Review Article

Prevalence of Osteoporosis and Osteopenia in People Over 60 Years in Iran: A Systematic Review and Meta-analysis

Abstract

Background: Osteoporosis in the elderly has dangerous complications, the most important of which are bone fractures and reduced quality of life in the elderly. The present study was aimed at estimating the prevalence of osteoporosis in Iranian elderly using systematic review and meta-analysis. **Methods:** This search was conducted using authentic Persian and English keywords in national and international databases including Scientific Information Database, Magiran, IranDoc, PubMed, Scopus, Cochrane, Embase, and Web of Sciencewith no time limit until 20.06.2020. Heterogeneity of studies was assessed using I^2 index. Data were analyzed using STATA Ver. 15 software. **Results:** In 30 studies with a sample size of 13,347 people, the prevalence of osteoporosis and low bone density in people over 60 years in Iran were 34% (95% CI: 27%, 42%) and 47% (95% CI: 41%, 53%), respectively. We also found that 34% of women and 41% of men over the age of 60 suffer from osteoporosis. Prevalence of osteoporosis was in lumbar bone 23% (95% CI: 20%, 26%), spine 25% (95% CI: 19%, 31%), hip 35% (95% CI: 7%, 62%), and femur 23% (95% CI: 15%, 31%). Prevalence of low bone density was in lumbar bone 41% (95% CI: 19%, 63%), spine 30% (95% CI: 15%, 46%), and femur 35% (95% CI: 21%, 48%). **Conclusion:** The prevalence of low bone density in people over 60 years is higher than the prevalence of osteoporosis in them. About one-third of Iranian elderly people suffer from osteoporosis, but about half of them have low bone density.

Keywords: *Age-related bone loss, elderly, Iran, low bone density, metabolic bone disease, osteopenia, osteoporoses, osteoporosis*

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Introduction

The phenomenon of aging in the global population has led to an increase in the population of people aged 60 years and older due to the reduction in the mortality rate resulting from advances in medical sciences, health, education and, consequently, the increase in life expectancy and longevity. As defined by the World Health Organization, they are called elderly people[1-4] According to this definition, more than 600 million people in the world are elderly, and this figure will double by 2025, and by 2050, it will reach over 2 billion people.[5,6] In Iran, surveys and statistical indicators indicate the rapid growth of the elderly population. The population of the elderly is expected to increase by 10.5% by 2025.[7]

As the aging population grows, people are at risk of a variety of physical, social, economic well-being problems, and chronic diseases such as diabetes, cardiovascular, joints, and bones diseases.[3,8] Metabolic bone disorder is an abnormality of bones indicated by reduced bone mass and high risk of fractures. Several lines of evidence have demonstrated that the local bone tissue renin-angiotensin system is directly involved in bone metabolism and influences the bone health.[9] Osteoporosis is one of the most important health threats to the elderly community, as more than half of all women over 45 and 90% of women over the age of 75 are afflicted with osteoporosis.[10,11] This silent disease is often preventable and curable and sometimes leads to disability, and due to the reduced bone mass and bone loss, it is the major cause of fractures and increases mortality, disability, and medical costs.[12-14] Osteoporosis is a major public health problem in the world, and fracture is the most important consequence of this disease. Among various types of fractures, hip fracture, especially in the elderly, is one of the major threats to human societies. Pain, reduced physical activity, depression, disability,

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medical problems, psychological problems, and social isolation are other complications of the chronic disease worldwide.[3] These complications impair the daily activities of the elderly and lead to a decline in their quality of life.[15-18] Therefore, the need for a meta-analysis seems necessary. A systematic review of all documentation and their combinations can provide comprehensive and accurate statistics on the prevalence of osteoporosis in Iranian elderly people.

Methods

Study Protocol: The present study used systematic review and meta-analysis methods and aimed at estimating the prevalence of osteoporosis and osteopenia in people over 60 years in Iran. This study made use of the PRISMA[19] protocol which is used for systematic review and meta-analysis studies.

Statistical Population: Participants in the selected studies were people over 60 years.

Study outcomes **Primary outcomes:** The main outcome of this study is the prevalence of osteoporosis and low bone density in people over 60 years in Iran.

Secondary outcomes: The subsidiary outcomes of this meta-analysis were the prevalence of osteoporosis and low bone density in different parts of the elderly (Femur, hip, lumbar, spine), as well as the prevalence of osteoporosis in men and women of different ages.

Search strategy: The present study is a systematic review and meta-analysis, which examines the prevalence of osteoporosis and osteopenia in people over 60 years in Iran. To obtain related articles in Persian and English, internal databases: Scientific Information Database, Magiran, IranDoc, and international databases: PubMed, Scopus, Cochrane, Embase, Web of Science were searched independently by two researchers using Persian keywords and their English equivalent ("Iran," "Meta-analysis," "Elderly," "Osteopenia," "Osteoporosis"). In order to finalize the search, keywords were also searched in the Google Scholar search engine without time limit until 20.06.2020. It should be noted that a combination of keywords was also searched using "OR, AND" operators.

Inclusion and exclusion criteria

Inclusion criteria

All studies that reported the prevalence of osteoporosis and osteopenia in people over 60 years in Iran entered the study. There were no language or temporal limitations on the selection of studies. However, there was a location limitation and only studies on Iranian elderly were reviewed. The criteria for measuring osteoporosis and bone mineral density were the same in all articles. Osteopenia is a term to define bone density that is not normal but also not as low as osteoporosis. By definition from the WHO osteopenia is defined by bone densitometry as a T score -1 to -2.5. Osteoporosis, according to WHO definition, is when the bone mass density is above the standard deviation of more than 2.5 below the average value of young adults (T score < 2.5).[20]

Exclusion criteria

Studies have survey at the prevalence of osteoporosis and low bone density in people under 60 years of age; studies conducted outside Iran; studies have reported osteoporosis and low bone density as mean scores; studies have examined the effect of a drug or intervention on osteoporosis or low bone density in the elderly; studies that were of low quality in the qualitative evaluation stage; and studies that not mention the number of samples or the prevalence of osteoporosis.

Qualitative evaluation of the studies

In order to assess the quality of the studies, STROBE[21] was used as the standard checklist. This checklist contains 22 items that cover different parts of a report (sampling, measurement of variables, study objectives, and statistical analysis). Depending on the type of study, all of which were descriptive-analytical and cross-sectional, we used different items on the Strobe checklist. Therefore, sections related to cohort or case-control studies were not used. One point was given to each item and some other items that were more important to us had more points. Articles that scored below 15 were removed from the meta-analysis process.

Data extraction

To reduce reporting bias and error in data collection, two researchers independently extracted data from articles and entered the extracted data into a checklist containing the following items: name of first author, study title, sample size, year of publication, year of study, place of study, age group, prevalence of osteoporosis in male, prevalence of osteoporosis in female, number of male, number of female, and prevalence of osteoporosis and osteopenia in skeletal sites including: lumbar, spine, hip, femur.

Definition of keywords

Osteoporosis: Osteoporosis is a skeletal condition characterized by decreased density (mass/volume) of normally mineralized bone. The reduced bone density leads to decreased mechanical strength, thus making the skeleton more likely to fracture. Postmenopausal osteoporosis (Type I) and age-related osteoporosis (Type II) are the most common primary forms of bone loss seen in clinical practice. Secondary causes of osteoporosis include hypercortisolism, hyperthyroidism, hyperparathyroidism, alcohol abuse, and immobilization.[22]

Osteopenia: Osteopenia is a term to define bone density that is not normal but also not as low as osteoporosis. By definition from the World Health Organization, osteopenia

is defined by bone densitometry as a T score -1 to -2.5.[23]

Elderly: Ageing, an inevitable process, is commonly measured by chronological age and, as a convention, a person aged 65 years or more is often referred to as "elderly."[24]

Statistical analysis

To analyze and combine the results of various studies, the prevalence of osteoporosis in each study was considered as a probability of binomial distribution and its variance was calculated by binomial distribution. Heterogeneity of studies was investigated using Q-test and I square (I^2). Regarding the heterogeneity of the studies, the random effect model was used to combine the results of various studies. Meta-regression was used to investigate the relationship between the prevalence of osteoporosis in the elderly and the number of samples and years of study. The data were analyzed using STATA Ver. 15 and the significance level of the test was considered 0.05.

Results

Study Selection Process: At the first stage of the search, 460 articles were found, and after reviewing the titles of articles, 195 duplicate and overlapping articles were deleted and 265 articles remained. In total, 190 articles were removed due to noncompliance with the criteria, the extract of 75 potentially related articles were reviewed, and 45 articles were excluded due to lack of access to the full text of the article. Finally, 30 appropriate papers were selected to enter the meta-analysis stage [Figure 1].

In 30 reviewed articles with a sample size of 13,347 people, the prevalence of osteoporosis in over 60 years in Iran was 34% (95%CI: 27–42%). The lowest and highest prevalence of osteoporosis in the elderly were found in the study of Cheraghi (8%)[25] and Javad-Mousavi (83.3%).[26] Considering the heterogeneity of studies, the confidence interval for each study based on the random effects model is presented in Figure 2 and Table 1.

As shown in Figures 2 and 3, the prevalence of osteoporosis and low bone density in people over 60 years in Iran were 34% (95% CI: 27, 42%) and 47% (95%CI: 41, 53%) respectively. The prevalence of low bone density is higher than the prevalence of osteoporosis, so that about one-third of the Iranian elderly suffer from osteoporosis, but about half of them have low bone density. We also found that 34% of Iranian women and 41% of men over the age of 60 suffer from osteoporosis. According to the results, the prevalence of osteoporosis is higher in men than women [Table 2].

In the analysis performed according to the age group of the subjects, the prevalence of osteoporosis in the age group of 60–64 years was 19% (95% CI: 15, 24%), 65–69 years 41% (95% CI: 33, 48%), 70–74 years 35% (95% CI: 18, 52%), and 75–79 years 41% (95% CI: 34, 47%). Also, the lowest prevalence of osteoporosis was in the age group of 60–64 years (19%) and the highest was in the age groups of 65–69 years and 75–79 years (41%). The prevalence of osteoporosis and low bone density also vary in different parts of the body. The prevalence of osteoporosis in lumbar bone 23% (95% CI: 20, 26%), spine 25% (95%

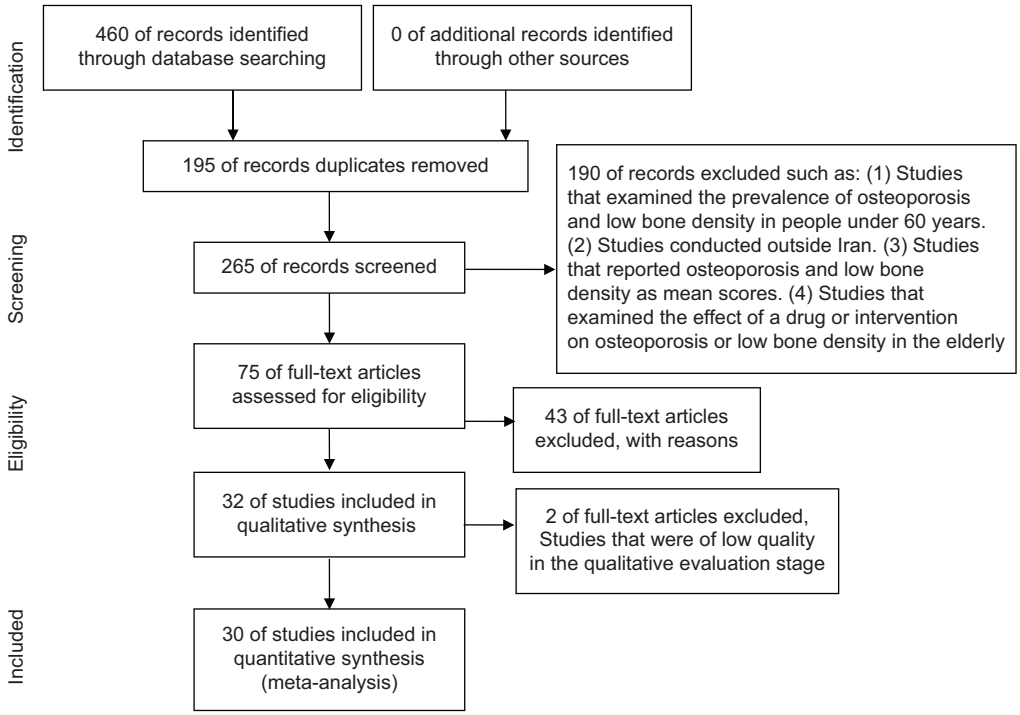

Figure 1: A flowchart of studies into the process of systematic review and meta-analysis

Table 1: Specifications of articles which entered into the meta-analysis process

Authors name	Male or female	Statistical Society	Age mean (SD)	Place of study	Sample size	Number of female	Number of male	Number of patients	Prevalence of osteopenia
Esmaeili-shahmirzadi, S, 2013[27]	F, M	Elderly	67.34	Tehran	424	154	270	145	-
Zamani B, 2010[18]	F, M	patients	71.7 (9.3)	Kashan	119	-	-	77	-
Javad-Mousavi SA, 2005[26]	F, M	Patients COPD Men	66.02	Tehran	30	-	-	25	-
Mojibian M, 2006[28]	F	Elderly women	60.57 (7.05)	Yazd	502	502	-	103	0.52
Agha ali khani M, 2012[29]	F, M	Elderly	>60	Tehran	131	-	-	26	0.362
Mazloumi-mahmoudabad S, 2014[30]	F, M	Elderly	71.93 (6.85)	Yazd	265	143	122	143	-
Aghajanpour M, 2014[31]	F	Menopausal women	60-71	Esfahan	600	-	-	-	-
Dana-siadat Z, 2011[32]	F, M	patients	66.8 (9.8)	Esfahan	240	-	-	-	-
Maddah M, 2011[33]	F	Menopausal women	62.5	Guilan	706	706	-	109	
Pourhashem Z, 2012[34]	F, M	Elderly	74	Amirkola	193	-	-	62	0.497
Pourhashem Z, 2012[34]	F, M	Elderly	60-64	Amirkola	193	-	-	45	0.616
Pourhashem Z, 2012[34]	F, M	Elderly	65-74	Amirkola	193	-	-	70	0.422
Pourhashem Z, 2012[34]	F, M	Elderly	75	Amirkola	193	-	-	78	0.432
Abbasi M, 2016[35]	M	Patients COPD Men	69	Qazvin	90	-	-	47	0.315
Abbasi M, 2016[35]	M	Patients COPD Men	60-69	Qazvin	90	-	-	-	-
Abbasi M, 2016[35]	M	Patients COPD Men	70-79	Qazvin	90	-	-	-	-
Abbasi M, 2016[35]	M	Patients COPD Men	80-89	Qazvin	90	-	-	-	-
Mojibian.M, 2009[36]	F	Menopausal women	60.87	Yazd	502	-	-	-	-
Salman-Roghani R, 2008[37]	F, M	patients LSS	67	Tehran	74	54	20	-	-
Mobini M, 2012[38]	F, M	Diabetic patients	69.15 (2.85)	Sari	160	-	-	-	-
Rahnavard Z, 2009[39]	F, M	patients	63.2	Tehran	286	237	49	-	-
Zamani B, 2010[18]	F	Women's	71.6 (9.3)	Kashan	87	-	-	-	-
Shams M, 2006[40]	F	Women's	60.7 (7.4)	Shiraz	296	-	-	-	-
Heidari B, 2017[41]	M	Men	70	Amirkola	553		553	90	-
Ebrahimpour M, 2019[42]	F, M	Elderly	69.27	Bushehr	2263	1172	1091	699	-
Cheraghi P, 2018[25]	F, M	Elderly	74.95	Hamedan	1779	990	674	142	-
Hosseini SR, 2014[43]	F, M	Elderly	68.55	Amirkola	1616	733	883	625	-
Hasani-ranjbar Sh, 2019[44]	F, M	Adults	62.67	Sanandaj and Arak	585	354	231	-	-
Ghadimi R, 2018[45]	M	Men	68.99	Amirkola	611	-	-	102	0.561
Honarvar B, 2019[46]	F, M	Elderly	67	Shiraz	386	200	186	175	-

CI: 19, 31%), hip 35% (95% CI: 7, 62%), and femur was 23% (95% CI: 15, 31%). The prevalence of low bone density in lumbar bone 41% (95% CI: 19, 63%), spine 30% (95% CI: 15, 46%), and femur was 35% (95% CI: 21, 48%). In lumbar, spine, and femur bones, the prevalence of low bone density was higher than the prevalence of osteoporosis [Table 2].

Discussion

The study was performed to investigate the prevalence of osteoporosis and low bone density in people over 60 years in Iran. Since the elderly are one of the most vulnerable groups of this disease, the need for such a study seems necessary and can be a basis for health care decisions. In 30 studies with a sample size of 13,347 people, the prevalence of osteoporosis in people over 60 years 34% (95% CI: 27, 42%) and the prevalence of low bone density was 47% (95% CI: 41, 53%).

Hemmati *et al*.'s study estimated the prevalence of osteoporosis and osteopenia in postmenopausal women to be 32 and 51%, respectively.[45] The results of this study are consistent with the results of the current meta-analysis. This shows that in Iran, the prevalence of osteopenia in the elderly is lower than postmenopausal women, but the

Table 2: Prevalence of osteoporosis and low osteopenia in the subgroups

Subgroups			Prevalence (95%CI)	*P*	I^2 (%)
Osteoporosis	Sex	Total	34 (95%CI: 27, 42)	<0.001	98.7
		Men	34 (95%CI: 10, 58)	<0.001	99.4
		Women	41 (95%CI: 23, 59)	<0.001	99.5
	Age group	60-64	19 (95%CI: 15, 24)	0.016	76
		65-69	41 (95%CI: 33, 48)	<0.001	97
		70-74	35 (95%CI: 18, 52)	<0.001	99
		75-79	41 (95%CI: 34, 47)	-	-
	Bone	Lumbar	23 (95%CI: 20, 26)	0.188	37.3
		Spine	25 (95%CI: 19, 31)	<0.001	95
		Hip	35 (95%CI: 7, 62)	<0.001	99.1
		Femur	23 (95%CI: 15, 31)	<0.001	97.9
Low Osteopenia	Total		47 (95%CI: 41, 53)	<0.001	87.2
	Bone	Lumbar	41 (95%CI: 19, 63)	<0.001	99
		Spine	30 (95%CI: 15, 46)	<0.001	98
		Femur	35 (95%CI: 21, 48)	<0.001	98.3

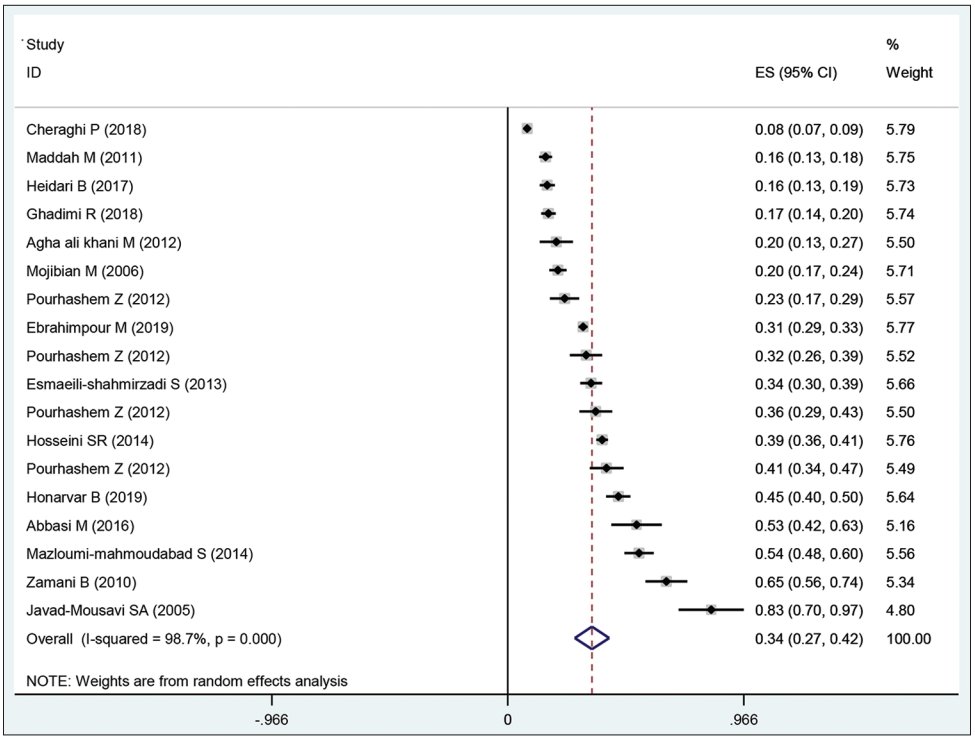

Figure 2: The prevalence of osteoporosis in Iranian elderly (95% CI) in terms of the author's name and years of research based on the random effects model. The midpoint of each section reveals the prevalence of elderly osteoporosis in each study. The lozenge shape shows the prevalence of osteoporosis in Iranian elderly for all the studies

prevalence of osteoporosis in the elderly is higher than postmenopausal women. In addition, in the meta-analysis of Hemmati *et al*.,[45] results show that the highest prevalence of osteoporosis was reported in the lumbar (32%) and the lowest prevalence of osteoporosis in the spine and hip (21%), which is not consistent with the results of our study.

The results of Doosti Irani study show that the prevalence of osteoporosis in lumbar was 17% and the prevalence of osteopenia was 35%. This study shows that the prevalence of osteopenia in Iranians people is higher than the prevalence of osteoporosis in them,[46] which is consistent with the results of our study, and this is a risk factor or alarm to increase the prevalence of osteoporosis in Iran.

Since about 25% of the Canadian population will be over 65 by 2041, it is estimated that osteoporosis will increase in the next few decades.[47] In the study of England in 2010, we found that the prevalence of osteoporosis in the elderly was 72% and the prevalence of low bone density was 43%, and the number of elderly people in the

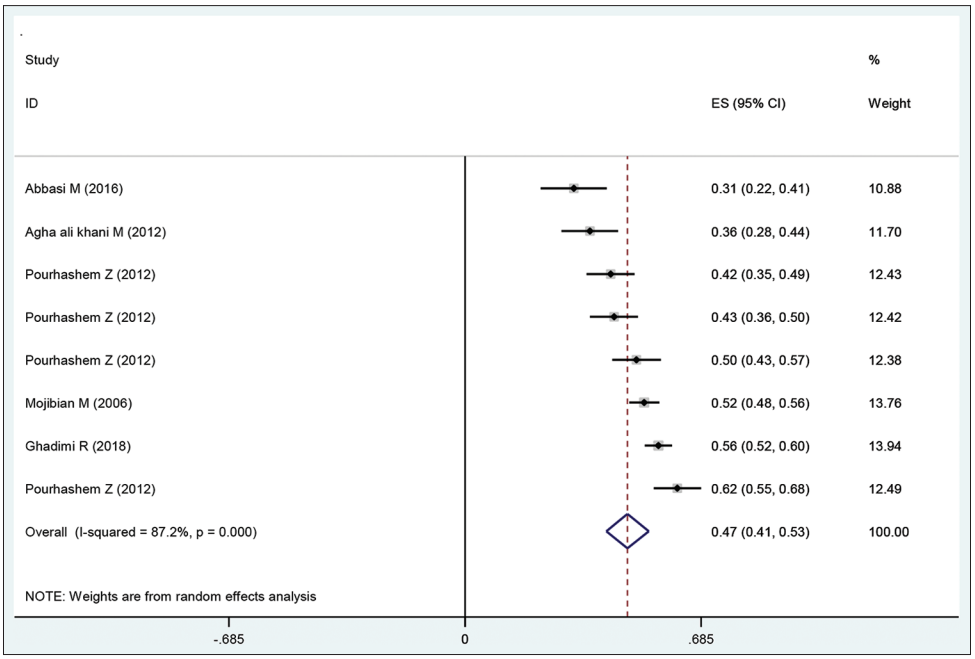

Figure 3: The prevalence of low osteopenia in Iranian elderly (95% CI) in Iran based on the author's name and years of research based on the random effects model. The midpoint of each section reveals the prevalence of low osteopenia in the elderly in each study. The lozenge shape shows the prevalence of low Osteopenia in Iranian elderly for all studies

study was 199 (113 males and 86 males).[48] In a study in Brazil, 73 patients over 65 years of age, hip fracture ratio of women to men was 3.3 to 1.[49] In a study by D.K. Chin in South Korea (2005), 759 elderly people (422 women and 337 men) with an average age of 62.55 years were evaluated. The prevalence of osteoporosis was 25.55% (51.3% for women and 14.5% for men) and low bone density (41.1% for women and 46.1 for men).[50] In these studies, the prevalence of osteoporosis in elderly women is higher than that of the elderly, which is not consistent with the results of our study. Planning short and simple educational programs has a great impact on the control of the disease and its complications by the patient.[51]

The prevalence of osteoporosis was reported to be 68.7% of women aged 65–74 in Chuncheon.[52] In a study by Jang *et al*. (2006)[52] on 362 elderly Dutch women, the prevalence of osteoporosis in women aged 74–75 was 67.5% in 75 years old and older women. The prevalence of osteoporosis in the elderly was higher in our studies than in our study.

The prevalence of osteoporosis in the elderly was 23% in the lumbar region, 25% in spine, 23% in femur neck, and 35% in hip joint. The prevalence of lower osteopenia was 41% in the lumbar region, 30% in the spine, and 35% in the femur neck. In Iranian elderly, the prevalence of osteoporosis in the hip area is higher than other areas and prevalence of osteopenia in the **Lumbar** is higher than other areas. In a study by Rahnavard *et al*.,[39] 70% of women and 50% of men were observed with hip osteoporosis and osteopenia. In addition, the prevalence of osteoporosis in the spine in Korean women aged 60–69 years was 62.2% and in women aged 70–79 was 88.9%. These figures were 35.8 and 88.4% for the hip area.[53] It can be observed that the prevalence of osteoporosis in the spine and hip of the Korean elderly is significantly higher than that of the Iranian elderly. In a UK study on 199 elderly, the prevalence of osteoporosis in the forearm was 14%, lumbar spine 8.5%, and proximal femur 8.2%.[48]

The prevalence of osteoporosis in Iranian elderly was also determined by the age group of the subjects. The prevalence of osteoporosis in the elderly is 60–64 years old, 19% (95% CI: 15–24%), the elderly is 65–69 years old, 41% (95% CI: 33–48%), the elderly is 70–74 years old, 35% (95% CI: 18–52%), and the elderly is 75–79 years old, 41% (95% CI: 34–47%). In a study done by Mojibian *et al*.[36] among elderly women in the age group of 60–69 in Yazd, the prevalence of osteoporosis was 51.4% and osteopenia was 22.7%, and in the age group of 70 years and above; these values were 44.3 and 52.5%. In a study among Saudi women, the prevalence of osteoporosis in women aged 60–69 was 62% and in the 70–79 years old, elderly was 73.8%.[54] The prevalence of osteoporosis in Saudi elderly seems to be higher than Iranian elderly.

Regarding the generalization of the results of this study to the whole Iranian elderly, given that the number of samples varied in different regions and in some regions or provinces of Iran there was no study in this field, and in contrast, in some areas of studies or other provinces more done. Therefore, studies have not been distributed uniformly in Iran. However, if the prevalence of osteoporosis in the whole of the Iranian elderly is similar, the outcome of this study could be generalized to the whole country because

it can be assumed that these 30 studies with a sample of 13,347 people were randomly selected from among the elderly in Iran and can be generalized to the whole country by the result of this study. If the assumption is not correct, the result obtained from this study cannot be generalized to the whole country and stratify sampling should be used. The sample size in each study is proportional to the population of the elderly of the same province. It would have been possible to provide a more accurate estimate of the prevalence of osteoporosis in Iranian elderly people. Of course, according to available data in Iran, it is not possible to estimate the prevalence of osteoporosis in Iranian elderly by categorical sampling method. The best and most economical method for estimating the prevalence of osteoporosis in Iranian elderly is the same method of meta-analysis.

Limitations of study

The insufficient information of some articles, lack of uniform distribution of studies in various regions of Iran, and many studies did not investigate the prevalence of osteoporosis and low osteopenia in all parts of the elderly. This estimate of the prevalence of osteoporosis and low bone density in Iran may be different from the actual rate of prevalence of osteoporosis and low bone density in Iran because, first, no study has been conducted in some regions of Iran. Second, there has been no use of classification sampling to estimate the prevalence of osteoporosis. However, now this is perhaps the most accurate estimate of the prevalence of osteoporosis in Iran.

Conclusions

The prevalence of low bone density in people over 60 years is higher than the prevalence of osteoporosis in them. About one-third of Iranian elderly people suffer from osteoporosis, but about half of them have low bone density. On the other hand, the prevalence of osteoporosis is higher in men than women. The highest prevalence of osteoporosis was reported in hip and the highest prevalence of osteopenia was reported in lumbar. Due to the high prevalence of osteoporosis and bone fractures in the Iranian elderly, health policymakers should encourage people in elderly to exercise, and follow a healthy and balanced diet can get calcium, vitamin D, and other substances important nutrients help.

Ethical considerations

Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the authors.

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Nil.

Conflicts of interest

The authors declare that they have no conflict of interest regarding the contents of this article.

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Supplementary

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((Low Bone Density[Title/Abstract] OR Osteopenia[Title/Abstract] OR Metabolic Bone Disease[Title/Abstract]) AND (Osteoporoses[Title/Abstract] OR Osteoporosis[Title/Abstract] OR Age-Related Bone Loss[Title/Abstract])) AND (Iran[Affiliation])) AND (elderly[Title/Abstract])