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Effect of Menopause on Handgrip Strength in Middle-Aged Women of Amritsar, Punjab, India

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Abstract: ***Introduction: Women may experience a decline in physical function during menopause due to decreased physical strength. The objectives of the present study were to estimate the handgrip strength of pre- and post-menopausal women of Amritsar, India, and to search its correlations with selected anthropometric variables studied. Materials and Methods: A total of 802 purposively selected middle-aged women (403 pre-menopausal, age group 35-45 years and 399 post-menopausal, age group 46-55 years) were considered as samples. To serve these purposes, dominant and non-dominant handgrip strength and three anthropometric variables, viz. height, weight and body mass index (BMI) were measured on all the subjects. Age of the subjects was estimated from their date of birth from urban areas. But in case of rural areas where birth records were not available, the age of the subjects was assessed with the association with some notable events such as age at marriage, age of the first child, any important festival, etc. Results: Pre-menopausal women had higher mean values in dominant and non-dominant handgrip strength and height, and lesser mean values in age weight and BMI then their post-menopausal counterparts, showing statistically significant differences (p≤0.01-0.001) in dominant and non-dominant handgrip strength, age and height. Significant positive correlations (p ≤ 0.017-0.001) of dominant handgrip strength were found with non-dominant handgrip strength and height both in pre- and post-menopausal women. Conclusion: In conclusion, it could be stated that the post-menopausal women had lower handgrip strength than their pre-menopausal counterparts.***

Keywords: Pre- and post-menopausal women. Handgrip strength. Anthropometric variables.

1. Introduction

1) Menopause is associated with significant reduction in circulating estrogen levels in females. It plays a key role in the maintenance of many tissues and organs function including skeletal muscles, nerves and neural tissues in females (Stephen et al., 2005). In fact, aging is one of the key factors responsible for decline in muscle mass and is associated with sarcopenia (Morley et al., 2001) and increase of catabolic factors such as oxidative stress and inflammation (Short and Nair, 2001). The estrogen may lead to decrement in functional performance and physical disability in women (Baumgartner et al., 1998). The loss of muscle mass is primarily due to an imbalance between muscle protein synthesis and muscle protein breakdown (Short and Nair, 2000). It was also reported that muscle mass in women tend to decrease gradually after the 3rd decade of age and showed an accelerated decline after the 5th decade (Aloia et al., 1991).

2) Pre-menopause is word used to describe the years leading up to the last period, when the levels of reproductive hormones become lower and more erratic, and the effects of hormone withdrawal may be present. While post- menopause is the period in which women have not experienced a menstrual bleed for bleed for a minimum of 12 month, if they do still have a uterus, and are not pregnant or lactating (Sekar et al., 2011).

3) Handgrip strength is positively related to lower and upper muscular strength so that it is considered a surrogate measure of overall muscular strength (Dionne et al., 2000). To our knowledge, very few literatures are available regarding the handgrip strength of menopausal women. The primary objectives of the present study were to assess the impact of handgrip strength on the menopausal transition in middle aged women of Amritsar, and to determine the association of handgrip strength with selected anthropometric variables in this population.

2. Materials and Methods

1) Participants

A total of 802 purposively selected middle-aged women (403 pre-menopausal, age group 35-45 years and 399 post-menopausal, age group 46-55 years) were considered as samples taken from Amritsar, Punjab state, India. As many as 769 (95.88%) samples of the present study were right hand dominant. The Age of the subjects was estimated from their date of birth from urban areas. But in case of rural areas where birth records were not available, the age of the subjects was assessed with the association with some notable events such as age at marriage, age of the first child, any important festival, etc. A pre-structured questionnaire was applied to gather the information regarding their menopausal status, socio-economic status, diet, education, occupation and other related issues.

2) Measurement of Handgrip Strength

The handgrip strength measurement was done using a standard adjustable digital handgrip dynamometer (Takei Scientific Instruments Co., LTD, Japan) at standing position with shoulder adducted and neutrally rotated and elbow in full extension. The dynamometer was held freely without support, not touching the subject's trunk. The subjects were asked to exert maximum force on the dynamometer thrice from their hand and the average maximum value in kilograms was recorded. Anthropometric equipment and handgrip dynamometer were calibrated before each assessment. Thirty

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seconds time interval was maintained between each handgrip strength testing.

3) Anthropometric Measurements

Anthropometric variables of the subjects were measured using the techniques provided by Lohmann et al. (1988) and were measured in triplicate with the median value used as the criterion. Subjects were weighed in minimal light-weight clothing, bare foot, using standard weighing machine. Stadiometer (Holtain Ltd. Crymych, Dyfed, UK) was used for measuring standing height. Subjects were asked to stand bare foot on horizontal surface. Heel touched the ground, counter board of stadiometer was brought down till it touches the vertex. The height of subjects was recorded in cm. The weight was measured by digital standing scales (Model DS-410, Seiko, Tokyo, Japan) to the nearest 0.1 kg. Body mass index (BMI) was calculated from height and weight as follows: BMI=weight (kg) / height^2(m^2).

4) Statistical Analysis

Descriptive statistics (mean ± standard deviation) were determined for the directly measured variables as well as the derived one. Student's t-test was applied for the comparisons of data between the pre- and post-menopausal women. Correlation coefficients of dominant handgrip strength with other variables were done using SPSS (Statistical Package for Social Science) version 20.0. A 5% level of probability was used to indicate statistical significance.

3. Results

1) The descriptive statistics of handgrip strength and selected anthropometric variables in pre- and post-menopausal women were shown in Table 1. Pre-menopausal women had higher mean values in dominant and non-dominant handgrip strength (21.38 kg and 17.76 kg respectively), height (154.56 cm), and lesser mean values in age (40.42 years), weight (66.44 kg) and body mass index (28.03 kg/m^2) than their post-menopausal counterparts (17.02 kg, 14.15 kg,153.40 cm, 50.51 years, 67.18 kg and 28.72 kg respectively). However, statistically significant differences ($p \leq 0.01$-0.001) were observed in dominant and non-dominant handgrip strength, height and age between these two groups.

Table 1: Descriptive statistics of handgrip strength and selected anthropometric variables in pre- and post-menopausal women

Variables	Pre- menopausal women(n=403)		Post –menopausal women(n=399)		t-value	p-value
	Mean	SD	Mean	SD		
DHGS (kg)	21.38	5.58	17.02	4.72	11.93	**<0.001**
NDHGS (kg)	17.76	5.54	14.15	4.75	9.89	**<0.001**
Age (years)	40.42	4.90	50.51	4.37	30.70	**<0.001**
HT (cm)	154.56	5.08	153.40	7.53	2.56	**<0.01**
WT (kg)	66.44	13.29	67.18	12.50	0.809	0.419
BMI (kg/m^2)	28.03	5.49	28.72	5.21	1.83	0.07

DHGS = Dominant handgrip strength, NDHGS = Non-dominant handgrip strength, HT = Height, WT = Weight, and BMI = Body Mass Index.

2) Table 2 showed the correlation coefficients of dominant handgrip strength with selected anthropometric variables in pre- and post-menopausal women. Both in pre- and post-menopausal women, significant positive correlations ($p<0.017$-0.001) of dominant handgrip strength were found with non-dominant handgrip strength and height.

Table 2: Correlation coefficients of dominant handgrip strength with selected anthropometric variables in pre- and post-menopausal women

Variables	Pre- menopausal women (n= 403)		Post–menopausal women (n= 399) Women (n=303)	
	r	p-value	r	p-value
NDHGS (kg)	0.650	**<0.001**	0.706	**<0.001**
Age (years)	-0.094	0.06	-0.054	0.282
HT (cm)	0.119	**<0.017**	0.182	**<0.001**
WT (kg)	0.044	0.382	0.062	0.22
BMI (kg/m^2)	-0.008	0.88	-0.009	0.86

NDHGS = Non-dominant handgrip strength, HT = Height, WT = Weight, and BMI = Body Mass Index.

4. Discussion

1) Menopause is a natural physiological process in women. Number of physical, physiological and emotional changes occur during menopause. Of those, muscle mass in women tend to decrease gradually after the 3rd decade of age, and shows an accelerated decline after the 5th decade (Aloia et al., 1991). The findings of the present study showed firstly, that post-menopausal women had lower values in dominant and non-dominant handgrip strength than their pre-menopausal counterparts, and secondly, dominant handgrip strength had significant positive correlations with non-dominant handgrip strength and height. These findings were supported by the findings of Kurina et al. (2004) where similar type of trends was reported. Maltais et al. (2009) and Anadkat and Tanna (2016) reported that there were decrements in muscles mass, muscles strength, mobility and bone density in the post-menopausal women than pre-menopausal women. Another study conducted by Petrofsky et al. (1975) showed weaker handgrip strength in post-menopausal women than their pre-menopausal counterparts.

2) In fact, according to Jubrias et al. (1997) women of age 65-80 years old have twice the amount of non-contractile muscle tissue per unit of muscle cross-sectional area as compared to younger women aged 23 to 57 years old. Evidence have also shown that there is increase in non-contractile tissue such as intramuscular fat after menopause (Forsberg et al., 1991). Women tend to lose muscle strength at around the 5th and 6th decades of age (Phillips et al., 1993, Samson et al., 2000). As such, some studies showed that women experience a 21% decrease in strength between the age of 25 and 55 years (Asmussen et al., 1961).

5. Conclusion

It could be concluded from the present study that the post-menopausal women had lower handgrip strength than their pre-menopausal counterparts. Special care should be taken for the post-menopausal women regarding their diet and lifestyle including proper exercise programs.

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