Physical inactivity and its association with hypertension among adults in Ethiopia: A systematic review and meta-analysis

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ABSTRACT

Background: Physical inactivity is one of the most significant risk factors for hypertension, which is currently a serious public health concern in developing nations, including Ethiopia. This systematic review and meta-analysis aimed to estimate the pooled magnitude of physical inactivity and its association with hypertension among adults in Ethiopia.

Methods: We authors searched articles using PubMed, Science Direct, Google, Google Scholar, and manual search of unpublished research articles from March 10, 2021, to June 15, 2021. Data extraction and analysis were performed using Microsoft Excel16 and STATA version 14 software, respectively. The quality of eligible studies was checked using the Joanna Briggs Institute (JBI) critical appraisal assessment tool. Heterogeneity of the included studies was tested using the I² statistic, and publication bias was checked using the Egger's test.

Results: A total of 7036 adults were included, and the pooled magnitude of physical inactivity among adults was found to be 57.44% (95% CI: 44.94–69.98). Adults who do not perform physical activity were 2.55 (95% CI: 1.08–6.01) times more likely to be hypertensive compared with their counterparts. Subgroup analysis revealed that the magnitude of physical inactivity was higher among studies done in 2016 and onwards 63.01 (95% CI: 47.76–78.26) compared to studies conducted before 2016, 50.80% (95% CI: 30.23–71.37).

Conclusions: The pooled magnitude of physical inactivity among adults was high, and a risk factor for hypertension in adults. Thus, community engagements and integration of physical activity with the existing health system are the best strategies to decrease the increment of the magnitude of hypertension among adults.

1. Introduction

Physical inactivity is defined as unable to meet the minimum requirements for physical activity for health and is the fourth leading cause of death worldwide [1]. Meanwhile, the magnitude is rising from day to day in many countries, with a major increment in the prevalence of non-communicable diseases like hypertension worldwide [2]. According to the World Health Organization (WHO) estimations, physical inactivity contributes to approximately 17% of diabetes and heart disease, 12% of falls accidents in the elderly, and 10% of breast and colon cancers [3, 4].

The analyses of the global burden of diseases estimate that, insufficient physical activity accounts for an estimated 13.4 million disability-adjusted life years (DALYs) related to ischemic heart disease, diabetes, and stroke [5]. It causes 5.3 million annual deaths worldwide, and 6–10% of deaths caused by non-communicable diseases are attributed to physical inactivity [6].

Hypertension is one of the main public health problems because of its high risk of cardiovascular and kidney diseases such as myocardial infarctions, strokes, and renal failures. And the leading cause of death, which accounting for 9.4 million deaths and 7% of disability worldwide. This makes it a single most important cause of morbidity and mortality worldwide [7]. The prevalence of hypertension is rapidly increasing in developing countries [8]. In Ethiopia, the estimated overall prevalence of hypertension was 19.6% and 23.7% in rural and urban areas, respectively [9].

Although a number of studies were conducted on physical inactivity among adults across the regions of Ethiopia, their results were inconsistent [10, 11, 12, 13]. Moreover, in the past few years, the prevalence of hypertension is increasing in Ethiopia due to life styles changes secondary to urbanization [14, 15]. Along with these, systematic review and meta-analysis were conducted on hypertension in Ethiopia [15, 16]. Nevertheless, no systematic review and meta-analysis has been conducted...
to verify the magnitude of physical inactivity at the national level and its association with hypertension among adults in Ethiopia. Thus, the objective of this study was to systematically review and analyze the pooled magnitude of physical inactivity and its association with hypertension among adults in Ethiopia. As a result, this review will inform possible recommendations for policymakers, governments, health program implementers and future researchers to minimize the incidence of hypertension among adult population.

2. Materials and methods

2.1. Identification and study selection

This systematic review and meta-analysis were conducted to determine the pooled magnitude of physical inactivity and its association with hypertension among adults in Ethiopia through identifying and searching primary articles published up to June 15, 2021, in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [17]. Articles were searched using PubMed, ScienceDirect, Google and Google Scholar. In addition, the reference lists of the included studies were also searched manually so as not to miss relevant articles. The searching process of the articles was carried out from March 10, 2021, to June 15, 2021. The search terms included subject headings (e.g. MeSH in PubMed) and free text words for the key concepts. The MeSH terms used to retrieve the studies were (“Prevalence” OR “Magnitude” OR “Epidemiology”) AND (“Physical inactivity” OR “Insufficient physical activity”) AND (“Physical activity”) AND (“Ethiopian adults”). All the literature available until June 15, 2021, were considered in this systematic review and meta-analysis.

2.2. Inclusion criteria

The two researchers (TME, and DS) carefully reviewed the contents of each retrieved article. And those kinds of literature that fulfill the following criteria were included in the analysis.

1. Study area: Studies conducted in Ethiopia among adults either in the community or institution settings were considered.
2. Study design: Observational studies (cross-sectional, case-control, and cohort studies) reporting the prevalence and/or its association with hypertension were included.
3. Language: Research articles published in the English language were included.
4. Population: Studies conducted on adults (age ≥18 years) were included.
5. Publication issue: No limitation on publication status was imposed (both published and unpublished articles were included) in this systematic review and meta-analysis.
6. Studies that reported on either prevalence and/or determinants of physical inactivity
7. Publication year: Studies published until June 15, 2021, were included.

2.3. Exclusion criteria

Studies with inadequate data and duplicated citation were excluded from this review.

2.4. Data extraction

Two authors (TME, and DS) independently extracted all the necessary data using a standardized data extraction format prepared in Microsoft Excel16. Each paper was reviewed and selected by two reviewers (TME, and DS) and when there was a disagreement, it was resolved through discussion with the other researchers (RHK, and BM). The information included in the data extraction format were the first author, publication year, region, setting (institutional/community), sample size, response rate, and prevalence of physical inactivity. For the second objective (association of physical inactivity with hypertension) two by two table was used to extract the data described in the primary article.

2.5. Outcome measurements

Our systematic review and meta-analysis has two main objectives. The first objective was the pooled magnitude of physical inactivity, which was defined as a sedentary activity level which describes adult who gets little to no exercise [18] or individuals who do not meet the criteria for moderate and high physical activity [19]. The second objective was to estimate the association (pooled odds ratio) of physical inactivity with hypertension. Hypertension was defined as when the systolic blood pressure 140mmHg or greater average of two consecutive measurements, or an average diastolic blood pressure 90 mmHg and above, or both [20]. The magnitude of physical inactivity of each study was calculated by dividing the total number of adults with physical inactivity by the total number of adults included in the study and multiplied by one hundred.

2.6. The quality of the studies included in this review

All studies included in this review were assessed for eligibility by their titles, abstracts, and full texts. Then, two authors (DS, and TME) independently evaluated the qualities of the original articles using the JBI Critical Appraisal Assessment Tool as a guideline. All of the studies were assessed with the JBI critical appraisal checklist for cross-sectional studies [21].

2.7. Statistical procedure

Data were extracted using Microsoft Excel sheet format. After extraction, the data were imported into STATA version14.0 software for analysis. The characteristics of the original articles were described using texts, tables, and forest plots. Subgroup analyses was performed to manage heterogeneity among studies. Heterogeneity among the reported prevalence of studies was checked by using a heterogeneity I² test [22]. In addition, Publication bias was also examined objectively by performing Egger’s test, and Begg’s regression intercept tests at a 5% significance level [23, 24].

3. Results

3.1. Literature search results

In the first step of this systematic review and meta-analysis, a total of 173 articles were systematically retrieved regarding the magnitude of physical inactivity among adults in Ethiopia using different databases such as PubMed, EMBASE, Google Scholar, and Science Direct and

| Table 1. The search result of articles using different databases for assessing the magnitude of physical inactivity. |
|---------------------------------------------------------------|
| Databases            | Searching terms                                  | Number of studies |
|----------------------|--------------------------------------------------|-------------------|
| Google scholar       | Magnitude of physical inactivity and its association with hypertension among adults | 55                |
| PubMed               | (“Prevalence” OR “Magnitude” OR “Epidemiology”) AND (“Physical inactivity” OR “Insufficient physical activity”) OR (“Physical activity”) AND (“Ethiopian adults”). | 87                |
| From other databases | Magnitude of physical inactivity and its association with hypertension among adults. | 31                |
| Total articles retrieved                                   | 173                |
| Final full text papers appropriate to our review and analysis | 11                |
reference lists of previous studies to retrieve more related articles as described Table 1 and Figure 1.

### 3.2. Original article characteristics

The descriptive characteristics of eleven eligible primary studies were included in this systematic review and meta-analysis, which have been described in Table 2. The searching and collecting of the studies conducted in different regional state of Ethiopia were carried out from March 10, 2021, to June 15, 2021. Among the articles included in the review, 10 of them were quantitative cross-sectional studies [10, 11, 12, 25, 26, 27, 28, 29, 30, 31], and one study was a mixed study [13], with the sample sizes ranging from 318 (25), to 1472 (26).

### 3.3. Meta-analysis

In this systematic review and meta-analysis, a total of 7036 participants were included, and the pooled magnitude of physical inactivity among adults in Ethiopia was 57.46% (95% CI: 44.94–69.98). In addition, the lowest magnitude of physical inactivity was reported from the Southern Nations, Nationalities, and People's Region (SNNPR) 21% (95% CI: 17.51–24.49), and the highest in Addis Ababa 83% (95% CI: 79.66–86.33), and Oromia region 83% (95% CI: 79.30–86.70). Heterogeneity was seen across the studies which was detected by the I² statistic (I² = 99.3%, p-value < 0.001) (Figure 2). Therefore, a random-effects model was conducted to estimate the pooled magnitude of physical inactivity among adults in Ethiopia. With regard to publication

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**Figure 1.** A PRISMA flow chart explaining the selection of primary studies for systematic review and meta-analysis of magnitude of physical inactivity among adults in Ethiopia.

**Table 2. Summary of the studies for the magnitude of physical inactivity among adults in Ethiopia included in the analysis.**

| Region      | First author               | Mean age (±SD) | Study design | Study setting | Publication year | Sample size | Quality  |
|-------------|----------------------------|----------------|--------------|---------------|------------------|-------------|----------|
| Addis Ababa | Abebe S et al. [10]        | 46 (±15.67)    | Cross-sectional | Institutional | 2019             | 487         | Low risk |
| Amhara      | Hansen B et al. [25]       | 38 (±10.88)    | Cross-sectional | Community    | 2019             | 318         | Low risk |
| Amhara      | Tesfaye T et al. [26]      | 37 (±15.71)    | Cross-sectional | Community    | 2019             | 1472        | Low risk |
| Amhara      | Endries et al. [27]        | 44 (±13.36)    | Cross-sectional | Community    | 2019             | 598         | Low risk |
| Dire Dawa   | Roba H et al. [28]         | 40 (±12.98)    | Cross-sectional | Community    | 2019             | 903         | Low risk |
| Harar       | Abdeta C et al. [11]       | 35 (±12.5)     | Cross-sectional | Community    | 2018             | 601         | Low risk |
| SNNPR       | Darebo T et al. [29]       | 31 (±7.5)      | Cross-sectional | Community    | 2019             | 565         | Low risk |
| SNNPR       | Dereje E et al. [30]       | Not stated     | Cross-sectional | Community    | 2020             | 634         | Low risk |
| Tigray      | Gebreselassie T et al. [13] | 36 (±12.4)    | Mixed         | Community    | 2017             | 544         | Low risk |
| Oromiya     | Gudina K et al. [31]       | 29 (±15.5)     | Cross-sectional | Community    | 2014             | 422         | Low risk |
| Somali      | Asreshagnet H et al. [12]  | 35             | Cross-sectional | Community    | 2017             | 492         | Low risk |
bias, Begg’s and Eggers’s tests were checked, and no significant publication bias was observed as evidenced by p = 0.755 and P = 0.582, respectively.

3.4. Subgroup analysis

In our meta-analysis, we performed a subgroup analysis based on the sample size, study period, and region. The studies were grouped based on the sample sizes, the magnitude of physical inactivity in those studies with sample size less than 600 was 57.28% (95%CI: 38.32–76.24) and those with sample sizes 600 and above was 57.78 % (95%CI: 40.33–75.23). In addition, the magnitude of physical inactivity was higher in Addis Ababa 83% (95%CI: 79.66–86.34) and Oromiya region 83% (95%CI: 79.30–86.70). Regarding study period, the magnitude of physical inactivity was higher among studies done in 2016 and onwards than studies conducted before 2016, as shown in Table 3.

3.5. Association of physical inactivity with hypertension

We have examined the association between physical inactivity and hypertension among adults. Analysis of six studies [10, 12, 13, 25, 28, 31] depicted that, those adults who had physical inactivity habit were 2.55 (95% CI: 1.08–6.01) times higher risk of having hypertension compared with their counterparts (Figure 3).

4. Discussion

This systematic review and meta-analysis showed that the pooled magnitude of physical inactivity among adults in Ethiopia was 57. 44%. This finding was higher than the studies conducted in Oceania (12.3%) [32], East and Southeast Asia (17.6%) [33], South Africa (34%) [34].

This might be because of adults residing in Ethiopia are not performing physical activity adequately. And the discrepancies might be because in Ethiopia, urbanization is increasing, which facilitates the increment of a sedentary lifestyles, and physical inactivity.

Regarding subgroup analysis, the pooled magnitude of physical inactivity was increased by 13 % when compared the studies conducted before 2016, and in 2016 and onwards. These could be due to the transition...
towards more urban development, sedentary lifestyles, and vehicle transportation, which probably explains the dramatically increment of the level of physical inactivity among adults. Furthermore, physical inactivity among adults was higher in Addis Ababa, and Oromiya regional state of Ethiopia. The odds of having hypertension were found to be higher among adults who had physical inactivity habit than those who were performing physical activity. This finding is supported by the studies conducted in South Africa, Nepal, and the United States of America [32, 33, 34], which found that physically active adults had a significantly lower rate of progression from prehypertension to hypertension than their counterparts. However, the mechanisms by which physical activity reduces the development of hypertension are yet unknown.

5. Strength and limitations

The strengths of this study were the following; the use of multiple databases to search literature, JBI critical appraisal tool for quality assessment, inclusion of studies conducted in almost all regions of Ethiopia, and use of the predetermined standard format to minimize error. Whereas the limitations to this review was study subjects varied in terms of socio-cultural characteristics that might affect the overall magnitude of physical inactivity.

6. Conclusion

Results of the present systematic review and meta-analysis showed that the magnitude of physical inactivity is high in Ethiopia. There is a dramatic increment in the magnitude of physical inactivity among Ethiopian adults which warranted the attention of health policymakers of the country. Moreover, this systematic review and meta-analysis provide clear direction for policymakers and stakeholders that there may be greater gains for community health at the national level by targeting the adult population. So, community-level approaches for developing the culture of physical activity will be effective in reducing the burden of non-communicable diseases like hypertension.

Consent for publication

Not applicable.

Declarations

Author contribution statement

Temesgen Muche Ewunie, Robel Hussen Kabthymer: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Daniel Sisay, Birhanie Mekuriaw: Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interest’s statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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References

[1] M. Gichu, G. Asiki, P. Juma, et al., Prevalence and predictors of physical inactivity levels among Kenyan adults (18–69 years): an analysis of STEPS survey 2015, BMC Public Health 18 (Suppl 3) (2018) 1217.

[2] M. Fogelholm, Physical activity, fitness and fatness: relations to mortality, morbidity and disease risk factors. A systematic review, Int. J. Obes. 11 (2010) 202–221.

[3] R. Guthold, G.A. Stevens, L.M. Riley, F.C. Bull, Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1.9 million participants, Lancet Global Health 6 (10) (2018) e1077–e1086.

[4] E.E. Shaw, E.A. Sicree, P.Z. Zimmet, Global estimates of the prevalence of diabetes for 2010 and 2030, Diabetes Res. Clin. Pract. 87 (1) (2010) 4–14.

[5] Institute for Health Metrics and Evaluation (IHME), GBD Compare, IHME, University of Washington, Seattle, WA, 2015. Available from, http://vizhub.healthdata.org/gbd-compare. (Accessed 19 March 2021).

[6] I.M. Lee, E.J. Shiroma, F. Lobelo, P. Puska, S.N. Blair, P.T. Katzmarzyk, Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy, Lancet (London, England) 380 (9838) (2012) 219–229.

[7] The lancet publishes the global burden of disease 2010 study. Geneva. http://www.uic.org/lancet-publishes-global-burden-disease-2010-study (Accessed April 28, 2021).

[8] A. Chokalingam, N.R. Campbell, J.G. Fodor, The worldwide epidemic of hypertension, Can. J. Cardiol, 22 (7) (2006) 553–555.

[9] K.T. Kibret, Y.M. Mesfin, Prevalence of hypertension in Ethiopia: a systematic meta-analysis, Publ. Health Rev. 36 (1) (2015) 14.

[10] S. Abebe, W.W. Yallew, Prevalence of hypertension among adult outpatient clients in hospitals and its associated factors in Addis Ababa, Ethiopia: a hospital-based cross-sectional study, BMC Res. Notes 12 (1) (2019) 87.

[11] C. Abdeta, Z. Teklemariam, B. Seyoum, Prevalence of physical inactivity and associated factors among adults in Harar town, Eastern Ethiopia, Baltic J. Health Phys. Act. 10 (2018) 78–80.

[12] H. Aresnahegn, F. Tadesse, E. Beyene, Prevalence and associated factors of hypertension among adult outpatient clients in hospitals and its associated factors in Addis Ababa, Ethiopia: a hospital-based cross-sectional study, BMC Res. Notes 12 (1) (2019) 87.

[13] T.A. Gebrihet, K.H. Mesgna, Y.S. Gebregiorgis, Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy, Lancet (London, England) 380 (9838) (2012) 219–229.

[14] T.M. Ewunie et al. Heliyon 8 (2022) e12023

[15] ICAP, Strengthening Chronic Disease Services in Ethiopia. Lessons Learned from HIV/AIDS Program Implementation, 2010, pp. 11–17. https://www.gbdonline.org/uploads/ICAP_HIV-NCD_report_Feb2011.pdf. (Accessed 3 September 2022).

[16] N. Legese, Y. Tadiwos, Epidemiology of hypertension in Ethiopia: a systematic review, Integrated Blood Pres. Control 15 (2020) 125–143.

[17] A. Abebe, W.W. Yallew, Prevalence of hypertension among adult outpatient clients in hospitals and its associated factors in Addis Ababa, Ethiopia: a hospital-based cross-sectional study, BMC Res. Notes 12 (1) (2019) 87.

[18] E.M.Z.E. Aromataris, JBI manual for evidence synthesis, Available from, https://synthesismanual.jbi.global.

[19] World Health Organization, Chronic Diseases and Health Promotion. STEP wise Approach to Chronic Disease Risk Factor Surveillance (STEPS), World Health Organization, Geneva, 2010.

[20] A.V. Chobanian, G.L. Bakris, H.R. Black, W.C. Cushman, L.A. Green, J.L. Izzo Jr., D.W. Jones, B.J. Materson, S. Oparil, J.T. Wright Jr., E.J. Roccella, Joint national committee on prevention, detection, evaluation, and treatment of high blood pressure, national heart, lung, and blood institute; national high blood pressure education program coordinating committee. Seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure, Hypertension 42 (2003) 1206–1252.

[21] E.M.Z.E. Aromataris, JBI manual for evidence synthesis, Available from, https://synthesismanual.jbi.global.

[22] G. Rücker, G. Schwarzer, J.R. Carpenter, M. Schumacher, Undue reliance on I2 in assessing heterogeneity may mislead, BMC Med. Res. Methodol. 8 (1) (2008) 79.

[23] J. Sterne, M. Egger, J.A.C. Sterne, M. Egger, Funnel plots for detecting bias in meta-analysis: guidelines on choice of axis, J Clinical Epidemiology 54: 1046-1055, J. Clin. Epidemiol. 54 (2001) 1046–1055.

[24] M. Egger, G. Davey Smith, M. Schneider, C. Minder, Bias in meta-analysis detected by a simple, graphical test, BMJ 315 (7109) (1997) 629–634.

[25] B. Hansen, H. Mamo, Prevalence and associated anthropometric and lifestyle predictors of hypertension among adults in Kombolcha town and suburbs, Northeast Ethiopia: a community-based cross-sectional study, BMC Cardiovasc. Disord. 19 (1) (2019) 241.

[26] T.D. Tesfaye, W.A. Temesgen, A.S. Kasa, Y.S. Yismaw, Prevalence and associated factors of hypertension in Ambha regional state city and its surrounding rural districts: a community-based cross-sectional study, Afr. Health Sci. 19 (3) (2019) 2580–2596.

[27] T. Endris, A. Woreda, D. Asmelash, Prevalence of diabetes mellitus, prediabetes and its associated factors in dassie town, northeast Ethiopia, A Community-Based Study 12 (2019) 2799–2809.

[28] H.S. Roba, A.S. Beyene, M.M. Mengesha, B.H. Ayele, Prevalence of hypertension and associated factors in dire dawa town, eastern Ethiopia: a community-based cross-sectional study, Int. J. Hypertens. 2019 (2019), 9878437.

[29] T. Darebo, A. Mesfin, S. Gebremedhin, Prevalence and factors associated with overweight and obesity among adults in Hawassa city, southern Ethiopia: a community based cross-sectional study, BMC obesity 6 (2019) 8.

[30] N. Dereje, A. Easiilo, L. Aleye, A. Abebe, Prevalence and associated factors of diabetes mellitus in hosanna town, southern Ethiopia, Annals Global Health 86 (2020).

[31] E.K. Gudina, F. Bonsa, K.W. Hajito, Prevalence of hypertension and associated factors in bedele town, southwest Ethiopia, Ethiop. J. Heal. Sci. 24 (1) (2014) 21–26.

[32] H. Aljaadhry, Physical inactivity as a predictor of high prevalence of hypertension and health expenditures in the United States: a cross-sectional study, Trop. J. Pharmaceut. Res. 11 (6) (2012) 983–990.

[33] R.H. Dhungana, A.R. Pandey, B. Rista, S. Joshi, S. Devkota, Prevalence and associated factors of hypertension: a community-based cross-sectional study in municipalities of kathmandu, Nepal, Int. J. Hypertens. 2016 (2016), 1659638.

[34] S. Mbambo, B. Tou, T. Dfungwane, Factors Associated with Physical Activity Amongst Patients with Hypertension in Two Community Health Centers in Mgunyundlovu Health District, KwaZulu-Natal, South African Family Practice, 2018, p. 61, 2019.