

## Impact of Perceived Stress on handgrip muscle strength and Endurance in healthy young adults.

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### ABSTRACT –

**Introduction** – Stress has many adverse effects on physical and mental health. But its impact on handgrip muscle strength and endurance and in turn on physical performance and wellbeing in healthy young adults is not clearly known.

**Aim and objectives** – The aim of this study was to investigate the association of perceived stress with handgrip muscle strength and endurance in healthy young adults. The objectives were to measure muscle strength, endurance, perceived stress and analysing the correlation between them.

**Method and materials**– Handgrip muscle strength and endurance were measured using a handgrip dynamometer. Perceived stress was measured using Cohen's perceived stress scale (PSS) questionnaire, the global measure for perceived stress. Statistical analysis was done by the software SPSS 16. Descriptive statistics were used to measure the mean. Pearson's correlation coefficient was used to find the associations between different variables.

**Result** – In this cross-sectional study, 80 healthy young adults participated. Out of which 47 were male and 33 were female. Muscle strength and endurance were more in males than females but the stress was more in females in comparison to males. Perceived stress was correlated negatively with muscle strength but no correlation with endurance.

**Conclusion** – This study concluded that perceived stress has a negative impact on muscle strength in otherwise healthy young adults. Low muscle strength in turn is associated with many health hazards. As such it is very important to take care of the mental health of the youth to prevent developing other health hazards.

**Keywords** – Perceived stress, Handgrip muscle strength, Endurance

**Key message** - Perceived stress is negatively associated with hand grip muscle strength, indicating that higher levels of perceived stress are linked to decreased muscle strength. This finding suggests that psychological stress may have a detrimental impact on muscular performance.

### INTRODUCTION –

India is a young nation as its youth in total population in 2011 stands at 34.8%. Youth of a nation are considered the trustees of prosperity.<sup>[1]</sup> In the fast-paced modern world, stress has become an integral part of daily life, affecting individuals across various domains. Stress can arise from a multitude of sources, including work-related pressures, academic demands, personal relationships, and financial challenges. In today's world of competition, young generation are more prone to suffer from mental ill health like psychological stress which most often goes unnoticed. A survey conducted by Cigna TTK Health Insurance, The 2018 Cigna 360 Well-Being Survey - Future Assured, revealed that in comparison to the global average of 86 per cent, in India 95 per cent of youth between the age group of 18-34 were stressed.<sup>[2]</sup> Stress has impact throughout the body which can result in a variety of issues. Understanding the relationship between stress and physiological parameters can provide valuable insights into the impact of stress on human health. Studies have shown association of Perceived stress with many diseases like diabetes,<sup>[3]</sup> hypertension etc. But does it have any impact on skeletal muscle health is not properly explored.

Out of the three main types of muscles, skeletal muscle mainly concerns with the purposeful movement of the body and maintenance of posture.<sup>[4]</sup> Muscle strength is defined as the ability of specific groups of muscle to generate force against resistance within a single exertion. And Endurance is the ability of a group of muscles to generate sub-maximal force over a sustain amount of time.<sup>[5]</sup> With the increase in muscle strength & endurance, the physical performance also increases. A commonly recommended assessment technique for measuring muscle strength and muscle function is Handgrip muscle strength (HGS) test.<sup>[6]</sup> This test is widely used to measure strength as it is relatively simple, non-invasive, and inexpensive.<sup>[7]</sup> Because of its simplicity, non-invasiveness and predictive validity HGS can be used as health-screening tool for various diseases in primary health care system. Poor physical function and increased risk for many health hazards are signified by Low HGS.<sup>[8]</sup> Studies were also available reporting the association of increased risk of depressive symptoms with low handgrip strength among older adults.<sup>[9-12]</sup> But not much study is available on effect of perceived stress on muscle health of otherwise healthy young adults. Understanding the correlation between perceived stress and handgrip muscle strength and endurance can shed light on the interplay between psychological and physiological factors and how they influence overall well-being.

Therefore, this research aims to explore the correlation between perceived stress and handgrip muscle strength and endurance among healthy young adults. The objectives of this study were to measure the hand grip muscle strength, endurance, perceived stress by pre validated questionnaires and then to analyse if there is any correlation of perceived stress with handgrip muscle strength and endurance. By investigating the relationship between perceived stress and handgrip parameters, we seek to uncover potential connections between psychological stress and physical performance.

Overall, this research holds promise for enhancing our knowledge of the complex relationship between perceived stress and physical performance, offering valuable insights into the potential mechanisms underlying this connection.

### **Method & Materials –**

This cross-sectional study was done in 2019 at Department of Physiology, Gauhati Medical college & Hospital, Guwahati, Assam. Institutional ethical committee clearance (No. MC/190/2007/Pt-11/7) and written informed consent of the participants were taken prior the onset of the study. Total 80 healthy young adults of 18 to 21 years age had participated in this

study. On the day of examination, after taking brief history to know whether the participants meeting the inclusion criteria or not, the procedure was explained to the participants. Then perceived stress questionnaires were given to fill up and later handgrip muscle strength&endurance were measured.

**Inclusion criteria** – The healthy young adults of 18 – 21 years who were not having any musculoskeletal disorders or who were not athletes or doing regular gym activities, were included.

**Sample size calculation** – In a previous study<sup>[13]</sup> done on undergraduate medical students, prevalence for perceived stress among undergraduate medical students was found to be 46.3% (1), therefore  $q = 1 - 0.463 = 0.537$ , Confidence level = 95% (conventional),  $Z = 1.96$  (corresponding to significance level 0.05), Precision chosen was 11%,

$$n = z^2 pq/d^2 = (1.96)^2 (0.463)(0.537)/0.11 \times 0.11 = 78.93 = 79.$$

Rounding it up, we took 80 as sample size for this study.

**Perceived Stress Scale** - Perceived stress refers to an individual's subjective appraisal of the stressors they encounter and their ability to cope with them. Cohen's Perceived Stress Scale, which is globally accepted pre validated Questionnaire containing both positive and negative statements were administered to find out the stress level. The stress questionnaire contained statements where 0 = no stress and 4 = maximum stress. It has 10 questions asking the participants about their feelings and thoughts during the last month and the participants had to indicate by circling how often they felt that way in a 5-point Likert response format. Four of the items were reversely scored. The total score was calculated by summing the responses. (Scores of 0-13 = low stress, scores of 14-26 = moderate stress, scores of 27- 40 = high stress).<sup>[14]</sup>

**Hand grip muscle strength and endurance** were measured using hand grip dynamometer (INCO instruments & chemicals, Ambala). HGS was measured by asking the subject to hold the hand grip dynamometer in the dominant hand on the table and to perform a maximum contraction maintaining an angle of 90° flexion at the elbow. Two readings were taken, and between each reading one-minute rest was given to the subject. Best among the readings was taken. It was measured in kilograms.<sup>[15]</sup> To measure handgrip muscle endurance, the subjects were asked to maintain 1/3rd of maximal voluntary contraction for as long as he/she could. Then the time was recorded in seconds by using a stop watch.<sup>[16]</sup>

**Statistical analysis** of data was done by using SPSS software. Descriptive statistics was used to calculate mean of the variables of primary outcome measures that is mean of Handgrip muscle strength, endurance, perceived stress level. Student's t-test was used to compare the variables among males and females. Pearson correlation coefficient was used to correlate all the parameters that is to find association between different variables. P value of < 0.05 was taken as statistically significant.

## **Result** –

In this cross-sectional study, conducted to find the association of perceived stress with muscle strength and endurance in otherwise healthy young adults, total 80 healthy young adults had participated. Out of which, 47 were male and 33 were female. Average muscle strength in male was  $27.15 \pm 6.98$  (in kg), which is significantly higher than the female ( $10.76 \pm 6.19$ ).

Hand grip muscle endurance  $41.55 \pm 31.42$  (in second) is also significantly higher in male than female ( $16.15 \pm 9.8$ ). Average stress score was more in females ( $21.27 \pm 6.22$ ) than the males ( $18.28 \pm 5.093$ ). These general descriptive values of participants were shown in table 1.

Table 1 – General characteristics of the participants –

	All (Mean±SD) (n=80)	Male (Mean±SD) (n=47)	Female (Mean±SD) (n=33)	P value
HGS (in kg)	20.39±10.48	27.15±6.98	10.76±6.19	P=.00*
HE (in sec)	31.07±27.78	41.55±31.42	16.15± 9.8	P=.00*
Stress	19.51±5.74	18.28±5.093	21.27±6.22	P=.02*

\*P≤0.05 is significant

The correlation of perceived stress with hand grip muscle strength and endurance were tried to analyse. Although there was not any significant association of stress with muscle endurance, but we found significant negative correlation ( $r = -.270^*$ ) of stress with muscle strength which was shown in table 2.

Table 2 – Correlation coefficient

		Correlation coeff. (r)	Significance (p)
Stress vs. Handgrip strength	Male	-.013	.932
	Female	-.254	.153
	Total	-.270*	.015*
Stress vs. Muscle endurance	Male	.050	.737
	Female	-.173	.337
	Total	-.114	.313

\*P≤0.05 is significant

## Discussion –

This cross-sectional study, which was carried out in the Department of Physiology, Gauhati Medical college & Hospital, Guwahati, Assam, attempts were made to find any association of perceived stress with hand grip muscle strength and endurance. And we found significant negative correlation of perceived stress with hand grip muscle strength. Which means with increase in perceived stress there is significant decrease in muscle strength. This finding was same as that of the study done by K N Poornima et al where they got similar results in geriatrics.<sup>[17]</sup> Our finding is also in the line of a Japanese study where they found negative correlation of hand grip muscle strength with the Geriatric depression.<sup>[18]</sup> Previous studies proved negative effect of stress or depression on muscle health in geriatric population but our study added evidence that stress is negatively associated with skeletal muscle health in young

adults also. The possible mechanism explaining the association of perceived stress with muscle strength is that stress increases blood cortisol level, which in turn decreases muscle mass and strength.<sup>[19]</sup> Stress hormones decrease the muscle strength by increasing the muscle protein catabolism.<sup>[20]</sup> Oxidative damage in the skeletal muscle is also induced by stress hormones and thereby decreases muscle function.<sup>[21]</sup> A study done in healthy volunteers have shown that concentration of ribosomes and polyribosomes in skeletal muscles are decreased by infusion of stress hormones.<sup>[22]</sup> Another study done by Allen DL et al., has proved that atrophic gene expression and loss of muscle mass is induced by acute daily psychological stress.<sup>[23]</sup> An important concept which could be drawn from all these findings is, as the stress hormone increases it causes catabolism of proteins in the skeletal muscle and thereby reducing the muscle strength. Our study also showed that with increase in stress level there is decrease in muscle strength.

To the best of our knowledge, this study is the first to examine the association of stress with muscle endurance, as we could not find any previous literature in this context. But the findings of this study did not reveal a statistically significant association between perceived stress and muscle endurance. One possible explanation for the lack of statistical significance is the small sample size employed in this study. Or some uncontrolled variables may have introduced noise into our data, making it more challenging to identify a significant association. Although, the sample size in our study was representative of the target population, may have limited the power to detect subtle associations. Larger sample size, more sensitive methodologies might have been a greater chance of providing further insights into this relationship.

These findings imply that increased perceived stress may lead to decrease muscle strength and poor muscle strength is associated with increased risk of many other health hazards. So, proper care should be taken of the mental health of this young generation to ensure a productive future. Also, regular monitoring of hand grip muscle strength may be useful in prevention or early diagnosing many health hazards.

The strength of this study is that it was done in healthy young adults whereas most of previous studies were done in geriatric populations. And to the best of our knowledge this is the first study trying to find association of endurance with stress. This research may provide valuable insights for health professionals, exercise scientists, and psychologists in developing targeted interventions to mitigate the negative impact of stress on physical health. This study contributes to the existing knowledge by shedding light on the intricate interplay between perceived stress and muscular attributes, provides a foundation for future investigations in this area.

Limitation of this study was small sample size and stress was assessed by questionnaires only. We have not measured the stress hormone levels.

The findings of this study highlighted the complex nature of the relationship between perceived stress and muscular attributes, necessitating further research that could delve deeper into understanding the underlying mechanisms. Future studies incorporating larger and more diverse samples, employing precise measurement techniques such as electromyography, examining biomarkers, such as cortisol levels or inflammatory markers and considering longitudinal designs could provide deeper insights into the relationship between perceived stress and different aspects of muscular performance.

**Conclusion –**

In this study we found negative correlation of stress with muscle strength in healthy young adults. With increase in stress, the stress hormone level increases which in turn enhances muscle catabolism and decreases the strength. Poor muscle strength is also associated with many other health ailments. Therefore, stress should be viewed as an important risk factor in healthy young adults and should be managed efficiently through counselling, yoga or meditation to prevent development of other disability and comorbidity following muscle loss. Or some other effective stress management strategies and interventions should be developed that can promote both physical and mental well-being.

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**Conflict of interest** – Nil

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