnose filariasis and *Taenia solium* and reported a prevalence of 4.1% (95% CI 3.2% to 5.2%); I^2 index heterogeneity (0); *Q-value* (0.121) (Fig. 4) (44, 48). We also calculated the prevalence of protozoa and worms within the subgroup using molecular and microscopic detection methods.

Table 2*: Intestinal protozoa profile (in terms of reported numbers) among migrant workers in the Middle East

No	Country	Sample size	Intestinal protozoa				Reference
			Giardia spp.	*Cryptosporidium* spp.	*Entamoeba histolytica/dispar*	*Blastocysts* sp.	
1	United Arab Emirates	60268	1474	-	86	-	(27)
2	Saudi Arabia	5518	6	-	66	-	(29)
3	Saudi Arabia	994	17	-	39	-	(31)
4	Qatar	1737	116	-	36	213	(32)
5	Qatar	9208	179	-	28	398	(33)
6	Qatar	1538	31	-	12	44	(34)
7	Saudi Arabia	2000	152	-	108	-	(35)
8	Saudi Arabia	2732	100	-	81	-	(36)
9	Qatar	18563	315	-	50	668	(37)
10	Saudi Arabia	120	13	-	19	-	(38)
11	Qatar	126	12	-	-	-	(39)
12	Qatar	2486	57	-	22	137	(40)
13	United Arab Emirates	21347	269	-	230	-	(41)
14	United Arab Emirates	134	15	26	6	-	(42)
15	Qatar	839	-	38	-	-	(43)
16	United Arab Emirates	102	1	14	9	-	(45)
17	Saudi Arabia	355	6	-	3	16	(46)
18	Saudi Arabia	169	1	10	-	-	(47)
19	Saudi Arabia	407	8	8	31	-	(49)
20	Saudi Arabia	188	2	-	4	3	(7)

***** The parasite counts in Table 2 were calculated from individuals infected with one or more parasites in the studies

Table 3: Characteristics of identified species of helminthic infections among migrant workers in the Middle East

Country	Sample size	Intestinal worms							Reference
		Ascaris lumbricoides	*Hookworm*	*Strongyloides stercoralis*	*Trichuris trichiura*	*Taenia* spp.	*Hymenolepis nana*	*Enterobius vermicularis*	
United Arab Emirates	60268	4010	4065	-	3755	-	173	-	(27)
Saudi Arabia	5518	1225	822	33	1589	-	11	44	(29)
Saudi Arabia	994	110	116	4	113	-	-	4	(31)
Qatar	1737	18	97	-	126	-	-	-	(32)
Qatar	9208	31	193	-	46	-	9	-	(33)
Qatar	1538	38	128	8	54	8	15	2	(34)
Saudi Arabia	2000	179	163	28	190	119	120	16	(35)
Saudi Arabia	2732	73	60	16	75		41	2	(36)
Qatar	18563	55	315	92	74	92	37	-	(37)
Saudi Arabia	120	8	10	4	4	1	3	1	(38)
Qatar	2486	45	87	10	35	2	10	2	(40)
United Arab Emirates	21347	93	39	15	38	31	14	2	(41)
Kuwait	1000	-	-	-	-	42	-	-	(44)
United Arab Emirates	102	5	-	-	2	4	-	12	(45)
Saudi Arabia	355	8	5	2	23	-	2	1	(46)
Saudi Arabia	169	5	7	-	7	1	-	1	(47)
Saudi Arabia	407	3	-	-	-	3	-	5	(49)
Saudi Arabia	188	4	9	4	7	-	1	-	(7)

***** The parasite counts in Table 3 were calculated from individuals infected with one or more parasites in the studies

Table 4 presents the prevalence of different protozoan and helminthic parasites identified through molecular and microscopic diagnostic methods. For protozoa, *Cryptosporidium* spp. displayed the highest prevalence at 10.8% (95% CI: 3.9-26.5) using molecular methods, while *Blastocystis* sp. had the lowest prevalence at 1.6% (95% CI: 0.5-4.8). The *Entamoeba histolytica/dispa*r prevalence was 6.5% (95% CI: 3.3-12.4) by molecular techniques, but much lower with microscopy at 1.5% (95% CI: 0.7-2.8). Among helminths, *Enterobius vermicularis* showed the highest prevalence of 11.8% (95% CI: 6.8-19.6) by molecular methods, while *Hymenolepis nana* had the lowest at 0.5% (95% CI: 0.1-3.7). Notably, both *Enterobius vermicularis* and *H. nana* had only one study included in the molecular analysis, which resulted in zero heterogeneity for these parasites. For other parasites, high heterogeneity was observed, particularly among those diagnosed by molecular methods, which may reflect variability in study designs, population samples, or diagnostic techniques.

Table 4: Prevalence of protozoa and helminths in subgroups based on molecular and microscopic detection methods

Parasite	Molecular			Microscopic		
	Prevalence (%)	CI* (95)%	Heterogeneity	Prevalence (%)	CI (95)%	Heterogeneity
Giardia spp.	7.8	3.7-15.8	76.47	2.3	1.7-3	97.512
Cryptosporidium spp.	10.8	3.9-26.5	94.84	3.5	1.2-9.9	82.11
Entamoeba histolytica/dispar	6.5	3.3-12.4	60.43	1.5	0.8-2.9	98.79
Blastocystis sp.	1.6	0.5-4.8	0*	4.6	3.1-6.8	98.74
Ascaris lumbricoides	3.3	1.5-7.4	67.37	2.4	1.3-4.2	99.58
Hookworm	4.3	2.1-8.3	0*	3.9	2.6-6	99.35
Trichuris trichiura	3.2	1.7-6.1	0*	3.2	1.7-6.1	99.71
Strongyloides stercoralis	2.1	0.8-5.5	0*	0.6	0.4-1	91.01
Taenia spp.	3.9	1.5-2.5	0*	0.5	0.1-2	91.45
Enterobius vermicularis	11.8	6.8-19.6	0*	0.3	0.1-0.6	75.11
Hymenolepis nana	0.5	0.1-3.7	0*	0.5	0.2-1.3	99.08

* Due to the fact that only one study was included in the meta-analysis, the heterogeneity was reported as zero.
Confidence Interval*

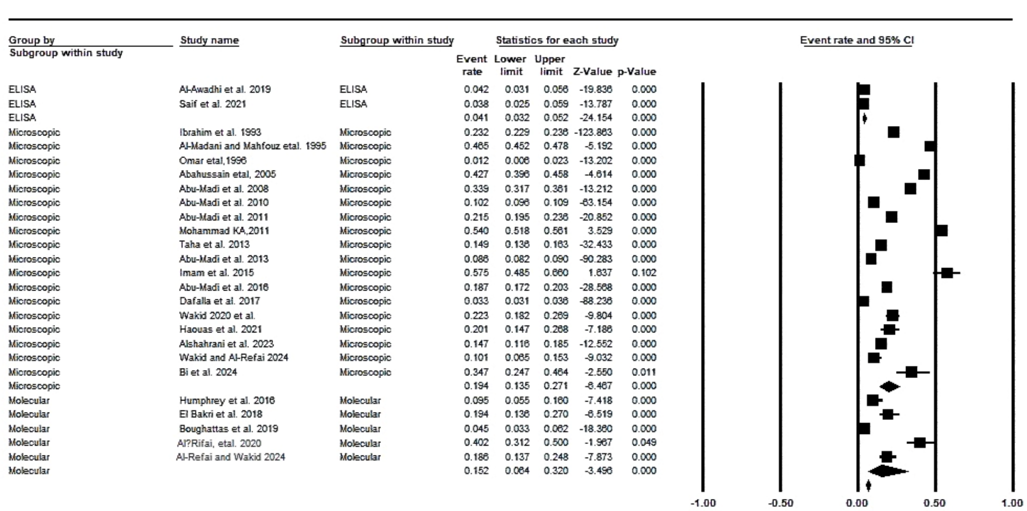

Fig. 4: Forest plot of parasitic infection prevalence by diagnostic method

Overall prevalence of parasitic infections in the country

There are 15 countries in the Middle East. Nevertheless, only five countries have reported studies on parasitic infections in migrant workers, Including the reported prevalence in Iraq (one study) 34.7% (95% CI 24.7% to 46.4%), I² index heterogeneity (0); Q-value (0) Saudi Arabia (twelve studies) 19.6% (95% CI 12.8% to 28.8%), I² index heterogeneity (99.23); Q-value (14.28). Kuwait (one study) 4.2% (95% CI 3.1% to 5.6%), I² index heterogeneity (0); Q-value (0). Qatar (seven studies) 13.2% (95% CI 8.3% to 20.5%), I² index heterogeneity (99.48); Q-value (11.74), and the United Arab Emirates (four studies) 16.8% (95% CI 4.4% to 46.8%), I² index heterogeneity (99.90); Q-value (30.74) (Fig. 5).

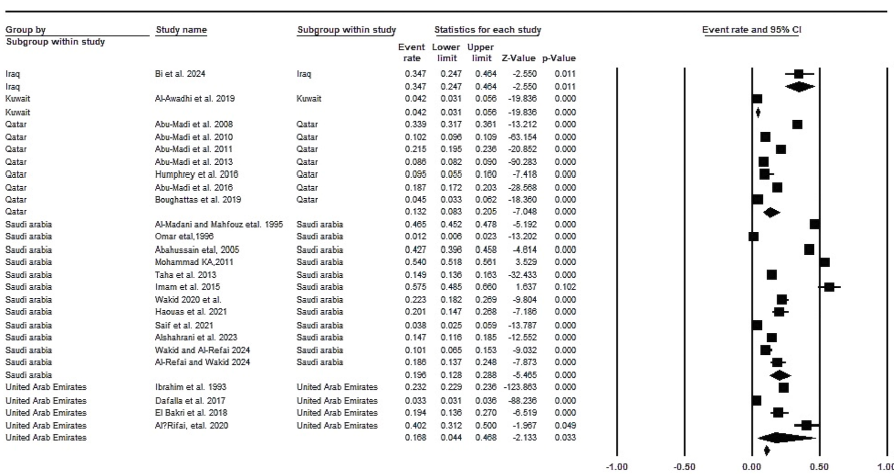

Fig. 5: Forest plot of parasitic infection prevalence in Middle Eastern migrant workers by country

Publication bias and Egger's regression

Publication bias was assessed using both Egger's regression test and a funnel plot for the Pooled prevalence of parasitic infections. The *P*-value for the two-tailed test was 0.5348, which is well above the conventional threshold of 0.05, indicating no significant publication bias.

The funnel plot supports Egger's test, showing symmetry and an even distribution of study estimates. This indicates no significant publication bias, as both small and large studies are similarly represented, with no skewness or distortion (Fig. 6) (50).

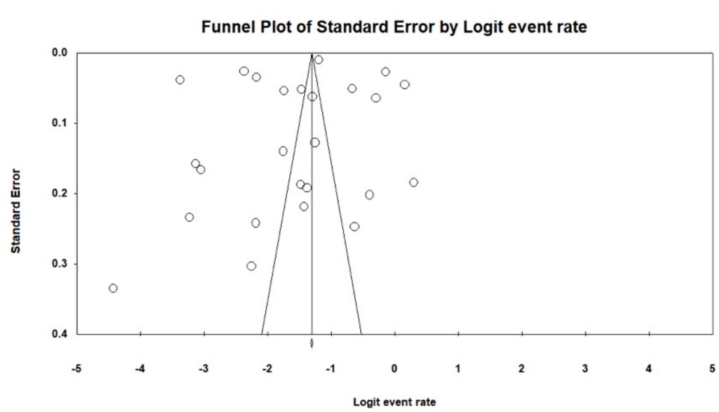

Fig. 6: Funnel plot for assessing the overall prevalence of intestinal parasites

Discussion

This meta-analysis is the first comprehensive analysis of data on parasitic infections among migrant workers in the Middle East, providing valuable insights for occupational health organizations, policymakers, and clinicians in both developed and developing countries (51). Despite large-scale migration, many migrant workers face significant health challenges, including parasitic infections (52, 53). The prevalence of parasitic infections among migrant workers in the region is estimated at 16.5%, covering various infections identified through work-related health screenings and medical visits.

The 95% prediction interval for the overall prevalence was notably wide (2.7–58.5%), reflecting the high heterogeneity (I^2 = 99.74%). This variation is largely attributable to differences in diagnostic sensitivity (microscopy vs. molecular/ELISA) and geographic setting, as evidenced by the significant reduction in heterogeneity and more precise estimates in several subgroups (e.g., I^2 = 0% in ELISA-based studies). The wide interval highlights the potential for future studies in similar populations to observe prevalence within this broad range, highlighting the necessity for standardized diagnostic methods.

The Middle East, known for its developing energy infrastructure and tourism potential, attracts a large number of migrant workers. In Saudi Arabia, 19.6% of migrant workers suffer from parasitic infections, mostly employed in housekeeping, energy, and construction, with significant numbers coming from the Philippines, India, Pakistan, and Bangladesh. In 2021, Saudi Arabia's private sector employed 6.17 million migrant workers, accounting for 76.4% of the workforce (54). Lower healthcare standards in migrant workers' home countries often lead to the entry of workers with parasitic infections, acting as carriers in the transmission cycle. In Saudi Arabia, the prevalence of parasitic infections among migrant workers is 19.6%, compared to 32.3% in Malaysia. The differences may be related to factors like proximity to garbage dumps, stray animals, poor hygiene, and eating with bare hands (55). A study conducted in Saudi Arabia reported intestinal parasitic infection rates of 24.3% among Saudi nationals, compared to 18.2% in Egyptian expatriates, 11.8% in Indian workers, and 9.6% in Pakistani workers (49). These findings highlight variability in transmission patterns among indigenous Saudi residents and may reflect differences in diagnostic methods, occupational characteristics, and sample size.

The United Arab Emirates, known for its high energy production efficiency and strong welfare system, is a major destination for employment and tourism (56). The prevalence of parasitic infections among migrant workers in the UAE is estimated at 16.8%, higher than rates reported previously in 2010 and 2017 surveys, likely due to differences in the population studied (41, 57). Indian migrants in the UAE exhibit a higher prevalence of parasitic infections, such as *Cryptosporidium* spp., compared with migrants from other countries. Indeed, the use of molecular techniques provides a more accurate estimation of prevalence (42). The changes in prevalence were smaller than those reported by Ibrahim et al., who used microscopy in a large-scale study. However, the risk of transmission remains high even after three decades (27). Likewise, in Bandar Abbas, Iran, the prevalence rate of intestinal protozoa was 23%. The decrease in protozoan infections is mainly due to improvements in healthcare; nonetheless, further efforts are needed to control infectious agents (58). A study in Sharjah, UAE, found that the prevalence of intestinal parasitic infections was 15.7% among Emirati nationals, compared to 3.2% among expatriates. The higher rate among locals was attributed to ongoing local transmission, while strict medical screening of migrant workers likely explains the lower prevalence among expatriates (57).

Qatar, with advanced infrastructure in energy, tourism, and sports, hosts more foreign workers than natives (59). Parasitic infections among migrant workers in Qatar are estimated to affect 13.2%, with studies over the past two decades primarily focusing on food handlers (60). *Blastocystis* prevalence was reported at 13.3% by Abu-Madi et al., lower than in studies from Southeast Asia and Kenyan children in Australia (32, 61-62). Qataris mainly descend from native tribes, while most foreign workers in Qatar come from Southeast Asia and Africa. A study found that newly arrived workers, especially those from Nepal, accounted for 47% of worm infections, likely reflecting weaker health and economic conditions (33). A study in Qatar reported a 11.7% prevalence of intestinal protozoa over three years, with African nationals showing higher rates of *Blastocystis* sp. and *Giardia* than other non-native residents (40). The prevalence of intestinal protozoan infections is lower among Qatari nationals (3.49%) than among settled immigrants from the Eastern Mediterranean (3.97%), Africa (7.68%), and Asia (7.63%) (63). This difference is attributed to better public health conditions and access to clean water and sanitation, rather than to immigrant screening alone. Despite the industrial and tourism potential of countries like Iran, Turkey, and Egypt, there is a notable lack of research on parasitic infections among foreign workers (64). A report in Turkey found 27% of people and food handlers infected with *Blastocystis* sp., while this study reported 10% infected with *Entamoeba histolytica/dispar* (65). Also, in western Iran, *Blastocystis* sp. is reported at 2.1%, and *Giardia* spp. at 3.7% among bread production workers (66).

The prevalence of *G. duodenalis* among food handlers in northern Iran is reported at 53.3%, indicating a distinct infection profile in this group. Notably, these studies focused on the indigenous populations of the respective countries (67). In southern Iran, contamination rates in food suppliers differ, with *Blastocystis* sp. at 24% and *G. duodenalis* at 6.8% in Bandar Abbas in 2018, similar to rates reported in Persian Gulf countries (68). Differences in prevalence between studies may result from variations in diagnostic methods and laboratory expertise. This study found a 19.4% prevalence using microscopy, higher than the 15.2% identified with molecular methods. Studies using sensitive techniques, like molecular tests, tend to report higher prevalence. Among the reviewed studies, 5 used molecular methods, and 18 relied on microscopy (69). Accurate diagnosis and estimation are possible with specialized techniques. In Mozambique, Mandomando et al reported a 1.1% prevalence of *S. stercoralis* in children under five with diarrhea, using direct smears, which are ineffective for detecting this parasite (70). In a study of 303 individuals using multiple diagnostic methods, real-time PCR proved significantly superior to microscopy in sensitivity and the range of species detected (71). Moreover, geographical differences, climatic conditions, sample size, and detection methods all contribute to accurate prevalence estimation.

Based on the keyword criteria, three studies were identified on parasitic infections among migrant workers, primarily addressing filariasis, cysticercosis, and cutaneous leishmaniasis, with the Middle East as the main global focus for cutaneous and visceral leishmaniasis (72, 73). Few studies have investigated *Leishmania* infections among foreign workers at risk in endemic regions of the Middle East. In Iraq, a study by Chinese researchers found that 34.7% of Chinese construction workers were infected, primarily with *L. major*, highlighting their high risk in this endemic region (28). A serological study in Saudi Arabia reported that 3.8% of Indian workers tested positive for filariasis, emphasizing the need for mandatory screening for parasitic infections upon entry into the country (48). Although *T. solium* is not endemic in the Middle East, a study in Kuwait found that 42% of food handlers had cysticercosis titers (44). No studies specifically targeting foreign workers from Iran, Turkey, or Egypt were found through the meta-analysis criteria, although national reports indicate parasite infection in these populations. Conducting studies on parasitic infections among migrant workers in the Middle East would provide more accurate data. This study assessed infection prevalence among foreign workers and emphasized the need for monitoring programs with mandatory screening, especially in industrial and food-related sectors.

Limitations of this study include the small number of studies on foreign workers and the lack of research from large Middle Eastern countries with significant migrant populations. We also included studies that referred to migrant workers or non-native populations in their titles. Subgroup analyses by age, sex, occupation, and nationality were not performed because most studies did not report these variables in sufficient detail or in a standardized format for meta-analysis. Furthermore, the use of microscopic diagnostic methods in most studies may increase the risk of diagnostic error.

Conclusion

This study identified an overall parasitic infection prevalence of 16.5%, with microscopy revealing 19.4% and molecular methods 15.2%. Most migrant workers were employed in food handling, domestic services, construction, or industrial labor. These findings highlight the risk for workers acting as carriers, which could impact productivity. Mandatory pre-employment screening and health education programs are recommended to reduce transmission risk and improve workers' health.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

The authors declare no conflict of interest.

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