ORIGINAL ARTICLE

Internal Medicine Section

# The correlation of the duration of **Diabetes** with **Anthropometric Indices** in **Type-2 Diabetes Mellitus**

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## ABSTRACT

Background: With the increasing incidence of type-2 diabetes mellitus, there is an ever increasing need to correlate this disease with many parameters in order to ease the diagnosis and, to predict the risk factors and the hazards which are associated with it.

Aim: To correlate the duration of diabetes with the waist-hip ratio (WHR) and thigh circumference .

Settings and design: This is was a comparative study which was conducted on 30 subjects.

Material and Methods: Twenty two males and eight females who were, already diagnosed as to be having type-2 diabetes mellitus, were considered for the study. The history regarding the duration of diabetes mellitus with its duration was noted down. The anthropometric measurements (height, weight, waist circumference, hip circumference and, thigh circumference) were made by using standard procedures. The Body Mass Index (BMI) and the Waist Hip Ratio were also calculated.

Statistical analysis: The statistical analysis was made done by Pearson's correlation, by using the SPSS software (version 15.0).

Results: There was a positive correlation between the duration of diabetes and the waist hip ratio and a negative correlation between the duration of diabetes and the thigh circumference.
Conclusion: As the duration of diabetes mellitus increases, the anthropometric parameters also increase, and so does the incidence of cardiovascular risk, thus signaling suggesting that a check to must be kept on the much easily measurable anthropometric parameters, which could warn about the future risks.

## KEY MESSAGES

- As the duration of diabetes mellitus increases, the anthropometric parameters also increase, and so does the incidence of cardiovascular risk.

- Hence, a check has to be kept on the much easily measurable anthropometric parameters, which could warn about the future risks.

**Key Words:** Waist- hip ratio, Thigh circumference, Type-2 diabetes mellitus, Anthropometry

## INTRODUCTION

India is experiencing an epidemic of type-2 diabetes and related disorders [1], [2]. Several anthropometric indices have been devised to help the clinicians to predict the cardiovascular risk, including body mass index, waist circumference, hip circumference and the waist-hip ratio [3]. A higher waist-to-hip ratio, which can be due to a higher waist circumference, a lower hip circumference, or both, is associated with higher glucose levels and incident diabetes [4]. Both the waist circumference and the waist-to-hip ratio (WHR) are commonly used indicators of abnormal obesity [5], apart from body mass index.

Several studies in adults have reported a stronger positive association between the cardiovascular risk factors such as hypertension, and lipid and glucose concentrations with abnormal adiposity (measured by waist circumference or WHR), than with the overall adiposity(as measured by BMI) [6], [7], [8].

The muscle mass might may be better reflected by the thigh circumference [4]. The thigh circumference might be a better indicator for the leg muscle mass than the hip circumference because it might be less influenced by the bone (pelvic width) and the gluteal fat [4]. In this study, we considered the independent contributions of the thigh circumference and the waist-hip ratio with the duration of diabetes mellitus.

## MATERIALS AND METHODS

This comparative study comprised of 30 subjects who were, aged above 30 years, with a past history of diabetes mellitus. An equal number of age and sex matched controls were included in the study. Ethical clearance was obtained from the institution. Informed consent was also obtained from each subject. The history of diabetes mellitus was noted down by oral questioning.

The height was measured in from barefoot to the nearest 0.1cm by using a wall fixed stadiometer. The body weight was recorded to the nearest 0.1 kg by using a portable weighing machine. The body mass index was calculated as the weight divided by the squared height squared (kg/m2). By using a measuring tape, the waist circumference was measured at the level which was midway between the lowest rib margin and the iliac crest, the hip circumference at the widest level over the trochanters and the thigh circumference directly below the gluteal fold of the left leg. WHR was calculated as by dividing the waist circumference divided by the hip circumference.

The statistical analysis was made done by Pearson's correlation by using the SPSS software package (version 15.0).

## RESULTS

The mean age of the subjects in the study group (cases) was 52.74 years and that of the subjects in the control group (controls) was 51.93 years. The distribution of the subjects into different age

groups is shown in [Table/Fig 1].

| Age (years) | Number of Controls | Number of Cases |
|---|---|---|
| 31 – 40 | 3 | 3 |
| 41 – 50 | 12 | 10 |
| 51 – 60 | 8 | 7 |
| 61 – 70 | 6 | 8 |
| 71 - 80 | 1 | 2 |
| Total | 30 | 30 |

**[Table/Fig 1]:** Age-wise distribution of subjects

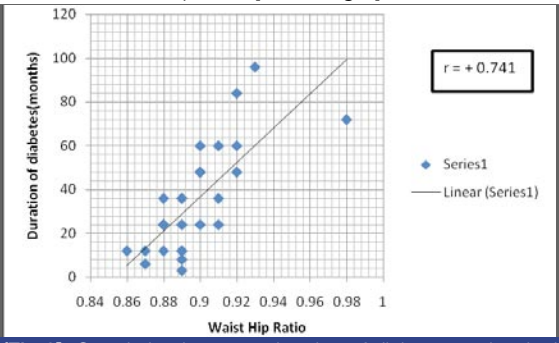
There were 22 male and 08 female subjects in the study group whereas and 20 male and 10 female subjects in the control group.

The mean height of the subjects in the study group was 158.20±9.37 and that of the subjects in the control group was, 154.63±8.05. The mean weight of the subjects in the study group was 71.20±12.7 and that of the subjects in the control group was, 65.84±13.06. The mean BMI of the subjects in the study group was 28.83±5.87 and that of the subjects in the control group was, 24.42±5.5. The mean waist circumference of the subjects in the study group was 92.46±10.23 and that of the subjects in the control group was, 88.3±4.10. The mean hip circumference of the subjects in the study group was 105.58±6.09 and that of the subjects in the control group was, 98.63±9.87. The mean WHR of the subjects in the study group was 0.91±0.11and that of the subjects in the control group was, 0.61±0.64. The mean thigh circumference of the subjects in the study group was44. 92±4 and that of the subjects in the control group was, 43.8±4.31 [Table/Fig 2].

| | Cases(n=30) (Mean ± SD) | Controls(n=30) (Mean ± SD) | 't' value | 'p' value | Significance |
|---|---|---|---|---|---|
| Waist Circumference (cm) | 92.46±10.23 | 88.3±4.10 | 1.87 | <0.05 | Significant |
| WHR | 0.91±0.11 | 0.61±0.64 | 2.02 | <0.05 | Significant |
| Thigh Circumference (cm) | 44.92±4 | 43.8±4.31 | 0.45 | 0.87 | Not-Significant |
| Hip circumferenc (cm) | 105.58±6.09 | 98.63±9.87 | 2.43 | <0.05 | Significant |
| Height(cm) | 158.20±9.37 | 154.63±8.05 | 0.62 | 0.46 | Not significant |
| Weight(Kg) | 71.20±12.7 | 65.84±13.06 | 2.25 | <0.05 | Significant |
| BMI(Kg/m2) | 28.83±5.87 | 24.42±5.51 | 2.04 | <0.05 | Significant |

**[Table/Fig 2]:** Comparison of various biological measurements of the study subjects

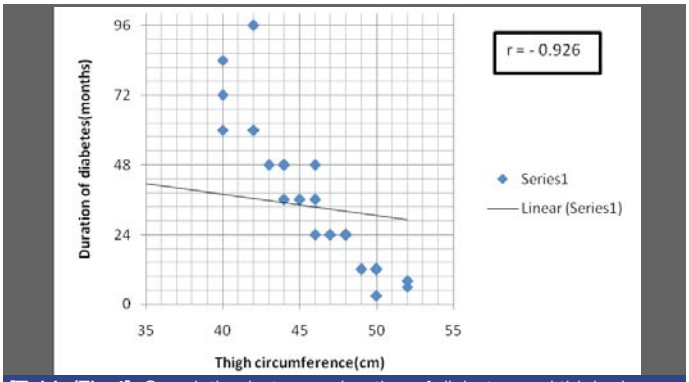
A positive correlation was found between the duration of diabetes mellitus and the waist-hip ratio [Table/Fig 3].




**[Table/Fig 3]:** Correlation between duration of diabetes and waist hip ratio

Note: n = 30, but some points are overlapping in the scatter diagram.

There was a negative correlation between the duration of diabetes mellitus and the thigh circumference [Table/Fig 4].




**[Table/Fig 4]:** Correlation between duration of diabetes and thigh circumference

Note: n = 30, but some points are overlapping in the scatter diagram.

## DISCUSSION

On analyzing the results of the present study, it was found that the subjects in the study group had significantly more weight and BMI, whereas there was no significant difference in the height. BMI is the most frequently used measure of obesity because of the robust nature of the measurements of weight and height and the widespread use of these measurements in the population health surveys. BMI does not however take into account the proportion of the weight which is related to the increased muscle or the distribution of excess fat within the body, both of which affect the health risks which are associated with obesity [6]. The waist-hip ratio and BMI have been found to be powerful predictors of NIDDM in men and women [9], [10], [11]. Recent reports document the associations of the waist circumference with cardiovascular risk factors [9], [12], [13].

In the present study, the study group subjects had a significantly higher waist circumference, hip circumference and WHR. Although, there was a higher thigh circumference, it was not statistically significant. There was a positive correlation between the duration of diabetes and the WHR, whereas a negative correlation was found between the duration of diabetes and the thigh circumference.

Shigetoh et al (2009), in their study, suggested that there are at least three mechanisms by which the sympathetic activation may predispose to diabetes mellitus, as well as and by which the higher sympathetic activity may predispose ing to many cardiovascular ill effects [14]. There is more sympathetic activation in obesity. It was demonstrated by Deibert et al (1980), that the stimulation of the ß-adrenergic receptors caused acute insulin résistance [15]. They infused epinephrine into humans, which caused an acute reduction in the insulin-stimulated uptake of glucose [15]. Secondly, chronic ß-adrenergic stimulation increases the proportion of insulin-resistant fast-twitch muscle fibers in rats [16]. The third mechanism may be the most important; the sympathetic activation causes vasoconstriction and decreases the skeletal muscle blood flow, resulting in the impairment of glucose uptake into the skeletal muscles [17].

Studies by Parker et al (2009) have shown that a larger hip circumference significantly reduces the risk of incident diabetes and coronary heart disease [18]. Studies by Snijder et al (2003) [4] have also suggested that the thigh circumference was strongly and negatively associated with the waist-hip ratio and the duration of diabetes. A high WHR has been associated with a higher proportion of type II b muscle fibers and a lower capillary density at the thigh, which may be associated with decreased glucose transport and reduced insulin sensitivity [4], [19].

Larger thigh and hip circumferences could also reflect increased femoral and gluteal subcutaneous fat respectively. Particularly in

women, these depots have a relatively high lipoprotein lipase activity and a relatively low rate of basal and stimulated lipolysis [20]. These depots may protect the liver and muscle from a high exposure to free fatty acids through uptake and storage. The interpretation of the hip circumference, however, may be different between in men and women. It is plausible that the variation in the hip circumference in women is explained mostly by the variation in the gluteal fat mass and the pelvic width, whereas in men, the muscle mass might be the main determinant [4].

In conclusion, the present study shows that the duration of diabetes mellitus has a positive correlation with the WHR whereas and a negative correlation with the thigh circumference. Further research is needed to elucidate the underlying mechanism that may lead to the negative association of the thigh circumference with diabetes mellitus.

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