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Original Research Article

Changes in body composition parameters with duration in type II diabetics: an observational study

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ABSTRACT

Background: Diabetes mellitus being a metabolic disorder lot of alteration takes place in body composition parameters such increase in fat mass, decrease in muscle mass, increase visceral fat. With advancing age, the predominant feature develops which is more prevalent in diabetes. These changes in body composition should be monitored. The changes if monitored at an early age, can be well managed and proper interventions can be developed. The study was conducted to observe the changes taking place in the body composition parameters in individuals with type II diabetes with varied duration of the disease.
Methods: This cross- sectional study was done in 228 type II diabetic subjects from the clinics of the Mumbai and Pune. The baseline data was collected from the all the subjects coming to the clinic through the general questionnaire, Anthropometric measurements and Body composition analysis was done by the BIA principle-based Analyser. Then these subjects were distributed according to the duration of the disease and then analysed. The data was analysed using SPSS version 22 and mean values p values were obtained.
Results: The results showed that there is statistically significant increase in fat mass, visceral fat and decrease in muscle mass.
Conclusions: There is change in body composition parameters like decrease in muscle mass, increase in fat and visceral fat along with the increase in the duration of the disease.

Keywords: Body composition, Type II diabetes, Sarcopenia

INTRODUCTION

In recent years, there is rapid increase of age in developing countries like India.[1] The census report of 2011 reported 5.3% percent of people are above 65 years and is projected to rise above 11.1% by 2025.[2] They suffer from high rate of morbidity and mortality as they are more prone to infections and chronic noncommunicable diseases.[3] Diabetes and its complications take a major toll on the quality of life of the elderly population and the healthcare cost of the society. According to IDF,[4] the global prevalence is estimated to be 387 million adults of 20-79 years and 8.8% of these are from India.

Diabetes mellitus (DM) being a chronic metabolic disorder characterised by hyperglycaemia and caused by defects in the secretion or action of insulin, altering body composition parameters, leading to inflammation, oxidative stress, redistribution of fat, and lipid infiltrations.[5,6] Hence, unfavourable changes are observed in DM such as, increased fat mass, visceral fat, and decrease in muscle mass.[7] With advancing age, a predominant feature Sarcopenia (loss of muscle mass) is observed.[8] The current prevalence of Sarcopenia is

17.5%.[9] Sarcopenia is almost two to three times more prevalent in individuals with Type II diabetes.[10] Studies conducted in India have shown changes in the body composition parameters in Type II diabetes.[11]

If altered body composition diagnosed at an early stage, they can be well managed. In India, the studies done on changes in body composition parameters in Type II Diabetes are limited. Hence with appropriate diagnosis of pre sarcopenia and proper interventions in the diet and exercise, the development of sarcopenia can be controlled.

The study was conducted to observe the changes taking place in the body composition parameters in individuals with type II diabetes mellitus in varied duration of the diseases.

METHODS

This cross-sectional study was done in the year February to September 2016 in metro cities of India, Pune and Mumbai. The samples were collected from the clinic with diabetologists Dr. Ravindra Sethiya in Pune and Dr. Vijay Kulkarni in Thane Mumbai. The study was approved by institutional ethics committee. The data collection was done by Random selection technique. The randomly selected individuals diagnosed with type II diabetes were from the clinic setting area. The required permissions and approvals for approaching the subjects in clinics were obtained from the respective physicians or medical practitioners after discussing the proposal with them in details and obtaining their consent and willingness to cooperate. Thus, the subjects were contacted and their consent was obtained for voluntary participation.

The inclusion criteria for this observational study were the subjects with type II diabetes above the age of 45 years with higher BMI, and the exclusion criteria was those with pacemakers, having the steel rods and insulin dependent individuals were excluded.

The study included 228 subjects on voluntary participation which were equally distributed according to the duration of the disease. The categories were a) 1 month to 5 years and 11 months, b) 6 to 10 years and 11 months, c) 11 to 15 years and 11 months, d) 16 to 20 years and 11 months and e) 21 years and above.

Tools used for data collection included: a) Questionnaire to collect the personal information regarding, age, sex, and duration of the disease. b) Anthropometric measurements such as weight, height and waist and hip circumferences were taken using calibrated standardised equipment like weighing scale, stadiometer and measurement tapes c) The assessment of body composition is done using calibrated body composition analyser (Tanita, Model - MA 420) which works on the principle of bio-electrical impedance. The values and measurements for body fat (%) muscle mass (Kg), fat mass (kg), fat percentage, Total body water (kg), were obtained by use of analyser.

RESULTS

The total study population comprised of 103 males and 125 females aging between 45 to 80 years with the mean age of 68.53±7.82 years in males and 67.2±8.4 years in females. The mean duration observed was 12.6 years and 12.1 years respectively in males and females.

Changes in anthropometric parameters

The overall study showed the mean weight of 66.9±7.47 kgs and mean height of 156.9±4.4 cms with average BMI of 27.89±2.9 kg/m^2. The results obtained from the overall population showed a significant positive correlation between the weight, BMI, WHR, and duration of the disease. As age advanced there was increase in weight, BMI and WHR, also these values were statistically significant with duration of the disease (p value <0.05). When the total population was compared between males and females the results showed significant relation with WHR (<0.005).

Table 1: The following table indicates the mean values of anthropometric measurements in males and females.

Anthropometric Measurements	Males (n=103)	P value	Females (n=125)	P value
Weight (kgs)	68.1 (±6.43)	0.001*	65.8 (±8.1)	0.002*
Height (cms)	158.09 (±4.65)	0.09	156.01 (±3.97)	0.1
BMI (kg/m2)	27.3 (±2.91)	0.003*	27.09 (2.89)	0.00*
Waist (cms)	98.4 (±9.1)	0.00*	98.7 (±9.81)	0.00*
Hip (cms)	113.2 (±7.9)	0.00*	113.5 (± 7.3)	0.00*
WHR	0.89 (±0.51)	0.00*	0.91 (± 0.07)	0.00*

*P<0.05.

Table 2: The following table shows the p values of the body composition parameters categorised in males and females.

Body composition parameters	Mean		P values		Std deviation		Reference values (body composition analyser)	
	n=103	n=125	n=103	n=125	n=103	n=125		
	Males	Females	Males	Females	Males	Females	Males	Females
Fat (%)	42.4	42.4	0.90	0.48	±5.7	±6.4	14.2	25-35
Fat mass	27.07	29.07	0.69	0.72	±5.43	±6.70	8 -16.2	12-20.2
Muscle mass	18.8	19.2	-0.93	1	±7.15	±7.6	33-55	34-60
Bone mass	1.9	2.1	-0.63	0.19	±0.28	±0.24	>3.29	>2.4
Visceral fat	10.4	10.9	0.001*	0.00*	±2.8	±2.5	<10	<10

*P<0.05.

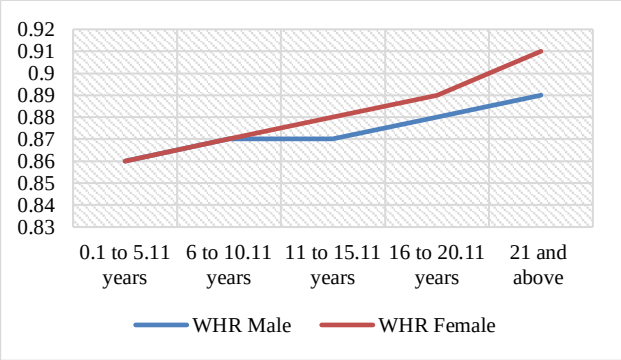

Figure 1: WHR comparison in males and females.

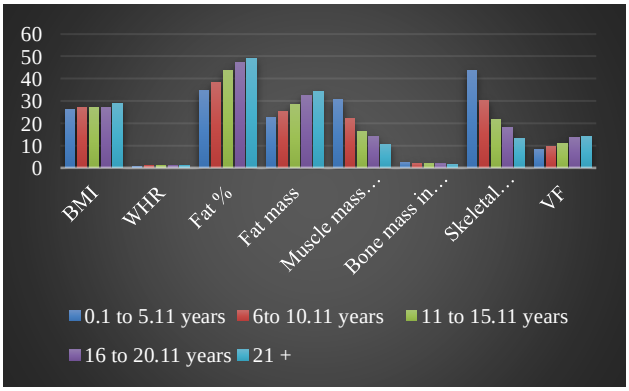

Figure 2: Changes in the body composition along with the duration of the disease.

Changes in body composition parameters

Body composition parameters obtained from the analyser are fat percentage, fat mass, muscle mass, bone mass, water content and visceral fat. The total study population average values were: 42.4±6.15 % fat percentage, 28.4±6.17 kgs fat mass, fat free mass 43.6±4.04 kgs, muscle mass 19.04±7.40 kgs, bone mass 2.05±1.81kgs and visceral fat 10.7±2.69.

The data obtained showed that along with increase in age there is increase in fat percentage, fat mass, and visceral fat. These parameters also showed the statistically positive significant correlation with the duration of the disease (p values less than 0.001, 0.00 and 0.00 respectively). When the total population was compared gender wise the results showed increase in the fat percentage, fat mass, visceral fat and decrease in the muscle mass and bone mass when they were compared with the reference values of the calibrated analyser.

The visceral fat values when compared gender wise were found to be statistically significant with the duration of the disease (p<0.05).

DISCUSSION

The present study showed significant changes in anthropometric measurements majorly in females in weight and BMI. Similar results were stated by Olivarius in 2015 which showed the results of increase in weight and consequently BMI.[12] This increase in weight may be due to physical inactivity after the retirement. Also, the subjects mainly comprised of the postmenopausal women who had some hormonal changes which increase the inflammation and oxidative stress and this also causes increase in weight.[7] The results also showed increase in WHR and increase in the fat percentage as the subjects had higher visceral fat in females. Increase in the inflammation leads to higher visceral fat which is reported by the present study.[9] The overall increase in the body fat, this also increases the adipose tissues and thus there is redistribution of these adipose tissues in the abdominal areas more than in peripheral adipose tissues. This abdominal fat further increases the hyperglycaemia due to insulin resistance.[11,13,24]

The present study shows that with advancement of age and duration of the disease there are changes in Body composition parameters. There is substantial decrease in muscle mass and increase in fat mass. Some of the other studies also reported the same results that individuals with Type II diabetes have significantly lower muscle mass than those without diabetes.[17] The health, aging, and body composition (Health ABC) study also showed that older adults with type II diabetes lost their knee extensor strength more rapidly than nondiabetic subjects did.[18] Another study done by Pegah in diabetic patients also

showed that there was greater decline in muscle mass and leg muscle strength, and muscle quality was poorer[19] Similarly, Jang et al in 2016 also have demonstrated that leg muscle strength and gait speed is reduced in older peoples with diabetes.[20] The possible reasons for increase in fat mass and decrease in muscle especially in Diabetes is progression of the disease and its complications.[14] Another major reason for reduction of muscle mass and strength is age, as it inevitable.[10] Other possible reasons may be increased insulin resistance, inflammatory cytokines, and endocrine changes associated with Diabetes having adverse effects on muscle. As there is decline in muscle mass, the muscle mass quality is affected and hence physical performance is also affected. This in turn also affects the glycaemic control.[8,21]

As reported by Hamasakhi et al in 2014, the possible reasons for decrease in muscle mass may be that amino acid metabolism decreases in Type II diabetes.[22] Insulin resistance (IR) inhibits the mammalian target of the rapamycin pathway that leads to protein synthesis and protein degradation. IR also increases activation of the ubiquitin-proteasome pathway, that results in degradation of muscle protein. Overall, increased inflammation with insulin resistance leads to increase in fat mass and decrease in muscle mass.

CONCLUSION

Type II diabetes a metabolic disorder has a major influence on parameters of body composition. This altered body composition will lead to overall ill health and reduced physical capacity decrease the physical performance which in turn will reduce morale and overall interest of individuals towards life. Through this study we understood that there was age wise progression in altered body composition. Thus, this study will be beneficial for the community as it will create awareness about the body composition analysis at early stage which will reduce the complications like sarcopenia and frailty. The study could be done for longer duration and a greater number of people and follow up was not limited. The further study can be development of the strategies for maintaining the muscle mass and its implementation before the period of peak muscle accretion to improve muscle function and physical performance.

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