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Correlation Between Hand Grip Strength And Body Mass Index Among Adult Women In Rural Area

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Abstract

Background *Obesity has emerged as a critical public health challenge, particularly affecting women in rural settings, where it is commonly correlated with diminished physical capacity and functional decline. Although Body Mass Index (BMI) is widely used to evaluate obesity, It fails to shed light onmuscle strength or overall physical fitness. In contrast, Hand Grip Strength (HGS) is a straightforward and dependable indicator of muscular strength and functional health. This study seeks to To delve into the interplay betweenBMI and HGS in adult women from rural communities.*

Method *A cross-sectional observational study was conducted on a cohort of 120 adult women, aged between 30 and 45 years, residing in the rural areas of Karad, Maharashtra. Participants were selected through a simple random sampling method to ensure unbiased and representative inclusion. Anthropometric measurements were taken to calculate Body Mass Index (BMI), using the conventional formula based on recorded height and weight. Hand Grip Strength (HGS) for both dominant and non-dominant hands was assessed using a calibrated push-pull dynamometer, adhering strictly to standardized assessment protocols. The collected data were statistically analyzed to examine the relationship between BMI and hand grip strength across the sample population.*

Result *- The analysis revealed a Findings indicate a subtle decline in grip strength as BMI increases, suggesting a weak inverse linkage. in the dominant hand ($r = -0.179$, $p = 0.050$), suggesting a slight inverse relationship.Pertaining to the non-dominant hand, the correlation was very weak and not statistically significant ($r = -0.112$, $p = 0.218$). Additionally, a moderate positive correlation ($r = 0.465$) Was evident in the context of grip strength in the dominant and non-dominant hands, indicating a fairly consistent level of muscular strength on both sides.*

Conclusion *Study outcomes demonstrate that a higher Body Mass Index is associated with rural women is modestly linked to reduced hand grip strength, highlighting that Higher body weight does not imply improved muscle strength. Evaluating both BMI and hand grip strength provides a more holistic view of physical health and functional capacity in this demographic. The results emphasize the critical role of incorporating physiotherapy-based strategies and lifestyle modifications to enhance musculoskeletal health and functional independence in women from rural communities.*

Keywords *Body Mass Index, Hand Grip Strength,Rural Health, Obesity,Muscle Strength, Women's Health.*

INTRODUCTION

The global surge in obesity, identified by the accumulation of excess body fat, Presents a substantial barrier to both individual health outcomes and healthcare systems worldwide[1]. Although previously concentrated in wealthier, urban populations, obesity is now increasingly observed in rural communities, With rural female populations disproportionately affected [2]. This shift is primarily attributed to ongoing Changes in daily routines, characterized by diminished physical exertionreliance on processed foods rich in calories, and limited access to healthcare services and nutrition education[3]. Additionally, cultural practices, economic limitations, and entrenched gender roles contribute to the growing risk of undetected and unmanaged obesity in these settings.Rural women encounter distinctive physiological and environmental influences at various stages of life—such as puberty, pregnancy, and menopausethat significantly affect body composition. Hormonal variations during these periods often lead to Heightened accumulation of visceral fat, linked to metabolic dysregulation and diminished muscular function [4]. Consequently, even women of similar body weight may exhibit differing physical capabilities due to variations in fat-to-muscle ratios, highlighting the inadequacy of relying solely on general anthropometric measures to assess health and fitness[5].

The Body Mass Index (BMI) is a commonly utilized and accessible Framework for sorting individuals intoweight classifications based on height and weight. However, BMI fails to distinguish between muscle mass and fat mass or To capture the spatial distribution of body fat [6]. This can result in inaccurate health evaluations, especially in populations like rural women, who often engage in physically demanding labor such as farming and domestic work[7]. Therefore, assessing BMI in isolation may overlook muscle weakness or impaired functionality.To complement BMI and address its limitations, hand grip strength (HGS) has emerged as a practical and informative metric for assessing muscle function and general health[8]. As a quick, low-cost, and non-invasive tool, HGS reflects upper limb strength and has been linked to important health outcomes such as physical independence, mobility, and even mortality risk[9]. It provides insight into overall muscle health And is shaped by multiple determinants, including age, sex, hormone levels, diet, and activity levels[10]. HGS has also gained recognition as a clinical marker in the evaluation of sarcopenia and frailty, conditions that are often underdiagnosed in rural healthcare contexts[11].

Contrary to common belief, aaugmented body weight does not necessarily indicate superior muscle strength. Research reveals that an increase in body fat—especially fat located within muscles or in the abdominal region—can impair muscle quality, diminishing strength and physical performance[12]. Individuals with high BMI do not always display greater hand grip strength; in fact, excessive fat can place stress on the musculoskeletal system, leading to reduced function[13]. Among rural women, this trend is especially prominent, as those with elevated BMI from sedentary lifestyles or unbalanced diets often show lower grip strength than similarly weighted women in urban areas[14].

In adolescent and young adult populations as well, evidence Highlights a potential link between increased weightdoes not automatically translate to greater strength. Rather, excess weight can negatively impact biomechanics and reduce efficiency of movement, ultimately weakening muscular performance[15]. Data from grip strength reference studies indicate that beyond certain BMI thresholds, HGS may plateau or even decline, suggesting Suggesting that elevated adiposity may counteract any benefits of added weight on strength[16]. These findings emphasize the value of using HGS alongside BMI for more comprehensive health evaluations.

Furthermore, when obesity and sarcopenia occur togethera condition termed sarcopenic obesitythe consequences on musculoskeletal health are amplified. This dual burden, common in middle-aged and older women, increases vulnerability to mobility issues, falls, and chronic metabolic conditions[17]. Hence, periodic monitoring of grip strength among women in rural areas is essential for early detection of declining functional capacity, allowing for prompt intervention through physiotherapy and targeted nutritional strategies[18].

Altogether, evaluating both BMI and HGS provides a more holistic view of an individual's functional and physical health, particularly in populations where activity levels and body composition are diverse. The dynamic interplay between fat mass and muscle strength demands multifaceted screening approaches for accurate health monitoring and policy planning in underserved rural regions[19]. Ongoing research focused on this dual assessment in rural female populations will contribute to more informed health strategies aimed at preserving independence and improving overall quality of life[20].

Aim of the study

Correlation Between Hand Grip Strength And Body Mass Index Among Adult Women In Rural Area.

MATERIALS AND METHODOLOGY –A cross-sectional observational study was designed Aimed at exploring the correlation between grip strength and BMI (BMI) among adult women residing in rural areas of Karad, Maharashtra. Prior to the Before the onset of the research, the study received approval from the institutional ethics committee. The study recruited 120 participants selected via a simple random sampling approach**.**Eligible participants were women aged between 30 and 45 years, identified as housewives, and classified under Grade II and III obesity according to World Health Organization (WHO) BMI guidelines. Women were excluded if they were pregnant, underweight, regularly engaged in physical exercise, or had medical conditions that could affect muscle functionConsent to participate was obtained in writing from all individuals after providing them with full information about thestudy.Anthropometric measurements included height, assessed using a stadiometer, and weight,

recorded using an analog weighing scale. BMI was calculated using the standard formula: BMI = weight in kilograms divided by height in meters squared (kg/m²).Hand grip strength (HGS) was assessed using a calibrated push-pull dynamometer. Measurements were Obtained in a seated posturewith the participant's elbow flexed at 90 degrees, wrist slightly extended, and forearm in a neutral position. All participants completed three iterations of the assessmentwith both the dominant and non-dominant hands, with appropriate rest intervals to prevent fatigue. The strongest recorded reading from each hand served as the basis for analysis.All procedures followed standardized protocols to ensure consistency and accuracy of the measurements.The primary objective of this methodology was Intended to measure the extent of association betweenBMI and muscular strength, as indicated by hand grip strength, within this rural female population.

Outcome Measures

- Hand Grip Strength (kg): Assessed using a calibrated push-pull dynamometer under standardized positioning and procedure.
- Body Mass Index (kg/m²): Calculated using the formula BMI = weight (kg) / height² (m²).

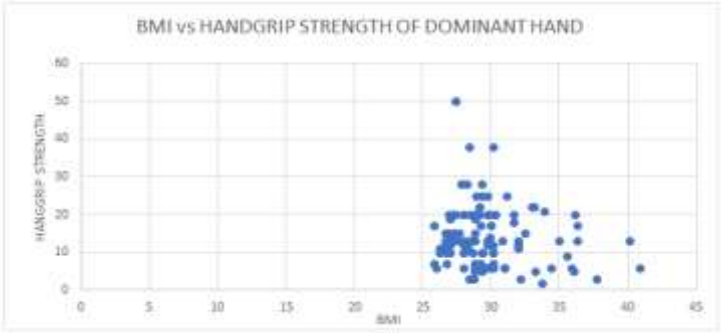
RESULT–

- **Table 1 and 2-**

	BMI (kg/m2)	*Dominant hand*	*Hand grip strength of dominant hand (kg)*	*Hand grip strength of non-dominant hand (kg)*
BMI (kg/m2)	1			
Dominant hand	-0.134993288	Right		
Hand grip strength of dominant hand (kg)	-0.179355928	0.287799417	Right	
Hand grip strength of non-dominant hand (kg)	-0.111557414	0.227947698	0.465022849	Right

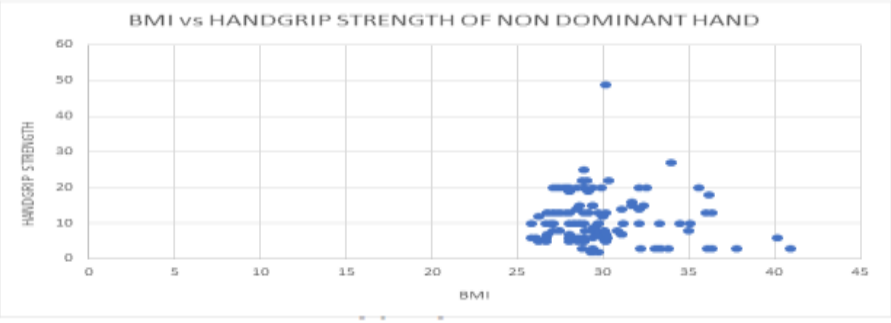
Interpretation- The findings demonstrate a weak Reciprocal relationship betweenBody Mass Index and hand grip strength in both the dominant and non-dominant hands, suggesting that as BMI increases, grip strength tends to decrease slightly. Additionally, a moderate There was a strong linear association betweendominant and non-dominant hand strength, indicating that participants generally exhibited greater strength in their dominant hand. Since all participants were right-handed, this further supports the influence of hand dominance on grip strength outcomes.

Graph-1



Interpretation- A modest inverse relationship was observed between Body Mass Index (BMI) and grip strength among the dominant hand ($r = -0.179$, $p = 0.050$), suggesting that higher BMI is marginally linked to reduced grip strength in the dominant hand. The p-value, being close to with values near 0.05, places the result at the threshold of statistical significance, indicating a potential but not definitive association.

Graph-2



Interpretation -There appeared to be an insubstantial inverse relationship between Body Mass Index and grip strength among the non-dominant hand (r = –0.112, p = 0.218). This suggests that as BMI rises, there is a slight tendency for grip strength in the non-dominant hand to decline, although the association is minimal.

DISCUSSION

This academic inquiry examined how Body Mass Index relates to (BMI) and hand grip strength (HGS) in both dominant and non-dominant hands among adult women living in rural areas. The results indicated a weak inverse correlation between BMI and grip strength, with correlation coefficients of r = –0.179 for the dominant hand and r = –0.111 for the non-dominant hand. These findings suggest that as BMI increases, there is a slight tendency for muscular strength to decrease, although the relationship is not strongly significant.

1. A plausible rationale for this finding inverse trend is the imbalance between fat accumulation and lean muscle mass in individuals with higher BMI. Excess body fat without proportional muscle development may compromise overall strength and reduce physical performance.This observation corroborates previous evidence suggesting thatparticularly in sedentary or non-athletic women, a higher BMI is often associated with diminished muscle function and lower grip strength.Although the correlation was weak, the outcomes align Reflecting the conclusions of prior studies that point tothat elevated BMI does not necessarily correspond with increased strengthespecially in populations with limited physical activity and potential nutritional deficiencies. This emphasizes the limitations of BMI as a standalone indicator, as Due to its inability to differentiate between fat and muscle mass, it may not serve as a precise indicator of functional status.In addition, the study revealed a moderate positive correlation (r = 0.465) between grip strength in the dominant and non-dominant hands. This suggests a relatively symmetrical distribution of muscular strength between both hands among the participants. As the predominant portion ofsubjects were right-handed, this correlation supports the commonly observed dominance effect, where the dominant hand typically exhibits slightly higher strength, but overall symmetry is maintained in healthy individuals.While some studies have found a positive association between BMI and grip strengthparticularly in individuals with greater muscle mass due to occupation or trainingsuch a pattern was not observed in this rural female cohort. The lack of regular physical activity or strength-based tasks among the participants likely contributed to the absence of any significant strength advantage with increased body weight.The findings highlight the importance of assessing both body composition and functional capacity when evaluating physical health. Relying solely on BMI may not provide a complete picture, particularly in populations where muscle mass is low despite a higher overall weight. Introducing targeted interventions such as resistance training and strength-based exercise routines may help enhance muscular function and improve quality of life in similar rural communities.To further interpret these data with greater precision future research should consider incorporating more precise body composition measurements, such as fat percentage and skeletal muscle mass, Complementing detailed assessments of physical activity and dietary habits. ProspectiveThese analyses may further presentinsight into whether rising BMI contributes to a gradual decline in strength, or whether reduced muscle function leads to increased inactivity and subsequent weight gain.

CONCLUSION

1. This study revealed a weak Hand grip strength in both dominant and non-dominant hands declined slightly with increasing Body Mass Index.among adult women from rural areas. As BMI increased, a slight reduction in grip strength was noted, suggesting that excess body weight may not necessarily enhance muscular strength in this demographic. While the association was not statistically strong, the findings suggest that increased adiposity could have a subtle negative impact on functional ability.

The moderate positive correlation observed between grip strengths of both hands indicates a general balance in bilateral muscle strength. These outcomes underscore the importance of promoting and maintaining healthy body composition and muscle function, particularly through consistent physical activity and strength-building exercises. This is especially relevant in rural settings, where access to health education and fitness resources may be limited.

Future research should focus on detailed assessments of body composition—such as measurements of lean muscle mass and fat distribution—to gain a more accurate understanding of their influence on physical strength. Including evaluations of physical activity levels and lifestyle factors could further enhance insight into how BMI affects overall functional capacity.

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