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Musculoskeletal disorders among computer user workers in Ethiopia: a systematic review and meta-analysis

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Musculoskeletal pain was the leading cause of physical injuries and disabilities, and ranking sixth among the top ten diseases in terms of global burden of disease. Approximately 9.5 million working days lost. Office workers including bank workers are vulnerable group for work related musculoskeletal disorders (MSDs) due to prolonged sitting, computer work, repetitive tasks, static posture, and uncomfortably working conditions. In Ethiopia, the annual prevalence of MSDs among computer users ranged from 55.2% to 77.6%. Previous primary studies presented inconsistent findings. Therefore, this review aimed to determine the pooled prevalence of musculoskeletal disorders and their associated factors among computer users in Ethiopia. We have extensively searched the PubMed, Cochrane, Web of Science databases, and Google Scholar for all available studies. All retrieved studies were exported to EndNote version 7 reference manager and analyzed using STATA version 17 statistical software. A weighted inverse-variance random-effects model was used to compute the overall MSDs among computer users. Publication bias was assessed using the funnel plot's symmetry and a significant publication bias was identified using Egger's test with a p-value of less than 0.05. The quality and risk of bias was evaluated using the quality rating standards of the Joanna Briggs Institute and risk of bias assessment tool respectively. The pooled prevalence of MSDs among computer users was 65.86% (95% CI 60.53, 71.18). The pooled prevalence of neck, shoulder, upper back, elbow, lower back, wrist/hand, hip/thigh, knee and ankle were 38.2% (95% CI 27.65, 48.77), 29.06% (95% CI 17.62, 40.49), 30.94% (95% CI 23.76, 38.11), 17.32% (95% CI 9.25, 25.38), 44.41% (95% CI 37.75, 51.06), 19.37% (95% CI 12.44, 26.30), 13.23% (95% CI 7.52, 18.95), 15.50% (95% CI 9.98, 21.01), and 13.34% (95% CI 8.32, 18.36) respectively. Being aged 30 and above 4.019 (95%CI: 1.92, 8.43), working in awkward posture 4.49 (95% CI: 2.66, 7.58), not doing physical exercise 3.43 (95% CI 2.1, 5.32), and prolonged computer work 2.56 (95% CI 1.34, 4.9) were significantly higher risk to MSDs. In Ethiopia, the overall prevalence of MSDs among computer users was significantly high. Therefore, employees should reduce the time spent on computers, engage in at least 150 min of exercise per week, and follow appropriate work practices and procedures while at work.

Abbreviations

AOR	Adjusted odds ratio
CI	Confidence interval
JBI	Joanna Briggs Institute
MSDs	Musculoskeletal disorders
OR	Odds ratio
PRISMA	Preferred reporting items for systematic reviews and meta-analyses

MSDs refer to degenerative and inflammatory diseases that impact the muscles, tendons, ligaments, joints, peripheral nerves, and supporting blood vessels. WRMSDs (Work related Musculoskeletal disorders) are used to describe any musculoskeletal damage that arises from an incident related to the workplace[1,2]. WRMDs is one of the most important public health concerns that can affect the health of workers and create a burden on the health system as well as economic and social costs[3]. According to the Global Burden of Disease survey done

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in in 2010 and 2016, MSDs was the leading cause of physical injuries and disabilities and ranked sixth among the top ten diseases[4–6]. Approximately 9.5 million working days were lost due to musculoskeletal symptoms at work[7,8]. Work-related upper extremity disorders represent more than 67% of all work-related injuries and cost over $110 billion annually for medical expenses, lost wages, and productivity[9,10]. Globally, the annual prevalence of WMSDs among computer users varied from 33.8[11] to 95.3%[12], while in Ethiopia it ranged from 55.4[13] to 77.6%[14].

Academic jobs require constant computer use, including typing, reading, writing manuscripts for publication and sitting, which increases the risk of musculoskeletal problems[9,10]. Computer use is widely perceived as a new risk factor for MSDs[15]. MSD is very common among computer user office workers[16]. Office workers are a vulnerable group for WMSDs due to their job often involves prolonged sitting, awkward postures, physically demanding and stressful, long working hours, a repetitive task in front of computers without having adequate rest and recovery time[14,17–22]. Extended work hours, decreased physical activity, poorly designed workstations, and psychosocial and physiological factors can exacerbate MSDs[23–27]. Prior to this study, there are two published reviews on the prevalence of work-related musculoskeletal disorder and associate factors among computers users, however the first article investigated only about neck and upper extremity disorders among general populations[28] and the second review[29] didn't analyze the pooled estimate of MSDs. Various primary studies done in Ethiopia presented inconsistent findings. Since earlier research from Ethiopia revealed that the annual prevalence of MSDs among computer users was 77.6%[14], 61.1%[30], 73.1%[18], 65.5%[31], 65.2%[32], 59.1%[33], 77.2%[5], 55.4%[13], 71.2%[34], 63.2%[35] and 55.2%[36]. Therefore, this study aimed to determine the pooled prevalence and associated factors of musculoskeletal disorders among computer users in Ethiopia.

Methods

Reporting and registration protocol

The results of this systematic review and meta-analysis was reported using Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist[37]. The review protocol was registered with Prospero database: (PROSPERO, 2024: CRD42024517198).

Databases and search strategy

We have extensively searched the PubMed, Cochrane, Web of Science databases, and Google Scholar for all available studies reporting on MSDs and associated factors among computer users in Ethiopia: (″Musculoskeletal disorder″ [MeSH term] OR ″work related musculoskeletal disorder″ [MeSH term] OR ″Prevalence″ [MeSH term]) OR "Body area" [MeSH term] OR " Computer user" [MeSh term] OR "Office worker" [MeSH term] OR "Bank worker" [MeSH term] OR "Risk factors" [MeSH term] OR "Associated factor" [MeSH term] OR "Predictors" [MeSH term] OR "Determinants" [MeSH term] AND ″Ethiopia″. The search string was developed using ″AND″ and ″OR″ Boolean Operators. Moreover, a manual search of the reference lists of included studies was also performed. All selected primary studies were published in English in Ethiopia between 2020 and 2024.

Eligibility criteria

The review includes all observational (cross-sectional) studies written in English and which have reported the prevalence of MSDs and associated factors among computer users in Ethiopia, workers whose age was 18 and above, studies reported the odds of MSDs and associated factors related to computer use with corresponding 95% confidence interval. However, citations without abstracts, full texts, anonymous reports, editorials, studies conducted outside of Ethiopia and systematic reviews and meta-analyses studies were excluded from the review.

Study selection

All the retrieved studies were exported to EndNote version 7 reference manager and the duplicated studies were removed. In order to ascertain each study's eligibility, two independent reviewers (BD and TMA) screened the titles and abstracts, followed by the full-text reviews. The disagreement between the two reviews was resolved through discussion.

Data extraction

The data were extracted by two independent reviewers (BD and TMA) using a structured Microsoft Excel data extraction form. Whenever variations were observed in the extracted data, the phase was repeated. While the discrepancies between the data extractors persisted, the third reviewers (GBM) were involved. From the included primary studies, the name of the first author, year of publication, study area, study design, sample size, and response rate were extracted.

Primary outcome measure of interest

The pooled prevalence of MSDs was determined by the number of computer users who experienced MSDs divided by the total number of study participants, and the result was multiplied by 100. The odds ratio was used to quantify the variables associated to MSDs. To determine the odds ratio from primary research, we employed two-by-two contingency tables.

Operational definition

Work-related musculoskeletal disorder is perceived pain, ache or discomfort for at least 2–3 workdays in last 12 months in any part of body region (neck, shoulder, upper back, lower back, hip/thigh, knee/leg, and ankle/foot and wrist/hand) caused by workplace exposures[14,18,38].

Data analysis

All statistical analyses were performed using STATA version 17 statistical software. The overall musculoskeletal disorders and the impact of predictors factors were computed using, a weighted inverse-variance random-effects model[39]. Publication bias was assessed using the funnel plot's symmetry and a significant publication bias was identified using Egger's test with a p-value of less than 0.05[40]. The percentage of total variation across studies due to heterogeneity was assessed using I^2 statistics. The values of I^2 25,50 and 75% represented low, moderate and high heterogeneity respectively[41]. A significant heterogeneity was defined as when p- value of I^2 statistic < 0.05. Sensitivity analysis was done to determine the impact of a particular study on the entire meta-analysis. The effect of independent factors on the outcome variable was estimated using a forest plot, and a measure of association with a 95% CI interval was reported. Among eligible primary studies, the Odds Ratio (OR) was the most commonly reported measure of association[42,43]. To estimate the pooled OR effect, either a fixed-effects or a random-effects model is used. A fixed-effects model is used when all included studies have comparable methodology and samples from the same populations, whereas a random-effects model is used when the included studies used different methodologies and were sampled from different populations. In our review, the included primary studies used similar methodologies but were drawn from different populations. Thus, this study employed a random-effects model.

Quality appraisal of the included studies

The quality of the included studies was assessed by two independent reviewers (BD and TMA), who also provided a score for the results' validity. The quality of every study was evaluated by applying the quality rating standards of the Joanna Briggs Institute (JBI)[44]. All[5,13,14,18,30,32,34–36,38,45] were evaluated using the JBI cross-sectional checklist. As a result, among eleven cross-sectional studies, nine studies scored seven of eight questions, 87.5% (low risk), and the other two studies scored six of eight questions, 75% (low risk). Studies with a quality evaluation indicator score of 50% or above were considered low risk. Following a comprehensive quality assessment, we concluded that the primary studies that were part of our analysis showed a high degree of reliability in their methodological quality scores. Out of a possible 8 points, all included studies received a score between 6 and 7. Therefore, all included studies[5,13,14,18,30,32,34–36,38,45] had high quality.

Risk of bias assessment

The risk of bias was evaluated using the risk of bias assessment tool[46]. The test comprises 10 items that evaluate four aspects of bias: external validity and internal validity. Items 1–4 assess external validity, non-response bias, and selection bias. Measure bias, analysis-related bias, and internal validity are evaluated on items 5 to 10. Thus, seven included studies received 10 out of ten, while four studies received nine out of ten. The study was classified as "low risk" if eight or more questions had a "yes" response; as "moderate risk" if six to seven questions had a "yes" response; and as "high risk" if five or fewer questions had a "yes" response. Therefore, all included studies[5,13,14,18,30,32,34–36,38,45] had low risk of bias (high quality).

Result

Search results

A total of 793 studies were obtained from PubMed (n = 156), Web of Science (n = 16), Cochrane (n = 56), Google Scholar (n = 556), Web of Science (n = 16), manual search (n = 6) and University's research repository online library (n = 3). After carefully removing irrelevant studies based on their titles and abstracts (n = 538)) and duplicate studies (n = 124)), a total of 131 studies were selected for full-text review. Subsequently, full-text reviews were carried out, and 85 studies were removed due to lack of complete texts. Then, 46 studies were assessed for full article review, and 35 studies were excluded (their full texts were not published in English, they were done outside of Ethiopia, and the outcomes were not well defined). Finally, eleven studies were found relevant to determining MSDs and associated factors among computer users in Ethiopia. We followed the path of the PRISMA flow chart (Fig. 1) to show the selection process of studies[47].

Characteristics of the included studies

All studies were conducted using cross sectional study design[5,13,14,18,30,32,34–36,38,45]. Based on geographical location, two studies were done in Tigray[32,38], two from Addis Ababa[14,34], four from Amhara[13,30,35,45], one from Oromia[18], one from Sidama[36] and one from nationwide[5]. The combined sample sizes of the included studies came to 4647 with a response rate ranged from 85.7% to 100%. Both the largest (755)[14] and smallest sample size (233)[34] was reported from Addis Ababa. The prevalence of MSDs and data regarding to associated factors were reported by all studies[5,13,14,18,30,32,34–36,38,45]. Out of all the included studies, seven were conducted on computer-using bank workers[13,14,18,30,35,36,38], three were conducted on computer-using academic staff[5,32,45] and one from Ethiopian Roads Authority office workers[34].

The summary of studies characteristics has been presented in Table 1.

Meta-analysis

Musculoskeletal disorders among computer users in Ethiopia

Finally, eleven primary studies were included in the meta-analysis[5,13,14,18,30,32,34–36,38,45]. The prevalence of MSDs in Ethiopia ranges from 55.2[36] to 77.6%[14]. However, the overall annual estimate of MSDs among computer users in Ethiopia was found to be 65.86% (95% CI 60.53, 71.18) with a *P* value of < 0.001 and an I^2 value of 93.58% (Fig. 2).

Nine selected primary studies conducted in Ethiopia[5,14,18,30,32,34,35,38,45] reported the prevalence of neck pain varies from 9.6%[5] to 50%[35]. The pooled prevalence of neck pain was 38.21% (95% CI 27.65, 48.77) with a *P* value of < 0.001 and an I^2 value of 98.07% (Fig. 3).

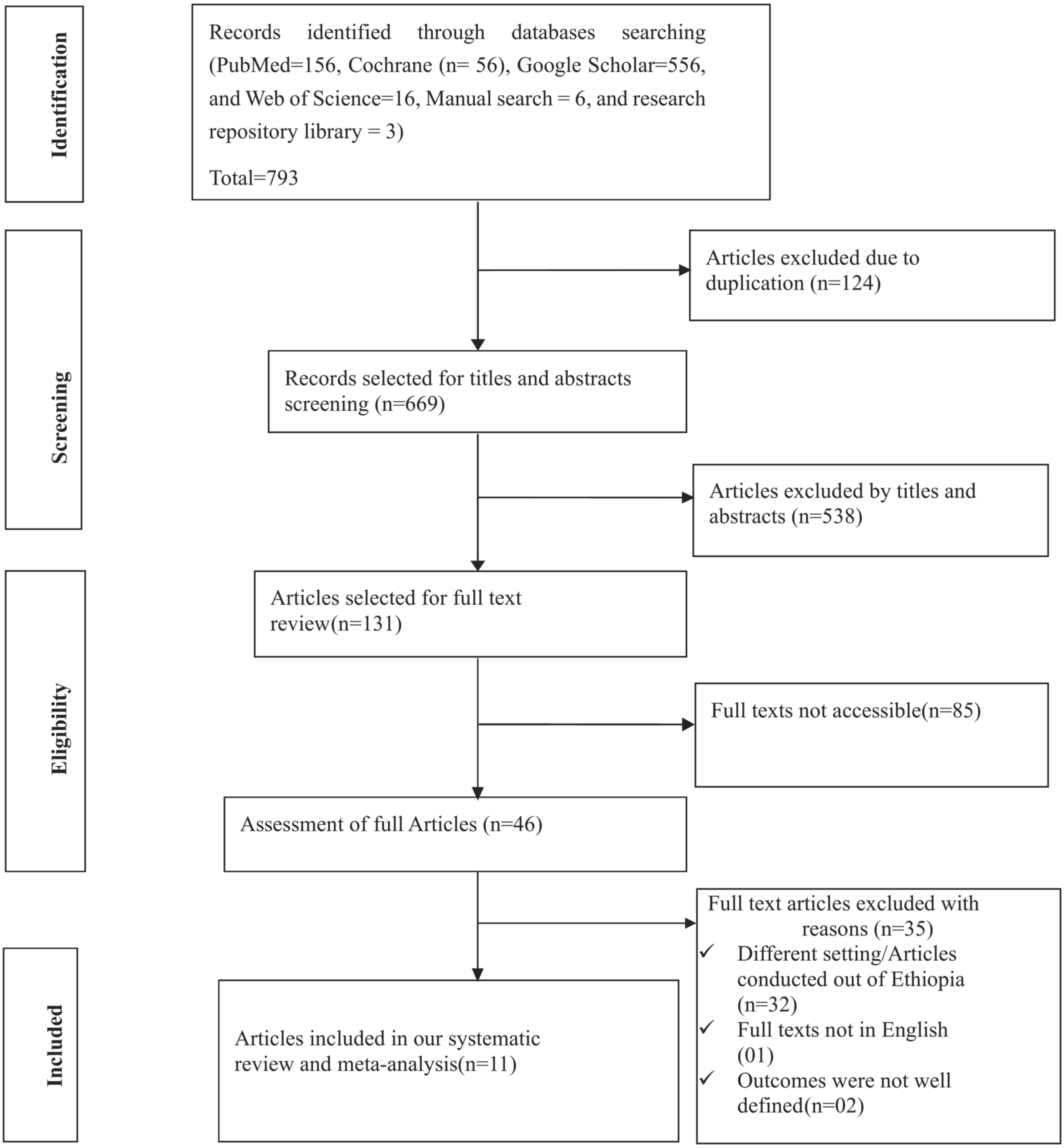

Fig. 1. PRISMA flow chart showing the studies selection process, 2024.

Nine primary studies published in Ethiopian[5,14,18,30,32,34,35,38,45] found that the lowest and highest prevalence of shoulder pain was 4.3%[34] to 49.66%[45] respectively, whereas the pooled prevalence of shoulder pain was [29.06% (95% CI 17.62, 40.49 with a P value of < 0.001 and $I^2 = 98.77\%$)] (Fig. 4).

Seven selected primary studies discovered in Ethiopia[5,14,18,30–32,35] shows upper back pain prevalence ranges between 15.5%[32] and 42.7%[18]. The overall pooled estimate of upper back pain was [30.94% (95% CI 23.76, 38.11 with a *P* value of < 0.001 and $I^2 = 94.75\%$)] (Fig. 5).

Eight selected studies carried out in Ethiopia[14,18,30,32,34,35,38,45] indicated that elbow pain was found between 1.4%[32] to 49.20%[35], but the overall pooled prevalence of elbow pain was [17.32% (95% CI 9.25, 25.38 with a P value of < 0.001 and $I^2 = 98.48\%$)] (Fig. 6).

Ten selected Ethiopian primary studies[5,13,14,18,30,32,34–36,38] evidences that the prevalence of lower back pain ranges from 28%[5] to 55.4%[13]. However, the overall pooled estimate of lower back pain was [44.41% (95% CI 37.75, 51.06 with a *P* value of < 0.001 and $I^2 = 94.80\%$)] (Fig. 7).

Author	Year	Region	Study design	Type of work	Sample size	Response rate (%)
Dagne et al	2020	Addis Ababa	CS	Bank worker	755	90
Demissie et al	2022	Amhara	CS	Bank worker	422	100
Etana et al	2021	Oromia	CS	Bank worker	335	98
Kasaw Kibret et al	2020	Tigray	CS	Bank worker	307	93.6
Meaza et al	2020	Tigray	CS	Academic worker	414	92.2
Tesfaye et al	2022	Amhara	CS	Academic worker	607	95.6
Zenbaba et al	2022	Nationwide	CS	Academic worker	416	98.6
Workneh BS and Mekonen EG	2021	Amhara	CS	Bank worker	285	96.3
Gondol BN and Anbese AT	2020	Addis Ababa	CS	Road authority worker	233	85.7
Jonga et al	2024	Sidama	CS	Bank worker	607	96.8
Temesgen et al	2022	Amhara	CS	Bank Worker	266	98.8

Table 1. Summary characteristics of the included studies to estimate the prevalence and associated factors of MSDs among computer users in Ethiopia, 2020–2024 (n = 11). *CS* cross-sectional.

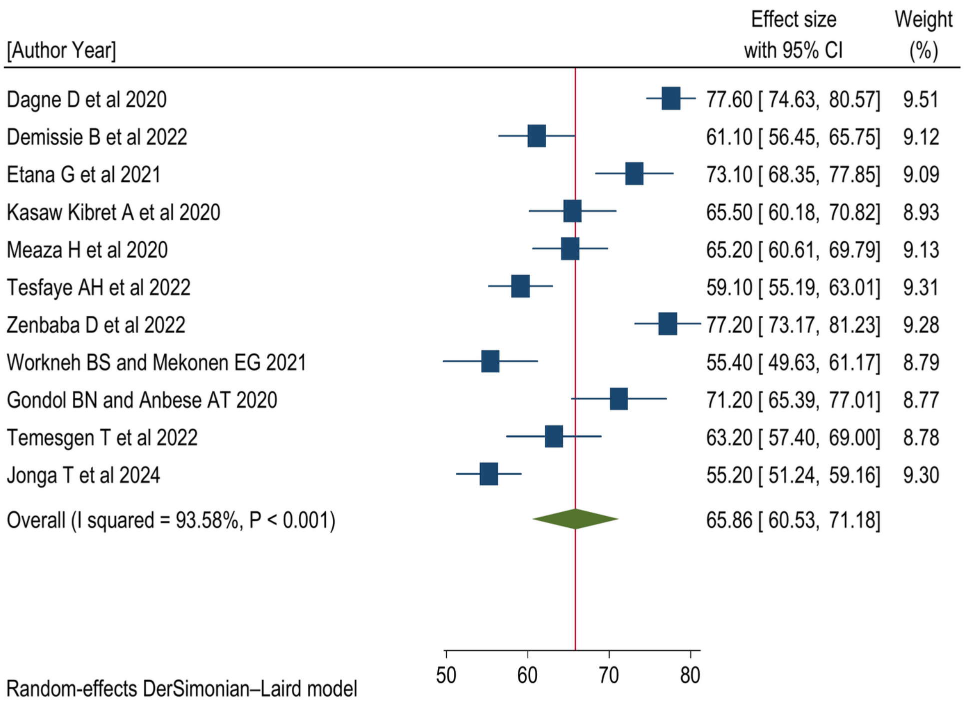

Fig. 2. Forest plot showing the overall pooled prevalence of MSDs with 95% CI in Ethiopia, 2024.

Eight primary studies[14,18,30,32,34,35,38,45] done in Ethiopia presented the prevalence of wrist/hand pain was varied from 6.3%[32] to 38.3%[35]. The overall pooled prevalence of wrist/hand pain was [19.37% (95% CI 12.44, 26.30 with a *P* value of < 0.001 and I^2 = 96.80%)] (Fig. 8).

Seven primary Ethiopian studies[14,18,30,32,34,35,38] reported the prevalence of hip/thigh pain was between 4.1%[32] and 33.8%[35]. The overall pooled prevalence of hip/thigh pain was [13.23% (95% CI 7.52, 18.95 with a *P* value of < 0.001 and I^2 = 96.05%)] (Fig. 9).

Seven investigations done in Ethiopia[14,18,30,32,34,35,38] reveled that knee pain ranges from 6.3%[32] to 29.7%[35]. The overall pooled knee pain was [15.50% (95% CI 9.98, 21.01 with a *P* value of < 0.001 and I^2 = 94.57%; $P < 0.001$)] (Fig. 10). Six selected primary investigations[14,18,30,32,35,38] in Ethiopia shows the prevalence of ankle pain ranged from 5.1%[32] to 28.9%[35]. The overall pooled estimate of ankle pain was [13.34% (95% CI 8.32, 18.36 with a *P* value of < 0.001 and I^2 = 93.84%)] (Fig. 11).

Publication bias

The asymmetric distribution of the included primary studies on the funnel plot suggests the presence of publication bias (Fig. 12a). Additionally, the p-value from Egger's regression test (P < 0.001) further indicates the existence of publication bias. Therefore, we conducted a trim and fill analysis to address this issue (Fig. 12b). However, the results of the trim and fill analysis confirmed that publication bias is still present.

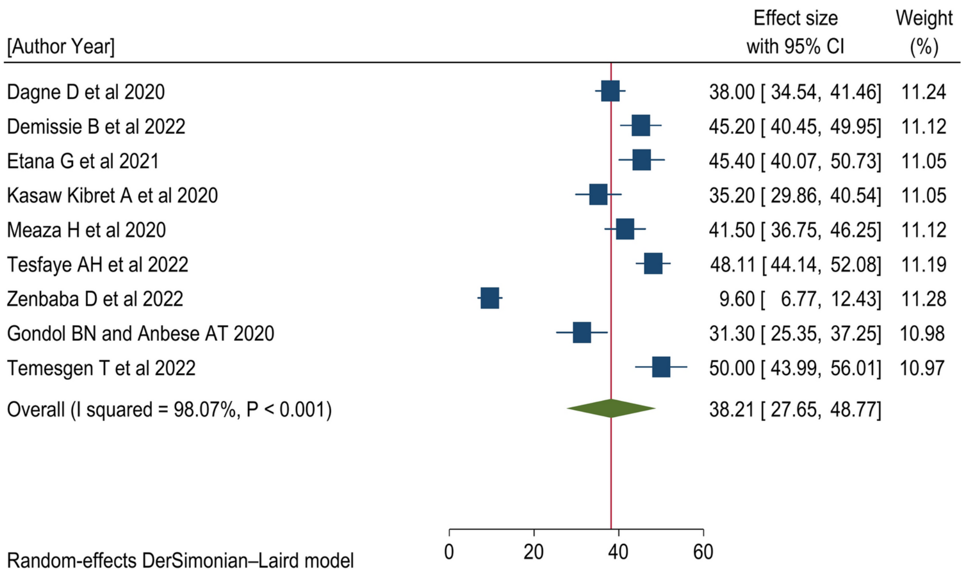

Fig. 3. Forest plot showing the pooled prevalence of neck pain with 95% CI in Ethiopia, 2024.

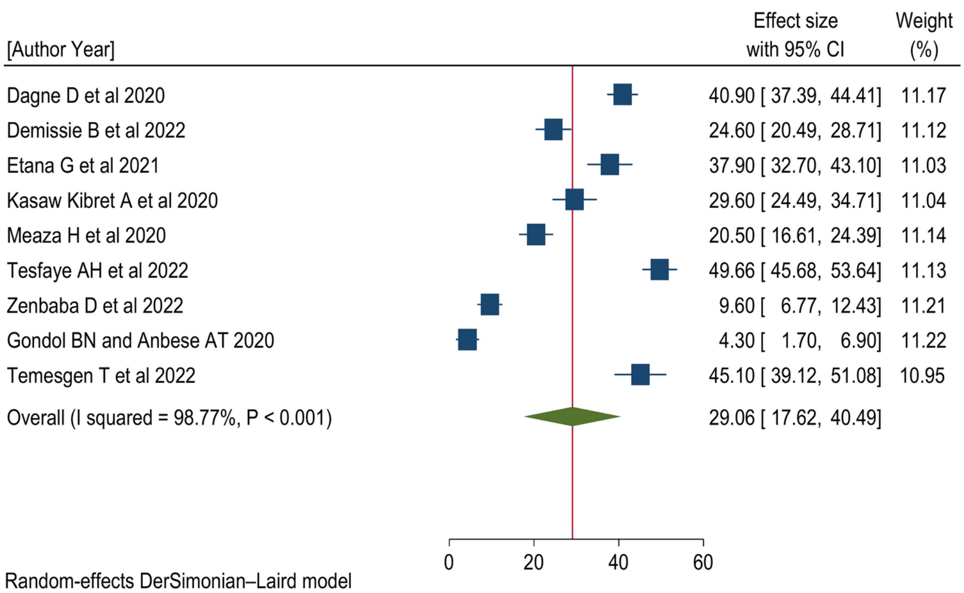

Fig. 4. Forest plot showing the pooled prevalence of shoulder pain with 95% CI in Ethiopia, 2024.

Investigation of heterogeneity
The I^2 statistic from the forest plot indicates a high level of heterogeneity among the included studies ($I^2 = 93.58\%$, $P < 0.001$) (Fig. 2). Hence, sensitivity analysis and sub-group analysis were performed to minimize the heterogeneity.

Sensitivity analysis

To assess the influence of a particular study on the overall meta-analysis, we conducted a sensitivity analysis using a random-effects model. The funnel plot indicated that the estimate from a single study was close to the combined estimate, suggesting the absence of a significant single study effect on the overall pooled estimate. Therefore, it was demonstrated that no solitary study had a substantial impact on the overall outcome of the meta-analysis (Fig. 13).

Sub-group analysis by the sample size

Following the subgroup analysis, the highest pooled prevalence of MSDs was observed in studies with a sample size of less than 422, reported as 67.40% (95% CI 61.95, 72.84, $I^2 = 87.64\%$, $P < 0.001$). This was followed by

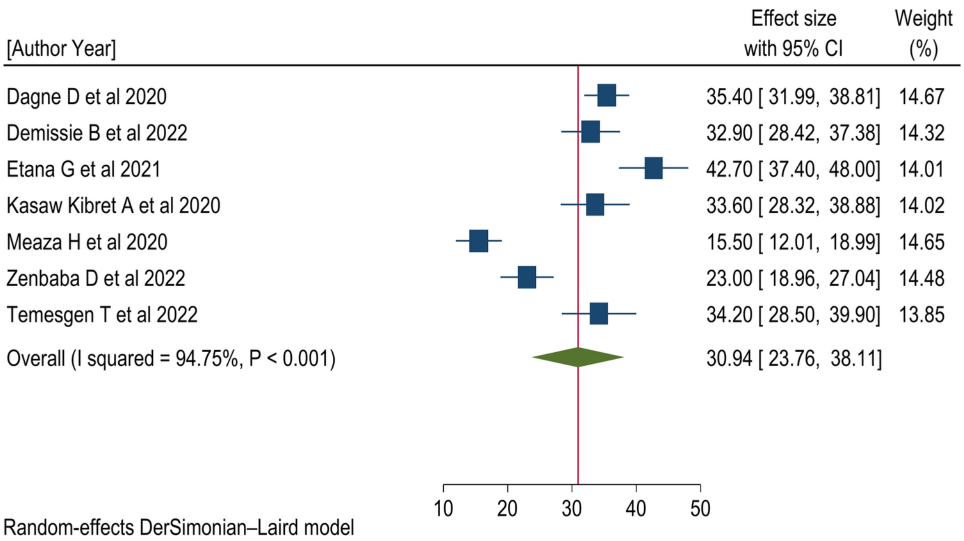

Fig. 5. Forest plot showing the pooled prevalence of upper back pain with 95% CI in Ethiopia, 2024.

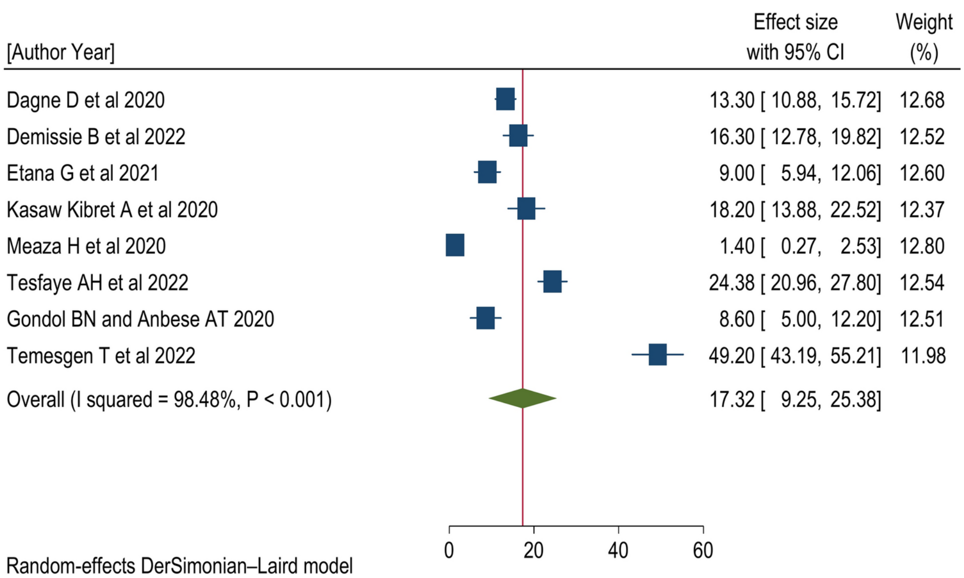

Fig. 6. Forest plot showing the pooled prevalence of elbow pain with 95% CI in Ethiopia, 2024.

studies with a sample size of 422 or more, which showed a prevalence of 63.31% (95% CI 52.15, 74.46, $I^2 = 97.09\%$, $P < 0.001$) (Fig. 14).

Factors associated with computer users

In the review, four included studies[5,30,36,38] reveled that older computer users had a significantly higher risk of MSDs. The pooled AOR for MSDs among computer users aged 30 and above was 4.019 (95% CI 1.92, 8.43; $I^2 = 84.62\%$; $P < 0.001$).

Five selected studies[5,14,18,30,48] reported that working in an awkward posture increased the risk of MSDs. As a result, computer users who worked in awkward posture were 4.49 times more likely to develop MSDs compared to those who maintained appropriate postures [AOR: 4.49 (95% CI 2.66, 7.58) with a P value of < 0.001 and $I^2 = 75.11\%$].

Six primary studies[5,13,30,32,38,45] discovered that computer users who had never participated in physical exercise faced a 3.43 times higher risk of developing MSDs compared to those who exercised regularly [AOR: 3.43 (95% CI 2.1, 5.32), $P < 0.001$, $I^2 = 76.88\%$].

Four articles published in Ethiopia[5,32,33,35] reported a significant association between prolonged computer use and musculoskeletal disorders (MSDs). Computer users who spend 4 or more hours a day on computers have a 2.56-fold higher chance of developing MSDs [AOR: 2.56 (95% CI 1.34, 4.9), $P < 0.017$, $I^2 = 81.96\%$] compared to those who work fewer than 4 h.

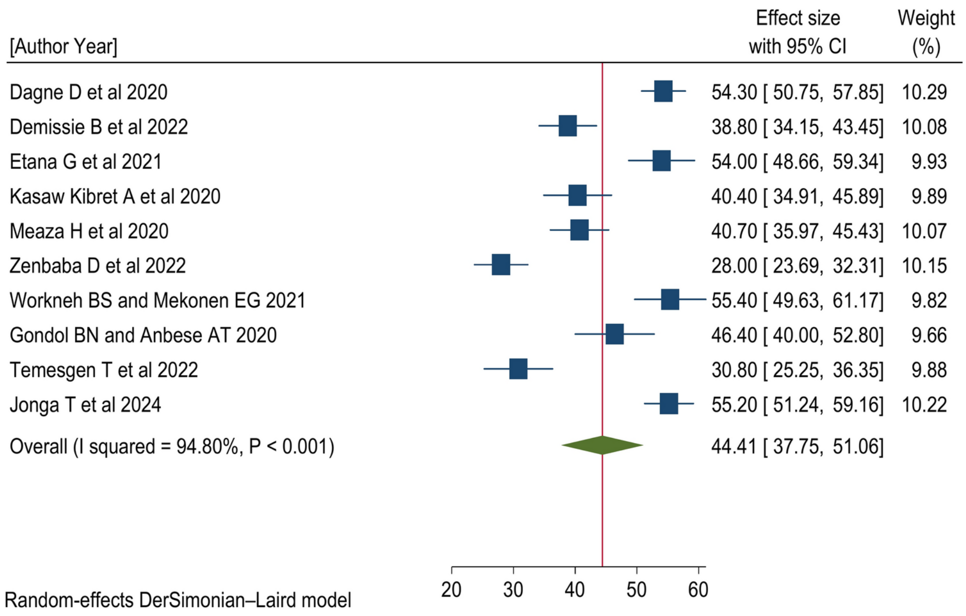

Fig. 7. Forest plot showing the pooled prevalence of lower back pain with 95% CI in Ethiopia, 2024.

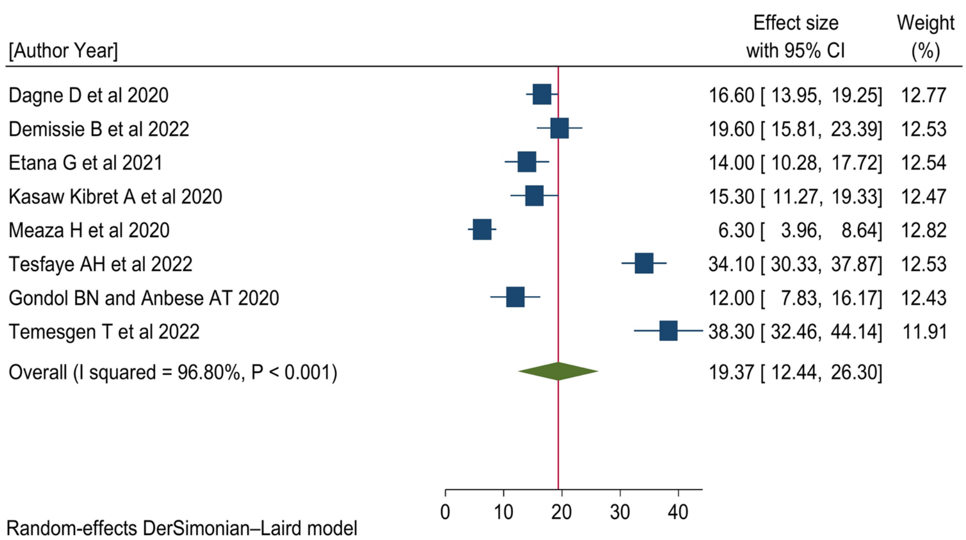

Fig. 8. Forest plot showing the pooled prevalence of wrist/hand pain with 95% CI in Ethiopia, 2024.

Discussion

This review aimed to determine the overall pooled prevalence of MSDs and their associated factors among computer users in Ethiopia. This review demonstrated that the one-year pooled prevalence of MSDs was 65.86% (95% CI 60.53; 71.18), which is in agreement with the result in Colombo, Sri Lanka (63.6%)[49]. However, this finding was higher than the results reported in Mangaluru, India (57.3%)[50], Alexandria, Egypt (54.1%)[51], Bhopal, India (41.1%)[52], Hong Kong (20%)[53], Tamil Nadu, India (33.8%)[11], China (34.1%)[54], Karnataka, India (57.7%)[55], Qazvin, Iran (52.6%)[56], Malaysia (44.2%)[57], and Isfahan, Iran (50%)[58], but lower than those from Hayat, Pakistan (71.8%)[59], Dhaka, Bangladesh (77.8%)[60], Kurdistan, Iran (78.5%)[61], Buraydah, Saudi Arabia (89.7%)[62], Kumasi, Ghana (83.5%)[17], Punjab, India (83.55)[19], Kuwait (80%)[20], Estonia (77%)[63], and Shah Alam, Malaysia (95.3%)[12].

In this study, the pooled prevalence of neck pain among computer users in Ethiopia was 38.21% (95% CI 27.65, 48.77). This finding aligns with results from Colombo, Sri Lanka (37.1%)[49], Hong Kong (31.4%)[53], Punjab, India (38.6%)[52], Kumasi, Ghana (47.4%)[17], and Tamil Nadu, India (48.22%)[11]. However, it is higher than the prevalence reported in Mangaluru, India (6.9%)[50], Hayat, Pakistan (14.8%)[59], while being lower than that in Dhaka, Bangladesh (75.0%)[60], Kurdistan, Iran (48%)[61], Alexandria, Egypt (69%)[51], Bhopal, India (55%)[52], Buraydah, Saudi Arabia (59.4%)[62], Kuwait (53.5%)[20], China (55.5%)[54], Qazvin, Iran (52.6%)[56], Estonia (51%)[63], Malaysia (78%)[57], and Isfahan, Iran (54.9%)[58].

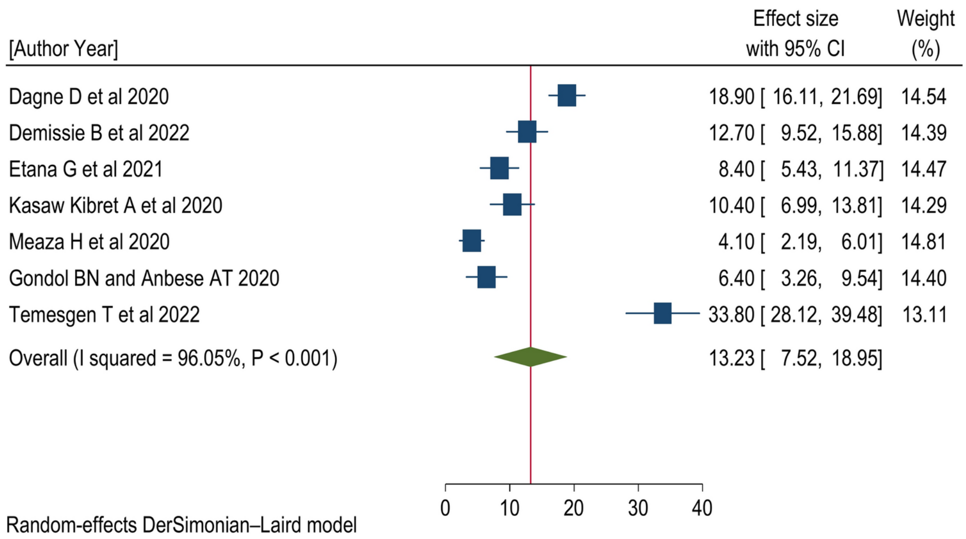

Fig. 9. Forest plot showing the pooled prevalence of hip/thigh pain with 95% CI in Ethiopia, 2024.

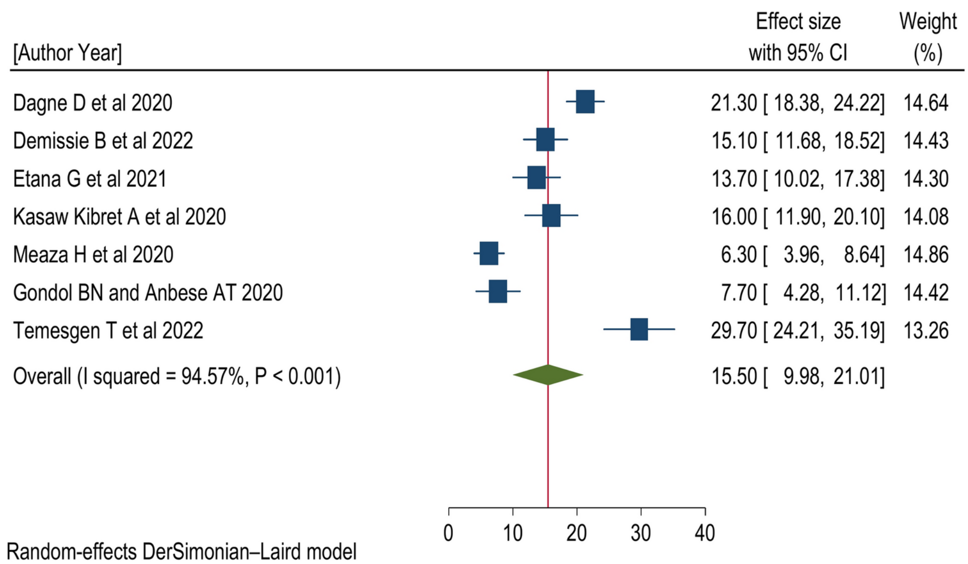

Fig. 10. Forest plot showing the pooled prevalence of knee pain with 95% CI in Ethiopia, 2024.

The pooled prevalence of shoulder pain in Ethiopia was found to be 29.06% (95% CI 17.62, 40.49). This finding is in agreement with results from Estonian (30%)[63], Dhaka, Bangladesh (30.8%)[60], Mangaluru, India (20.7%)[50], Kurdistan, Iran (26%)[61], Kumasi, Ghana (37.4%)[17], Sri Lanka (34.3%)[49], and Tamil Nadu, India (40.2%)[11]. Despite, it is higher than studies conducted in Punjab, India (15.2%)[19], Hong Kon (16.5%)[53], and Hayat, Pakistan (12.1%)[59], while lower than the findings from Qazvin, Iran (42.1%)[56], Alexandria, Egypt (70%)[51], Bhopal, India (49.8%)[52], Buraydah, Saudi Arabia (51.4%)[62], Kuwait (49.2%)[20], China (50.7%)[54], and Malaysia (72%)[57].

The pooled prevalence of upper back pain in Ethiopia was 30.94% (95% CI 23.76, 38.11). This finding is consistent with the results reported by Qazvin, Iran (31.6%)[56], Kurdistan, Iran (36%)[61], and China (26.22%)[54]. However, it is higher than the prevalence found in Mangaluru, India (14.2%)[50], Dhaka, Bangladesh (22%)[60], and lower than those from Kuwait (38.4%)[20], Bhopal, India (52.2%)[52], Buraydah, Saudi Arabia (41.7%)[62], Kumasi, Ghana (61.7%)[17], Punjab, India (39.5%)[19], Tamil Nadu, India (39.6%)[11], and Malaysia (64%)[57].

The pooled estimate of elbow pain in Ethiopia was 17.32% (95% CI 9.25, 25.38). Comparable results were reported from Kurdistan, Iran (12%)[61], Bhopal, India (12.3%)[52], Punjab, India (10%)[19], Kuwait (11.5%)[20], Colombo, Sri Lanka (11%)[49], Buraydah, Saudi Arabia (16%)[62], Kumasi, Ghana (15.2%)[17], and Qazvin, Iran (15.8%)[56]. Although this result is higher than those found in Hayat, Pakistan (2.5%)[59], and Tamil Nadu, India (5%)[11], it is lower than those reported from Mangaluru, India (7.5%)[50], Dhaka, Bangladesh (8.5%)[60], Shah Alam, Malaysia (20.9%)[12], and Isfahan, Iran (43.2%)[58].

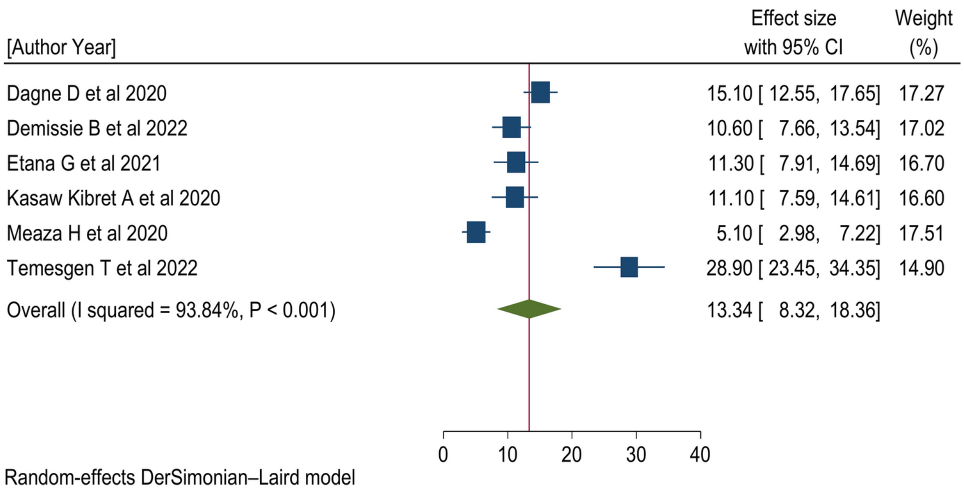

Fig. 11. Forest plot showing the pooled prevalence of ankle pain with 95% CI in Ethiopia, 2024.

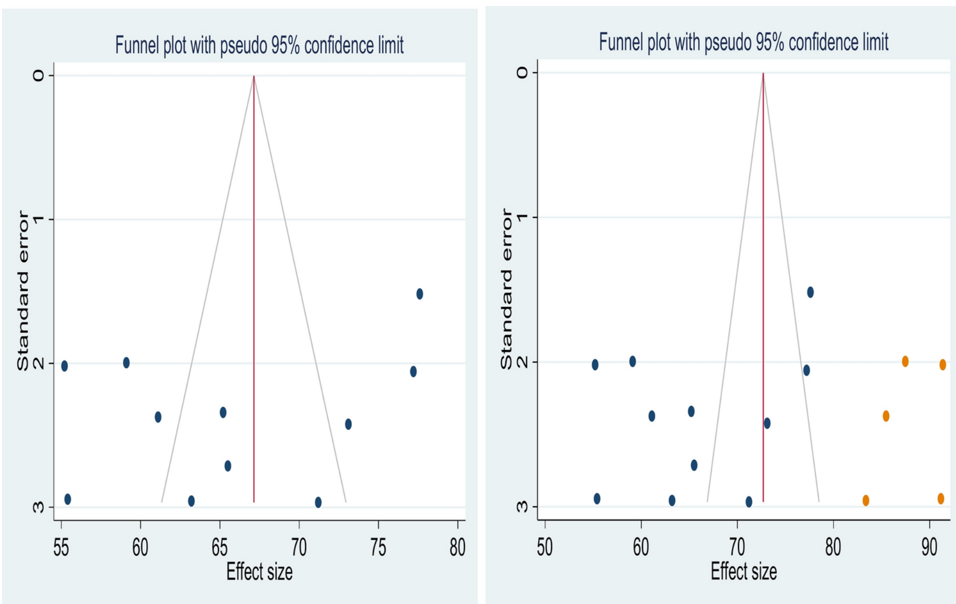

Fig. 12. Funnel plot before adjustment (**a**) and after adjustment (**b**) using trim and fill analysis for publication bias of MSDs among computer users in Ethiopia, 2024.

The pooled prevalence of lower back pain in Ethiopia was 44.41% (95% CI 37.75, 51.06). This result is in line with the studies reported in Estonia (42%)[63], Punjab, India (40.4%)[19], Dhaka, Bangladesh (48%)[60], and Kurdistan, Iran (44%)[61]. However, higher than the results reported in Mangaluru, India (7.1%)[50], Hayat, Pakistan (18.5%)[59], China (6.6%)[54], Bhopal, India (34.7%)[52], yet lower than those observed in Tamil Nadu, India (51.8%)[11], Kuwait (51.1%)[20], Buraydah, Saudi Arabia (66.9%)[62], Kumasi, Ghana (64.8%)[17], Qazvin, Iran (63.2%)[56], Malaysia (62%)[57], and Shah Alam, Malaysia (70.9%)[12].

The pooled prevalence of wrist/hand pain in Ethiopia was 19.37% (95% CI 12.44, 26.30), which is supported by findings from Mangaluru, India (15.2%)[50], Hong Kong (14.9%)[53], Dhaka, Bangladesh(19%)[60], Kurdistan, Iran (20%)[61], Colombo, Sri Lanka (21.4%)[49], Bhopal, India (24.3%)[52]. This result is higher than that observed in Kumasi, Ghana (3.4%)[17] and Tamil Nadu, India (6%)[11], but lower than the rates reported in Alexandria, Egypt (73%)[51], Buraydah, Saudi Arabia (26.9%)[62], Punjab, India (36.8%)[19], Kuwait (28.3%)[20], China (31.5%)[54], Qazvin, Iran (26.4%)[56], Estonia (35%)[63], Shah Alam, Malaysia (50%)[12], and Isfahan, Iran (31.5%)[58].

The pooled prevalence of hip/thigh pain was 13.23% (95% CI 7.52, 18.95). This finding is consistent with those from Kurdistan, Iran (8%)[61], Bhopal, India (12.7%)[52], Kumasi, Ghana (13.9%)[17], Kuwait (13.3%)[20], and Mangaluru, India (6.4%)[50]. However, it is higher than the results from Hayat, Pakistan (3%)[59], Tamil Nadu, India (3%)[11], Dhaka, Bangladesh (6%)[60], Punjab, India (6.2%)[19], Mangaluru, India (6.4%)[50], and lower than those from Buraydah, Saudi Arabia (26.3%)[62], Qazvin, Iran (31.6%)[56], and Shah Alam, Malaysia (25.6%)[12].

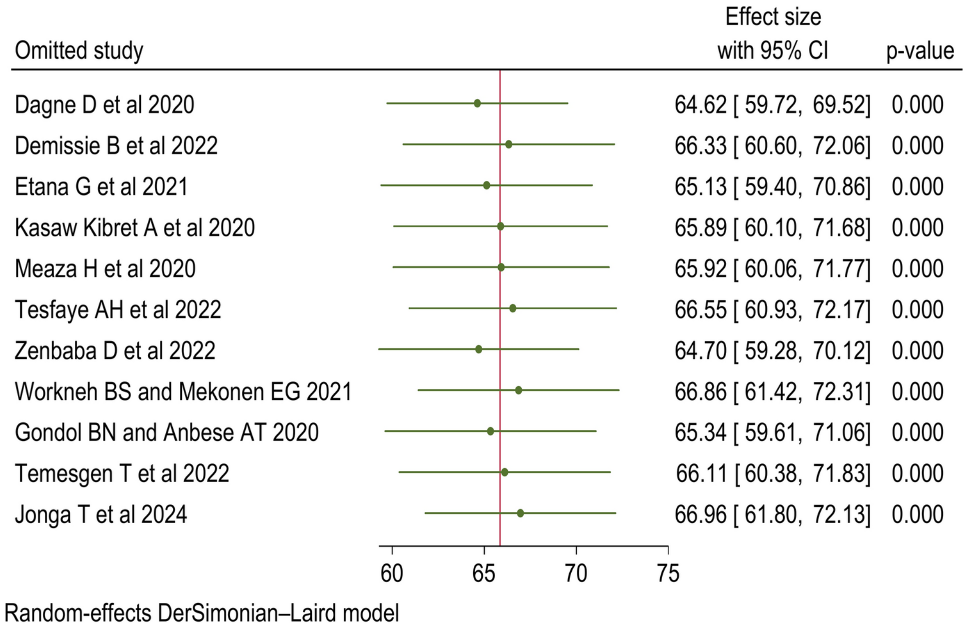

Fig. 13. Sensitivity analysis of MSDs among computer users in Ethiopia, 2024.

The pooled prevalence of knee pain in Ethiopia was 15.50% (95% CI 9.98, 21.01). This result is similar to findings from studies conducted in Mangaluru, India (12.5%)[50], Dhaka, Bangladesh (10.8%)[60], Kurdistan, Iran (12%)[61], and Bhopal, India (11.2%)[52]. Whereas, it is higher than the results reported in Kumasi, Ghana (2.2%)[17], Hayat, Pakistan (3%)[59], Punjab, India (2.2%)[11], Tamil Nadu, India (2%)[11], Shah Alam, Malaysia (4.9%)[12], and lower than studies from Buraydah, Saudi Arabia (33.7%)[62], Kuwait (22.9%)[20], Qazvin, Iran (42.1%)[56], and Isfahan, Iran (39.6%)[58].

The pooled prevalence of ankle pain in Ethiopia was 13.34% (95% CI 8.32, 18.36). It is comparable with results from Qazvin, Iran (10.5%)[56] and Kuwait (16.8%)[20]. This finding is higher than those reported in Bhopal, India (6.5%)[52], Kumasi, Ghana (6.5%)[17], Dhaka, Bangladesh (5.2%)[60], Hayat, Pakistan (2.5%)[59], Tamil Nadu, India (4%)[11], and lower than Mangaluru, India (22.7%)[50], Kurdistan, Iran (20%)[61], Buraydah, Saudi Arabia (43.4%)[62], Shah Alam, Malaysia (33.7%)[12], and Isfahan, Iran (18.9%)[58].

Therefore, lower back, neck, upper back, and shoulder were the most affected body parts, whereas hip/thigh, ankle, knee, elbow, and wrist/hand were the least affected. Similar results have been reported in Dhaka, Bangladesh[60], Kurdistan, Iran[61], Bhopal, India[52], Kumasi, Ghana[17], Tamil Nadu, India[11], Kuwait[20], and Malaysia[57]. In addition, this finding was supported by previous systematic review report[29].

The odds of musculoskeletal disorders (MSDs) among computer users aged 30 and older were higher than those among users under 30. This finding is supported by studies reported in Dhaka, Bangladesh[60], Kurdistan, Iran[61], Punjab, India[19], Estonia[63], and Isfahan, Iran[58]. People's ability to meet the physical demands of their jobs naturally declines with age, especially when it comes to physical characteristics like muscle mass and strength. Thus, an increased risk of MSD for elderly workers seems plausible. MSDs have significantly increased from the middle to the older age groups[64]. Musculoskeletal tissues exhibit a number of age-related changes that impair the tissues' capacity to perform their intended tasks, including increased bone fragility, decreased ligament elasticity, cartilage resilience loss, muscle strength loss, and fat redistribution[65]. Aging increases the frequency and severity of MSDs[65]. People become more susceptible to obesity as they get older because they engage in less physical activity and obesity is one of the determinant factor for MSDs[50].

In Ethiopia, computer users who worked in awkward postures had higher odds of MSDs compared to those who maintained appropriate postures. This finding aligns with evidence from Alexandria, Egypt[51], Hayat, Pakistan[59], Hong Kong[53], Punjab, India[19], Colombo, Sri Lanka[49], China[54], and Qazvin, Iran[56]. When using a computer, it's usual to adopt awkward postures like forward bending and repetitively rotating the head, neck, and trunk to one side. As posture deviates more from neutral, the muscles that are responsible for the preferred side of rotating or bending become stronger and the matching antagonistic muscles become elongated and weakened, creating a muscle imbalance. Muscles that are under stress from prolonged static posture are susceptible to ischemia, due to the prolonged contraction and following fatigue[66]. Working in backbends, twisting or bending can increase the stress on the joints, muscles, and nerves and cause fatigue, pain and discomfort throughout the body[18,54] and it can cause the skeletal and muscle areas to become tight and compressed, which can lead to pain and discomfort across the entire musculoskeletal system[67,68].

The likelihood of musculoskeletal disorders (MSDs) among computer users was higher for those who had never engaged in physical exercise compared to those who did. Similar findings were reported in China[54], Qazvin, Iran[56], and Shah Alam, Malaysia[12]. This may result in limited flexibility, weakened muscles, and decreased muscle strength. As a result, the muscles and bones become stiff, fragile, and deconditioned[69,70]. Physical activity reduces occupational stress and musculoskeletal pain. Physical activity for 20 min, three times a week, helps ease

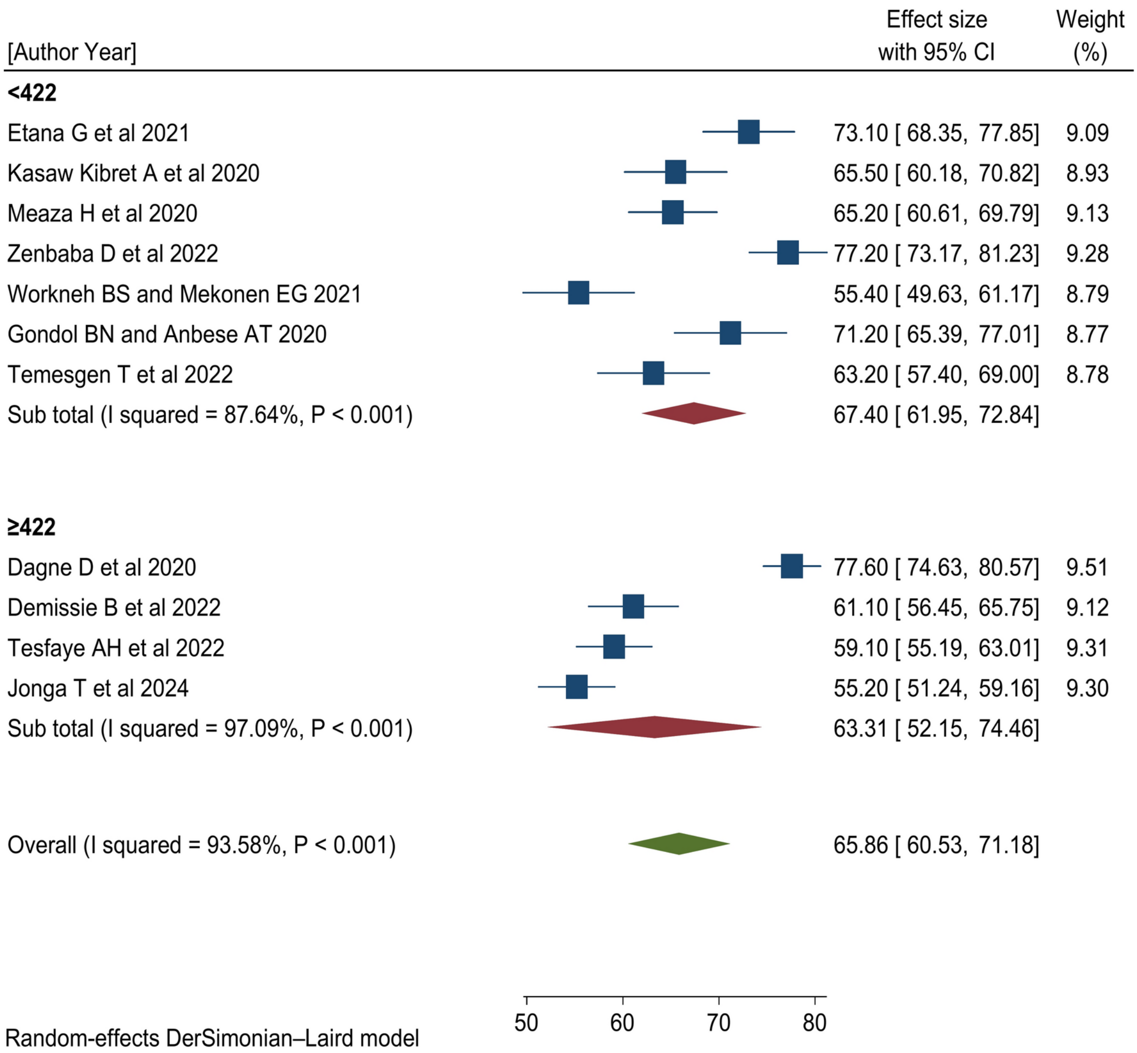

Fig. 14. Forest plot of the prevalence of MSDs with 95% CIs of the sub-group analysis by sample size among computer users in Ethiopia, 2024.

musculoskeletal discomfort[29,60,71–73]. Encouraging physical activity and exercise, preserving fitness and health, and avoiding injury[48].

Those who spent 4 and more hours per day with computer were more susceptible to MSDs than those spend less than 4. This finding was strongly supported by the studies conducted in Dhaka, Bangladesh[60], China[54], Malaysia[57], and Alexandria, Egypt[51]. Employees who work for extended periods of time without shifting positions run the risk of developing soft tissue injuries and micro trauma. Soft tissue injuries can result in pain and raise the chance of developing MSDs[74]. Longer working hours with computer have been suggested that it may negatively impact the body and causes MSDs by reducing the amount of time available for stress relief and recovery from cumulative fatigue[75]. Extended computer use increases pressure on joints, stresses ligaments and provokes muscle pain[76].

Limitation of the study

This review evaluated MSDs and their associated factors among computer users in Ethiopia exclusively. Thus, future researchers ought to examine the pooled estimates of MSDs among computer users in Africa and around the world. The trim and fill analysis result indicated that the funnel plot was not symmetrical distributed. As a result, the funnel plot shows the presence of publication bias. Therefore, for strong evidence and conclusion additional primary studies should be done. Furthermore, this review was limited to articles published in English. As a result, future researchers should aim to include studies published in other languages.

Conclusions

In Ethiopia, the overall prevalence of MSDs among computer users was significantly high. Lower back, neck, upper back, and shoulder were the most affected body parts, whereas the hip/thigh, ankle, knee, elbow and wrist/hand were the least affected. This review found that computer users aged 30 and older, those who work in awkward positions, those who do not participate in physical exercise, and those who engage in prolonged computer use are at an increased risk of developing MSDs. Therefore, employees should reduce the time spent on computers, engage in at least 150 min of exercise per week, and follow appropriate work practices and procedures while at work. This review has verified the existence of publication bias; thus, further primary studies should be conducted.

Data availability

All necessary data were included in the manuscript.

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Author contributions

BD has generated the idea of this review, GBM and TMA, contributed to data collection and statistical analysis. BD wrote the first draft of this manuscript. GBM and TMA, revised the manuscript. All authors took their responsibility for the accuracy of the analysis and the contents of the review. Finally, all authors read and approved the final version of the manuscript.

Declarations

Competing interests

The authors declare no competing interests.

Additional information

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