

Regional insights: a systematic review and meta-analysis of cardiovascular risk factors and predictors of cardiovascular outcomes in the middle eastern population

H. Radhi¹, M. Hopkins², M. Zulyniak², S. Moore², M. Alawami¹

¹King Fahd Hospital of the University, Al Khobar, Saudi Arabia

²University of Leeds, Leeds, United Kingdom of Great Britain & Northern Ireland

Funding Acknowledgements: None.

Background: Cardiovascular disease (CVD) remains the leading cause of mortality globally including the Middle East. Disproportionately high premature CVD events were reported in Middle Eastern population with 11.2% of total myocardial infarction cases presenting before the age of 40 years compared to only 2.7% in Western Europe. While traditional risk factors are well established, the contribution of regional lifestyle, environmental, and genetic determinants are less well defined. Understanding the distribution and impact of CVD risk factors and region-specific risk profile is crucial for planning prevention strategies tailored to the regional needs.

Purpose: This systematic review aims to offer a detailed synthesis of the current evidence on the association of various risk factors and cardiovascular diseases specific to the Middle East. This review will provide insights into regional risk profiles and offer valuable information to support the development of region-specific cardiovascular prevention strategies.

Methods: Observational studies conducted in Middle Eastern populations were systematically reviewed based on Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. PubMed/MEDLINE, Global Health, and EMBASE electronic databases were searched for studies published between January 2004 and November 2024 reporting coronary artery disease (CAD), myocardial infarction (MI), stroke, or cardiovascular death in Middle Eastern populations. Data were extracted using DistillerSR, and study quality was assessed with the Risk of Bias in Non-randomized Studies of Interventions (ROBINS-I) tool. Pooled prevalence estimates were generated, and random-effects meta-analyses were performed for exposure-outcome pairs.

Results: Eighty-one studies were included from 1,767 screened records. Traditional risk factors were consistently more prevalent in patients with CVD compared with the general population: hypertension (48.6% vs 25.6%), diabetes mellitus (37.5% vs 14.3%), dyslipidaemia (34.4% vs 30.0%), and smoking (32.7% vs 25.3%) (all $p < 0.001$). Meta-analyses demonstrated strong associations between hypertension and stroke (OR 2.74, 95% CI 1.66–4.52), cigarette smoking and CAD (OR 7.51, 95% CI 1.86–30.31), diabetes and CAD (OR 2.50, 95% CI 1.22–5.13), and obesity and CAD (OR 1.51, 95% CI 1.03–2.23). Beyond these traditional factors, sedentary behaviour, adverse dietary patterns, environmental pollution, psychosocial stress, khat and opium use, waterpipe smoking, and genetic polymorphisms were linked to higher cardiovascular risk. Biomarkers, notably the ApoB/ApoA1 ratio, showed additional predictive utility.

Conclusion: Traditional risk factors remain strongly associated with CVD in Middle Eastern populations, but distinctive regional genetic predispositions and lifestyle factors may further amplify risk. These findings emphasise the need for region-specific risk prediction models and preventive strategies.

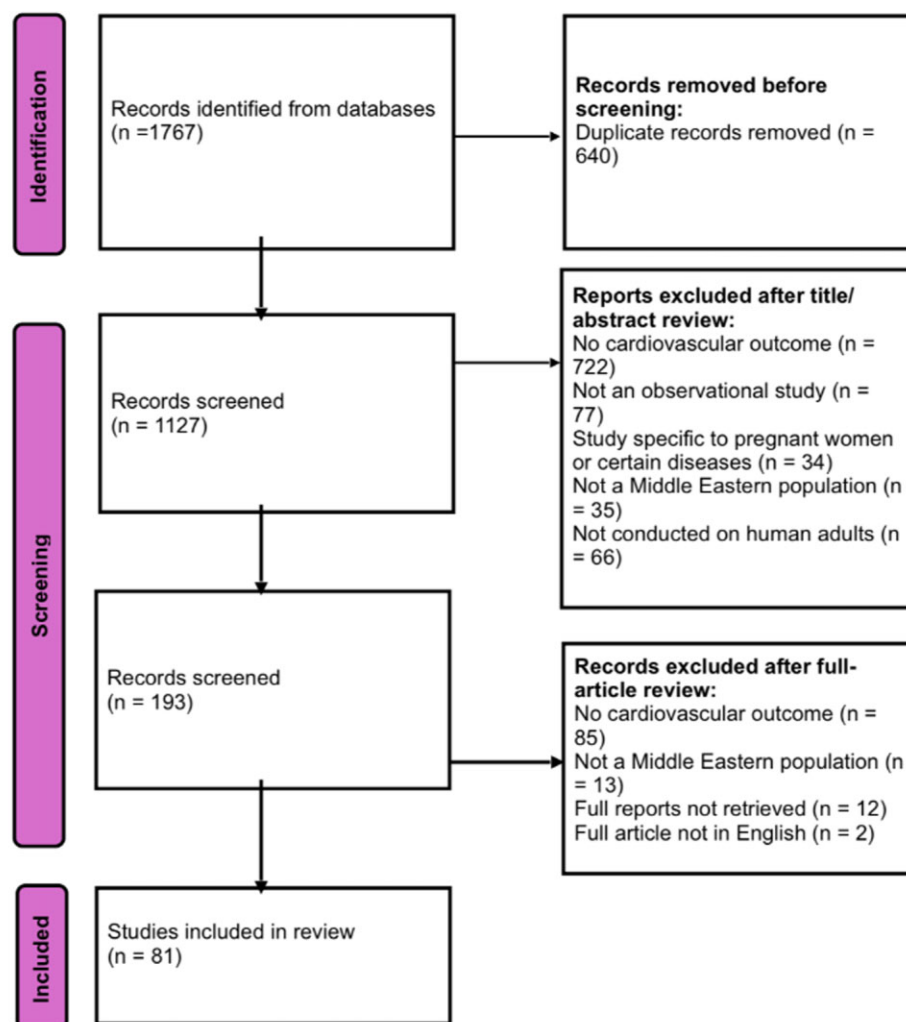


Figure 1. PRISMA flow diagram of the systematic review

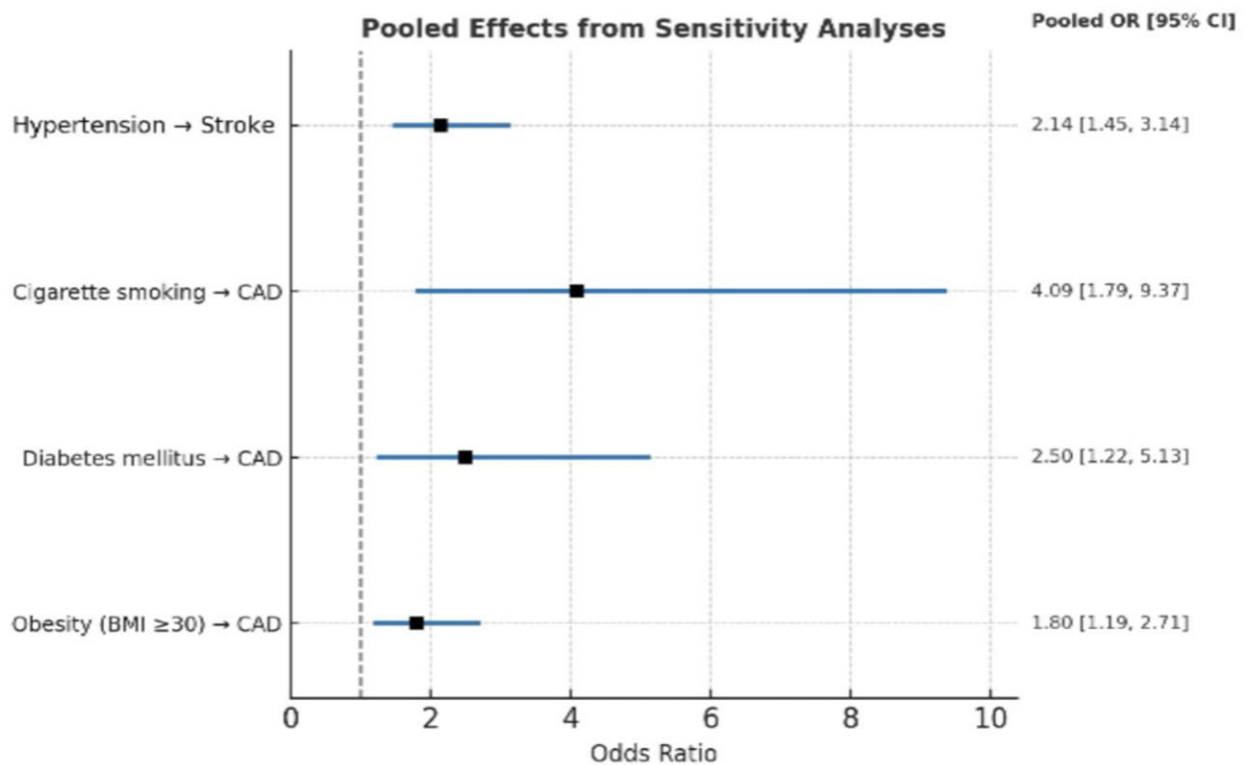


Figure 2. Forest plot showing the association between major cardiovascular risk factors and outcomes. The plot presents pooled odds ratios (OR) with 95% confidence intervals (CI) for the relationship of hypertension with stroke, cigarette smoking with coronary artery disease (CAD), diabetes mellitus with CAD, and obesity with CAD. All exposure-outcome pairs were combined in a single figure to facilitate visual comparison of relative effect sizes across different risk factors. This forest plot presents the sensitivity-adjusted pooled estimates

Abbreviations: OR = odds ratio; CI = confidence interval; CAD = coronary artery disease.