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Original Research Article

A Study on Handgrip Strength in Pre- and Post-Menopausal Women of Amritsar on the Basis of Their Rural and Urban Habitat

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ABSTRACT

Introduction: Menopause is experienced in every woman as they get aged and is marked by the end of their reproductive period. Numerous studies have previously conducted on handgrip strength with regard to nutritional status, falls and fractures, but there is limited information regarding age related changes in women as they proceed from pre-menopause to peri and post-menopausal stage. Hence, the present study was conducted to assess the handgrip strength among pre- and post-menopausal women on the basis of their habitat.

Methods: The study was based on a sample of 802 middle aged women (pre-menopausal= 403 of age 35-45 years and post-menopausal women= 399 of age 45-55years). The data were collected from Civil Hospital, Amritsar and Guru Nanak Dev Hospital, Amritsar, Punjab, India. Further, these women were divided into various groups on the basis of their habitat like rural pre- (n=251) and post-menopausal women (n=303) and urban pre- (n=152) and post-menopausal women (n=96). Apart from dominant and non-dominant handgrip strength, seven anthropometric variables, viz., height vertex, body weight, BMI, upper arm, waist and hip circumferences, waist to hip ratio were measured on all the subjects by standardized techniques.

Results: Results of the present study showed that statistically significant differences ($p<0.001$) were noted between rural pre- and post-menopausal women in dominant and non-dominant handgrip strength, age, waist and hip circumferences and waist to hip ratio. Statistically significant differences ($p<0.02$-0.001) were noted in dominant and non-dominant handgrip strength, age, height vertex, BMI, waist and hip circumference, between urban pre- and post-menopausal women. However, in case of rural and urban pre-menopausal women, statistically significant differences ($p<0.02$) were depicted in body weight and BMI respectively. Statistically significant difference ($p<0.03$) was noted only in height vertex between rural and urban post-menopausal women. In the rural and urban pre- and post-menopausal women, statistically no significant differences ($p>0.05$) were noted in dominant and non-dominant handgrip strength.

Conclusion: Rural and urban pre-menopausal women had higher mean values in handgrip strength as compared to their rural and urban post-menopausal counterparts. Statistically no significant differences were found between the pre- and post-menopausal women of rural and urban areas, highlighting on effect of habitat on the handgrip strength of pre- and post-menopausal women.

Key words: Handgrip strength. Rural pre- and post-menopausal women. Urban pre- and post-menopausal women.

INTRODUCTION

Menopause is one of the important events that is experienced by every woman as they get aged. It marks the end of the reproductive period of women, when their menstrual period stops permanently and will

not able to give birth to a child. [1] At the physiological level, menopause occurs due to the decreased production of estrogen and progesterone hormones in the ovaries. [2,3] With the ageing process, there is decrement in muscle mass, called as sarcopenia [4-7] and loss of muscle strength (dynapenia) which causes functional limitations and mortality among these women. [8] There is reduction of type-2 muscle fibers whose main function is to produce fast and strong muscle contractions in peri- and post-menopausal women, and has negative effect on upper and lower limb muscles, especially on the hand. [9-11]

Hand is one of the most important parts of human body which helps in performing variety of the tasks. Continuous and repetitive movement of the hand causes fatigue and resulting in the damage of the hand. [12, 13] Excessive force on the hands can also lead to upper limb disorders. [14, 15] With the ageing process, there is decrement in muscle strength and loss of bone mineral density which directly effects on muscle mass, causing osteoporosis which is one of the important factors responsible for decrement in handgrip strength. [16, 17]

Low socio-economic status, illiteracy, gender discrimination, early and unregulated fertility along with poor access to health facilities, sedentary lifestyle, malnutrition, low dietary intake and reduced physical activity are the important factors that are responsible for declining in overall health of females as well as causing decrement in muscle strength. [18-20] Ageing is one of the other important factors causing deterioration of hand function and may lead to various disorders such as osteoporosis, osteoarthritis and rheumatoid arthritis. [1] Number of studies has previously conducted on handgrip strength with regard to nutritional status, falls and fractures, but there is limited information regarding age related changes in women as they proceed from pre-menopause to peri- and post-menopausal stage on the basis of heritage. Hence, the present study was conducted to assess the handgrip strength among pre- and post-menopausal women on the basis of their habitat.

MATERIALS AND METHODS

In the present study, a total of 802 middle aged women were selected purposively as samples from Civil Hospital, Amritsar and Guru Nanak Dev Hospital, Amritsar, Punjab, India. Of those, 403 samples were the pre-menopausal and 399 post-menopausal women. Further, these women were divided into various groups on the basis of their habitat like rural pre- (n=251) and post -menopausal women (n=303) and urban pre- (n=152) and post-menopausal women (n=96). Apart from dominant and non-dominant handgrip strength, seven anthropometric variables, viz., height vertex, body weight, BMI, upper arm, waist and hip circumferences and waist to hip ratio were measured on all the subjects by standardized techniques. The age of the subjects were recorded from their date of birth. Demographic data such as, socio-economic status, ethnicity and habitat of the subjects were collected through self-structured questionnaire. A written consent was obtained from the subjects. The data were collected under natural environmental conditions in morning (between 8 AM. to 12 noon). The study was approved by the institutional ethical committee.

Anthropometric Measurements

Seven anthropometric variables viz., height vertex, body weight, body mass index, upper arm, waist and hip circumferences and waist to hip ratio were measured following standard techniques. [21] The height was recorded by using anthropometric rod in cm. The body 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). Upper arm, hip and waist circumferences were assessed with the help of the steel tape in cm. Waist to hip ratio (W-hr) was calculated from waist circumference and hip circumference as follows: W to hr = waist

circumference (cm) / hip circumference (cm).

Handgrip Strength Measurement

The grip strength of both right and left hands was measured 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 position of the hand remained constant without the downward direction. The subjects were asked to put maximum force on the dynamometer thrice from both sides of the hands. The maximum value was recorded in kg. Handgrip dynamometer was calibrated before each assessment. All subjects were tested after 3 minutes of independent warm-up. Thirty seconds time interval was maintained between each handgrip strength testing.

Statistical Analysis

Standard descriptive statistics (mean ± standard deviation) were determined for directly measured and derived variables. Data were analyzed using SPSS (Statistical Package for Social Science) version 20.0. Student's t-test was applied for comparisons of data between rural and urban pre- and post-menopausal women. A 5% level of probability was used to indicate statistical significance.

RESULTS

The comparison of handgrip strength and selected anthropometric variables between rural pre- and post-menopausal women were shown in table 1. Statistically significant differences ($p<0.001$) were noted between rural pre- and post-menopausal women in dominant and non-dominant handgrip strength, age, waist and hip circumferences and waist to hip ratio.

Table 2 showed the comparison of handgrip strength and selected anthropometric variables between urban pre- and post menopausal women. Statistically significant differences ($p<0.02$-0.001) were noted between urban pre- and post-menopausal women in dominant and non-dominant handgrip strength, age, height vertex, BMI, waist and hip circumferences.

Table 1. Comparison of handgrip strength and selected anthropometric variables between rural pre- and post-menopausal women

Variables	Rural pre-menopausal women (n=251)		Rural post-menopausal women (n=303)		t-value	p-value
	Mean	SD	Mean	SD		
Dhgs (kg)	21.24	5.89	17.25	4.77	8.82	<0.001
Ndhgs (kg)	17.52	5.64	14.24	4.76	7.44	<0.001
Age (years)	40.59	4.99	50.54	4.54	24.5	<0.001
Hv (cm)	154.48	4.79	153.86	5.30	1.44	0.15
Bw (kg)	67.60	14.29	67.15	12.64	0.40	0.69
BMI (kg/m^2)	28.55	6.02	28.58	5.22	0.08	0.94
Uac (cm)	31.46	4.11	32.01	3.94	1.61	0.11
Wc (cm)	96.13	11.62	100.37	10.67	4.47	<0.001
Hc (cm)	108.40	11.74	111.56	10.94	3.27	<0.001
W-hr	0.89	0.06	0.90	0.05	2.91	<0.001

Dhgs = dominant handgrip strength, Ndhgs = non-dominant handgrip strength, Hv = height vertex, Bw = body weight, BMI = body mass index, Uac = upper arm circumference, Wc = waist circumference, Hc = hip circumference, W –hr = waist to hip ratio.

Further, the comparison of handgrip strength and selected anthropometric variables between rural and urban pre- menopausal women was shown in table 3. Statistically significant differences ($p<0.02$) were noted in body weight and BMI only between them.

Table 4 highlighted the comparison of handgrip strength and selected anthropometric variables between rural and urban-post menopausal women. Statistically, significant differences ($p<0.03$) were noted in height vertex only between rural and urban post-menopausal women.

Table 2. Comparison of handgrip strength and selected anthropometric variables in urban pre- and post-menopausal women

Variables	Urban pre-menopausal women (n=152)		Urban post-menopausal women (n=96)		t-value	p-value
	Mean	SD	Mean	SD		
Dhgs (kg)	21.61	5.05	16.31	4.50	8.38	<0.001
Ndhgs (kg)	18.14	5.37	13.88	4.74	6.37	<0.001
Age (years)	40.14	4.77	50.41	3.83	17.77	<0.001
Hv (cm)	154.69	5.55	151.94	12.05	2.43	<0.02
Bw (kg)	64.53	11.24	67.29	12.12	1.82	0.07
BMI (kg/m^2)	27.18	4.38	29.16	5.17	3.22	<0.001
Uac (cm)	30.97	6.44	31.53	4.81	0.76	0.45
Wc (cm)	96.97	10.63	100.58	11.47	2.85	<0.01
Hc (cm)	108.22	10.89	111.71	11.38	2.41	<0.02
W-hr	0.89	0.06	0.90	0.04	1.12	0.29

Table 3. Comparison of handgrip strength and selected anthropometric variables between rural and urban pre-menopausal women

Variables	Rural pre-menopausal women (n=251)		Urban pre-menopausal women (n=152)		t-value	p-value
	Mean	SD	Mean	SD		
Dhgs (kg)	21.24	5.89	21.61	5.05	0.64	0.53
Ndhgs (kg)	17.52	5.64	18.14	5.37	1.09	0.23
Age (years)	40.59	4.99	40.14	4.77	0.887	0.37
Hv (cm)	154.48	4.79	154.69	5.55	0.39	0.70
Bw (kg)	67.6	14.28	64.53	11.24	2.25	<0.02
BMI (kg/m^2)	28.55	6.02	27.18	4.38	2.43	<0.02
Uac (cm)	31.46	4.11	30.97	6.44	0.94	0.35
Wc (cm)	96.13	11.62	96.52	10.63	0.33	0.74
Hc (cm)	108.40	11.74	108.22	10.89	0.150	0.88
W-hr	0.89	0.06	0.89	0.06	0.92	0.36

Table 4. Comparison of handgrip strength and selected anthropometric variables between rural and urban post-menopausal women

Variables	Rural post-menopausal women (n=303)		Urban post-menopausal women (n=96)		t-value	p-value
	Mean	SD	Mean	SD		
Dhgs (kg)	17.25	4.77	16.31	4.50	1.70	0.09
Ndhgs (kg)	14.24	4.76	13.88	4.74	0.65	0.52
Age (years)	50.54	4.54	50.41	3.83	0.26	0.80
Hv (cm)	153.86	5.30	151.94	12.05	2.19	<0.03
Bw (kg)	67.15	12.64	67.29	12.12	0.09	0.93
BMI (kg/m^2)	28.58	5.22	29.16	5.17	0.94	0.35
Uac (cm)	32.01	3.94	31.53	4.21	1.03	0.30
Wc (cm)	100.37	10.67	100.58	11.47	0.17	0.87
Hc (cm)	111.56	10.94	111.71	11.38	0.12	0.91
W-hr	0.90	0.05	0.90	0.04	0.01	1.00

DISCUSSION

Menopause marks a time of dramatic hormonal as well as social change for women. It is the most important period in women life time when their menstrual period stops permanently and they will be not able to give birth to a child. [1,22] At the physiological level, menopause occurs due to the decreased production of the hormones in the ovaries viz., estrogen and progesterone. [23] The main objective of the study was to compare the handgrip strength and selected anthropometric variables in rural and urban pre- and post-menopausal women. In the present study, statistically significant differences were observed in dominant and non-dominant handgrip strength, age, waist and hip circumferences and waist to hip ratio between rural pre- and post-menopausal women. Similar sort of results were depicted by earlier studies. [18,24,25] Higher value of handgrip strength in rural pre-menopausal women than their post-menopausal counterparts may attribute to their lifestyles, socio-economic status. Large number of rural pre-menopausal women was more engaged in physical work, whereas the urban pre-menopausal women had more sedentary lifestyle. Hence, it is observed that lifestyle is one of the important factors influencing both body

composition and muscle strength among these women. [26]

However, in case of urban pre- and post-menopausal women, statistically significant differences were noted in dominant and non-dominant handgrip strength, age, height vertex, BMI, waist and hip circumference. These differences were probably due to illiteracy, unregulated fertility along with poor assess of health services, low dietary intake, reduced physical activity, malnutrition and deteriorating quality and quantity of food intake with the advancement of age, which are mainly associated with normal ageing process. As with the progression of age, lower levels of estrogen hormone among women were associated with lower handgrip strength in post-menopausal women, thereby indicating that, besides anthropometric factors, hormonal status also affects the handgrip strength. [27,28] Further, it has been reported that statistically significant differences were observed in body weight and BMI between rural and urban post-menopausal women. However, in case of rural and urban post-menopausal women, statistically significant difference was observed in height vertex only. It has also found that the subjects with lower body mass index and height had lower mean values in their handgrip strength. [29] Further, handgrip strength has been correlated with habitat in few numbers of studies. [18, 29- 30] In contrary, the findings of the present study did not support the findings of the earlier studies, showing statistically no significant differences between the pre- and post-menopausal women of rural and urban habitat.

CONCLUSION

It can be concluded from the present study that rural and urban pre-menopausal women had significantly higher mean values in handgrip strength as compared to their rural and urban post-menopausal counterparts. Decrement in handgrip strength may lead to various disorders like osteoarthritis, rheumatoid arthritis and osteoporosis. The present study showed statistically no significant differences between the pre- and post-menopausal women of rural and urban areas, highlighting on effect of habitat on the handgrip strength of pre- and post-menopausal women.

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