

The prevalence of type 2 diabetes and prediabetes among armed forces personnel: a systematic review and meta-analysis

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Abstract

Background: Previous studies of diabetes among armed forces personnel did not assess a comprehensive disease prevalence. We conducted a systematic review and meta-analysis to estimate the prevalence of type 2 diabetes and prediabetes among military personnel and police officers.

Methods: We carried out a systematic search on electronic databases from January 2000 to July 2020. All studies with a report of the prevalence of diabetes and/or prediabetes among armed forces personnel were selected. The Cochran test and I^2 statistics were used to determine the heterogeneity of the studies. Random- or fixed-effects model, along with subgroup analysis on diabetes or prediabetes as well as the component of armed forces, was carried out to determine the overall prevalence. All analyses were conducted using STATA software.

Results: Among 858 citations, 30 studies were entered into the meta-analysis, involving 1879170 individuals. The meta-analysis estimated the prevalence of type 2 diabetes among the military personnel (9.15%; 95% confidence intervals [CI]: 5.35-12.96) and police officers (9.58%; CI: 5.98-13.18). The overall prevalence of prediabetes among the military personnel and the police officers were 7.32% (CI: 4.22-10.42) and 6.35% (CI: 5.26-7.44), respectively.

Conclusion: The prevalence of diabetes and prediabetes among armed forces was consistent with global reports among the general population. These results will inform policy-makers and healthcare providers to find solutions and help to take action to reduce diabetes risk factors on a wider scale, particularly among armed forces personnel.

Background

Diabetes mellitus is a major global healthcare challenge. Based on the International Diabetes Federation (IDF) diabetes atlas, 463 million people influenced by diabetes in 2019 worldwide and estimated to be 700 million by 2045 [1]. The expenditure of annual global health on diabetes is approximately USD 760 billion [2]. Diabetes causes a number of micro- and macrovascular complications, as the main reason for morbidity and mortality among patients with diabetes [3]. Furthermore, it significantly affects the life expectancy and quality of patients as well as the development of other diseases [4].

Among the risk factors of diabetes, the occupation has a crucial role. Nowadays, the relationship between occupational factors and the prevalence of diabetes takes the interest of researchers [5]. Armed forces are at high risk of developing cardiometabolic syndrome because they have unique lifestyles and expose to stressful situations [6]. A body of evidence demonstrated that this occupational group, compared to the general population, had a higher prevalence of metabolic diseases, including diabetes [7, 8]. Additionally, other occupational characteristics, like dietary regimens, atypical physical activity, long work hours, social isolation, and ergonomic problems, have a negative impact on the health conditions of armed forces personnel [9, 10]. The countries' human development index (HDI) as another remarkable factor impress the quality of life and incidence of many diseases among different occupations [11]. The HDI is a statistic composite indicator of life expectancy, education, and income, ranked countries into four categories including low (0.350-0.549), medium (0.550-0.699), high (0.700-0.799), and very high (0.800-1.000) [12].

The combination of these elements contributes to making negative changes in lifestyle among this occupational group. The results of a cohort study showed that armed forces are more prone to non-communicable diseases, especially at earlier ages, and they die much earlier compared to other groups [13].

This evidence warrants for more comprehensive strategies of monitoring and screening to reduce the prevalence of diabetes and its burden. Therefore, we carried out a systematic review and meta-analysis of relevant studies to improve the understanding and knowledge of the prevalence of type 2 diabetes and prediabetes among different components of armed forces personnel (military personnel and police officers) around various geographical parts of the world.

Methods

The current study is a systematic review and meta-analysis conducted to estimate the prevalence of prediabetes and diabetes among armed forces personnel in 2020. The study was carried out based on Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [14].

Literature Search

A comprehensive literature search of published studies was conducted using Medline/PubMed, Scopus, ProQuest, and Web of Science, as well as Google Scholar in July 2020. The medical subject headings (MeSH) keywords included "army", "military", "soldiers", "police", "policemen", "cop", "conscript", "diabetes", "prediabetes", "metabolic syndrome", and "prevalence". The keywords dashboard is represented in Supplementary file 1. All articles list were imported to EndNote X7 (Thomson Reuters, Carlsbad, CA, USA) library, and the duplicates were automatically removed. Moreover, the references list of included studies were manually searched to ensure satisfying coverage.

Selection criteria

The primary screening was performed according to the title and abstract by two independent researchers (MF and SH). After that, data extraction and quality assessment were done by reading the full-text of the remaining articles. In the case of conflict in any of the secondary stages, the corresponding author (MS) made the final decision.

The primary inclusion criteria were original studies with a report of the prevalence of diabetes and/or prediabetes among in-service armed forces personnel. The selected studies consist of cross-sectional studies as well as cohort studies reported the prevalence in the baseline. Studies with an inappropriate population (retired personnel, veterans, and outlier ages), estimation of incidence, and non-English language, as well as conference abstracts, poster papers, and editorial, were excluded.

Definitions

Type 2 diabetes was defined as a fasting blood glucose (FBG) level of ≥ 126 mg/dL (7.0 mmol/L), hemoglobin A1c (Hb1Ac) level of ≥ 6.5 %, current use of anti-diabetic drugs (either insulin, oral anti-diabetic drugs, or both), or a previous diagnosis made by a physician.

Prediabetes was defined as FBG level of 110 to 125 mg/dL (6.1 mmol/L to 6.9 mmol/L), impaired oral glucose tolerance test, or Hb1Ac level of 5.7-6.4 %.

Data extraction

A spreadsheet was prepared using all targeted statistics. This checklist included the name of the first author, year of publishing, time period, location of study, number of participants, method of diagnosis, and frequency (with lower and upper 95% confidence intervals) for diabetes and prediabetes.

Quality assessment

The Joanna Briggs Institute (JBI) checklist was applied in order to evaluate the quality of the included studies [15]. This appraisal is aimed to estimate the methodological quality and to assess the possibility of bias in the design, conduct, and analysis of studies. The included studies were scored out of nine using this assessment tool and categorized as satisfactory (score = 7-9), good (score = 4-6), and low (score = 1-3) quality.

Meta-regression analysis

The meta-regression was utilized due to the high level of heterogeneity of the included studies. One of these subgroup analyses was the country's HDI as a relative index of life expectancy and quality as well as literacy and education. The other subgroups consisted of the mean age of participants, sample size, and publication year of study.

Meta-analysis

The Cochran test (with a significance level of <0.1) in combination with I^2 statistics (with a significance level of $>50\%$) was used to determine the heterogeneity of the studies. Thereafter, the random-effects model with the inverse-variance method was applied in the presence of heterogeneity. The subgroup analysis was performed in the case of heterogeneity based on the type of disease (diabetes or prediabetes), the component of armed forces personnel (military personnel or police officers), geographical regions (America, Asia, or Africa), and sample size (<1000 or >1000 subjects). All analyses were conducted using STATA software (version 13).

Sensitivity analysis

In order to evaluate the quality and consistency of the findings and to assess the robustness of the obtained results, sensitivity analysis was conducted through deleting each study separately.

Assessing risk of bias

The publication bias was evaluated using the Egger test [16].

Results

Results of the search

The primary stage of searches yielded 858 citations. Additionally, 44 studies also identified through gray literature. After removing duplicates, 657 studies selected to investigate the titles and abstracts, and 108 articles remained for the full-text review. Of these, 46 studies fulfilled the inclusion criteria. Finally, 30 articles, involving 1879170 individuals, were extracted for the meta-analysis. The reasons for exclusion of 645 papers were irrelevant title ($n = 567$), studies with inappropriate population ($n = 12$), not reporting prevalence of either diabetes or prediabetes ($n = 11$), reporting incidence of either diabetes or prediabetes ($n = 2$), review or meta-analysis study ($n = 6$), non-English papers ($n = 10$), and editorial, conference abstracts, or poster papers ($n = 7$). The flowchart of the included studies is shown in Fig. 1.

Description of studies

Among 30 included studies (26 cross-sectional and four cohort studies), 11 studies conducted in India [7, 8, 17-25], four in the USA [26-29], two in Iran [30, 31], two in Saudi Arabia [32, 33], one in Brazil [34], one in Sweden [35], one in Canada [36], one in Poland [37], one in Zambia [38], one in Jordan [39], one in Guinea-Bissau [40], one in Thailand [41], one in Brunei [42], one in Sri Lanka [43], and one in Ethiopia [6], with report of diabetes ($n = 30$) and prediabetes ($n = 9$) prevalence. Studies participants consisted of military personnel, soldiers, and conscripts, as well as police personnel and officer. The participants' age ranged from 17 to 60 years old. FBG was used as the main diagnosis method of diabetes and prediabetes in most studies. The basic characteristics of the included studies are shown in Table 1.

Quality assessment

Based on the JBI checklist, included studies categorized as satisfactory ($n = 21$), good ($n = 9$), and low ($n = 0$) quality. The results of the quality assessment are summarized in Table 1 and Supplementary file 1.

Heterogeneity

Considerable inter-study heterogeneity was observed based on the Cochran test and the I^2 index. The results of heterogeneity and the models of analysis are expressed in Table 2.

Results of the meta-regression

The Results of meta-regression demonstrated an association between publication year of study and the prevalence of diabetes among military personnel (Reg Coef = 0.062, $p = 0.069$). However, this was not significantly associated with HDI score (Reg Coef = -8.11, $p = 0.441$), sample size (Reg Coef = 0.001, $p = 0.935$), and mean age of the participants (Reg Coef = 0.024, $p = 0.879$).

On the other hand, the obtained results showed an association between the mean age of the participants and the prevalence of diabetes among police officers (Reg Coef = 0.064, $p = 0.089$). Such a meaningful finding was not observed for HDI score (Reg Coef = 2.21, $p = 0.182$), sample size (Reg Coef = -0.001, $p = 0.593$), and publication year of study (Reg Coef = -0.001, $p = 0.919$).

Results of the meta-analysis

Prevalence of diabetes

The analysis of pooled data indicated the overall prevalence of diabetes among the military personnel was 9.15% (95% confidence intervals [CI]: 5.35-12.96; $I^2 = 99.8\%$, $p < 0.001$). The results of subgroup analyses showed the Asian countries had the highest prevalence of diabetes among the military personnel (12.38%; CI: 5.89-18.86) (Supplementary file 3). The prevalence of diabetes among the police officers was 9.58% (CI: 5.98-13.18; $I^2 = 98.6\%$, $p < 0.001$). The obtained results of subgroup analysis also demonstrated the highest prevalence of diabetes among police officers was related to Asian countries (13.09%; CI: 5.47-20.70) (Supplementary file 4). The results of the meta-analysis of diabetes prevalence stratified by a different variable are demonstrated in Table 2.

Prevalence of prediabetes

The overall prevalence of prediabetes among the arm forces personnel was 6.51% (CI: 5.49-7.53, $I^2 = 62.7\%$, $p = 0.006$). The results of subgroup analyses indicated the prevalence of prediabetes among the military personnel and police officers were 7.32% (CI: 4.22-10.42, $I^2 = 44.3\%$, $p = 0.166$) and 6.35% (CI: 5.26-7.44, $I^2 = 70.0\%$, $p = 0.005$), respectively (Supplementary file 7). The results of the meta-analysis of prediabetes prevalence among armed forces personnel are demonstrated in Table 2.

Sensitivity analysis

The findings were reanalyzed by deleting each study separately. The results demonstrated the studies with small sample size, and the outlier studies had no significant effect on the final finding.

Publication bias

Results of Egger's tests demonstrated a lack of publication bias ($p > 0.10$).

Discussion

To the best of authors' knowledge, this is the first meta-analysis conducted on the prevalence of diabetes and prediabetes among armed forces personnel. Several investigations have reported the prevalence of diabetes and prediabetes among different components of armed forces. However, the result of these studies has demonstrated a range of variability in the prevalence. The reported prevalence of diabetes in armed forces was varied from 0.0% to 34.7% or even higher, depending on different diagnostic criteria, age, HDI of countries, special diet, various comorbidities, and other environmental factors. The present meta-analysis also indicated that different types of armed forces might play a significant role in the prevalence of dysglycemia.

The obtained results demonstrated that the prevalence of diabetes among the military personnel (9.15%) is relatively lower compared to that of the police officers (9.58%). The highest reported prevalence of diabetes ($>30\%$) was also related to studies carried out among police officers [7, 17, 20, 23]. The overall prevalence of diabetes among military personnel, not police officers, is under the global prevalence of diabetes (9.30%) [44]. The highest prevalence of diabetes among arm forces personnel ($>30\%$) were related to the medium HDI countries. This prevalence is uneven since policemen are expected to be in good shape with regular physical activities. Several previous studies conducted among police officers demonstrated the high prevalence of overweight and obesity made them susceptible to metabolic and heart disease [45, 46]. These risk factors of dysglycemia also were associated with a mean age of study population, and elderly participants were more prone to develop diabetes [46].

The most frequent and highly rated stressors might be the other main reasons for the high prevalence of many mental and non-communicable diseases in this occupation group [47, 48]. Moreover, ergonomic problems, long work hours, and a particular nutrition regimen should not be underestimated [49, 50]. Recent comprehensive studies also showed the prevalence of metabolic syndrome, and its component is high among policemen relative to the general population [9, 20].

However, the overall prevalence of diabetes among military personnel was lower than that of other components of armed forces. Several studies reported that diabetes only affected less than two percent of this occupational group [31, 35, 39]. In addition to a more appropriate lifestyle, there are some other factors contributing to the relatively low prevalence of diabetes in the military unit. Men are initially recruited at younger ages and undergo regular medical checkups, physical training, and calorie-controlled diets. Then, those individuals with underlying medical conditions, including central obesity, are exempted from these services or replaced in public services [9, 51]. Hence, some included military personnel in the present investigation might have a better health-related quality of life compared to the police officers or the general population [51].

The results also showed that the prevalence of diabetes among this population was not associated with the year of study. There are several other studies that indicated the prevalence of diabetes is increasing, passing the time [52, 53]. These are not only related to the increasing trend of physical inactivity and consumption of unhealthy diet but also progression in diagnostic techniques as well as effective strategies for detection and follow-up people with dysglycemia [54]. However, this kind of association was not observed in the present study.

Our findings demonstrated that the prevalence of prediabetes among the military personnel and the police officers were 7.32% and 6.35%, respectively. A body of evidence has demonstrated a range of prevalence of dysglycemia in armed forces according to different biochemical criteria. Some studies reported a prevalence of impaired fasting glucose about 30-40%, particularly among police officers [17, 20, 34, 55-57]. In several studies conducted on the arm forces personnel, age as well as obesity were found to be the strongest predictors

for prediabetes, especially in men. However, due to the low number of studies reported the prevalence of prediabetes, we could not conduct more analyses on the risk factors of prediabetes. The overall prevalence of prediabetes in included studies is under the estimated prevalence of the adult population (7.30%) around the world [58]. However, the fasting blood glucose should be screened regularly among armed forces personnel as an affordable and invaluable biochemical factor, and impaired fasting glucose would be better to consider as a critical index for early detection and prevention of at-risk population.

Strengths and limitations

The main strength of the current study is that this is the first analysis that showed the prevalence of diabetes and prediabetes among armed forces personnel. This study can supply reliable baseline information and may guide other scholars to design and conduct novel researches.

However, several limitations reflected by some factors of data are confirmed. Sufficient information was not available to conduct separate or subgroup analyses in terms of assessment of all age groups. The lack of data regarding lifestyle, physical activity, nutritional habits, and comorbid factors of the participants, which could explain the estimated prevalence of diabetes, is another main limitation. Because of the high level of heterogeneity of the included studies, it was only attempted to analyze the results according to countries' HDI.

Conclusion

In summary, this meta-analysis clearly demonstrated that the prevalence of diabetes and prediabetes among all types of armed forces personnel was consistent with global reports of these diseases among the general population. These results will inform policy-makers and healthcare providers to find solutions and help to take action to reduce diabetes risk factors on a wider scale, particularly among armed forces personnel. Future large-scale investigations studying the prevalence of diabetes and its associated factors among armed forces personnel would also help to estimate the more exact prevalence of dysglycemia, and help to take effective strategies in prevention, early detection, and management of diabetes among this occupational group.

Abbreviations

CI: 95% confidence interval; IDF: International Diabetes Federation; HDI: human development index; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses; MeSH: medical subject headings; JBI: Joanna Briggs Institute.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

All data is presented within the manuscript file.

Competing interests

The authors declare that they have no competing interests.

Funding

Not applicable.

Authors' contributions

All authors were responsible for conceiving and designing the protocol. MF, SH, and MS designed the study. MF and MT did the literature search and, together with SH, selected the studies, extracted the relevant data. SH and MS synthesized the data. MF wrote the first draft of

the Manuscript. MS and SA provided critical guidance on the analysis and overall direction of the study. All authors critically revised successive drafts of the paper and approved the final version.

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References

1. Sinclair A, Saeedi P, Kaundal A, Karuranga S, Malanda B, Williams R: **Diabetes and global ageing among 65-99-year-old adults: Findings from the International Diabetes Federation Diabetes Atlas, 9(th) edition.** *Diabetes research and clinical practice* 2020, **138**(1):108078.
2. Williams R, Karuranga S, Malanda B, Saeedi P, Basit A, Besancon S, Bommer C, Esteghamati A, Ogurtsova K, Zhang P *et al*: **Global and regional estimates and projections of diabetes-related health expenditure: Results from the International Diabetes Federation Diabetes Atlas, 9th edition.** *Diabetes research and clinical practice* 2020, **138**(1):108072.
3. Seghieri G, Policardo L, Anichini R, Franconi F, Campesi I, Cherchi S, Tonolo G: **The Effect of Sex and Gender on Diabetic Complications.** *Current diabetes reviews* 2017, **13**(2):148-160.
4. Maffi P, Secchi A: **The Burden of Diabetes: Emerging Data.** *Developments in ophthalmology* 2017, **60**(1):1-5.
5. Heden Stahl C, Novak M, Hansson PO, Lappas G, Wilhelmsen L, Rosengren A: **Incidence of Type 2 diabetes among occupational classes in Sweden: a 35-year follow-up cohort study in middle-aged men.** *Diabetic medicine : a journal of the British Diabetic Association* 2014, **31**(6):674-680.
6. Tesfaye T, Shikur B, Shimels T, Firdu N: **Prevalence and factors associated with diabetes mellitus and impaired fasting glucose level among members of federal police commission residing in Addis Ababa, Ethiopia.** *BMC endocrine disorders* 2016, **16**(1):68.
7. Ramakrishnan J, Majgi S, Premarajan K, Lakshminarayanan S, Thangaraj S, Chinnakali P: **High prevalence of cardiovascular risk factors among policemen in Puducherry, South India.** *J Cardiovasc Dis Res* 2013, **4**(2):112-115.
8. Madhusudhana M, Manjunath ML, Girish BM: **A study of distribution and determinants of diabetes mellitus among army personnel in Belgaum Cantonment in India.** *IJBAR* 2011, **2**(09):310-316.
9. Rostami H, Tavakoli HR, Rahimi MH, Mohammadi M: **Metabolic Syndrome Prevalence among Armed Forces Personnel (Military Personnel and Police Officers): A Systematic Review and Meta-Analysis.** *Military medicine* 2019, **184**(9-10):e417-e425.
10. Salimi Y, Taghdir M, Sepandi M, Karimi AA: **The prevalence of overweight and obesity among Iranian military personnel: a systematic review and meta-analysis.** *BMC public health* 2019, **19**(1):162.
11. Programme UND: **Human development indices and indicators: 2018 statistical update.** In.: United Nations Development Programme New York, NY; 2018.
12. Mirahmadizadeh A, Fathalipour M, Mokhtari AM, Zeighami S, Hassanipour S, Heiran A: **The prevalence of undiagnosed type 2 diabetes and prediabetes in Eastern Mediterranean region (EMRO): A systematic review and meta-analysis.** *Diabetes research and clinical practice* 2020, **160**(1):107931.
13. Wirth M, Vena JE, Smith EK, Bauer SE, Violanti J, Burch J: **The epidemiology of cancer among police officers.** *Am J Ind Med* 2013, **56**(4):439-453.
14. Moher D, Liberati A, Tetzlaff J, Altman DG: **Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement.** *PLoS medicine* 2009, **6**(7):e1000097.
15. Porritt K, Gomersall J, Lockwood C: **JB's Systematic Reviews: Study selection and critical appraisal.** *The American journal of nursing* 2014, **114**(6):47-52.
16. Lin L, Chu H: **Quantifying publication bias in meta-analysis.** *Biometrics* 2018, **74**(3):785-794.
17. Masih R, Pradesh H, Kaur S, Gupta NL, Kaur N, Singh D: **The metabolic syndrome: Its prevalence and risk factors among policemen of Patiala, Punjab.** *Blood Pressure* 2019, **130**(1):85.
18. Kumar P, Mallik D, Mukhopadhyay DK, Sinhababu A, Mahapatra BS, Chakrabarti P: **Prevalence of diabetes mellitus, impaired fasting glucose, impaired glucose tolerance, and its correlates among police personnel in Bankura District of West Bengal.** *Indian journal of public health* 2013, **57**(1):24-28.
19. Thayyil J, Jayakrishnan TT, Raja M, Cherumanalil JM: **Metabolic syndrome and other cardiovascular risk factors among police officers.** *North American journal of medical sciences* 2012, **4**(12):630-635.

20. Tharkar S, Kumpatla S, Muthukumaran P, Viswanathan V: **High prevalence of metabolic syndrome and cardiovascular risk among police personnel compared to general population in India.** *The Journal of the Association of Physicians of India* 2008, **56**(1):845-849.
21. Kumar S, Mukherjee S, Mukhopadhyay P, Pandit K, Raychaudhuri M, Sengupta N, Ghosh S, Sarkar S, Mukherjee S, Chowdhury S: **Prevalence of diabetes and impaired fasting glucose in a selected population with special reference to influence of family history and anthropometric measurements—the Kolkata policeman study.** *The Journal of the Association of Physicians of India* 2008, **56**(1):841-844.
22. Bandopadhyay A, Bandopadhyay S, Lele P, Patil RN: **A cross-sectional study to assess respiratory, eye and ear health problems among traffic police personnel in Nashik city.** *Journal of clinical and diagnostic research : JCDR* 2018, **12**(11):121.
23. Ravikumar TS, Kanagarethinam R, Nair D, Kar SS: **Are Police Personnel in Puducherry Healthy? Findings from "Partners in Prevention" Programme in Puducherry, India.** *Indian journal of occupational and environmental medicine* 2017, **21**(2):84-88.
24. Bhatia KM, Pandit N: **Prevalence of Chronic Morbidity and Sociodemographic Profile of Police Personnel - A Study from Gujarat.** *Journal of clinical and diagnostic research : JCDR* 2017, **11**(9):LC06-LC09.
25. Kamble SV, Phalke DB: **Study of occupational stress as a risk factor for various morbidities among policemen.** *Journal of the Indian Medical Association* 2011, **109**(4):238-240.
26. Moline JM, McLaughlin MA, Sawit ST, Maceda C, Croft LB, Goldman ME, Garcia MJ, Iyengar RL, Woodward M: **The prevalence of metabolic syndrome among law enforcement officers who responded to the 9/11 World Trade Center attacks.** *Am J Ind Med* 2016, **59**(9):752-760.
27. Yoo H, Franke WD: **Sleep habits, mental health, and the metabolic syndrome in law enforcement officers.** *Journal of occupational and environmental medicine* 2013, **55**(1):99-103.
28. Shrestha A, Ho TE, Vie LL, Labarthe DR, Scheier LM, Lester PB, Seligman MEP: **Comparison of Cardiovascular Health Between US Army and Civilians.** *Journal of the American Heart Association* 2019, **8**(12):e009056.
29. Rush T, LeardMann CA, Crum-Cianflone NF: **Obesity and associated adverse health outcomes among US military members and veterans: Findings from the millennium cohort study.** *Obesity* 2016, **24**(7):1582-1589.
30. Khoshdel A, Jafari SM, Heydari ST, Abtahi F, Ardekani A, Lak FJ: **The prevalence of cardiovascular disease risk factors, and metabolic syndrome among iranian military parachutists.** *Int Cardiovasc Res J* 2012, **6**(2):51-55.
31. Heydari ST, Khoshdel AR, Sabayan B, Abtahi F, Zamirian M, Sedaghat S: **Prevalence of cardiovascular risk factors among military personnel in southern Iran.** *Age* 2010, **30**(98):29.
32. Afifi RM, Omar SR, El Raggal AA: **A community screening plan for the prevalence of some chronic diseases in specified adult populations in Saudi Arabia: 1-prediabetes and diabetes mellitus.** *Int J Diabetes Dev Ctries* 2015, **35**(3):149-156.
33. Al-Qahtani DA, Imtiaz ML: **Prevalence of metabolic syndrome in Saudi adult soldiers.** *Saudi medical journal* 2005, **26**(9):1360-1366.
34. Filho RT, D'Oliveira A, Jr.: **The Prevalence of Metabolic Syndrome Among Soldiers of the Military Police of Bahia State, Brazil.** *American journal of men's health* 2014, **8**(4):310-315.
35. Crump C, Sundquist J, Winkleby MA, Sieh W, Sundquist K: **Physical Fitness Among Swedish Military Conscripts and Long-Term Risk for Type 2 Diabetes Mellitus: A Cohort Study.** *Annals of internal medicine* 2016, **164**(9):577-584.
36. Gendron P, Lajoie C, Laurencelle L, Trudeau F: **Cardiovascular health profile among Québec male and female police officers.** *Archives of environmental & occupational health* 2019, **74**(6):331-340.
37. Gielerak G, Krzesinski P, Piotrowicz K, Murawski P, Skrobowski A, Stanczyk A, Galas A, Uzieblo-Zyczkowska B, Kazmierczak-Dziuk A, Maksimczuk J *et al*: **The Prevalence of Cardiovascular Risk Factors among Polish Soldiers: The Results from the MIL-SCORE Program.** *Cardiology research and practice* 2020, **2020**(1):3973526.
38. Phiri M, Mulenga D, Mazaba ML, Siziya S: **Prevalence of Diabetes mellitus and association between knowledge of diabetes and Diabetes mellitus among police officers in Peter Singogo camp, Zambia.** *Asian Pac J Health Sci* 2017, **3**(3):87-89.
39. Khazale NS, Haddad F: **Prevalence and characteristics of metabolic syndrome in 111 Royal Jordanian Air Force pilots.** *Aviation, space, and environmental medicine* 2007, **78**(10):968-972.
40. Lindman J, Strom K, Biague A, Da Silva ZJ, Jakobsson K, Norrgren H, Mansson F, grp SC: **Diabetes and pre-diabetes among police officers in Guinea-Bissau.** *AJDM* 2017, **25**(2):19-20.
41. Saengdidtha B, Kasemkijwattana P, Kaoaiem H: **Prevalence of chronic diseases risk factors among persons attending six administrative courses in the Army Training Command area in 2006.** *Journal of the Medical Association of Thailand = Chotmaihet thangphaet* 2009, **92** Suppl 1(1):S67-73.
42. Win KN, Balalla NB, Lwin MZ, Lai A: **Noise-Induced Hearing Loss in the Police Force.** *Safety and health at work* 2015, **6**(2):134-138.

43. Jayaweera J, Joseph A: **Assessment of healthiness among long term inhabiting army soldiers in dry zone of Sri Lanka.** *BMC research notes* 2018, **11**(1):474.
44. Cho NH, Shaw JE, Karuranga S, Huang Y, da Rocha Fernandes JD, Ohlrogge AW, Malanda B: **IDF Diabetes Atlas: Global estimates of diabetes prevalence for 2017 and projections for 2045.** *Diabetes research and clinical practice* 2018, **138**(1):271-281.
45. Alghamdi AS, Yahya MA, Alshammari GM, Osman MA: **Prevalence of overweight and obesity among police officers in Riyadh City and risk factors for cardiovascular disease.** *Lipids in health and disease* 2017, **16**(1):79.
46. Arredondo G: **Body mass index in a group of security forces (policemen). Cross-sectional study.** *New Insights in Obesity: Genetics and Beyond* 2017, **12**(1):1124-1131.
47. Violanti JM, Fekedulegn D, Hartley TA, Charles LE, Andrew ME, Ma CC, Burchfiel CM: **Highly Rated and most Frequent Stressors among Police Officers: Gender Differences.** *American journal of criminal justice : AJCJ* 2016, **41**(4):645-662.
48. Violanti JM, Charles LE, McCanlies E, Hartley TA, Baughman P, Andrew ME, Fekedulegn D, Ma CC, Mnatsakanova A, Burchfiel CM: **Police stressors and health: a state-of-the-art review.** *Policing* 2017, **40**(4):642-656.
49. Vila B, Morrison GB, Kenney DJ: **Improving shift schedule and work-hour policies and practices to increase police officer performance, health, and safety.** *Police Q* 2002, **5**(1):4-24.
50. Gibson R, Eriksen R, Lamb K, McMeel Y, Vergnaud AC, Spear J, Aresu M, Chan Q, Elliott P, Frost G: **Dietary assessment of British police force employees: a description of diet record coding procedures and cross-sectional evaluation of dietary energy intake reporting (The Airwave Health Monitoring Study).** *BMJ open* 2017, **7**(4):e012927.
51. Barrett DH, Boehmer TK, Boothe VL, Flanders WD, Barrett DH: **Health-related quality of life of U.S. military personnel: a population-based study.** *Military medicine* 2003, **168**(11):941-947.
52. Pereira M, Carreira H, Lunet N, Azevedo A: **Trends in prevalence of diabetes mellitus and mean fasting glucose in Portugal (1987-2009): a systematic review.** *Public health* 2014, **128**(3):214-221.
53. Telo GH, Cureau FV, de Souza MS, Andrade TS, Copes F, Schaan BD: **Prevalence of diabetes in Brazil over time: a systematic review with meta-analysis.** *Diabetology & metabolic syndrome* 2016, **8**(1):65.
54. Lee B, Lee JS, Lee YW, Jang MA, Song J, Kim JH, Lee WG, Min WK, Lee J, Lee YK: **Effect of the Standardization of Diagnostic Tests on the Prevalence of Diabetes Mellitus and Impaired Fasting Glucose.** *Journal of Korean medical science* 2018, **33**(10):e81.
55. Lestrina D, Sihotang U, Siahaan G: **Obesity with metabolic syndrome to police in Polres Deli Serdang.** *Int J Pharm Technol* 2016, **8**(3):15109-15123.
56. Hartley TA, Knox SS, Fekedulegn D, Barbosa-Leiker C, Violanti JM, Andrew ME, Burchfiel CM: **Association between depressive symptoms and metabolic syndrome in police officers: results from two cross-sectional studies.** *Journal of environmental and public health* 2012, **2012**(1):861219.
57. Violanti JM, Fekedulegn D, Hartley TA, Andrew ME, Charles LE, Mnatsakanova A, Burchfiel CM: **Police trauma and cardiovascular disease: association between PTSD symptoms and metabolic syndrome.** *International journal of emergency mental health* 2006, **8**(4):227-237.
58. Hostalek U: **Global epidemiology of prediabetes - present and future perspectives.** *Clinical diabetes and endocrinology* 2019, **5**(1):5.

Tables

Characteristics of the studies included in the review.

	Author, year	Time period	Country	Population	Sex	Age	Sample size	methods of diagnosis	Prevalence		Quality assessment
									DM	PDM	
1	Gielerak, 2020 [37]	2013-2015	Poland	Military soldiers	Both	≥40	9440	D, SR	11.0	-	8
2	Masih, 2019 [17]	2017-2018	India	Police officers	Male	40-60	155	FBG	31.6	-	5
3	Shrestha, 2019 [28]	2012	USA	Military personnel	Both	17-64	263430	D, SR	9.8	-	8
4	Gendron, 2019 [36]	2015-2016	Canada	Police officers	Both	-	2685	SR	1.3	-	7
5	Bandopadhyay, 2018 [22]	2018	India	Traffic police	Both	20-60	196	FBG	7.1	-	8
6	Jayaweera, 2018 [43]	-	Sri Lanka	Police officers	Male	-	417	FBG	0.1	-	7
7	Phiri, 2017 [38]	-	Zambia	Police officers	Both	-	148	FBG, M, SR	9.1	-	8
8	Ravikumar, 2017 [23]	2013-2015	India	Police personnel	Both	30-59	1618	FBG, SR	34.7	-	6
9	Bhatia, 2017 [24]	2015	India	Police officers	Both	≥18	982	FBG, SR	2.6	-	7
10	Lindman, 2017 [40]	2009-2010	Guinea-Bissau	Police officers	Both	19-83	1104	HbA1c	4.1	4.2	7
11	Rush, 2016 [29]	2007-2008	USA	Military personnel	Both	-	42200	SR	2.3	-	8
12	Tesfaye, 2016 [6]	2015	Ethiopia	Federal police commission	Both	18-55	936	FBG	5.0	8.0	9
13	Moline, 2016 [26]	2008-2010	USA	Law enforcement officers	Both	≥40	2497	FBG, SR	14.0	-	7
14	Crump, 2016 [35]	1969-1979	Sweden	Military conscripts	Male	18	1547478	FBG	0.8	-	8
15	Win, 2015 [42]	2012	Brunei	Police personnel	Both	-	365	FBG	9.0	-	8
16	Afifi, 2015 [32]	2010-2011	Saudi Arabia	Armed force recruits	Male	40-54	117	RBG	21.4	-	5
17	Filho, 2014 [34]	2012	Brazil	Military police corps	Male	42-57	451	FBG	10.6	-	7
18	Yoo, 2013 [27]	2008-2009	USA	Law enforcement officers	Male	22-60	106	FBG, D	17.9	-	5
19	Ramakrishnan, 2013 [7]	2013	India	Police officers	Both	20-59	256	FBG, D	33.6	7.0	8
20	Kumar, 2013 [18]	2011	India	Police personnel	Both	20-59	1817	FBG, OGTT	15.0	6.8	9
21	Thayyil, 2012 [19]	-	India	Police officers	Male	26-58	823	FBG, D	7.0	6.7	6
22	Khoshdel, 2012 [30]	2010-2011	Iran	Military parachutists	Male	20-50	96	FBG	5.2	4.2	8
23	Madhusudhana, 2011 [8]	-	India	Military personnel	Both	25-55	600	FBG	6.7	-	7
24	Kamble, 2011 [25]	2007	India	Police officers	Male	-	55	FBG, D	36.4	-	6
25	Saengdidtha, 2009 [41]	2006	Thailand	Military personnel	Both	-	445	FBG	4.3	-	6
26	Heydari, 2010 [31]	-	Iran	Military personnel	Male	20-54	341	FBG	1.8	8.5	9
27	Tharkar, 2008 [20]	-	India	Police officers	Male	≥30	318	FBG	32.1	-	9
28	Kumar, 2008 [21]	-	India	Police officers	Male	20-60	2160	FBG	11.5	6.2	9
29	Khazale, 2007 [39]	2006	Jordan	Military pilots	Male	-	111	FBG, SR	0.0	9.6	6
30	Al-Qahtani, 2005 [33]	2004	Saudi Arabia	Military soldiers	Male	20-60	1079	FBG, SR	9.9	-	6

betes mellitus, PDM; prediabetes, FBG; fasting blood glucose, RBG; random blood glucose, HbA1c; hemoglobin A1c, ral glucose tolerance test, SR; self-reporting, D; use of anti-diabetic drugs.

Table 2 Result of meta-analysis.

	Subgroups	Variable	Number of study	Prevalence (95% CI)	I^2	P value	
Diabetes	Military personnel	Region	Asia	6	12.38 (5.89-18.86)	95.6	<0.001
			America	2	8.86 (6.33-11.40)	-	-
			Europe	1	0.8 (0.79-0.81)	-	-
	Police officers	Sample size	<1000	6	12.96 (5.66-20.27)	94.7	<0.001
			>1000	3	9.15 (5.35-12.96)	99.8	<0.001
		Region	Africa	3	4.98 (3.39-6.56)	56.8	0.099
			Asia	5	13.09 (5.47-20.70)	98.4	<0.001
			America	2	7.63 (4.81-20.08)	-	-
Prediabetes	Military personnel		3	7.32 (4.22-10.42)	44.3	0.166	
	Police officers		6	6.35 (5.28-7.44)	70.0	0.005	

Figures

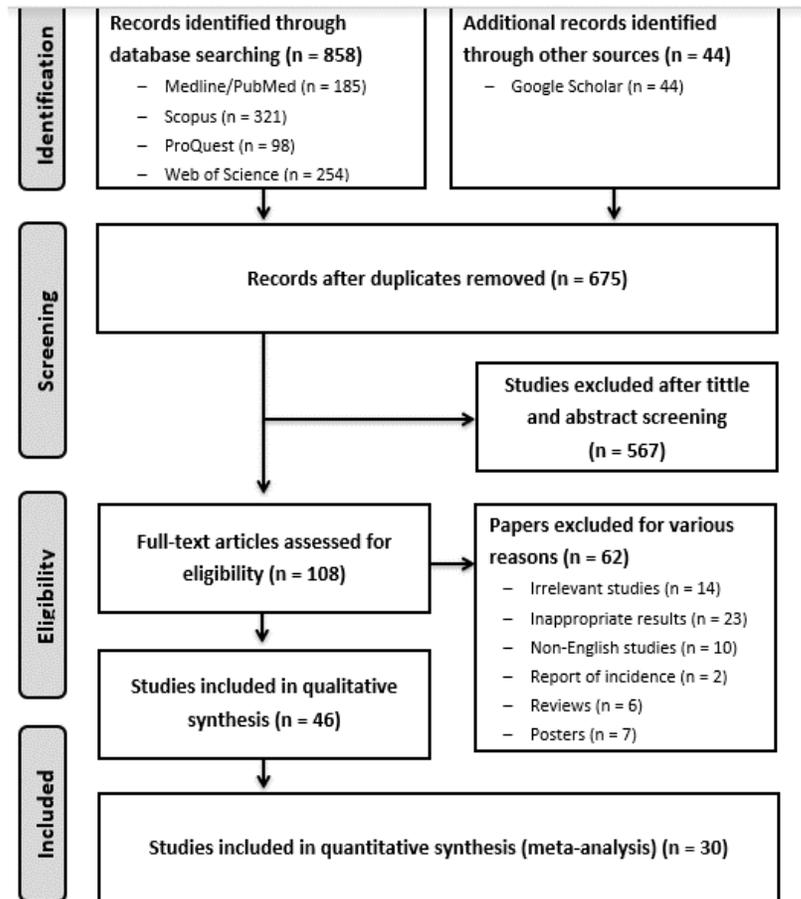


Figure 1

Flowchart of the included studies.

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