A Study of Risk Factors: Comparison between Osteoporosis and Osteopenia in the District of Patiala

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Abstract

The purpose of the study was to compare the risk factors of Osteoporosis and Osteopenia based on age, sex, education, address, occupation, BMI, Muscle Strength, VAS, POMA, Physical activity, Diet and Medical status. A total of 396 individual were assessed for Bone mineral density (BMD). Out of these 22 Osteoporotic subjects and 22 Osteopenic subjects were selected randomly with Inclusion Criteria: Subject of both sexes, age more than 40 years, BMD suggestive of Osteoporosis and Osteopenia, Subjects who were able to walk with or without walking aid and Exclusion Criteria: Individuals who were on medication known to influence bone metabolism, Individuals undergone prior balance training, Hemiplegia, Parkinson's diseases, Polyneuropathy, Grade 4 Osteo-arthritis, People suffering from acute illness and Non-ambulatory subject. Data was collected individually which was later tabulated under 2 major groups (Osteoporosis and Osteopenia). The mean values for various risk factors namely age, sex, education, social class, BMI, total muscle strength, POMA, physical activity, dietary calcium, vitamin D & Phosphorus, Caffeine, alcohol, steroids and medical status were compared between osteoporosis and osteopenia by using paired t-test. A highly significant value was found for Bone mineral density ($t = 13.030$, $p = .000$) and use of steroids ($t = -8.450$, $p = .000$). The study highlights the crucial role played by steroids. However, this study did not reveal any significant difference for other risk factors between Osteoporosis and Osteopenia. This suggests that both Osteoporotic and Osteopenic subjects have comparable risk factors, though Osteopenic subjects have better bone mineral density than Osteoporotic subjects. It is concluded that people with use of steroids are at a higher risk to develop Osteoporosis rather than Osteopenia following which their Bone mineral density should be assessed specifically.

Keywords: Osteoporosis, Osteopenia, Bone Mineral Density

INTRODUCTION

Osteoporosis is a systemic skeletal disease characterised by low bone mass and micro-architectural deterioration of bone tissue that leads to an increased fractures susceptibility *(Faulkner et al, 1993)*. The resulting low energy fractures are a major health concern, causing great suffering to those afflicted and placing a heavy burden on the society and health care system *(Johnell & Kani, 2005)*. This silently progressive metabolic bone disease is widely prevalent in India, and Osteoporotic fractures are the common cause of morbidity and mortality in adult Indian men and women *(Gupta, 1996)*.

Direct measurements of bone density in the clinical relevant sites are necessary to determine whether the individual is suffering from osteoporosis or not. There are many kinds of equipments available now-a-days. In the present study bone densitometer named 'Osteopro' has been used to check bone

mineral density at the calcaneum which is a very commonly measured clinical site that is cost efficient and less time consuming. Diagnostic categories are usually expressed as T-scores:

Normal BMD	**1 SD below young adult**
Osteopenia	**Between 1 SD and 2.5 SD below young adult**
Osteoporosis	**2.5 SD or more below young adult**

Thus, Osteopenia is a condition where bone mineral density is lower than normal which means the bones are weak and are getting closer to a condition termed as Osteoporosis.

The incidence of Osteoporosis is the highest in women, but the incidence in men is expected to triple over the next fifty years *(Gullberg et al, 1997)*. Mortality is greater in patients who have Osteoporosis in middle aged and older population *(Lee et al, 2005)*.

Tanaka et al. did a study to analyze the risk factors for osteoporosis in men (50 years and above) and observed body mass index, present physical activity and age as independent risk factors for osteoporosis *(Tanaka et al, 2001)*. *Lau et al. (2001)* in a study in 4 Asian countries that is Singapore, Malaysia, Thailand and Philippines found low dietary calcium intake, lack of physical activity, and alcoholism to be risk factors for hip fractures. Meyer et al. in a population based matched case control study in a 50 years population at Oslo, Norway found hip fracture associated with low grip strength and decreased levels of physical activity. But, length of education and total food intake was inversely related to hip fracture *(Meyer et al, 1995)*. *Cooper et al. (1992)* in a study on age stratified random sample of white women residing at Rochester, Minnesota found Caffeine consumption by elderly women with already a calcium balance impairment as a risk factor for osteoporosis. Another study done by Van staa on inhaled corticosteroids revealed positive results of increased risk of fracture with inhaled cortico-steroids mainly at the hip and spine *(Vanstaa et al, 2001)*.

Thus, a wide variety of risk factors for osteoporosis have been found and studied till date in various parts of the world. Nevertheless, all previous studies seem to be limited to three or four risk factors. Additionally no study has been reported to compare these risk factors between osteopenia and osteoporosis. Hence, this study was aimed to compare various risk factors namely age, sex, education, social class, body mass index (BMI), total muscle strength, POMA, Physical activity, dietary calcium, Vitamin D, Phosphorus, caffeine, alcohol, steroids and medical status for osteoporosis and Osteopenia in the district of Patiala (Punjab).

Aims & Objectives

- To study the risk factors of osteoporosis based on age, sex, education, address, occupation, BMI, Muscle Strength, VAS, POMA, Physical activity, Diet and Medical status.
- To study the risk factors of osteopenia based on age, sex, education, address, occupation, BMI, Muscle Strength, VAS, POMA, Physical activity, Diet and Medical status.
- To compare the risk factors of osteoporosis and osteopenia based on age, sex, education, address, occupation, BMI,

Muscle Strength, VAS, POMA, Physical activity, Diet and Medical status.

Materials and Methods

Study Design: Double group, single measure study.

The Institutional Ethical committee approved the study. Subjects were taken from the university campus, neighboring residential colonies ,old age home and de-addiction centre and were included if they fulfilled the inclusion and exclusion criteria. A total of 396 individuals were assessed for bone mineral density (BMD) with "Osteopro", a calcaneum ultrasound bone densitometer from 29th August 2009 to 28th October 2010 at the Department of Physiotherapy, Punjabi University, Patiala (Punjab).

Out of these 22 osteoporotic subjects and 22 osteopenic subjects were selected randomly with Inclusion Criteria: Subject of both sexes, age more than 40 years, BMD suggestive of osteoporosis and osteopenia, Subjects who were able to walk with or without walking aid and Exclusion Criteria: Individuals who were on medication known to influence bone metabolism, Individuals undergone prior balance training, Hemiplegia, Parkinson's diseases, polyneuropathy, Grade 4 osteo-arthritis, People suffering from acute illness and Non-ambulatory subject. All 44 subjects voluntarily entered the study and informed consent form was obtained from each subject.

A calcaneum ultrasound bone densitometer instrument named as 'osteopro' was used for the study wherein the density of calcaneum was checked for bone mineral density testing.

Calcaneum was the choice for measurement as calcaneum bone density is closely related to bone density of vertebrae and femoral regions and 90 % of which consists of cartilage which gives us an advantage to detect osteopenia and osteoporosis easily within 15 to 20 seconds by using a osteopro which is cost efficient to the subjects and the society.

The 'osteopro' report gives the value for T- scores (% young adult), Z – score (% age matched), osteoporosis index (OI),speed of sound (SS), osteoporosis progressing ratio(OPR) and judgement for degree of danger which is shown in the graph by a red colour for osteoporosis, yellow colour for osteopenia and blue colour region for normal bone mineral density.

Data was collected individually which was later tabulated under 2 major groups (osteopenia and osteoporosis).

Results

The Paired Sample T –test has been used for this study to compare the mean between the two groups to find out the statistical difference between the two.

Table 1 shows comparison of mean values of Bone Mineral Density between osteoporotic and osteopenic subjects. A highly significant value has been found for bone mineral density (t = 13.030, p= .000).

Table 1: comparison of mean values of Bone Mineral Density between osteoporotic and osteopenic subjects

	Osteoporosis			Osteopenia					
Parameter	Mean	SD	SEM	Mean	SD	SEM	Paired sample t-test	Df	Sig. (2-tailed)
Bone Mineral Density	-3.7223	.7925	.1690	-1.7514	.5834	.1244	13.030	21	.000

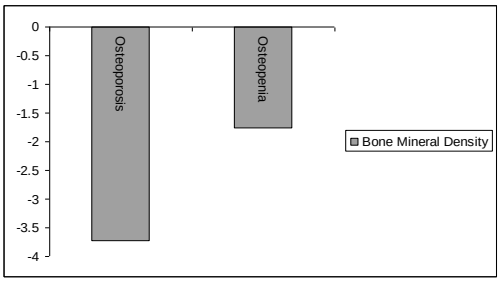

Figure 1: Bone Mineral Density of Osteoporotic & Osteopenic groups

Table – 2 shows comparison of mean values for demographic Parameters between osteoporotic and osteopenic subjects. No significant difference was found for demographic parameters of the two groups which were analysed.

Table 2: Comparison of demographic variables between Osteoporotic and Osteopenic subjects

	Osteoporosis			Osteopenia					
Parameter	Mean	SD	SEM	Mean	SD	SEM	t-test	df	Sig. (2-tailed)
Age	52.36	10.86	2.31	52.04	11.14	2.37	-0.09	21	0.92
Sex	1.50	0.51	0.109	1.64	49.24	0.11	0.90	21	0.38
Education	3.73	2.16	0.461	2.50	2.39	0.51	-1.50	21	0.15
Social	3.36	1.09	0.233	3.27	1.28	0.27	-0.23	21	0.82

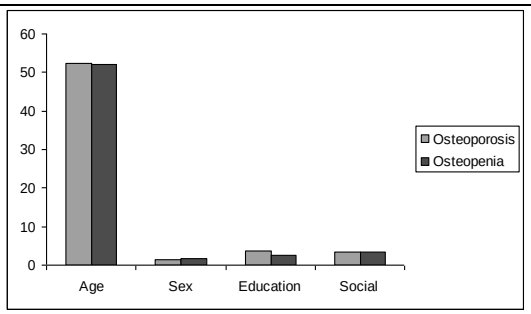

Figure 2: Comparison of demographic variables of osteoporotic and osteopenic groups

Table – 3 shows comparison of mean values of physical status between osteoporotic and osteopenic subjects. No significant values were found for physical status parameters between the two groups indicating that these parameters are common for both osteoporotic and osteopenic subjects.

Table 3: Comparison of physical status variables between Osteoporotic and Osteopenic subjects

	Osteoporosis			Osteopenia			t-test	Df	Sig. (2-tailed)
Parameter	**Mean**	**SD**	**SEM**	**Mean**	**SD**	**SEM**			
Body Mass Index	**24.99**	**3.55**	**0.76**	**25.49**	**3.10**	**0.66**	**0.45**	**21**	**0.65**
Muscle Strength	**131.42**	**43.31**	**9.23**	**143.47**	**47.28**	**10.08**	**0.88**	**21**	**0.39**
POMA	**31.73**	**6.25**	**1.33**	**29.91**	**5.92**	**1.26**	**-0.85**	**21**	**0.41**
Physical Activity	**0.55**	**0.80**	**0.17**	**0.77**	**0.87**	**0.19**	**1.23**	**21**	**0.23**

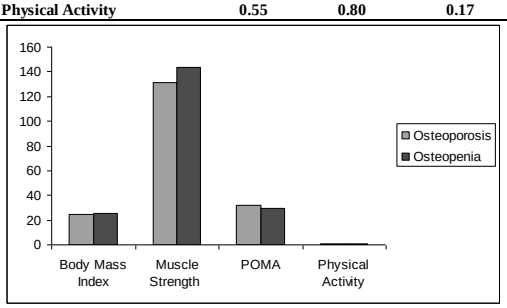

Figure 3: Comparison of BMI, muscle strength, POMA and physical activity between the osteoporotic and osteopenic groups

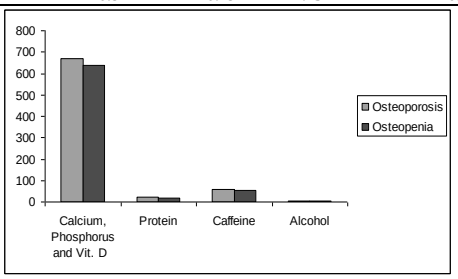

Figure 4: Comparison of dietary intakes of Ca\P\Vit D, protein, caffeine and alcohol between the osteoporotic and osteopenic groups

Table – 4 shows comparison of mean values of dietary parameters between osteoporotic and osteopenic subjects. No significant values were found for dietary parameters indicating that these parameters are common for both osteoporotic and osteopenic subjects.

Table 4:Comparison of mean dietary intakes between Osteoporotic and Osteopenic subjects

	Osteoporosis			Osteopenia			t-test	Df	Sig. (2-tailed)
Parameter	Mean	SD	SEM	Mean	SD	SEM			
Ca, P and Vit. D	669.9	354.6	75.6	639.8	339.4	72.4	-0.23	21	0.82
Protein	21.6	9.2	1.9	18.8	9.3	2.0	-0.82	21	0.42
Caffeine	60.3	20.3	4.3	55.6	16.6	3.6	-0.89	21	0.38
Alcohol	6.41.0	11.4	2.4	3.6	9.9	2.1	-0.78	21	0.45

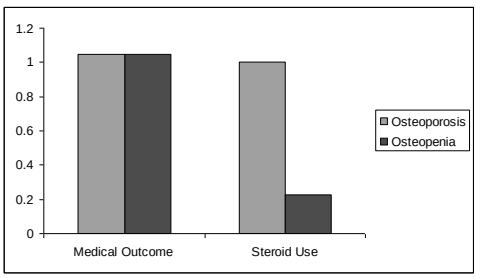

Figure 5: Comparison of medical outcome and steroid use between Osteoporotic and Osteopenic subjects

Table – 5 shows comparison of mean values for medical status between osteoporotic and osteopenic subjects. A highly significant value was found for steroid use (t= -8.450, p= .000) indicating that subjects on steroid use are at a higher risk to develop osteoporosis.

Table 2: Comparison of medical outcome and steroid use between Osteoporotic and Osteopenic subjects

	Osteoporosis			Osteopenia			t-test	Df	Sig. (2-tailed)
Parameter	**Mean**	**SD**	**SEM**	**Mean**	**SD**	**SEM**			
Medical Outcome	**1.045**	**0.99**	**0.21**	**1.05**	**0.89**	**0.19**	**0.00**	**21**	**1.00**
Steroid Use	**1.00**	**0.00**	**0.00**	**0.23**	**0.43**	**9.145E-02**	**-8.45**	**21**	**0.00**

DISCUSSION:

The comparison of osteoporotic individuals with osteopenic individuals revealed that statistically no significant difference was found for all risk factors studied in the present study except the use of steroids. Consequently, results of present study have established that risk factors for development of Osteopenia and Osteoporosis are nearly the same in nature including age, sex, education, social class, body mass index (BMI), total muscle strength, POMA, Physical activity, dietary calcium, Vitamin D, Phosphorus, caffeine, alcohol, steroids and medical status.

To the knowledge of authors, this is the first study comparing the risk factors between osteoporosis and osteopenia. Previously, Babu et al. found in their study that prevalence of Osteoporosis and Osteopenia increase steeply after the age of 50 years[11] however, it was not the comparative study. Most of the studies have been studies of risk factors with reference to bone mineral density or occurrence of fractures in patients of osteoporosis. For example, Stevenson et al. found alcohol consumption, lack of regular exercise as important risk factors in decreasing bone density and hence increasing risk of osteoporosis *(Stevenson et al, 1989)*, whereas, *Rowlands et al. (2004)* suggested that calcium intake and vigorous activity have a synergistic effect on bone mass in children. A study by *Cappuccio et*

al (1999) revealed that higher blood pressure in elderly white women is associated with increased bone loss at the femoral week which may contribute to risk of hip fractures. In a study done by Hernandez- Avila et al. on 484 U.S. women between 34-59 years found a positive relation between Caffeine intake and risk of hip fracture and alcohol intake with increased risk of hip and forearm fracture[15]. An important observation was made by Van Staa et al. stating that oral cortico-steroid therapy given in respiratory diseases increase risk of fracture at hip and spine and also stated a rapid offset of these steroids will reduce the risk of fracture at these skeletal sites simultaneously[16]. A Study done by Kanis et al. on 42,500 men and women revealed that prior and current exposure to corticosteroids confers an increased risk of fracture[17]. A study by Adinoff reveals that long term steroid therapy in asthmatic patients in associated with decreased trabecular bone density and an increased prevalence of ribs and vertebral fractures[18].

Thus, it is apparent that risk factors such as age, sex, calcium intake, alcohol consumption, lack of regular exercise, higher blood pressure, Caffeine intake and steroid therapy have been studied enormously in various parts of the world. However, no study has actually compared the level of these risk factors between osteoporosis and osteopenia.

The present study was the comparative study between osteoporosis and osteopenia, The findings highlight the crucial role played by steroids in the development of osteoporosis. However, this study did not reveal any significant difference for other risk factors between osteoporosis and osteopenia which suggests that both osteoporotic and osteopenia subjects have comparable risk factors though osteopenic subjects have a better bone mineral density than osteoporotic subjects. So, subjects on steroid medications are at a higher risk to develop osteoporosis rather than being limited to osteopenia. Additionally, the findings of present study imply that all individuals with osteopenia should be provided with appropriate therapeutic intervention so that the condition does not translate into osteoporosis.

Another important observation was that the diagnosis of bone mineral density by means of calcaneum ultrasound bone mineral densitometer is practical and economical even at the very basic community level which makes it a choice for various researches and studies including the present study.

This study also indicates that individuals who are on steroid medications prescribed for common conditions like asthma and arthritis etc. should be tested for bone mineral density at frequent and regular intervals to detect and monitor their bone mineral density to start early intervention of treatment if the detected values are lower than the normal suggested values.

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