



## Effects of Age on Hand Grip Strength and Bone Mineral Density in Postmenopausal Women

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### ABSTRACT

*Aim: This study examined the influence of age on grip strength and BMD in postmenopausal women with osteoporosis. Method: 90 postmenopausal women were enrolled in this study. The age ranged from 50 to 80 years. The subjects were further divided into three groups with the age range of 10 years i.e. 51-60 years, 61-70 years and 71-80 years. Results: The F-value of Handgrip as well as BMD is significant as its p-value is less than 0.05. It can be seen that the difference between the Decade-1 and Decade-2 in Handgrip strength was not significant (p-value=0.263) but in case of BMD the p-value was 0.001 which is significant at 0.05 level. The mean difference between Decade-1 and Decade-3 as well as Decade-2 and Decade-3 in both the Handgrip strength and BMD was significant at 0.05 levels. Conclusion: With advanced age, BMD and Grip strength is gradually decreased of the elderly women.*

**KEYWORDS : Grip Strength, Osteoporosis, Ageing, Post menopause, BMD**

### 1. Introduction:

Advancing age is associated with profound changes in body composition such as decreased bone mineral density (BMD), sarcopenia, and hormonal fluctuations.<sup>[1][4]</sup> After 30 years of age, BMD decreases at an average rate of 1% per year.<sup>[5]</sup> Muscular strength also declines during this time, with a gradual 10% loss from 25 to 50 years. After age 60, humans experience a 40% decline in lifetime muscle mass.<sup>[6]</sup>

Quantitative ultrasound of bone is a relatively new technique to assess bone mineral density; it is easy, cheap and suitable for public screening.<sup>[7]</sup> The site-specific relationship between muscle strength and bone mass previously has been demonstrated in grip strength and forearm bone density in adults and elderly.<sup>[8]</sup> A majority of the studies were conducted in white adolescents to establish the association between muscle strength and bone mass. There is uncertainty when extrapolating from these studies to Asians because of substantial differences in peak bone mass and body size in Caucasians when compared with their Asian peers.<sup>[9]</sup>

There is no study in the literature about osteoporosis methods and grip strength in our region. Most normative data are based on the western literature and may not apply. This information can provide clinicians with accurate guidelines for the normal changes in muscle strength and BMD throughout aging. Women in Bengal have inadequate knowledge about the severity of osteoporosis and unaware about the risks of fracture after menopause without any symptoms.

Therefore, the focus of this study was to evaluate the effect of aging on grip strength and bone mass of postmenopausal women in West Bengal, India.

### 2. Materials and Methods:

This study was performed from June 2013 to October 2013 involved 90 healthy postmenopausal women volunteers who satisfied the inclusion criteria. Postmenopausal women over 50 yr of were recruited; menopause was defined as the absence of menstruation for at least 1 yr. All were residents of old-age home from Bolpur Subdivision. The age ranged from 50 to 80 years. The subjects were further divided into three groups with the age range of 10 years i.e. 51-60 years, 61-70 years and 71-80 years. The ethical consideration was approved by the Institutional Ethical Committee.

All subjects were asked to read and sign an informed consent document prior to participation. All the data were collected by trained technicians, medical experts and experienced researchers blinded to group assignment.

**2.1 BMD Testing:** Bone mineral density was measured by ultrasound bone densitometry (Sunlight Omnisense Bone Sonometer 7000S) at distal radius of the dominant arm of the subjects.

**2.3 Hand Grip Strength Testing:** The subject was seated upright with shoulder in adduction: The elbow was flexed at 90 degree. The wrist was in a neutral position facing inwards. The device handle was opened to fit onto the palm with the fingers in 90 degree flexion at the proximal and distal interphalangeal joints with the thumb in 90 degree abduction. Grip strength (dominant arm), or torque, was measured

in KG. The mean value of the 3 most powerful grips was recorded and used for comparison.

**2.4 Statistical Analysis:** Descriptive statistics and One-way ANOVA were used to determine the difference among the age groups. If a statistical difference existed, LSD post-hoc test was used to determine which group was different from the other groups, with alpha level set at 0.05. The SPSS-17 software statistical program was used to analyze the data.

### 3. Results:

This study included 90 postmenopausal women with 3 decades of age. Each group consist 30 subjects. The mean age of first decade was 53.0 ± 3.25 years, the second decade was

65.93 ± 2.49 years and third decade was 75.06 ± 2.54 years. The mean BMI of all the three groups were 25.90 ± 5.05 (k.g/m<sup>2</sup>), 21.41 ± 2.95 (k.g/m<sup>2</sup>) and 24.40 ± 3.97 (k.g/m<sup>2</sup>) respectively. Age was a strong influencing factor on handgrip strength (Fig. 1) and handgrip strength decreased with age.

**Table 1: Characteristics of subjects grouped by decade (mean ± SD); n= number of subjects.**

Decade	Age (yrs.)	BMI(k.g/m <sup>2</sup> )	Hand Grip Strength(k.g)	BMD (T-score)
1. 51-60(n=30)	53.0±3.25	25.90±5.05	17.09±2.59	-2.74±0.21
2. 61-70(n=30)	65.93±2.49	21.41±2.95	16.03±2.39	-3.10±0.30
3. 71-80(n=30)	75.06±2.54	24.40±3.97	11.76±2.66	-3.62±0.29

The F-value of Handgrip as well as BMD is significant as its p-value is less than 0.05. Thus the null hypothesis of no difference among the means of the three groups (Decade-1, decade-2, and Decade-3) may be rejected at 5% level. Since the F-value is significant, Post hoc test was applied which was shown in Table 3. It can be seen that the difference between the Decade-1 and Decade-2 in Handgrip strength was not significant (p-value= 0.263) but in case of BMD the p-value was 0.001 which is significant at 0.05 level. Interestingly the mean difference between Decade-1 and Decade-3 as well as Decade-2 and Decade-3 in both the Handgrip strength and BMD was significant at 0.05 level.

**Table 2: ANOVA table for the data on Handgrip strength and BMD**

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Handgrip	Between Groups	238.507	2	119.254	18.245*	0.000
	Within Groups	274.516	87	6.536		
	Total	513.023	89			

BMD	Between Groups	5.883	2	2.942	38.769*	0.000
	Within Groups	3.187	87	0.076		
	Total	9.070	89			

**Table 3: Post Hoc comparisons of means using LSD test**

Multiple Comparisons					
LSD: Post Hoc					
Dependent Variable	(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.
Handgrip	Decade-1	Decade-2	1.06000	0.93353	0.263
		Decade-3	5.32667*	0.93353	0.000
	Decade-2	Decade-1	-1.06000	0.93353	0.263
		Decade-3	4.26667*	0.93353	0.000
	Decade-3	Decade-1	-5.32667*	0.93353	0.000
		Decade-2	-4.26667*	0.93353	0.000
BMD	Decade-1	Decade-2	0.35333*	0.10058	0.001
		Decade-3	0.88000*	0.10058	0.000
	Decade-2	Decade-1	-0.35333*	0.10058	0.001
		Decade-3	0.52667*	0.10058	0.000
	Decade-3	Decade-1	-0.88000*	0.10058	0.000
		Decade-2	-0.52667*	0.10058	0.000

\*. The mean difference is significant at the 0.05 level.

**Discussions:**

In this study, the hand grip strength not remained stable throughout the second and third decade of life. A gradual significant loss started at the third decade in these groups of subjects. It is not clear if the reduction in muscle strength during the third decade was due to age-related changes or from a sedentary lifestyle, or a combination of both. The present study found an expected age related decline in BMD consistent with a loss of bone after the menopause. In agreement with previous studies, aging was also found to be associated with a significant decrease in muscular strength. The gradual declines in grip hand strength and BMD as a result of aging have also been reported in various communities.<sup>[16]-[19]</sup> This decline is related to various normal aging processes,<sup>[20],[21]</sup> lifestyle and vocation, behavioral, cultural and physical activities.<sup>[22]</sup> The results of this study, like those of others, demonstrate

a relationship between age, upper extremity muscle strength,<sup>[16],[23]</sup> In this study the loss of strength began during the third decade of life. In another study, isometric grip hand strength began to decline in the fourth or fifth decade.<sup>[24]</sup> This study confines the extreme importance of muscle strength for activities of daily living. A regular endurance and muscle strengthening program may be helpful in maintaining functional activity.<sup>[28]</sup> Muscle strength has an integral role in the structure and function of joints and bone mass. The degree to which muscle strength loss in the third decade of life will affect the structure and function of joints and bone mass in the elderly is a question that needs to be answered. Health care expenditures increase when subjects begin to lose their functional ability. This could imply that people aged 30 and older in India may spend more money on health care than the younger population. Consequently, to lower health care expenditure for people aged 40 and over, it is necessary to find a proper solution to reduce the reported loss in functional ability.

**Conclusion:**

With advanced age after the menopausal years, BMD and Grip strength is gradually decreased of the elderly women. Subjects in their third decade of life and above are at increased risk for a variety of physical and functional limitations. Further research should address the potential use of muscle strength assessment in screening osteoporosis, and the effects of muscle strengthening exercise on bone health in the post-menopausal population in India.

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