



RELATIONSHIP OF HANDGRIP STRENGTH IN INDIVIDUALS OF IMPAIRED GLUCOSE TOLERANCE AS COMPARED WITH HEALTHY INDIVIDUALS.

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ABSTRACT

Background and Objectives- Diabetes mellitus is a slowly growing epidemic of the global world; with the morbidity and mortality associated with it, the knowledge of the disease is ever evolving. Handgrip strength is a simple non-invasive technique for detection of muscle strength. Association of handgrip strength with glycaemic levels and other anthropometric parameters provides an early pavement for detection of individuals at risk of diabetes mellitus. The current study aims at comparing handgrip strength among impaired glucose tolerance individuals as compared to healthy individuals. **Materials and Methods:** A total of 94 subjects; 48 individuals having impaired glucose tolerance and 48 individuals with normal blood glucose were taken as study population from patients visiting general medicine department kvg medical college and hospital, sullia, dakshin kannada. Handgrip strength was measured in both hands with Digital Hand Dynamometer. Average of 3 readings was taken. **Results:** A total of 96 individuals were in the study population, 48 were in IGT group and 48 were normal controls. The mean age in IGT group was 55.89 years with \pm 8.92 years. Handgrip strength was weak in 25 individuals in right hand and 33 individuals in left hand among IGT group. Blood sugar level had an inverse relationship with handgrip strength amongst IGT group and was statistical significant (p-value = 0.000). **Conclusion:** Hand grip strength could be an inexpensive tool for predicting likelihood of occurrence of diabetes mellitus. National non-communicable disease programme should include exercise routines for improving muscle strength and further large- scale studies needs to be taken up for the causality of handgrip strength on the risk of pre-diabetes.

KEYWORDS : Impaired glucose tolerance, Digital hand dynamometer, Handgrip strength

INTRODUCTION

India has been labeled as the world's IGT capital. The IGT population in the country is close to hitting the alarming mark of 69.9 million by 2025 and 80 million by 2030. (1) Impaired glucose tolerance (IGT) is a state in which an individual's blood sugar is more than normal but not crossed the level for diagnosis of diabetes mellitus. IGT prevalence is showing an increasing trend in India with current prevalence of 15% (2). More cases should be detected at this stage so as to prevent progression of disease to overt diabetes mellitus (Figure-1). Digital Hand Dynamometer is an effective, simple and non-invasive method to detect handgrip strength. There have been multiple studies in literature showing handgrip strength in IGT patients but there are no studies in our region addressing handgrip strength in IGT individuals. In the current study we are finding the relationship of handgrip strength with blood glucose levels and other anthropometric measurements so as to get a tool for early detection of IGT.

conducted at kvg medical college and hospital, sullia,DK,karnataka. Study was conducted after taking written informed consent from all participants.

Inclusion Criteria

- All individuals aged above 18 years and who fall in category of IGT according to American Diabetes Association (ADA) guidelines.

Exclusion Criteria

- Individuals with history of trauma/fracture/pain of upper limb
- Patients of chronic kidney disease, chronic liver disease, myopathies and cerebro-vascular accident.

METHODOLOGY

A total of 96 individuals were recruited for study out of which 48 of them were having IGT and 48 were normal controls. Individuals attending to outpatient department as well as the admitted individuals meeting the inclusion criteria were taken for study. Demographic data in form of age, gender and Body Mass Index (BMI) was obtained from all individuals.

Digital hand dynamometer was used to measure handgrip strength of both hands separately, average of three readings were taken with a gap of 20 seconds each after every attempt. Individuals were seated comfortably on chair without armrests. The shoulder was abducted and, with the elbow at flexion and the forearm and wrist in a neutral position. Oral instructions to squeeze the handle as hard as possible were given prior to as well as during the measurements.

Other anthropometric measurements were taken according to the standard protocol, relevant blood workup was done. All the data was entered in excel sheet and appropriate statistical analysis was applied.

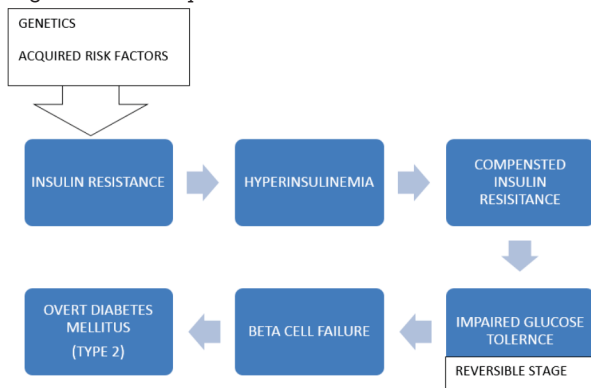


Figure 1 – Sequential Steps In Development Of Overt Type 2 Diabetes Mellitus

MATERIALS AND METHODS

The current study is a hospital based cross-sectional study

Statistical Analysis

SPSS (Statistical Package for Social Sciences) version 20. [IBM SPSS statistics (IBM corp. Armonk, NY, USA released

2011)) was used to perform the statistical analysis

- Data was entered in the excel spread sheet. Descriptive statistics of the explanatory and outcome variables were calculated by mean, standard or quantitative variables, frequency and proportions for qualitative variables. Chi square was applied to test the statistical association between qualitative variables. Unpaired t test was applied to test the mean difference between IGT and Normal controls groups with respect to age, weight, height, BMI, WC, HC, WHR, BP, Hand grips. ANOVA was applied to test the statistical mean difference between hand grip strength and BMI. The level of significance was set at 5%.

RESULTS

There were total of 96 individuals of which 48 had IGT amongst them 26 were male and 22 were female. The mean age of individuals under IGT group was 55.89 years with ± 8.92years [Table 1 and Table 3].

Table 2 depicts the handgrip strength among IGT and normal individuals. In comparison to normal individuals IGT group individuals had weaker handgrip strength which was statistically significant (p- value – 0.001).

Table 3 depicts various characteristics of study participants.

Table 3 – Depicts Comparison Of Various Characteristics Among IGT Individuals And Normal Controls.

Variables	Groups	N	Mean	Std. Dev	Mean Difference	p value*
Age	IGT	48	55.44	8.925	.646	.723
	Normal controls	48	54.79	8.899		
Height in meters	IGT	48	1.5863	.04783	.003	.767
	Normal controls	48	1.5833	.04822		
Weight in kgs	IGT	48	73.046	9.018	2.581	.166
	Normal controls	48	70.465	9.104		
BMI	IGT	48	29.100	3.946	.936	.243
	Normal controls	48	28.164	3.861		
Waist circumference in cms	IGT	48	98.06	4.450	.188	.840
	Normal controls	48	97.88	4.639		
Hip circumference in cms	IGT	48	102.348	4.792	1.552	.111
	Normal controls	48	100.796	4.653		
Waist to hip ratio	IGT	48	0.959	0.041	-.013	.130
	Normal controls	48	0.972	0.042		
SBP in mm of Hg	IGT	48	131.75	4.697	.292	.774
	Normal controls	48	131.46	5.231		
DBP in mm of Hg	IGT	48	84.92	3.780	.833	.279
	Normal controls	48	84.08	3.712		
RBS in mg/dl	IGT	48	173.33	21.350	51.854	.000
	Normal controls	48	121.48	17.052		
Hand grip strength value in kg - right	IGT	48	23.640	6.199	-2.823	.043
	Normal controls	48	26.463	7.230		
Hand grip strength value in kg - left	IGT	48	22.258	5.734	-4.038	.003
	Normal controls	48	26.296	7.295		

Table 3- Depicts Division Of Individuals According To BMI.

Hand grip strength	BMI	N	Mean	Std. Dev	Min	Max	F value	p value*
Right	Normal	7	22.19	6.68	13.60	34.80	0.221	0.803
	Overweight	24	23.95	5.71	11.20	33.60		
	Obese	17	23.80	6.94	13.50	34.90		
	Total	48	23.64	6.20	11.20	34.90		
Left	Normal	7	20.50	5.38	13.40	29.80	0.386	0.682
	Overweight	24	22.45	5.17	11.10	31.90		
	Obese	17	22.72	6.76	14.50	34.80		
	Total	48	22.26	5.73	11.10	34.80		

Hand grip - Right	BMI			Total
	Normal	Overweight	Obesity	
Normal	4	10	9	23
	8.3%	20.8%	18.8%	47.9%
Weak	3	14	8	25
	6.3%	29.2%	16.7%	52.1%
Total	7	24	17	48
	14.6%	50.0%	35.4%	100.0%

RBS had an inverse relationship with handgrip strength in IGT individuals and was statistically significant (p-value-0.000).

Table 4 and Table 5 include BMI and it's correlation with handgrip strength. There is no statistically significant correlation between handgrip strength and BMI in IGT group individuals.

Table1- Depicts The Gender Distribution Among Study Individuals

Gender	IGT	Normal controls	Total
Male	26	26	52
Female	22	22	44
Total	48	48	96

Table 2- Depicts The Handgrip Strength Among Study Individuals.

Hand grip	Right			Left		
	IGT	Normal controls	Total	IGT	Normal controls	Total
Normal	23	48	71	15	48	63
Weak	25	0	25	33	0	33
Total	48	48	96	48	48	96
	Chi square - 33.803			Chi square - 50.286		
	p value - 0.001			p value - 0.001		

Table 4 - Depicts Correlation Of Handgrip Strength With BMI.

Hand grip - Left	BMI			Total
	Normal	Overweight	Obesity	
Normal	2	8	5	15
	4.2%	16.7%	10.4%	31.3%

Weak	5	16	12	33
	10.4%	33.3%	25.0%	68.8%
Total	7	24	17	48
	14.6%	50.0%	35.4%	100.0%
Chi square - 0.075				
p value - 0.963				

DISCUSSION

The current study was undertaken to compare handgrip strength between individuals with IGT and with normal blood glucose levels. In a prospective observational study conducted by neha et al it was found that diabetics had significantly lower handgrip strength when compared to normal individuals [3] But no such study has been conducted amongst Indian population and our region. The present study was undertaken to analyze the handgrip strength among individuals of impaired glucose tolerance and correlate it with multiple variables so as to know the utility of handgrip strength as a tool for early prediction of possibility of occurrence of overt diabetes mellitus.

Individuals with IGT had significantly (p-0.001) had lower handgrip strength as compared to normal controls [Table-2]. A study conducted by Yeung et al showed improvement in muscle mass and strength can be a protective sink for disposal of glucose [4]. The possible mechanism would be that individuals with stronger muscles have increased insulin action with lower blood glucose levels and better insulin tolerance. Muscle strength improvement leads to increase in GLUT-4 transporter action, reduced blood glucose levels and better insulin action [5].

There was no significant correlation between handgrip strength and BMI.

This indicates that handgrip strength can be a strong predictor for risk of diabetes mellitus but will not depend on whether the individual is obese or not.

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