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Corelative Assessment of Hand Grip Strength and the Indian Diabetes Risk Score in Young and Middle-Aged Adults

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ABSTRACT

Introduction: Type 2 Diabetes Mellitus (T2DM) poses a significant public health challenge in India, with increasing prevalence among younger and middle-aged adults. Early identification of at-risk individuals is essential for timely intervention. Hand Grip Strength (HGS), a simple and validated measure of muscular fitness, has been suggested as a potential predictor of metabolic disorders, including T2DM. This study aimed to explore the correlation between absolute HGS and the Indian Diabetes Risk Score (IDRS), a widely used screening tool for undiagnosed T2DM.

Materials and Methods: A cross-sectional study was conducted at Sree Gokulam Medical College and Research Foundation from March to December 2023. A total of 180 participants aged 18–49 years, including students and faculty, were recruited. Anthropometric data, waist circumference, and HGS (measured using a TKK dynamometer) were recorded. IDRS was calculated based on age, physical activity, family history, and waist circumference. Absolute HGS was defined as the sum of the maximum grip strength from both hands. Participants were grouped by age (18–24, 25–35, and 36–49 years), and Spearman's correlation was used to assess the relationship between HGS and IDRS.

Results: The highest mean HGS was observed in the 25–35 age group, while the highest IDRS was noted in the 36–49 age group. However, no statistically significant correlation was found between absolute HGS and IDRS across any age group (p > 0.05).

Conclusion: Although no significant association was observed, the study highlights the potential value of combining physical and metabolic screening tools. Future research should explore relative HGS and longitudinal risk prediction.

Keywords: Hand Grip Strength, Indian diabetes risk score, Diabetes screening

INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) is an escalating health issue across India. [1] The projections for the year 2025 for India is approximately 69.9 million population affected with T2DM in which enormous number of cases would go undiagnosed. [1, 2] The primary causes of the same is nutritional transition in combination with lack in physical activity creating glycometabolic imbalance resulting in Diabesity. [1, 2] WHO reports a high prevalence of Impaired Fasting Glucose in the age group of 30- 49 years and 18- 29 years[2] and also states that 35- 64 years as the most prevalent age group with T2DM in the lower- & middle-income countries. [2] Hence screening younger adults with quick timely intervention is the key to prevention T2DM that would result in health promotion in India.

Handgrip strength (HGS) is an easy and validated tool which is associated with insulin action which can be used as predictor of onset of T2DM. [3, 4] HGS is reported to be affected by age, gender, and anthropometric indices (Height, weight, hand size) in combination with hand dominance. [5, 6] A recent meta-analysis has reported Hand Grip strength can be an efficient predictor of Type 2 Diabetes Mellitus. [7] Higher muscle strength leads to enhancement of glucose transport and several myokines which regulate glycometabolism. [8, 9] Previous literature from large cohort studies in US and China have reported lower HGS is associated with early onset of T2DM. [10, 11]

Indian Diabetes Risk score was created by Madras Diabetes Research Foundation and has been validated across various age groups for prediction of T2DM. [12] The tool considers 4 risk factors namely age, family history, physical activity and abdominal adiposity. This tool categorises subjects into 3 categories – Low, Moderate and High risk. [13]

It is crucial to understand the effect of muscular strength and adiposity on development of T2DM as both are essential to improvise public health recommendations. For example, if people with overweight/obesity can reduce the risk of T2DM

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by improving muscular strength, this has a large clinical and public health impact since overweight/obesity is prevalent in most middle and high-income countries. [14] Therefore, the purpose of this study is to investigate the relationship of absolute hand grip strength with risk of developing T2DM using Indian Diabetes Risk Score.

Research question:

Is there a correlation of absolute hand grip strength and Indian Diabetes Risk score in young and middle-aged adults?

Primary objective: To explore the correlation between absolute hand grip strength and Indian Diabetes Risk score in young and middle-aged adults

METHODOLOGY

Study design, study setting, study period: This cross-sectional study will be performed in Department of Physiology, Sree Gokulam Medical College and Research Foundation from the period of March 2023 to December 2023

Study population: The study population include the students and faculty of Sree Gokulam Medical College of either gender aged between 18- 49 years and who volunteer to participate in the study

Inclusion Criteria

1) Individuals aged between 18- 49 years of either gender

Exclusion Criteria

1) Any swelling, injury, fracture, pain in both the hands in past one year
2) Self-reported case of Hypertension, Type 2 Diabetes Mellitus, Thyroid disease

Sample size:

A pilot study was conducted with 10 participants to aid in sample size calculation. With a correlation co-efficient of 0. 218, $Z\alpha$= 1. 96, $Z\beta$= 0. 8416 the sample size of 180 participants was calculated.

Anthropometric measurement:

Anthropometric measurements will be recorded using standard medical equipment in subjects wearing light indoor wearing clothing. Body weight and body height will be rounded off to the nearest 0.5 kg and 0.5 cm respectively. Body mass index (BMI) was calculated as body weight (kg) divided by height (m^2). Waist circumference (WC) was measured using non stretchable tape in the midway section between the least palpable rib and the iliac crest with an accuracy of 0.1 cm.

Measuring the Hand Grip Strength

HGS will be measured with Dynamometer. This test will be performed with elbows at 90° angles on both sides in a standing (preferably) or sitting position. Keeping the wrist in a neutral position and adjusting the inner lever of the dynamometer to fit the hand. Both hands will be measured alternately thrice. Dominant HGS was regarded as the maximal value between three measurements of the dominant hand, and absolute HGS was defined as the sum of the maximum HGS values measured by both hands. [15]

RESULTS

Table 1: Anthropometric and HGS Data Across Age Groups"

Descriptive Results			
Variable	Group (A) Age 18-24(N=79)	Group (B) Age 25-35(N=48)	Group (C) Age 36-49(N=50)
Age	19.7±1.6	29.6±3.0	41.9± 4.1
Height	161.9±8.6	162.0±8.9	160.3±6.9
Weight	56.8±12.6	66.1±13.3	63.5±9.7
BMI	21.8±3.8	24.9±4.8	24.6±2.8
Waist circumference	78.5±8.4	88±11.9	89.5±7.5
HGS D	23.5±8.7	27.5±9.9	25.3±7.5
HGS ND	21.9±8.4	25.8±9.1	23.9±7.02
ABS HGS	48±17.7	55.3±19.1	52.1±14.8
IDRS SCORE	26.06±13.06	36.6±15.75	52.4±13.2

Correlation ABSOLUTE HGS and IDRS SCORE		
	Spearman's rank Corelation coefficient	P value
18-24(N=79)	-0.025	0.827
25-35(N=48)	-0.090	0.543
36-45(N=50)	-0.211	0.141
Total	0.015	0.839

The participants were divided into 3 groups A, B & C based on their age to reduce the age-related effects on the hand grip strength. The descriptive parameters of the participants in the 3 groups are given as mean and standard deviation.

The absolute hand grip strength was greatest in the 25- 35 age group which was expected for that age group. The IDRS score was highest for the 36- 49 age group which also was expected for this group as IDRS considers age is one of the risk factors for the onset of diabetes.

DISCUSSION

The present study investigated the relationship between absolute hand grip strength (HGS) and the Indian Diabetes Risk Score (IDRS) among young and middle-aged adults aged 18– 49 years. Despite the physiological rationale supporting an inverse relationship between muscular strength and diabetes risk, our study did not find a statistically significant correlation between absolute HGS and IDRS across any of the three age groups assessed.

The 25– 35 age group exhibited the highest average HGS, aligning with known age-related trends in muscle strength, while the 36– 49 group showed the highest IDRS, reflecting age as a direct component of the score. However, the Spearman's correlation coefficients for each subgroup were weak and non-significant. This contrasts with findings from Li et al. (2016) and Mainous et al. (2015), both of whom demonstrated significant inverse associations between hand grip strength and the prevalence of undiagnosed T2DM. [16, 17]

One possible reason for the inconsistency may lie in the use of absolute HGS in our study. Multiple investigations, including Peterson et al. (2016) and Churilla et al. ((2014, have highlighted that relative HGS (adjusted for BMI or body weight) is a more accurate predictor of metabolic disorders than absolute values alone. [18, 19] This adjustment accounts for variations in body composition, which plays a critical role in glucose metabolism.

Furthermore, Leong et al. (2015) in the PURE study involving 139,691 participants across 17 countries, identified grip strength as a strong predictor of cardiovascular and all-cause mortality, including diabetes-related outcomes, independent of physical activity or socioeconomic status. [20] The broader implications of muscle strength for metabolic health are therefore well-recognized globally.

In addition, Celis-Morales et al. (2018) in the UK Biobank cohort of nearly 500,000 participants found that lower grip strength was independently associated with a higher incidence of T2DM during follow-up, reinforcing the utility of muscular strength as a marker for early intervention. [21]

The lack of association in our study may also be influenced by the relatively homogeneous sample of medical students and faculty, whose lifestyle and physical activity patterns may not represent the broader population. Further, the sample size within each age group may not have been sufficient to detect subtle associations. Lifestyle confounders such as dietary intake, stress, sleep, and physical activity levels were not accounted for and may have diluted the correlation.

Conclusion & Recommendation: Despite these limitations, the use of simple screening tools such as HGS and IDRS in community and clinical settings offers promising opportunities for early detection and prevention of T2DM. While our findings do not support a direct correlation between absolute HGS and IDRS, further studies incorporating relative HGS, muscle mass indices, and longitudinal follow-up are warranted to elucidate the potential of muscular strength as a biomarker for diabetes risk.

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