

Correlation between Handgrip Strength and Upper Extremity Function in Pregnant Women Aged 20-35 Years

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ABSTRACT

Background: Musculoskeletal changes resulting from pregnancy are widely acknowledged, though, its magnitude is scarcely quantified. Hand Grip Strength (HGS) is reported as an indicator of the total body strength an objective test for physical capability and a valid predictor of work capacity degree of disease/injury, and rehabilitation outcomes. Upper limb dysfunction is a common musculoskeletal condition in general population.

Aim: To find the correlation between handgrip strength and upper extremity function in pregnant women in all three trimesters aged 20-35 years.

Method: A cross sectional survey study included 300 pregnant women. Study was conducted in obstetrics and gynecology department, General hospital, Ahmedabad. HGS was measured by using handheld dynamometer. Upper extremity function scale was used to measure upper extremity function.

Results: Moderate negative correlation found between Rt HGS and UEFS ($r=-0.790$) and between Lt HGS and UEFS ($r=-0.588$) which was statistically significant.

Conclusion: There is moderate negative correlation between handgrip strength and upper extremity function in pregnant women.

Key Words: Pregnancy, Handgrip strength, upper extremity function

INTRODUCTION

Pregnancy is a combination of series of physiological, psychological and physical alterations. Particularly, musculoskeletal changes resulting from pregnancy are widely acknowledged, though, its magnitude is scarcely quantified. [1] During pregnancy the pregnant woman undergoes various anatomical and physiological changes in her body. The changes of pregnancy are chiefly the direct result of the interaction of four factors. The hormonally mediated changes in collagen and involuntary muscle. The increase in body weight and adaptive

changes in centre of gravity and posture. These changes also include various musculoskeletal problems, respiratory, cardiovascular, endocrinal changes etc. [2] During the 3rd trimester of pregnancy, fluid retention can lead to oedema, which, as well as being visible in the ankles, feet, hands and face of the pregnant women, can lead to reduced joint mobility and a variety of nerve compression syndromes. [3] In pregnancy water retention quite frequently cause unusual pressure on nerves, particularly nerves which are passing through canals formed by bone and fibrous tissue with resulting neuropraxia (e.g. CTS). [4] Bone

turnover is low in the first trimester and increases in the third trimester when foetal calcium needs are increased. The source of the calcium in the third trimester is previously stored skeletal calcium. [5]

Usually weight gain experienced during pregnancy results in postural changes that produce pain and musculoskeletal complaints in pregnant women. Musculoskeletal changes are exaggerated lordosis of the lumbar spine, forward flexion of the neck, protracted shoulders typically occur to compensate for the enlarged uterus and change in center of gravity.

A significant increase in the anterior tilt of the pelvis occurs, with increased use of hip extensor, abductor, and ankle plantar flexor muscles. [6] Other musculoskeletal changes seen in pregnancy include: exaggerated lordosis of the lower back, forward flexion of the neck and downward movement of the shoulder joint laxity in the anterior and longitudinal ligaments of the lumbar spine, widening and increased mobility of the sacroiliac joints and pubic symphysis. [7]

Hand Grip Strength (HGS) is reported as an indicator of the total body strength [8, 9] an objective test for physical capability [10] and a valid predictor of work capacity [11,12] degree of disease/injury, and rehabilitation outcomes. [13,14] A better performance on the HGS is associated with high functional index of nutritional status, [15,16] reduced risk of a series of ill health outcomes [15-18] and decreased functional limitations [19-21] disability [22-23] and morbidity and mortality rates especially among older populations. [24-26] Muscle function correlates closely with whole body protein, [27-28] body cell mass [29] anthropometrically measured arm muscle mass, and even with body mass index (BMI). [30] In healthy people, age and gender are the strongest influencing factors on hand grip strength. [31]

Upper limb dysfunction is a common musculoskeletal condition in general population. [32] The prevalence of

upper limb dysfunction at any given point of time has been estimated as 20% to 53% in the working population. The lifetime prevalence of upper limb dysfunction is greater than 70%. [33-34] Upper limb dysfunction can arise from a spectrum of clinical conditions including neck pain. [35-36] This can have a substantial effect on quality of life, and loss of work capacity and is therefore a substantial socioeconomic burden for patients and society. [37-38] Stock and colleague identified 12 functional domains relevant to workers: work, household and family responsibilities, self-care, transportation, sleep, social activities, recreational activities, mood, self-esteem etc.

There are many studies in India regarding the common musculoskeletal dysfunctions experienced by a pregnant woman throughout the trimesters but from them fewer studies are there which correlates the upper extremity function and handgrip strength in pregnant women. This study may highlight the affection of upper limb function and handgrip strength in pregnant women in India.

MATERIALS AND METHODOLOGY

A cross sectional survey study was conducted during period of August to December 2017. Approval was taken from Institutional Review Board. A sample of 300 pregnant women based on inclusion and exclusion criteria. Inclusion criteria were pregnant women of all 3 trimesters with age between 20-35 years, Multigravida or primigravida and subjects who were willing to participate. Subjects were selected according to convenience sampling technique from Obstetrics and Gynaecology OPD, General Hospital, Ahmedabad. Subjects with previous history of injury to upper limb (e.g. fractures, burns, dislocation) SOL such as ganglia at wrist, medically unstable subjects and Underlying disease like RA, Gout, hypothyroidism were excluded.

Handheld dynamometer was used to measure handgrip Strength. Subject is

seated upright against the back of a chair with flat on the floor. The shoulder adducted and neutrally rotated, the elbow flexed at 90 degree and forearm in neutral and wrist between 0 degree and 30 degree of extension. [39] Subjects were asked to squeeze the hand dynamometer with their maximum strength. Therapist was standing in front of subject to read amount of force. 1 minute rest was given between each attempt to prevent fatigue. 3 successive trials were recorded for each treatment and maximum of them to be taken.

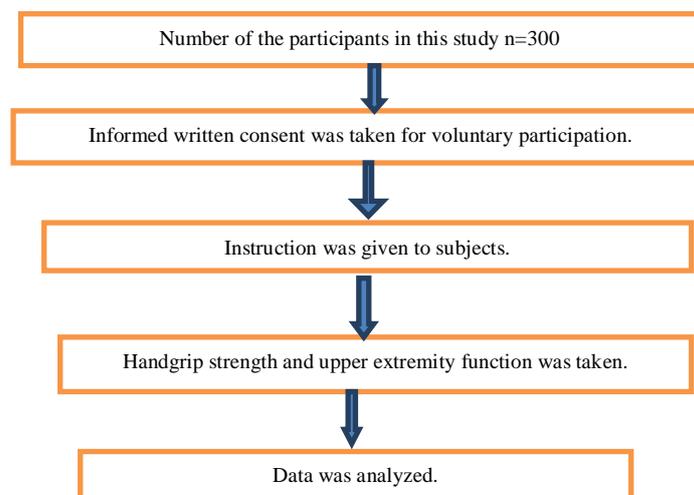
Mbada et al tested the reliability of one trial versus three HGS trials in pregnant and non-pregnant females and recommended that taking the mean of three repeated grip trials provides more reliable results than only one trial. [39] However, the American Society of Hand

Therapist recommended that the mean of the three successive trials be used as a measure of hand grip strength. [40]

However, some others advocate for the best of three trials [41,42] while others investigators prefer a single trial. [43,44] However, the repeated measure analysis used in the study showed significant difference in the HGS trials for the dominant and non-dominant hand.

The subjects were explained about the study and written consent was taken prior to the study. The questionnaire concerning handgrip strength affection and related to that difficulty in performing upper limb functional activities during pregnancy were administered to the subjects with all three trimesters of pregnancy. Upper extremity function scale was used to measure upper extremity function.

Flow chart of procedure:



Statistical Analysis:

The data was analyzed using SPSS Version 16. Significance level was kept at 5%.

A sample of 300 pregnant women during all three trimesters participated in the study. The handgrip strength and scale related to upper extremity function were administered in subjects with all three trimesters of pregnancy. Upper extremity function scale (UEFS) was used to evaluate upper extremity function.

Table 1 below shows mean, SD and median values of demographic data and variables.

Table 1: Mean of demographic data and variables

Variable	Mean	SD	Median
Age(years)	24.68	3.67	24
BMI(kg/m ²)	21.34	4.27	20.54
Duration of pregnancy (months)	5.05	2.37	5
Rt HGS (kg)	16.67	2.99	18
Lt HGS (kg)	13.29	2.94	14
UEFS	7.18	3.74	5

Handgrip Strength in all 3 trimesters:

Mean handgrip strength in 1st trimester for Right and Left hand is 17.05±3.28 kg and 13.43±3.10 kg, in 2nd trimester for Right and Left hand is 16.32±2.99 kg and

13.24±2.90 kg and in 3rd trimester for Right and Left hand is 16.66±2.66 kg and 13.20±2.84 kg respectively as shown in table 2.

Table 2: Mean value of Handgrip strength in all 3 trimesters

	Rt Handgrip Strength Mean±SD (kg)	Lt Handgrip Strength Mean±SD (kg)	Total Subjects
1 st trimester	17.05±3.28	13.43±3.10	100
2 nd trimester	16.32±2.99	13.24±2.90	100
3 rd trimester	16.66±2.66	13.20±2.84	100

One way Analysis of Variance (One way ANOVA) was used to compare the handgrip strength in the three trimesters. It shows that comparison of handgrip strength of both hands between trimester were statistically not significant (p>0.05) as shown in table 3.

Table 3: Comparison of Right and Left side handgrip strength between trimesters

	1 st trimester	2 nd trimester	3 rd trimester	F value	p value
Right side	17.05±3.28	16.32±2.99	16.66±2.66	1.492	0.227
Left side	13.43±3.10	13.24±2.90	13.20±2.84	0.173	0.841

UEFS Score in all 3 trimesters:

Mean UEFS Score in 1st trimester is 3.37 ± 1.3, in 2nd trimester is 4.95 ± 2.12, in 3rd trimester 10.85 ± 2.41 respectively shown in table 4.

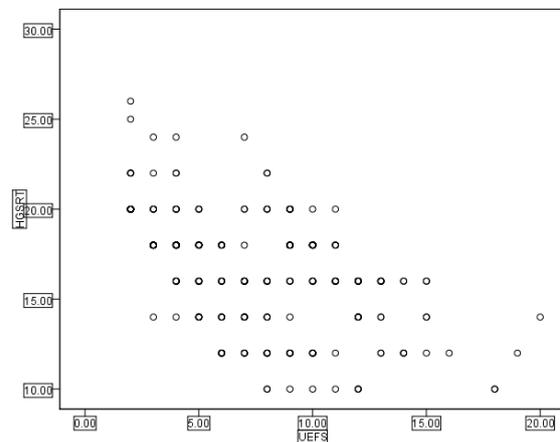
Table 4: Mean value of UEFS in all 3 trimesters

UEFS	Mean±SD	F value	p value
1 st trimester	3.37 ± 1.39	378.747	<0.001
2 nd trimester	4.95 ± 2.12		
3 rd trimester	10.85 ± 2.41		

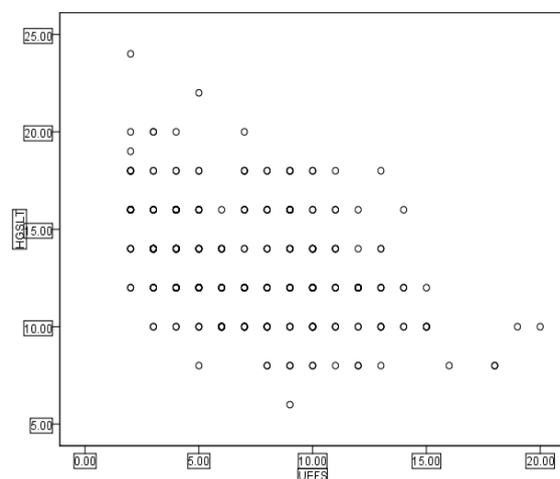
One way Analysis of Variance (One way ANOVA) was used to compare the upper extremity function in the three trimesters. It shows that comparison between groups was statistically significant (p<0.001) as shown in table 4.

Spearman’s correlation coefficient test was used to identify the relationship between handgrip strength and upper extremity function. Results show that there was a statistically significant negative correlation found between HGS and UEFS between trimesters and within trimesters (p<0.001).

There was a statistically significant moderate negative correlation found between Rt HGS and UEFS (r=-0.790) and moderate negative correlation between Lt HGS and UEFS (r=-0.588). As shown in graph 1 and graph 2 there was a statistically significant negative correlation found between Right and Left HGS and UEFS within groups (r=-0.551, -0.430).



Graph 1: Scatter plot between Rt HGS and UEFS



Graph 2: Scatter plot between Lt HGS and UEFS

DISCUSSION

The present study was conducted with aim to correlate the handgrip strength

and upper extremity function in pregnant women. There were 300 participants in the study. Among them 118 (39.33 %) subjects were primigravida and 182 (60.66%) participants were multigravida. There was a statistically significant moderate negative correlation found between handgrip strength (HGS) and upper extremity function (UEFS).

In the present study the mean handgrip strength for dominant hand was 16.67 ± 2.99 kg and for non-dominant hand was 13.29 ± 2.94 kg. Mean handgrip strength for dominant hand was 26.8 ± 8.9 kg and non-dominant hand was 24.7 ± 8.5 kg in all 3 trimesters was less compared to same age group population. [45]

Similar to this study it was reported that pregnant women had been found to have lower upper extremity strength than non-pregnant women [46] In fact, pregnancy related changes in musculoskeletal system might account for the significantly lower handgrip strength in pregnant women in the present study. Contrary to present study, Morrissey et al [45] found no significant difference in dominant and non-dominant handgrip strength between pregnant and non-pregnant women. Pregnancy leads to change in collagen metabolism and increased connective tissue pliability and extensibility. These changes are the result from altered levels of relaxin, estrogen, and progesterone. Their ligamentous tissues are predisposed to laxity with resultant reduced joint stability. To allow the birth of the baby the symphysis pubis, sacroiliac joints, and the tensile strengths of muscles are particularly affected and this ligamentous laxity may continue for six months postpartum. [47]

Nevertheless, no significant correlations were found either in pregnant or non-pregnant women between dominant handgrip strength and selected anthropometric variables which followed the findings of Mbada et al and Dumas et al and Morrissey et al. [2,45,48]

In present study handgrip strength and upper limb function were moderately

correlated. There was moderate negative correlation which was statistically significant ($r = -0.551$, $p < 0.001$).

Result suggests that as the handgrip strength decreases, difficulty in activities performed by upper limbs increased. As previous study found that Carpal tunnel syndrome (CTS) is a common cause of hand and wrist pain during pregnancy. [49] It is one of the most frequently diagnosed condition which may be one of the cause of the upper limb function affection during pregnancy. [50]

During the third trimester in addition to pain, paraesthesia or sensory loss in the median nerve distribution (the thumb, index finger, middle finger and radial half of the ring finger) is a presenting complaint. Symptoms are exacerbated by the repetitive movements and during the night. Physical examination reveals either a positive Tinel's sign test or positive Phalen's sign test, and longstanding cases will show wasting of the thenar eminence. [49] Wasting was however not found in present study.

30 subjects (10%) were presented with CTS. Among them 10 subjects were in 2nd trimester and 20 subjects were in 3rd trimester subjects presented with clinical significant signs and symptoms of Carpal tunnel syndrome. Graph 12 shows distribution of CTS among participants.

Upper limb function results in sliding or elongation of neural structures throughout the brachial plexus including the neck. Elongation of inflamed and sensitive neural structures at the neck may lead to a neck pain response resulting in reluctance of these patients to use their upper limbs. Finally, if patients limit the functional use of their upper limbs because of a direct mechanical pain response this may result in physical de-conditioning which may lead to reduced strength and endurance of muscles. [51]

Limitation of the present study were homogeneity of the subjects was not there because different subjects were taken at a time and follow up not taken according to

trimesters and occupation history was not taken.

Future Recommendations:

- ❖ Can correlate pinch grip strength with HGS/UEFS in pregnant women.
- ❖ Can compare HGS with different positions in pregnant women
- ❖ Can correlate HGS with hand-span, forearm length, CTS etc.
- ❖ Can correlate HGS with Physical activity and QOL in pregnant women.

CONCLUSION

Handgrip strength and upper extremity function is get affected most commonly in 2nd and 3rd trimester of pregnancy. There is moderate negative correlation between handgrip strength and upper extremity function which is statistically significant in pregnant women.

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How to cite this article: Pandya MR, Sheth MS. Correlation between handgrip strength and upper extremity function in pregnant women aged 20-35 years. *International Journal of Research and Review.* 2018; 5(6):165-172.
