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# The Analysis Study of Prevention of Osteoporosis and Sarcopenia in Older Adults: A Comprehensive Systematic Review and Metaaanalysist Study

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**ABSTRACT**

**Background:** Musculoskeletal health is an important component of healthy aging. Bone and muscle are the two most important components of the musculoskeletal system. Though age-related changes in both bone and muscle structure do occur, diseases that either directly or indirectly affect bone and muscle, and age associated lifestyle changes, have a greater impact on bone and muscle health. Poor bone and muscle integrity and strength predispose older adults to impaired function, disability, dependency, falls, pain, high medical care costs and death. Osteoporosis and sarcopenia are common in older adults. **Method**: This systematic review and meta-analysis, conducted following PRISMA guidelines and employing the PICO format, aim to explore about prevention of osteoporosis and sarcopenia in older adults. Inclusion criteria encompass diverse study designs (RCTs, observational, quasi-experimental, and case-control studies) investigating about prevention of osteoporosis and sarcopenia in older adults, while exclusion criteria filter out studies lacking relevance to prevention of osteoporosis and sarcopenia in older adults. **Result**: After three levels of screening, 9 articles directly relevant to the systematic review were chosen for full-text analysis. The selected articles, demonstrate a recent publication trend, with 3 are articles published in PubMed journal, 2 were published in Sage Journal, 2 were published in Lancet, 2 were published in ScienceDirect from 2014 – 2024. **Conclusion:** Several interventions to preserve bone strength and prevention of sarcopenia can be recommended to the general population. These include an adequate intake of calcium and vitamin D, lifelong participation in regular weight-bearing and muscle-strengthening exercise, cessation of tobacco use, identification and treatment of alcoholism, and treatment of risk factors for falling. In addition to maintaining adequate vitamin D levels and physical activity, as described above, several strategies have been demonstrated to reduce falls. These include, but are not limited to, multifactorial interventions such as individual risk assessment.

**Keywords**: Osteoporosis, sarcopenia, prevention, management.

## INTRODUCTION

The aim of this study is to systematically review and conduct a meta-analysis of prevention of osteoporosis and sarcopenia in older adults. By comprehensively synthesizing existing literature, this research seeks to explore the treatment, complications, and prognosis of prevention of osteoporosis and sarcopenia in older adults. Through rigorous evaluation and statistical analysis, the study aims to provide valuable insights into the treatment, complications, and prognosis of prevention of osteoporosis and sarcopenia in older adults. The systematic review and meta-analysis intend to inform healthcare practitioners, researchers, and policymakers about the current state of the treatment, complications, and prognosis of

prevention of osteoporosis and sarcopenia in older adults for future research and development in this critical area of public health.

According to the definition by experts at the National Osteoporosis Foundation and National Institute of Health (NOF/NIH, 2001), osteoporosis is an illness of the skeleton which is characterised by the handicapped endurance of the bones, causing increased risk of fracture. Osteoporosis is being ranked among the most often appearing diseases in the adult population. Statistical data show that this illness constitutes the most popular osteopathy, affecting about 75 million individuals in Europe, the USA and Japan, and every third postmenopausal woman, as well as the majority of individuals above 70 years of age.[1,2]

Osteoporosis is a silent disease, without any clear clinical symptoms, until a fracture occurs. Fractures are a major public health burden, as they are the main causes of morbidity, impairment, decreased quality of life and mortality. Osteoporosis has a lot of medical, economic and social consequences. The total burden of osteoporosis is estimated to grow by 50% with more than 3 million incident fractures by 2025, a cost that is translated into almost USD 25.3 billion per year in the US.[3,4]

Worldwide, 200 million people suffer from osteoporosis and 8.9 million fractures occur every year. By 2050, hip fractures may exceed 21 million cases. The prevalence of osteoporosis is 18.3% globally, and it is greater in women than in men (23.1 and 11.7, respectively). The direct cost of treating these osteoporotic fractures in five European countries (France, Germany, the United Kingdom, Italy and Spain) is EUR 29 billion, while for the 27 EU Member States as a whole it is EUR 38.7 billion, a cost that is expected to increase by 25% until 2025.[3,5,6]

Another additive syndrome which also affects humans is sarcopenia. Sarcopenia is not a syndrome which affects only daily life, reducing quality of life and strength, increasing likelihood of falls and loss of autonomy, but also leads to osteoporosis, obesity and impairs metabolic health. It has been shown that the loss of muscle mass that accompanies sarcopenia leads to increased insulin resistance, which promotes the development of metabolic syndrome and obesity.[3,7,8]

The origin of sarcopenia is multifactorial and its clinical significance, although universally recognized, it is not universally accepted. According to the European Working Group of Sarcopenia in Older People (EWGSOP2), sarcopenia requires the presence of both low muscle mass and low muscle function. This group defines sarcopenia as an age-related syndrome characterized by a progressive and generalized loss of skeletal muscle mass and strength with adverse effects on human health.[3,9,10]

## METHODS

This systematic review meta analysis was conducted in adherence to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) guidelines. Our health care question was defined a priori using the PICO (Population, Intervention, Comparator and Outcomes) format. Population: Individuals at risk of sarcopenia and osteoporosis. Intervention: Preventions efforts of sarcopenia and osteoporosis. Comparison: Did not take preventive. Outcome: Incident of sarcopenia and osteoporosis.

### Eligibility Criteria

For inclusion in this systematic review and meta-analysis on the exploration of prevention of osteoporosis and sarcopenia in older adults, studies with diverse designs will be considered. This encompasses randomized controlled trials (RCTs), observational studies, quasi-experimental designs, and case-control studies. Studies must specifically investigate about prevention of osteoporosis and sarcopenia in older adults, such as treatment, complications, and prognosis of prevention of osteoporosis and sarcopenia in older adults.

The eligible population includes individuals at risk of sarcopenia and osteoporosis or those already diagnosed, with no restrictions based on age, gender, or geographical location. Exclusion criteria encompass studies not directly relevant to sarcopenia and osteoporosis, reviews lacking original data, and studies solely not focusing on prevention of osteoporosis and sarcopenia in older adults.

Comparison groups are essential for this analysis, and eligible studies must incorporate a comparison group using the other methods for prevention of osteoporosis and sarcopenia in older adults. Excluded are studies without a comparison group or those comparing different of prevention of osteoporosis and sarcopenia in older adults.

Outcome measures of interest include prevention of osteoporosis and sarcopenia in older adults. Studies reporting outcomes unrelated to these measures or not directly addressing the prevention of osteoporosis and sarcopenia in older adults will be excluded. These criteria are designed to ensure the comprehensive inclusion of studies exploring the prevention of osteoporosis and sarcopenia in older adults, facilitating a thorough systematic review and meta-analysis of the current literature.

### Data Sources and Search Strategy

In pursuit of exploring prevention of osteoporosis and sarcopenia in older adults, a comprehensive search strategy was deployed. Authors systematically scoured relevant bibliographic databases, including the PubMed, Lancet, Google Scholar, and ScienceDirect.

**Table 1. Search Strategy**

| ***Database*** | **Search Strategy** | ***Hits*** |
|---|---|---|
| Pubmed | *((*"Sarcopenia*"[MeSH Subheading] OR* "Osteoporosis*"[All Fields] OR* "Risk factor*" [All Fields]) AND (*"Etiology*"[All Fields] OR* " Therapy*"[All Fields]) AND (*"Management*"[All Fields]) OR (*"Prognosis*" [All Fields]))* | 7234 |
| Science Direct | *((*"Sarcopenia*"[MeSH Subheading] OR* "Osteoporosis*"[All Fields] OR* "Risk factor*" [All Fields]) AND (*"Etiology*"[All Fields] OR* " Therapy*"[All Fields]) AND (*"Management*"[All Fields]) OR (*"Prognosis*" [All Fields]))* | 363 |
| Sagepub | *((*"Sarcopenia*"[MeSH Subheading] OR* "Osteoporosis*"[All Fields] OR* "Risk factor*" [All Fields]) AND (*"Etiology*"[All Fields] OR* " Therapy*"[All Fields]) AND (*"Management*"[All Fields]) OR (*"Prognosis*" [All Fields]))* | 301 |

## Study Selection

Title and abstract screening for eligibility was conducted by two independent investigators. Studies meeting the eligibility criteria were selected, and the full-text articles were obtained and reviewed. Any discrepancies in study selection were resolved through consensus agreement among all authors.

## Data Extraction

Data extraction was performed in duplicate from full-text versions of eligible studies by authors. The data included the total number of events and controls for the prevention of osteoporosis and sarcopenia in older adults. Data presented in tabular format were the primary source for extraction.

## Risk of Bias

The GRADE system was utilized to assess the quality of evidence. The risk of bias was evaluated based on limitations in study design, with RCTs considered high-quality evidence and observational studies as low-quality evidence. Each study underwent scrutiny for limitations, and bias was established across studies for each outcome.

**Heterogeneity**

Heterogeneity was evaluated based on similarity of point estimates, overlap of confidence intervals, and the statistic. Subgroup comparisons were created to explore potential sources of heterogeneity.

**Evaluating the Quality of Evidence**

The GRADE approach was employed to upgrade the quality of evidence, considering factors such as large pooled effects, dose-response relations, and confounders.

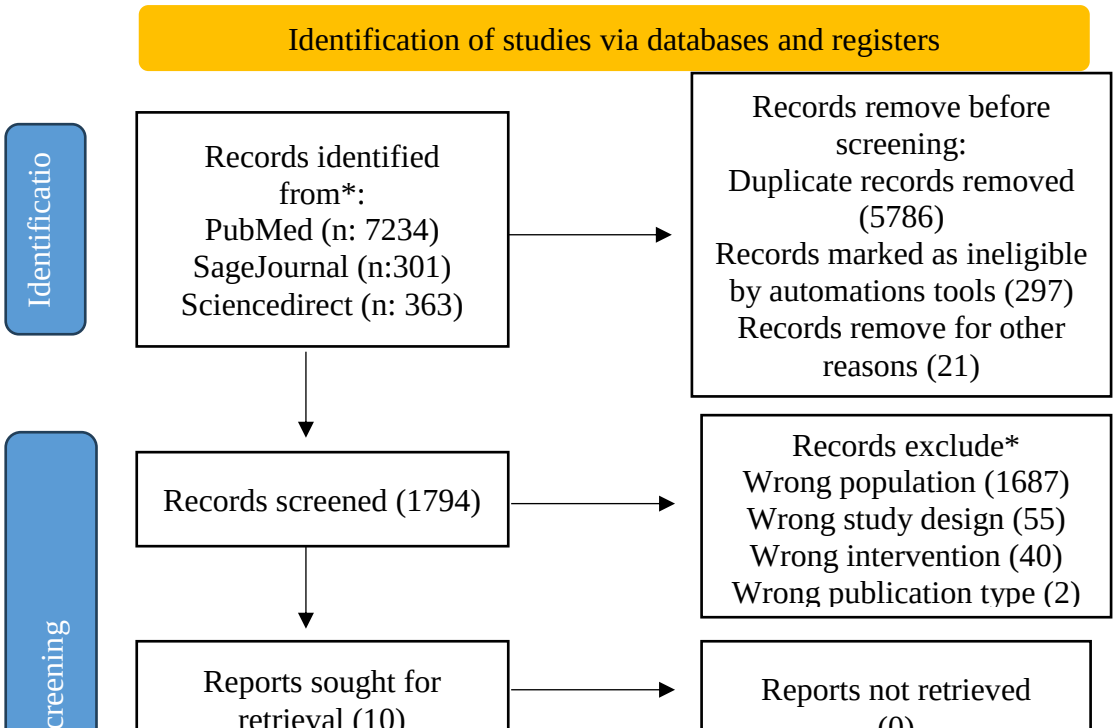

**Figure 1. Article search flowchart**

**Table 2. Critical appraisal of Study**

| Parameters | (Albrecht, BM et al., 2022) | (Ko, YC et al., 2021) | (Tsai, CH et al., 2024) | (Hashemi, R et al., 2014) | (Ezalina et al., 2023) | (Pinheiro, MB et al., 2020) | (Ardaneh, M et al., 2023) | (Khammash, AA et al., 2021) | (Okayama, A et al., 2022) |
|---|---|---|---|---|---|---|---|---|---|
| **1. Bias related to temporal precedence** | | | | | | | | | |
| Is it clear in the study what is the "cause" and what is the "effect" (ie, there is no confusion about which variable comes first)? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **2. Bias related to** | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **selection and allocation** | | | | | | | | | |
| Was there a control group? | No | No | No | No | No | No | Yes | Yes | No |
| **3. Bias related to confounding factors** | | | | | | | | | |
| Were participants included in any comparisons similar? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **4. Bias related to administration of intervention/exposure** | | | | | | | | | |
| Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest? | No | No | No | No | No | No | No | No | No |
| **5. Bias related to assessment, detection, and measurement of the outcome** | | | | | | | | | |
| Were there multiple measurements of the outcome, both pre and post the intervention/exposure? | No | No | No | No | No | No | No | No | No |
| Were the outcomes of participants included in any comparisons measured in the same way? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Were outcomes measured in a reliable way? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **6. Bias related to participant retention** | | | | | | | | | |
| Was follow-up complete and, if not, were differences between groups in terms of their follow-up adequately described and analyzed? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **7. Statistical conclusion validity** | | | | | | | | | |
| Was appropriate statistical analysis used? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

## RESULT

After conducting three levels of screening, 9 articles that have a direct relationship with the current systematic review have been selected for further screening based on full-text reading and analyses. The selected articles and their respective publication year along with the distribution of the publications years have been shown in Figure 1 above. As shown in Figure 1, the articles used for this systematic review included studies that have been published recently, where the majority of the studies representing 3 are articles published in PubMed journal, 2 were published in Sage Journal, 2 were published in Lancet, 2 were published in ScienceDirect from 2014 – 2024.

| Author | Origin | Method | Sample Size | Result |
|---|---|---|---|---|
| Albrecht, BM et al., 2022[11] | Germany | Cross-sectional data of 1610 community-dwelling older adults (65–75 years) residing in Bremen, Germany (53.4% female) were included. The Osteoporosis Self-Assessment Tool and self-reported osteoporosis diagnosis were used to classify participants by osteoporosis status (low risk, high risk, diagnosis). | 1610 | Descriptive statistics were applied, stratified by sex and osteoporosis status. A total of 91 women (10.6%) and 15 men (2.0%) reported an osteoporosis diagnosis, 457 women (43.2%) and 311 men (41.4%) were classified as having a high risk, and 311 women (36.2%) and 425 men (56.6%) as having a low risk. Adherence to bone health recommendations was high for calcium intake (93.3–100.0%), vitamin D intake (77.8–93.3%), and sun exposure (86.7–97.7%). Lower adherence was observed regarding resistance/weight-bearing exercise (36.3–54.4%), physical activity (14.3–57.7%), and alcohol consumption (40.0–72.4%). |
| Ko, YC et al., 2021[12] | Taiwan | Volunteers in this cross-sectional study were recruited from those attending senior health checkup program held at a regional hospital in Taipei City from May 2019 to Sep 2019. | 565 | 565 participants were recruited and data from 500 participants were used. The study participants had a mean age of 73.87 years old, with 47% men and 53% women. 138 (27.6%) participants were classified as having sarcopenia, among which 48 (45.3%) in low PA participants and 90 (22.8%) in moderate to high PA participants. Compared with those with low PA, moderate to high PA protected against the risk of sarcopenia with the odds ratio (OR) 0.46 (95% CI 0.27–0.79, p-value = 0.005). A significant protective effect of PA on sarcopenia was found among the older adults after adjusting for sex, institutionalization, age, BMI, albumin, |

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|---|---|---|---|---|
| | | | | hemoglobin, HDL-C levels, history of cardiovascular disease, education level and alcohol drinking. |
| Tsai, CH et al., 2024[13] | Taiwan | A nationwide cross-sectional telephone survey of older adults (≥ 65 years) was conducted in Taiwan from October 2019 to January 2020. Participants were interviewed to collect self-reported data on their level of physical activity (measured by the Taiwanese version of the IPAQ-SF), sarcopenia risk (measured by the SARC-F questionnaire), and sociodemographics. | 1068 | A total of 1068 older adults were surveyed. Compared with the optimal physical activity level recommendations in the WHO guidelines and after adjusting for potential confounders and proposing an association independent of sedentary behavior, older adults with insufficient physical activity levels (< 150 min/week) were more likely to have a higher risk of sarcopenia (OR: 3.24; CI: 1.67–6.27), whereas older adults who exceeded physical activity guidelines (> 300 min/week) were more likely to have a lower risk of sarcopenia (OR: 0.39; CI: 0.20–0.78). Maintaining moderate-intensity physical activity is essential for older adults, as physical activity that exceeds the guidelines can significantly lower the risk of sarcopenia; meanwhile, insufficient physical activity can greatly increase it. |
| Hashemi, R et al., 2014[14] | Iran | We used a semi-quantitative Food Frequency Questionnaire to assess the dietary intake of 300 randomly-selected elderly men and women (at least 55 years old) living in the 6th district of Tehran; and the dietary patterns of the subjects were obtained using principal component analysis. | 300 | Subjects in the highest tertile of the Mediterranean dietary pattern, characterized by a higher consumption of olive oil, fruits, vegetables, fish, and nuts, had a lower odds ratio for sarcopenia than those in the lowest tertile (OR = .42; 95% CI = .18-.97; p for trend = .04). In contrast, adherence to the Western dietary pattern, characterized by a high consumption of sugar, soy, and fast foods, was not associated with sarcopenia (OR = 0.51; |

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|---|---|---|---|---|
| | | | | 95% CI = .21-1.24; p for trend = .13). Similarly, adherence to the Mixed dietary pattern, characterized by a high consumption of animal proteins, potatoes, and refined grains, did not affect the odds of sarcopenia (OR = 1.45; 95% CI = .66-3.19; p for trend = .95). |
| Ezalina et al., 2023[15] | Indonesia | Cross sectional research design, with total sample of 84 elderly through the Accidental Sampling technique. The sample size was 84 respondents. The research instrument used the OKAT (Osteoporosis Knowledge Assessment Tool) questionnaire as the knowledge of osteoporosis and osteoporosis prevention measures questionnaire. | 84 | The results of this study found that the knowledge of the elderly was in high category of 60.7% and the prevention of osteoporosis was in good category of 53.6%. The results of statistical tests obtained p 0.02< 0.05, that Ho was rejected, so it can be concluded that there is a relationship between knowledge and osteoposition prevention measures in elderly. Research recommendations require further research by examining factors that have not been studied to explain the phenomenon and describe the condition of osteoporosis prevention comprehensively. |
| Pinheiro, MB et al., 2020[16] | Australia | Records were screened according to the following eligibility criteria: i) population: adults aged 65 years and older; ii) exposure: greater volume, duration, frequency, or intensity of physical activity; iii) comparison: no physical activity or lesser volume, duration, frequency, or intensity of physical activity; iv) outcome: osteoporosis related measures (e.g., bone mineral density). | 59 | We included a total of 59 studies, including 12 observational studies and 47 trials. Within the included trials, 40 compared physical activity with no intervention controls, 11 compared two physical activity programs, and six investigated different doses of physical activity. Included studies suggest that physical activity interventions probably improve bone health among older adults and thus prevent osteoporosis (standardised effect size 0.15, 95% CI 0.05 to 0.25, 20 trials, moderate-certainty evidence, main or most relevant |

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|---|---|---|---|---|
| | | | | outcome selected for each of the included studies). Physical activity interventions probably improve lumbar spine bone mineral density (standardised effect size 0.17, 95% CI 0.04 to 0.30, 11 trials, moderate-certainty evidence) and may improve hip (femoral neck) bone mineral density (standardised effect size 0.09, 95% CI −0.03 to 0.21, 14 trials, low-certainty evidence). Higher doses of physical activity and programs involving multiple exercise types or resistance exercise appear to be most effective. |
| Ardaneh, M et al., 2023[17] | Iran | This is the second phase of a previously published case–control study on 300 patients and 590 controls. | 890 | In addition to the socio-economic factors that were reported before, our results revealed that consumption of fish, vegetables, fruits, and nuts reduced the risk of falling, whereas consumption of cheese, red meat, and sweets raised the risk of falls among the participants. |
| Khammash, AA et al., 2021[18] | USA | A case-control study was designed to determine nutrients intake, as well as dietary and lifestyle patterns. One hundred patients who were newly diagnosed with osteoporosis, and 100 osteoporosis-free controls Jordanian postmenopausal women were enrolled in this study. | 200 | Several macro and micronutrients were identified as having a protective effect on the risk of osteoporosis. The intake of carbohydrates, vitamin B6 and phosphorus was associated with lower risk of osteoporosis in all quartiles. Moreover, Fiber, iron, magnesium, potassium, and zinc are protective in the third and fourth quartiles. A significant protective effect of fats, monounsaturated fats, and vitamins C consumption was detected in the fourth quartile. The present results suggest that a poor diet and a lack of a healthy lifestyle do have significant effects on the development of osteoporosis in postmenopausal women. |

| | | | | |
|---|---|---|---|---|
| Okayama, A et al., 2022[19] | Japan | In this cross-sectional analysis of 61 postmenopausal osteoporosis patients who regularly visited an osteoporosis outpatient clinic, we aimed to clarify the prevalence of sarcopenia and its related clinical factors. | 61 | Of 61 patients (mean age 77.6 ± 8.1 years), 24 (39.3%) had osteosarcopenia and 37 (60.7%) had osteoporosis alone. Age, nutritional status, and the number of prescribed drugs were associated with the presence of sarcopenia ($p$ = 0.002, <0.001, and 0.001, respectively), while bone mineral density (BMD) and % young adult mean BMD were not ($p$ = 0.119 and 0.119, respectively). Moreover, patients with osteosarcopenia had lower quality of life (QOL) scores, greater postural instability, and a higher incidence of falls in the past year than patients with osteoporosis alone. In contrast, BMD status showed no correlation with the nutritional status, QOL score, postural instability, or incidence of falls in the past year. In conclusion, the incidence of sarcopenia was relatively high among postmenopausal osteoporosis female patients in an osteoporosis outpatient clinic. |

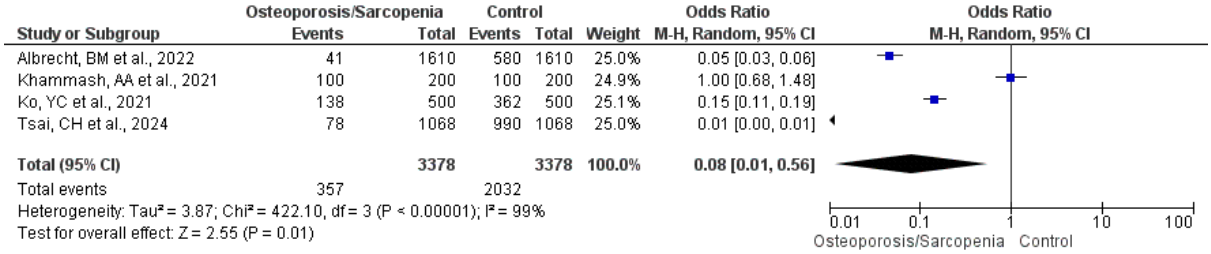


**Figure 2. Forest Plot of Physical Activity**

Based on the Z value of 2.55 and p value =0.01, there is a significant impact of physical activity to prevention Osteoporosis and Sarcopenia.

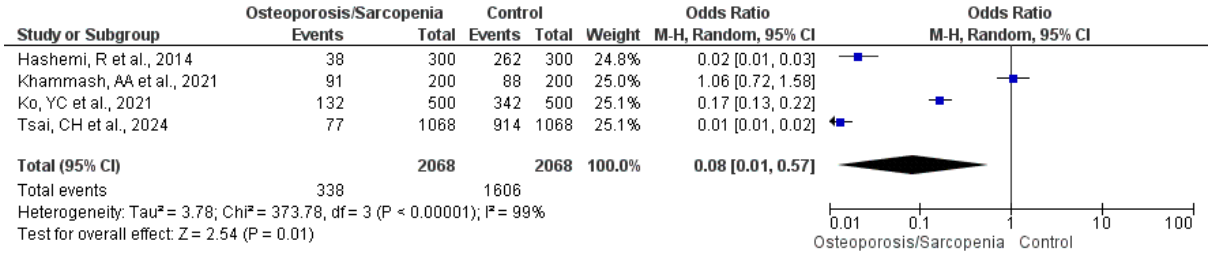


**Figure 3. Forest Plot of No Smoking**

Based on the Z value of 2.54 and p value =0.01, there is a significant impact of no smoking to prevention Osteoporosis and Sarcopenia.

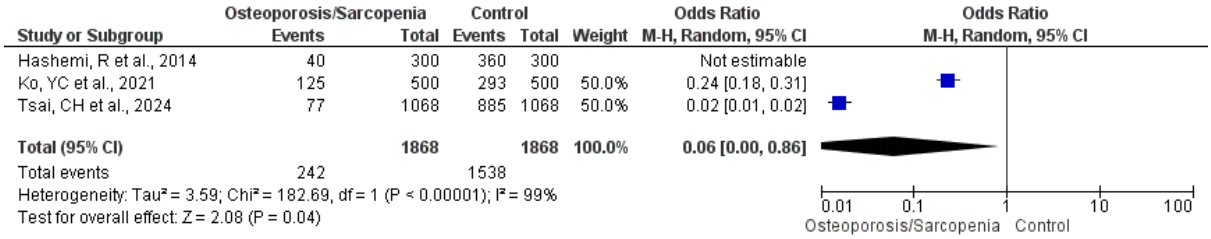


**Figure 4. Forest Plot of No Alcohol**

Based on the Z value of 2.08 and p value =0.04, there is a significant impact of no alcohol to prevention Osteoporosis and Sarcopenia.

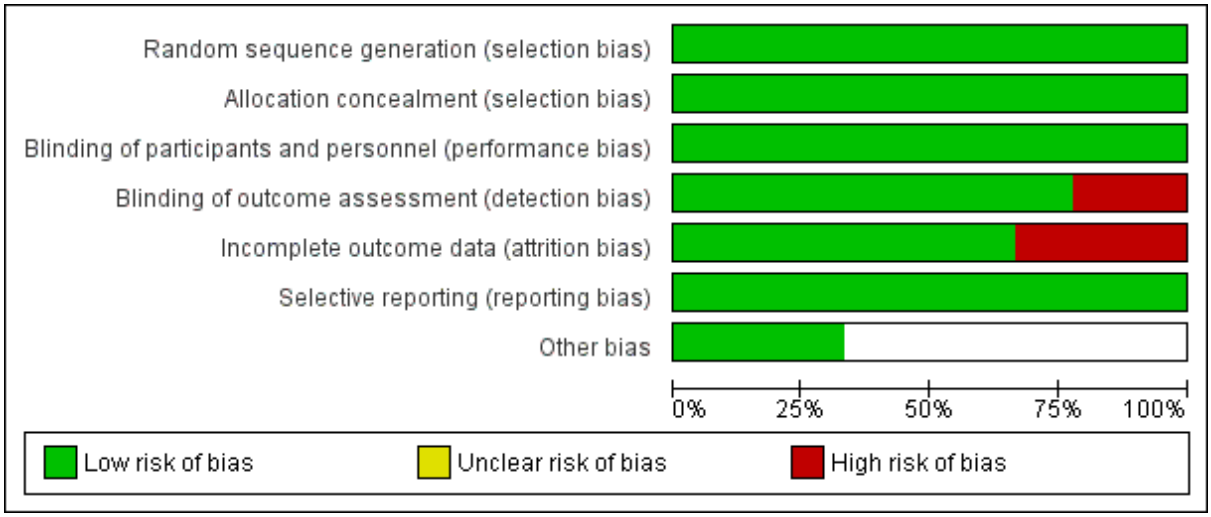


**Figure 5. Risk Of Bias**

Based on the risk of bias, there is a low risk of all criteria in the 9 studies concerned.

## DISCUSSION

Osteoporosis is a common disease all over the world. Osteoporosis has been operationally defined based on bone mineral density (BMD) assessment. According to the WHO criteria, osteoporosis is defined as a BMD that lies 2.5 standard deviations or more below the average value for young, healthy women (a *T*-score of $< -2.5$ SD) (1, 6). The most widely validated technique to measure BMD is dual-energy X-ray absorptiometry (DXA), and diagnostic criteria based on the *T*-score for BMD area recommended entry criterion for developing pharmaceutical interventions in osteoporosis (7–9).[5,20]

Osteoporosis is classified as primary (includes type I and type II) and secondary. Primary osteoporosis is seen in post-menopausal women and men and women over 70 years of age due to ageing. Secondary osteoporosis is caused by diseases, treatments or idiopathic. Systemic diseases, endocrine diseases, and malignant neoplasms are among the diseases that cause secondary osteoporosis. Besides, chronic use of glucocorticoids, lifestyle conditions, habits, and major depression are other causes of osteoporosis.[5]

Risk factors for osteoporosis are divided into two categories: modifiable and non-modifiable. Weight, smoking, alcohol consumption, physical inactivity, dietary calcium deficiency, and long-term glucocorticoid use are among the risk factors for the modifiable osteoporosis group. Gender, age, race, and genetic characteristics are among the risk factors for the non-modifiable osteoporosis group. These factors can also be more widespread with respect to gender. For example, in women, premature menopause and loss of ovarian function before menopause are other risk factors for osteoporosis.[5,21]

Sarcopenia is the term coined to define an age-related condition characterized by a supraphysiologic loss of muscle mass and strength. Sarcopenia increases the risk of negative health outcomes, such as falls, hospitalization, institutionalization, disability, and death. Sarcopenia may also impact the prognosis of other chronic conditions, such as cancer, diabetes and heart failure. Due to its clinical relevance, sarcopenia was recognized in 2016 as an independent nosological entity with an International Classification of Diseases-10 code.[22,23]

Several operational definitions of sarcopenia have been proposed over the years, with diagnostic algorithms varying according to the relevance attributed to strength/function parameters. Regardless of each definition's peculiarities, all identify muscle failure as the biological substratum of sarcopenia. According to the latest diagnostic criteria by the European Working Group on Sarcopenia in Older People 2 (EWGSOP2), low muscle strength is the cardinal element of sarcopenia, low muscle quantity or quality is necessary to confirm the diagnosis, and poor physical performance serves as an indicator of disease severity. The prevalence of sarcopenia and severe sarcopenia varies between 10% and 27% and between 2% and 9%, respectively, with different sex distributions depending on the definition used.[22,24]

In recent decades, the wider recognition of sarcopenia as a public health concern has led to it becoming a significant area of research interest and much has been learned about its multifactorial determinants, the pathophysiology of skeletal muscle loss, and underlying mechanisms. Regarding treatment, no licensed drug treatments are currently available for sarcopenia. However, the benefits of resistance exercise training are well known; the International Clinical Practice Guidelines for Sarcopenia (ICFSR) recommend the prescription of resistance exercise training as a principal management strategy for sarcopenia. Although nutrition is considered an important influence on skeletal muscle, there are many gaps in current evidence that limit the translation of findings to population dietary recommendations. The ICFSR guidelines therefore only make a conditional recommendation for dietary interventions to increase protein intakes as a component of sarcopenia management.[25]

## CONCLUSION

In conclusion, several interventions to preserve bone strength and prevention of sarcopenia can be recommended to the general population. These include an adequate intake of calcium and vitamin D, lifelong participation in regular weight-bearing and muscle-strengthening exercise, cessation of tobacco use, identification and treatment of alcoholism, and treatment of risk factors for falling. In addition to maintaining adequate vitamin D levels and physical activity, as described above, several strategies have been demonstrated to reduce

falls. These include, but are not limited to, multifactorial interventions such as individual risk assessment.

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