

Review Paper

Epidemiologic Features of Kawasaki Disease in Middle East Countries: A Systematic Review and Meta-analysis

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ABSTRACT

Background: Considering the geography and cultural affinity of Middle East countries, pooled data on the epidemiological features of Kawasaki disease (KD) in this region remain limited. **Objectives:** This study aims to review the studies on the most important epidemiological characteristics of KD in Middle East countries, including age and gender distribution, prevalence of atypical KD and coronary artery lesions (CAL), and the seasonal pattern of KD occurrence.

Methods: This is a systematic review and meta-analysis study conducted according to the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guideline. By using relevant keywords with Boolean operators and utilizing truncation and wildcards, a search was conducted on Google Scholar, PubMed, and Web of Science for related studies focusing on 19 countries in the Middle East, published until March 2025, excluding case reports and clinical trials, and including population-based or hospital-based studies with acceptable quality, assessed using the STROBE checklist. A meta-analysis was performed using STATA software, version 17.

Results: Forty-four articles were included for meta-analysis. The pooled estimation of age was 36.88 months (95% CI, 33.54%, 40.22%). The male-to-female sex ratio was 1.7:1, and the prevalence of CAL and atypical KD was estimated to be 32% (95% CI, 26%, 38%) and 38% (95% CI, 26%, 50%), respectively. The prevalence of KD in spring, summer, autumn, and winter was 30%, 20%, 19% and 31%, respectively.

Conclusions: While age, gender, and seasonal distribution of KD are consistent with global statistics, the prevalence of CAL in patients and atypical forms of this disease is notably higher in the Middle Eastern region.

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Introduction

Kawasaki disease (KD) is one of the most important causes of vasculitis in children, and manifests as a febrile systemic inflammatory disorder [1-3]. Approximately 20–25% of untreated children develop coronary artery lesions (CALs), including aneurysms, making it the most common cause of acquired heart disease in children from developed countries [1, 4-6]. Several studies have been conducted to clarify KD's etiology worldwide; however, it still has an unknown etiology and remains a clinical diagnosis without a pathognomonic diagnostic test, making it difficult to identify all children at risk for developing CALs, even in countries with extensive nationwide studies [3, 6-12]. Typical KD is characterized by the presence of specific clinical criteria, while atypical KD (or incomplete KD) presents with fewer symptoms that do not meet the full diagnostic criteria. The atypical form is important since it may be diagnosed later or with more difficulty, which can lead to late initiation of treatment and the development of complications [1, 13]. The prevalence of atypical KD may vary from 15% to 36% and is more prevalent in younger patients [14].

Affecting all racial and ethnic groups, KD has been reported in all countries [2-4]. The disease is usually diagnosed in early childhood, with an age range from 3 months to 10 years, and boys are slightly more likely to be affected than girls. The mainstay of treatment for KD is intravenous immunoglobulin, and the patients generally require hospitalization for diagnosis and treatment. Among ethnic groups, epidemiological studies have shown that children with Asian and Pacific Islander descent have the highest incidence of KD [1]. The incidence of KD in the United States is approximately 25 per 100,000 children <5 years of age. In Japan, the incidence is estimated at approximately 250 per 100,000 [15]. Most countries have recently observed a gradual increase in KD incidence. The reasons for this increase are unclear and may reflect a true rise in cases or improved ascertainment due to increased awareness among healthcare providers and greater access to specialist care resulting from economic growth and industrialization [7, 16]. Recent studies in Japan suggest that the proportion of Japanese patients with CAL has decreased over time [1].

Many studies have been conducted to investigate the epidemiological features of KD in developed countries worldwide, with many based on data from accurate disease registration systems in those countries [17]. These studies provide useful and practical information about

the incidence of the KD and its temporal and spatial distribution, which can help control the disease and make effective management decisions for its surveillance at the national level. The studies in Asian countries are limited to some countries with registration systems, such as Japan. But in most Asian countries, there is not enough scientific evidence about the epidemiology of the disease that can be relied upon by physicians and health officials, including those in the Middle East. Due to the relatively low prevalence of KD in some Middle Eastern countries, there is basically no national research on the epidemiology of KD. In other countries, most studies are case reports or case series.

The Middle East is a geopolitical region encompassing the Arabian Peninsula (including Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, the United Arab Emirates (UAE), Jordan, and Yemen), the Levant countries (including Cyprus, Israel, Jordan, Lebanon, Syria, and the Palestinian territories), Turkey, Egypt, Iran, and Iraq. In the 1980s, the term "Greater Middle East" came to encompass Pakistan and Afghanistan from Asia, as well as the Maghreb, Sudan, and Mauritania from Africa. In terms of the number of speakers, the two top languages in Middle East countries are Arabic and Persian [18-20]. Considering the geography of the Middle East and the cultural affinity of the countries in this region, pooled data on epidemiological features of KD in this region remain limited. A search of scientific sources shows that accurate and reliable information on the KD incidence or prevalence is lacking in many Middle East countries, while a few countries have detailed information from some national data or their disease registration systems. This is also true for some other basic epidemiological indicators such as age, gender, time, and spatial distribution of disease. To address this knowledge gap, joint research projects, such as the Kawarabi project, are being developed and implemented in some Middle East countries; however, the results have not yet been published [21].

The findings of studies in the Middle East on important epidemiological characteristics of KD (including age, gender, and seasonal incidence) and CAL (as the most important complication of KD) conducted so far can be examined and retrieved comprehensively, which is crucial for identifying the KD's burden and distribution, ultimately enabling better prevention strategies, tailored treatment protocols, and improved outcomes for affected individuals [3, 5, 6]. Therefore, given the lack of national studies in some countries in Middle East, this study aims to review and retrieve the valid scientific evidence regarding the most important epidemiological

characteristics of KD in Middle East countries and summarize them in the form of pooled indicators so that it can be generalized to other countries in the region as the most valid reportable scientific evidence obtained so far.

Methods

This is a systematic review and meta-analysis study. To prepare a profile of the KD epidemiology in the Middle East countries, we focused on 17 main countries belonging to the main Middle East region, plus two eastern neighboring countries of Iran, Afghanistan, and Pakistan. Information on the epidemiological characteristics at the national level can only be extracted from disease registration systems or through field survey studies. Given the lack of such systems or studies in the vast majority of countries in the Middle East, and the fact that most KD patients are hospitalized, we included all hospital-based studies in our review study, including retrospective, case-series, cohort, and cross-sectional studies. The goal was to reach acceptable estimates of the most important epidemiological indicators, including age and gender, prevalence of atypical KD and CAL, as well as the seasonal pattern of KD occurrence by summarizing the characteristics of the patients in the Middle East. The clinical trials and case reports were excluded because of the high risk of selection bias in these studies. To estimate the incidence of KD, it was not possible to obtain a pooled summary index for the Middle East due to a lack of eligible population-based studies or reports. Thus, we just conducted a concise narrative review of the available scientific evidence about the incidence of KD. For this systematic review and meta-analysis, the main questions were formulated based on the population, intervention, comparison, outcomes and study (PICOS) framework (Table 1).

By using relevant keywords with Boolean operators, truncation, and wildcards, the search was conducted in databases including [Google Scholar](#), [PubMed](#), and [Web of Science](#) for relevant studies published in English up to March 2025. In addition, the reference lists of the selected studies were screened to identify additional studies. The search strategy was as follows:

{(Kawasaki [Title/Abstract] OR KD [Title/Abstract] OR Kawasaki diseases [MeSH terms]) OR (Kawasaki AND incidence) [Title] OR (Kawasaki AND prevalence) [Title] OR (Kawasaki AND epidemiology) [Title]} AND {(Middle East OR Bahrain OR Kuwait OR Oman OR Qatar OR Saudi Arabia OR the United Arab Emirates OR UAE OR Jordan OR Yemen OR Cyprus OR Israel OR Lebanon OR Syria OR

Palestinian OR Turkey OR Egypt OR Iran OR Iraq OR Pakistan OR Afghanistan) [Title/Abstract]}

In this study, we used the [preferred reporting items for systematic reviews and meta-analyses \(PRISMA\)](#) flowchart as a guideline to depict the flow of information through the different phases of the systematic review. It maps out the number of records identified, included, or excluded, and the reasons for exclusions [22]. Evaluation and confirmation of the quality of studies were performed using the STROBE checklist, and articles that did not meet the required quality criteria were excluded. The quality evaluation was initially conducted by two authors (Majid Mirmohammadkhani and Elahe Ghods). In case of disagreement, it was resolved based on the opinion of the third author (Fatemeh Paknazar). Then, the data from each eligible article were extracted and recorded in Excel software.

In prevalence studies, two main biases are selection bias (related to the study population) and information bias. Prevalence studies can be population-based or non-population-based (generally hospital-based). Most of the studies included in this meta-analysis were hospital-based. Berkson's bias is a type of selection bias that can arise when the sample is taken not from the general population but from a subpopulation. The important types of information bias include misclassification, observer, and recall bias [23-25]. We evaluated the mentioned types of bias for each included study by using the Robvis tool and demonstrated by creating the risk-of-bias plots [26]. STATA software, version 17 was used for meta-analysis, applying "meta" and "metaprop" commands. To examine publication bias, a funnel plot was created using the data on age and gender. Forest plots were used to show the estimated values. Heterogeneity was measured using the I-squared (I^2) statistic.

Results

By searching for the studies using the terms related to disease, epidemiology, and region in [Google Scholar](#) (n=23777) and [Web of Science](#) (n=3033), out of 26,810 articles, 57 articles belonged to the target countries. Also, based on our search in [PubMed](#) using [MeSH \(medical subject headings\)](#) terms, of 7,740 articles related to KD, only 36 articles were related to the target countries. From the total number of 93 articles, after removing duplicates, 49 articles remained, of which 44 [4, 27-69] were selected after removing low-quality articles, articles with overlapping data (n=2), and articles with high selection bias (n=3) (Figure 1). The list of final included articles can be seen in Table 2. Risk-of-bias plots are demonstrated in Figures 2 and 3.

Table 1. Research questions, PICOS structure, and inclusion/exclusion criteria

No.	Questions
1	What is the gender distribution of KD in Middle East?
2	What is the average age of KD patients in Middle East?
3	What is the prevalence of CAL in KD in Middle East?
4	What is the seasonal distribution of KD in Middle East?
5	What is the prevalence of atypical KD in Middle East?
6	What is the estimated incidence of KD in Middle East?

PICOS	Description
Population	KD patients in 19 countries in the Middle East
Intervention	Age, gender, type of KD (typical/atypical), seasonal incidence
Comparison	N/A
Outcome	CAL
Study	Retrospective, cross-sectional, case-series, case-control, cohort

Inclusion Criteria	
Countries	Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, the United Arab Emirates (UAE), Jordan, Yemen, Cyprus, the Palestinian territories/Israel, Jordan, Lebanon, Syria, Turkey, Egypt, Iran, Iraq, Pakistan, and Afghanistan
Time period	Until March 2025
Study type	Cross-sectional, case-series, retrospective, prospective, population-based, and hospital-based studies
Study data	Age, gender, type of KD (typical/atypical), season, CAL, incidence, prevalence
Language	English
Quality	Moderate to good (based on the STROBE checklist)

Exclusion Criteria	
Study type	Case reports, clinical trials
Quality	Bad (based on the STROBE checklist)

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Abbreviations: KD: Kawasaki disease; CAL: Coronary artery lesion; N/A: Not-attributable.

Figure 4 presents the funnel plot for the graphical assessment of publication bias in the meta-analysis according to the age of KD patients. Figure 5 presents the forest plot of the pooled mean age of KD patients in the Middle East countries estimated at 36.88 months with a 95% confidence interval (CI) of 33.54% to 40.22%. Significant heterogeneity was reported for the articles included in the meta-analysis ($I^2=96.67\%$, $P<0.001$). Meta-regression did not show a significant effect of the year of study on age ($P=0.453$). Figure 6 shows the Bubble plot for the meta-regression. As can be seen, the re-

sults of some studies were outliers compared to others. A possible reason can be due to differences in patient selection strategies. By eliminating case-control and cohort studies (only one study from each one) that may differ in nature from the rest of the studies, the degree of heterogeneity was slightly reduced but was still significant and noticeable for both case series ($I^2=93.18\%$, $P<0.001$) and retrospective studies ($I^2=96.44\%$, $P<0.001$). Country can be considered as another source of heterogeneity regarding the test of group differences (chi-squared=48.81, $P<0.001$).

Table 2. Characteristics of the included studies for meta-analysis

Author(s), Year	Country/Place	Type of Study	No.	Mean±SD	M/F	CAL	T/A	Number of Cases in S/S/F/W
				Age (y)				
Majeed et al. 1999 [27]	Kuwait	Case series	41	31±19	28/13	No data	No data	14/11/7/19
Abushaban et al. 1999 [28]	Kuwait	Retrospective	135	24±25.5	82/53	16	No data	No data
Muzaffer et al. 2001 [29]	Saudi Arabia/Riyadh	Case series	13	40.8±13.4	10/3	4	9/4	No data
Sadeghi et al. 2001 [30]	Iran/Fars	Retrospective	50	54±19.7	34/16	10	No data	13/11/9/17
Bhatnagar et al. 2003 [31]	Oman/Muscat	Retrospective	40	29±13.3	21/19	15	No data	7/5/6/4
Saffar et al. 2005 [32]	Iran/Mazandaran	Retrospective	25	38±22.3	14/11	5	No data	8/4/10/3
Asadi-Pooya et al. 2006 [33]	Iran/Fars	Case series	113	46.7±22.6	77/36	10	No data	28/24/32/29
Moradinejad et al. 2007 [34]	Iran/Tehran	Retrospective	159	33.6±11.5	87/72	30	80/79	No data
Eltohami et al. 2007 [35]	Qatar	Retrospective	49	28±17.5	34/15	No data	No data	20/8/7/14
Kayiran et al. 2010 [36]	Turkey/Istanbul	Case series	35	30±22.8	27/8	9	35/0	10/3/3/19
Al-Harbi et al. 2010 [37]	Saudi Arabia/Madinah	Retrospective	24	37.2±28.8	15/9	3	No data	No data
Özdemir et al. 2010 [38]	Turkey/Ankara	Retrospective	24	24±21	14/10	8	16/8	No data
Ghotbi et al. 2011 [39]	Iran/Sanandaj	Retrospective	20	56.4±17	12/8	2	14/6	No data
Amoozgar et al. 2012 [40]	Iran/Shiraz	Case series	45	42.2±33.2	25/20	10	No data	No data
Iyad et al. 2012 [41]	Jordan/Amman	Case series	34	19±15.7	27/7	18	22/12	11/12/2/9
Rahmati et al. 2012 [42]	Iran/Bandarabbas	Retrospective	35	40.2±28.8	28/7	No data	No data	11/7/5/12
Akhtar et al. 2012 [43]	Pakistan/Karachi	Retrospective	56	33±30	32/24	23	46/10	15/13/13/15
Azhar et al. 2012 [44]	Saudi Arabia/Jeddah	Retrospective	44	26.7±14.7	27/17	26	23/21	No data
Shokrollahi et al. 2013 [45]	Iran/Qom	Case series	33	48.3±22.3	22/11	No data	No data	10/6/7/10
Lardhi et al. 2013 [46]	Saudi Arabia/Al khobar	Case series	35	25.5±15	23/12	18	32/3	12/4/3/16
Alsaggaf et al. 2013 [47]	Saudi Arabia/Jeddah	Retrospective	56	30.5±8	33/23	27	28/28	No data
Shamsizadeh et al. 2014 [48]	Iran/Ahvaz	Retrospective	104	33.6±24.2	66/38	21	No data	32/17/12/43
Sedighi et al. 2014 [49]	Iran/Hamedan	Retrospective	74	40.1±17.8	43/31	17	44/30	No data
Shivalingam et al. 2017 [50]	Oman/Sohar	Retrospective	64	26±37	40/24	30	33/31	No data
Cheraghali et al. 2018 [51]	Iran/Gorgan	Retrospective	51	28.1±19.7	30/21	5	39/12	16/13/11/11
Arslanoglu et al. 2019 [52]	Turkey/Ankara	Cohort	100	38±42	61/39	31	52/48	29/24/27/20
Ghandi et al. 2019 [53]	Iran/Markazi	Retrospective	69	33.5±24.3	45/24	8	44/25	19/12/10/28
Movahedi et al. 2020 [54]	Iran/Tehran	Case control	43	77.7±49.8	27/16	No data	No data	No data
Shashaani et al. 2020 [55]	Iran/Tehran	Case series	363	51.6±34.8	217/146	63	No data	No data
Sait et al. 2020 [56]	UAE/Dubai	Case series	27	24±22.3	20/7	15	23/4	No data

Author(s), Year	Country/Place	Type of Study	No.	Mean±SD	M/F	CAL	T/A	Number of Cases in S/S/F/W
				Age (y)				
Nasri et al. 2020 [57]	Iran/Isfahan	Retrospective	201	66.7±33.7	133/68	No data	No data	No data
Öztarhan et al. 2020 [58]	Turkey/Istanbul	Retrospective	259	39.7±19.5	162/97	45	80/179	No data
Al Mwaiti et al. 2021 [59]	Oman/Nationwide	Case series	156	25.2±25.8	100/56	67	No data	No data
Esmailzadeh et al. 2021 [60]	Iran/Shiraz	Retrospective	76	60.4±41	46/30	33	No data	No data
Sadeghi et al. 2021 [61]	Iran/Tehran	Retrospective	190	36±19	103/87	53	118/72	49/40/51/50
Alghamdi et al. 2021 [62]	Saudi Arabia/Jaddah	Retrospective	18	48.5±17	11/7	9	10/8	5/6/5/2
Malek et al. 2022 [63]	Iran/Mashhad	Cross-sectional	168	29.9±19.5	105/63	101	103/65	No data
Zubaidi et al. 2023 [64]	UAE/Abu Dhabi	Case series	74	36±30	64/10	18	38/36	No data
Koliou et al. 2023 [65]	Cyprus/Nationwide	Retrospective	136	35.6±25.8	76/60	56	88/48	No data
Hashemian et al. 2023 [66]	Iran/Guilan	Retrospective	75	35±19	45/30	8	No data	17/20/17/21
Hosseininasab et al. 2023 [67]	Iran/Kerman	Retrospective	360	29.8±22.5	209/151	283	316/44	No data
Shahbaznejad et al. 2023 [4]	Iran/Nationwide	Retrospective	1682	36.9±29.9	999/683	619	361/1321	No data
Türkuçar et al. 2023 [68]	Turkey/Nationwide	Retrospective	399	32±27.4	233/166	126	252/147	No data
Topçu et al. 2024 [69]	Turkey/Kocaeli	Retrospective	130	35.6±22.6	82/48	33	94/36	No data

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SD: Standard deviation; M/F: Males/females; UAE: United Arab Emirates; CAL: Coronary artery lesion; T/A: Typical/atypical; S/S/F/W: Spring/summer/fall/winter.

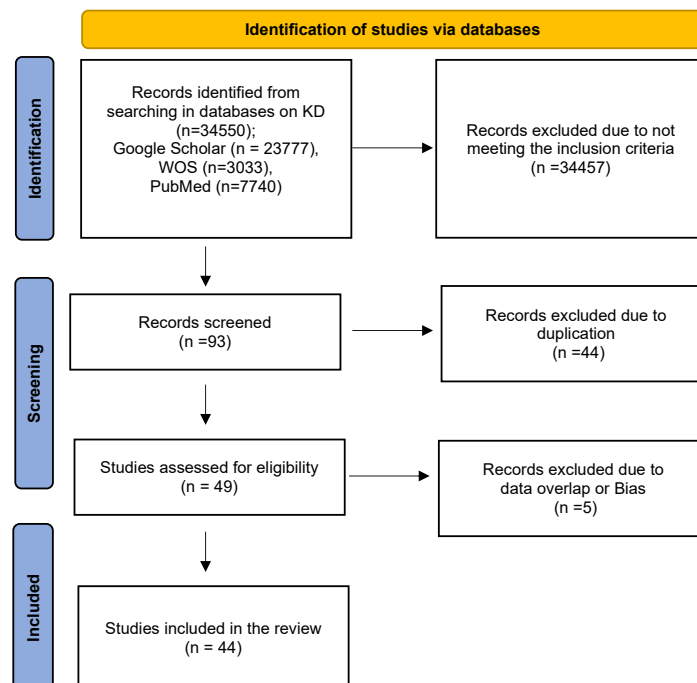


Figure 1. The flowchart of the study process

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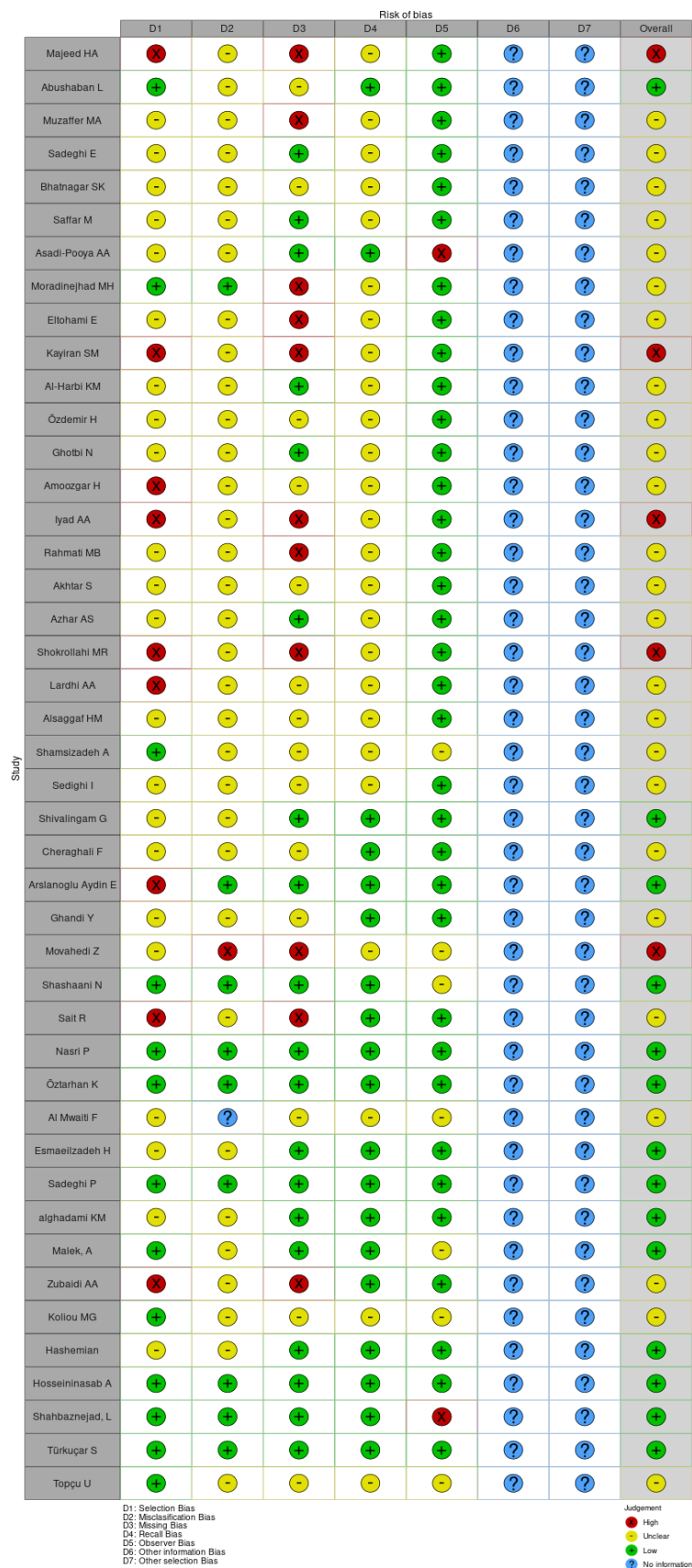


Figure 2. Risk-of-bias plot for each included study

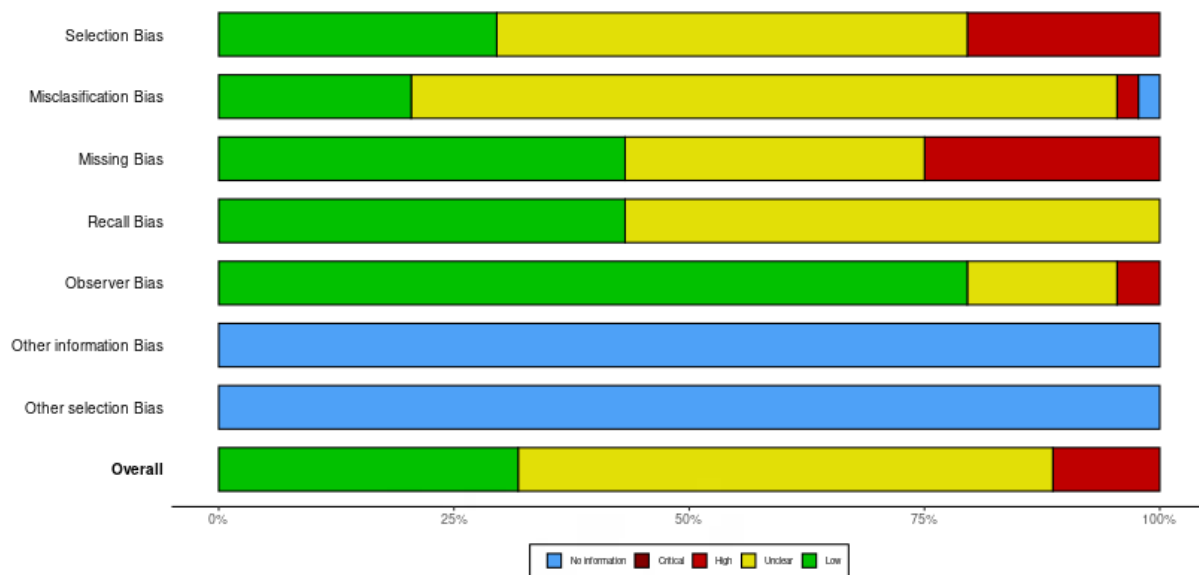


Figure 3. Summary plot of risk of bias for all included studies

According to meta-analysis results, the percentage of boys in total patients was reported to be 63% with a 95% CI of 61% to 65% ($I^2=44.57\%$, $P<0.001$), which indicates a male to female sex ratio of 1.7:1. Among all articles, 41 and 26 articles had data on CAL and type of KD, respectively, and were included for meta-analysis. Figure 7 presents the forest plot of the prevalence of CAL in KD patients in the Middle East countries (estimated preva-

lence: 32%; 95% CI, 26%, 38%; $I^2=96.32\%$, $P<0.001$). Figure 8 presents the forest plot of the prevalence of atypical KD (estimated prevalence: 38%; 95% CI, 26%, 50%; $I^2=98.5\%$, $P<0.001$). Due to the heterogeneity of study estimates for the prevalence of both CAL and KD type, meta-regression was performed, which did not show significant effect for time, country, and type of study.

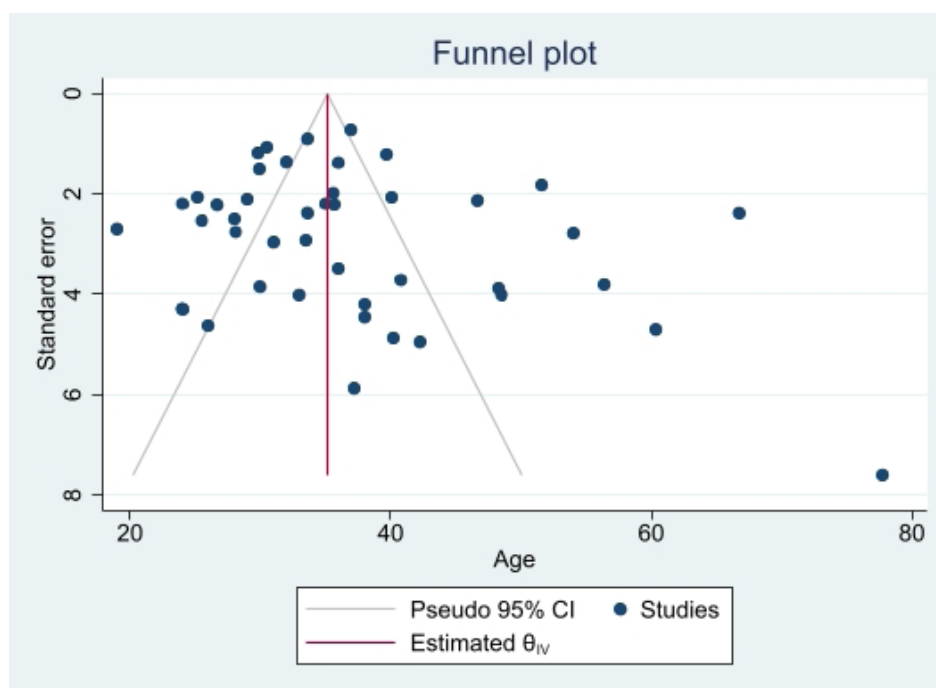


Figure 4. Funnel plot for the graphical assessment of publication bias in the meta-analysis according to the age of KD patients

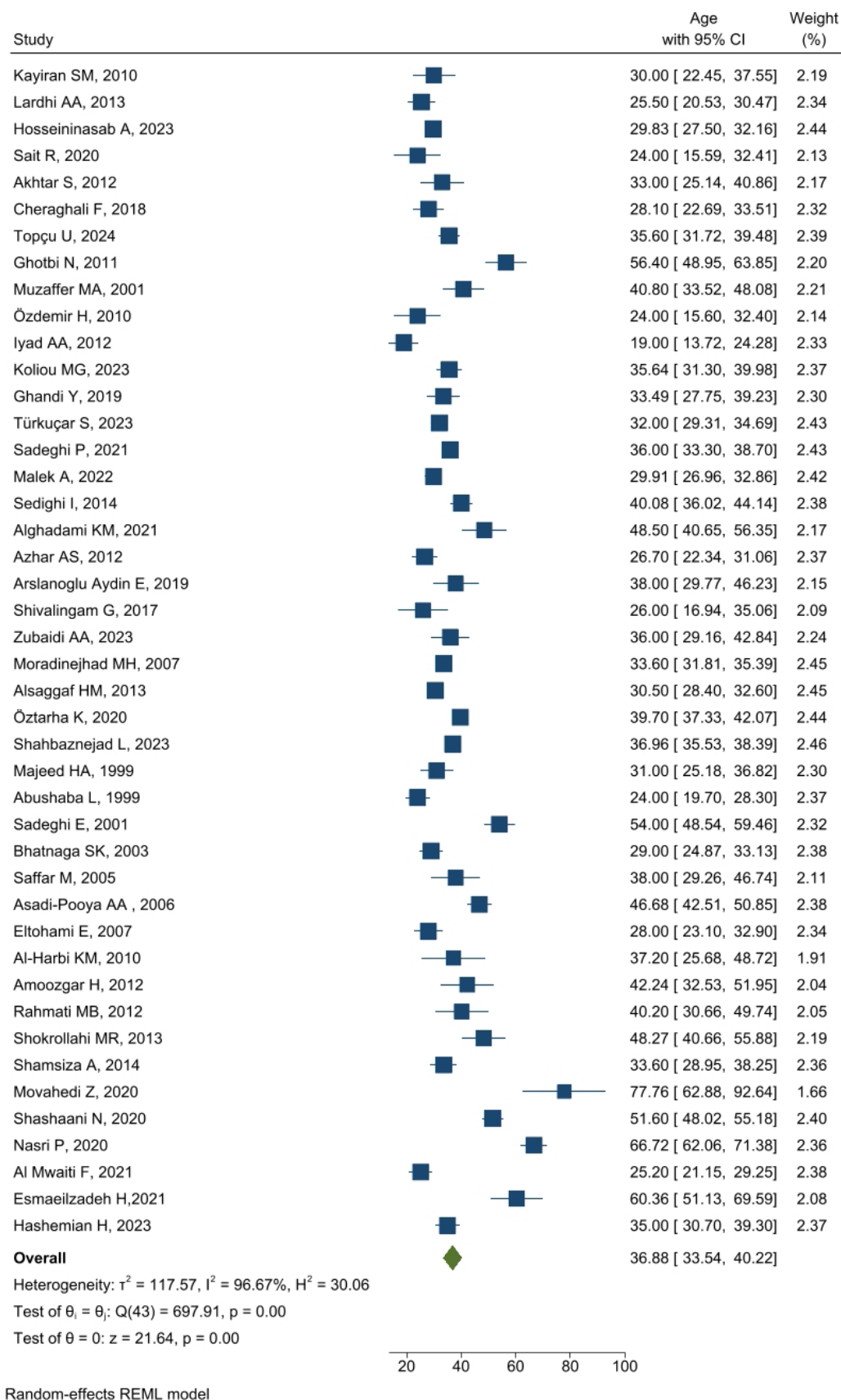
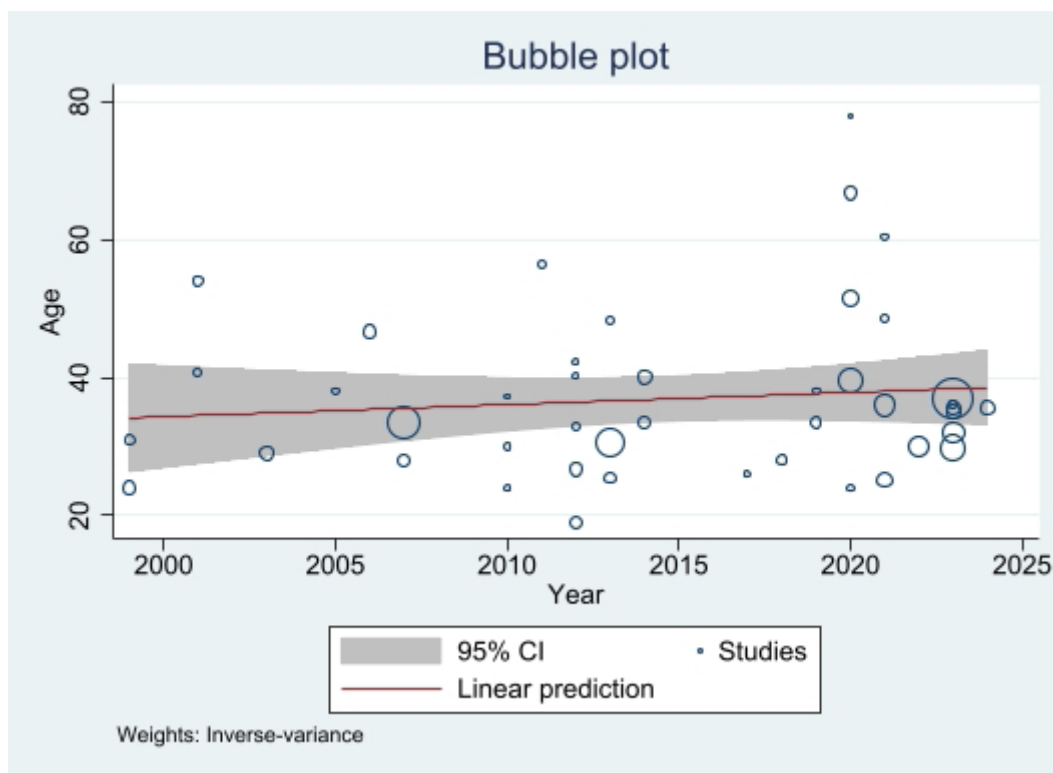


Figure 5. Forest plot of the pooled mean age of KD patients in the Middle East countries



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Figure 6. Meta-regression bubble plot of the age of KD patients in the Middle East countries based on the study year

Among studies, 20 had information on the season of KD occurrence that was included in the meta-analysis. The results for the prevalence of KD in four seasons of spring, summer, autumn and winter were 30%, 20%, 19% and 31%, respectively. No significant heterogeneity was reported for the articles included in the meta-analysis for the seasonal pattern of KD. The number of articles with reliable information on the KD incidence was not sufficient for meta-analysis, so meta-analysis was not conducted.

Discussion

The age and sex distribution patterns of KD have implications for early diagnosis and treatment strategies, emphasizing the importance of high awareness among pediatricians, especially those working with younger male children with prolonged fever and associated symptoms. Age and male gender are critical risk factors for the development of coronary artery aneurysms (CAAs) associated with KD [70]. According to the results of the present study, the pooled mean age of KD patients in the Middle East countries was estimated to be 36.88 months (95% CI, 33.54%, 40.22%). The mean age of onset for KD typically ranges from 1 to 5 years. However, this age may vary depending on the study population [31, 34, 58, 63, 71]. The findings from a nationwide

study in Japan indicated specific distributions related to age, showing a single-peak incidence rate predominantly among infants aged 9-11 months (with 81.7% of cases occurring in children under 4 years old) [72].

The male-to-female ratio of KD has been reported as approximately 1.5 to 2:1, indicating a higher incidence in males worldwide. According to meta-analysis results in our study, a male-to-female ratio of 1.7:1 was reported for KD in Middle East countries, indicating a male predominance similar to Eastern Asia, the USA, and European countries [33, 37]. The male-to-female ratio of a disease can provide insights into hormonal and genetic factors, health behaviors, and the trends in the disease pathogenesis [73]. This sex ratio can be attributed to biological factors, including differences in immune response and susceptibility to KD.

Cardiac involvement is one of the most serious complications of KD, with an increased risk of CAAs [44, 58]. In patients with typical KD, cardiac complications occur in approximately 15-25% of cases [31, 74], depending on the duration and effectiveness of treatment. However, in cases with atypical KD, where fewer clinical criteria are met, the risk of cardiac involvement may be underestimated. Recent findings indicate that even patients with atypical presentations can experience significant

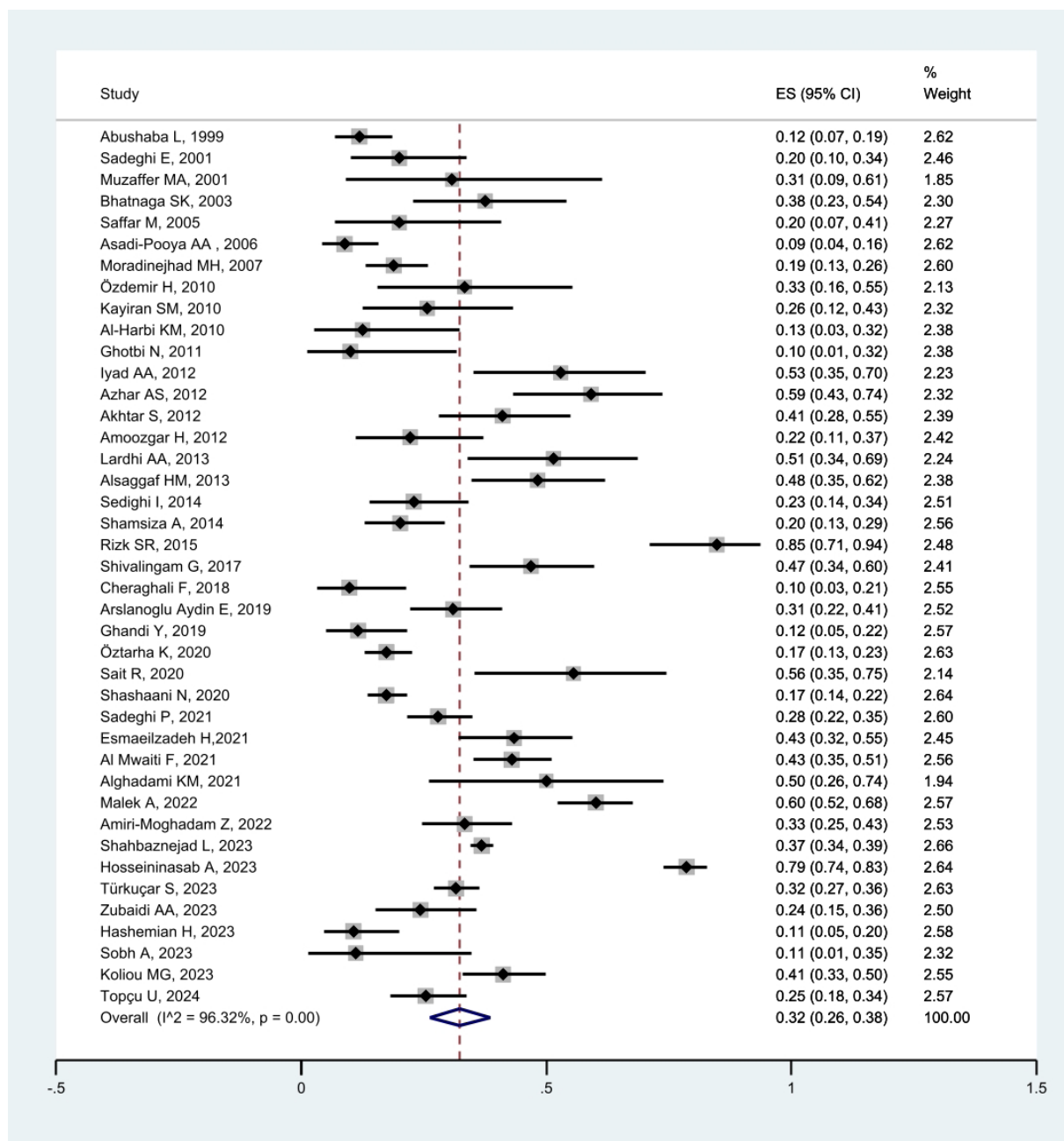


Figure 7. Forest plot of the prevalence of CAL in KD patients in the Middle East countries

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cardiac complications [63]. This necessitates careful monitoring and management of all children diagnosed with KD to mitigate long-term cardiovascular risks. Clinicians should maintain a high index of suspicion for cardiac involvement, regardless of the clinical presentation.

Age can influence the risk of cardiac involvement. Older children with KD may be at a higher risk of developing significant cardiovascular complications, including CAL, compared to younger children. This emphasizes the importance of recognizing KD in older children and be-

ing vigilant for atypical symptoms and potential cardiac issues. Increased vigilance for atypical presentations, particularly in older children or those with less classical manifestations, is essential for improving outcomes. In our study, the prevalence of CAL and atypical KD in the Middle East countries was estimated to be 32% and 38%, respectively. According to statistics, approximately 20–25% of untreated children develop CAL [1]. The results of our study confirm the higher prevalence of cardiac diseases in the Middle East. In a study conducted in Japan, the incidence of KD was found to be

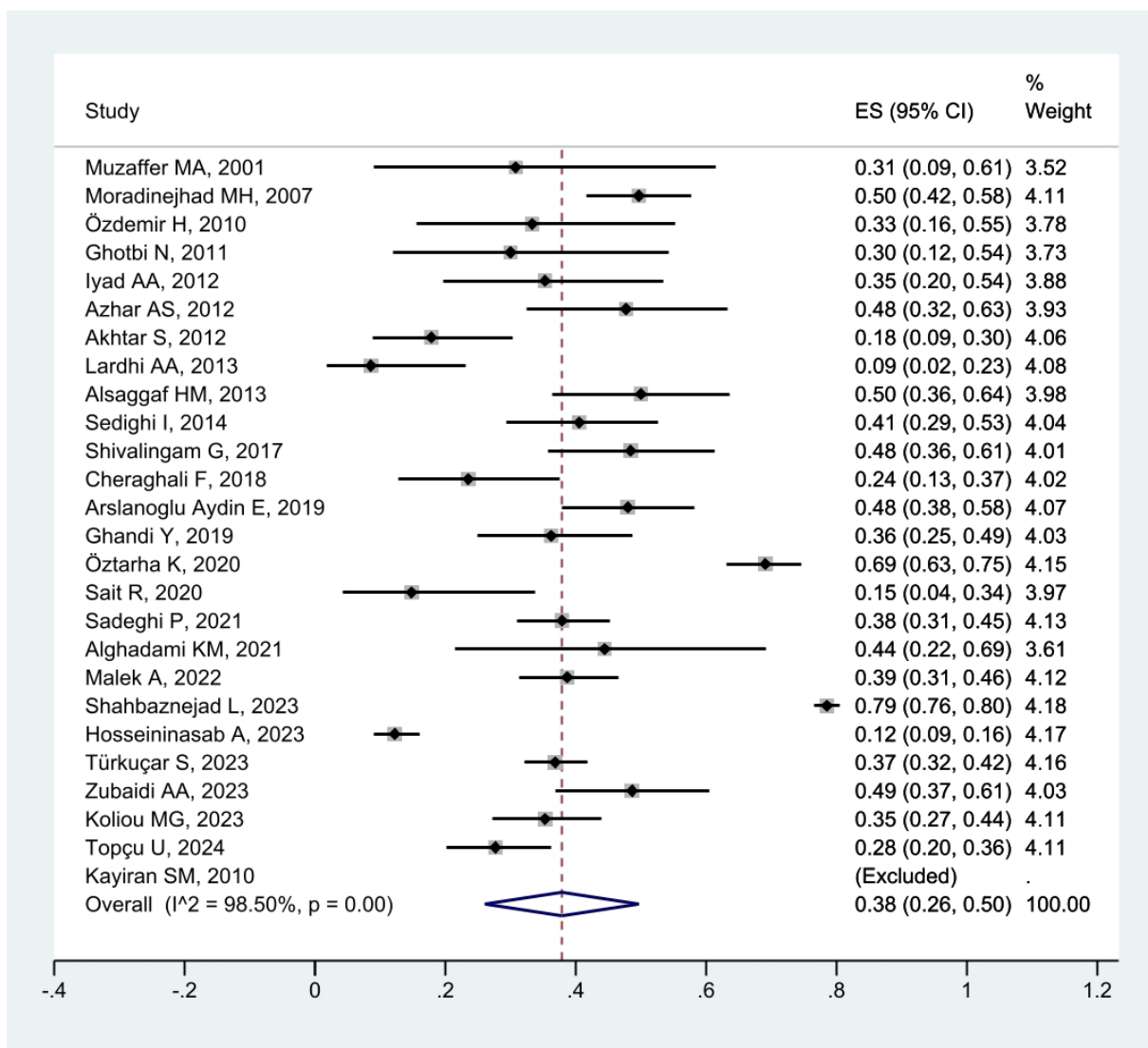


Figure 8. Forest plot of the prevalence of atypical KD in the Middle East countries

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1.4-1.7 times higher in males than in females; however, this proportion has declined over time for both genders [72]. The identification of atypical KD is crucial, as these cases may present with milder or non-specific symptoms and can lead to significant cardiovascular complications if not appropriately recognized and treated.

The CALs were observed in more than 25% of KD patients in a 20-year cohort study, with three cases showing persistent lesions in long-term follow-up [69]. Compared to global statistics that reported the prevalence of atypical KD between 15% and 36%, its prevalence in our study for Middle Eastern countries was estimated at 38%, which is slightly higher than the global rate [14]. The primarily winter-spring KD prevalence, as well as the well-documented Japanese epidemics with wave-like spread, also support an infectious trigger. In Iran,

one study showed that 37% of cases occurred in the spring [16]. Based on the results of the present review study, the prevalence of KD in the Middle East countries in the four seasons of spring, summer, autumn, and winter was 30%, 20%, 19% and 31%, respectively. The incidence of KD also varies significantly across different populations and geographic regions [7, 75]. This variation underscores the need for more comprehensive epidemiological studies to understand the factors contributing to these differences, such as genetic predisposition, environmental influences, and health-care access. Understanding the incidence is crucial for developing targeted public health interventions and awareness programs, particularly in areas where KD is less recognized. In a study, a total of 17 nationwide surveys were carried out biannually since 1970. The results showed that the annual incidence of KD for children

younger than 5 years of age in 2001 and 2002 was 138.8 and 151.2 per 100,000 children [72]. In Northeast Asian countries, including Japan, South Korea, China, and Taiwan, the incidence of KD is 10-30 times higher than in the United States [72, 76], where the rate of KD among children under 5 years old was reported to be 18-25 per 100,000 [77]. Data in Iran for 186,069 patients reported a mean annual incidence of 2.85 per 100,000 children under five years old. The annual incidence rates varied from 7.28 for children under 1 year to 0.78 for those over 5 years [4].

Due to a lack of population-based research in most countries in the Middle East, which are the best relevant studies for our purpose, we have to use hospital-based studies instead, including case series, which are subject to various types of selection bias including Berkson's bias, which was limitation for our meta-analysis. The most important source of heterogeneity in our meta-analysis seems to be related to the type of studies included, which cannot be addressed by subgroup analysis or meta-regression. The interpretation of the results should be considered in light of the above limitations. Conducting population-based research on the epidemiological characteristics of the KD in the Middle East countries is recommended.

Conclusion

A comprehensive understanding of KD characteristics, including its prevalence rate, age at onset, sex and seasonal distribution, cardiac involvement, and the distinction between typical and atypical cases, is essential for improving diagnosis, treatment, and outcomes in affected children. Although our results align with global statistics regarding age, gender, and seasonal distribution of the KD, the prevalence of CAL in KD patients and atypical form of the KD were higher in the Middle East. To accurately estimate the incidence of KD in the region, further population-based research is needed. This can be facilitated through consortia-based scientific activities aimed at establishing disease registration facilities in these countries.

Ethical Considerations

Compliance with ethical guidelines

There were no ethical considerations to be considered in this research.

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Authors contribution

Conceptualization and supervision: Majid Mirmohammadkhani and Elahe Ghods; Methodology: Majid Mirmohammadkhani and Fatemeh Paknazar; Data collection: Elahe Ghods and Fatemeh Paknazar; Data analysis: Majid Mirmohammadkhani and Fatemeh Paknazar; Funding acquisition and resources, investigation, and writing: All authors.

Conflicts of interest

The authors declared no conflict of interest.

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