wjpmr, 2018,4(3), 23-27

SJIF Impact Factor: 4.639

WORLD JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.wjpmr.com

Research Article

ISSN 2455-3301

WJPMR

ANTHROPOMETRIC MEASUREMENTS IN NORMOGLYCEMIC OFFSPRING OF PATIENTS WITH T2DM ON GRADED EXERCISE

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Article Received on 31/12/2017 **Article Revised on 21/01/2018** **Article Accepted on 11/02/2018**

ABSTRACT

Objectives: It is uncertain if exercise could influence the occurrence of T2DM in offspring of diabetic parents. Therefore this study was designed to assess the effect of exercise on anthropometric parameters of offspring of T2DM parents compared with offspring of non-diabetic parents. **Design:** This study involved purposive selection of 50 offspring of T2DM parents attending University Collage Hospital, Ibadan and 50 offspring of non-diabetic parents who are undergraduate students of the University of Ibadan, Nigeria. Participants were randomly assigned into four groups: 25 Normal-weight Offspring of Non-Diabetic Parents (NONDP), 25 Normal-weight Offspring of Diabetic Parents (NODP), 25 Overweight Offspring of Non-Diabetic Parents (OONDP) and 25 Overweight Offspring of Diabetic Parents (OODP). Each participant followed a protocol of graded exercise using tummy trimmer everyday spending 30-45 minutes daily for 24 weeks. Weight and Body Mass Index(BMI) were estimated using standard methods at baseline, six week, 12 week, 18 week and 24 week, respectively. Data were analyzed using descriptive statistic and repeated ANOVA at $\alpha_{0.05.}$ **Results:** Atbaseline, there were reduction in weight (kg) (NONDP:61.47±1.51to59.50±1.60,NODP:67.65±4.77to63.38±5.52,OONDP:66.99±2.01to64.42±1.95andOODP73.28±2.35to71.52±2.35andBMI(kg/m2)(NONDP:21.88±2.78to21.18±2.19,NODP:22.99±1.50to22.26±1.46,OONDP:26.37±4.42 to24.83±4.27 and OODP 29.30±3.23to27.92±3.23 after six months of exercise. **Conclusions:** Graded exercise alters body weight and BMI in all the groups. The clinical importance of graded exercise in prevention of diabetes mellitus among offspring of diabetic parents looks promising.

KEYWORDS: Graded exercise, Diabetic parents' offspring, weight, BMI.

INTRODUCTION

Diabetes mellitus, commonly known as diabetes, is a disorder of intermediary carbohydrate, protein and lipid metabolism. It is characterized by hyperglycemia, glucosuria, polydipsia, polyuria, polyphagia and weight loss. It is usually associated by secondary alterations in glucose, fat and protein metabolism, leading to many biochemical disorders. It is characterized by peripheral insulin resistance, impaired regulation of hepatic glucose production with declining β-cell function and eventually leading to β-cell failure.[1]

Diabetes Mellitus (DM) is one of the most common chronic diseases in the world and the most challenging health problems of the twenty first century.[2] It is estimated that by the 2030 the number of people with diabetes will increase to more than 366 million, more than twice the number in 2000.[3,4] Most of these new cases are from developing countries and it seems that the Middle East is among the regions that will have the largest increase in prevalence of diabetes by 2030.[4]

In 2011 it was estimated that 366 million people worldwide had diabetes,[5] but its prevalence is increasing rapidly because of increasing age of the population and surge of obesity in many countries including Iran. In Iran, about 10% of the general population had diabetes mellitus or impaired fasting glucose in 2008.[6] And in the recent study in Yazd, the result of study showed the prevalence of known diabetes and impaired fasting glucose was 16.3% and 11.9% respectively.[7]

Type 2 diabetes is a chronic disease characterized by hyperglycemia and dyslipidemia due to underlying insulin resistance. The condition commonly progresses to include micro vascular and macro vascular complications.[8,9] Obesity and particularly abdominal obesity are strongly associated with insulin resistance.[10,11] Diabetes results from the combination of genetic and environmental factors.[12] There are strong evidences to suggest that modifiable risk factors such as obesity and physical inactivity are the non-genetic determinants of the diabetes.[13,14]

The occurrence of rapid and major lifestyle changes in the many countries has increased the prevalence of obesity and other non-communicable disease risk factors such as hypertension and dyslipidemia, which have been reported to be the major etiologic factors the rising incidence of type 2 diabetes around the globe.[15]

The Body Mass Index (BMI), defined as the weight in kilograms divided by the height in meters squared, anthropometrics parameters to evaluate body fat and fat repartition in adults. And these parameters have ethnic susceptibility.[16,17] Some authors showed that BMI is predictor of type 2 diabetes outcome.[18] The aim of this study was to see the effect of exercise on some anthropometric measurements after six months of exercise in normoglycemic offspring of T2DM patients.

METHODS

Experimental interventional study was carried out in which weight and BMI was measured in offspring of patients with type 2 diabetes mellitus and normoglycemic offspring of non- diabetic parents. The parents of the test group were attending the medical out-patient clinic (MOP) of the University College Hospital (UCH), Ibadan and Catholic Hospital Oluyoro, Oke-Ofa, Ibadan, South Western, Nigeria. The normoglycemic offspring of non-diabetic parents aged 25years and above were randomly selected from general population of Ibadan Community, Ibadan, and South-Western, Nigeria and undergraduate students of University of Ibadan. These are normoglycemic offspring of non-diabetic with normal weight served as control subjects.

The participants were divided into four groups (n=100) as follows:

A – Overweight /Obese offspring of DM parents (OODP).
B – Normal weight/ Normal Body Mass Index (BMI) offspring of DM parents (NODP).
C – Overweight / Obese offspring of non-diabetic parents (OONDP).
D – Normal BMI / weight offspring of non-diabetic parents (NONDP).

The study was approved by the University of Ibadan Teaching Hospital Ethical Committee (UI /UCH joint IRB) and Catholic Hospital Ethical Committee prior to its implementation.

Heights of participants were taken using standard hospital-adult vertical rule with sliding arms which had been recalibrated and certified by a Biomedical Engineering technician prior to use. The study subject stood erect, upright and bare-footed. Those who had extra clothes such as coats and sweater removed them while Omron equipment measurements were being taken.

Body mass index (BMI) reading value for the subject was read off as displayed on the screen of Omron equipment. The BMI values were used to group subject into four categories. Underweight – BMI<18.5kg/m^2 Normal weight – BMI = 18.5 to 24.9 kg/m^2 Overweight- BMI = 25-29.9kg/m^2 Obese –BMI = >30.0 kg.m^2 (NIH calculator, 2011).[19]

Omron fat estimator (Yunmai smart scale)[20] was used to measure the BMI. The subject stood uprightly bare-footed put on light clothing. The subject held his stretched hands forward as if he was riding a motor-bike.

Readings (BMI and weight) were read off as displayed on the screen. The readings were recorded in the recording book.

Tummy trimmer, a portable, aerobic exercise, lightweight equipment (European Home Choice Company, Lagos, Nigeria) was selected for the study. It is in-door anaerobic equipment. It is compact and can fit right in the subject’s brief case.

During each phase of exercise the Tummy trimmer, a portable lightweight equipment, is held at the two handles and the sole of the two feet are put inside the pedal rest while the subject assume different positions. The subject will then pull the tummy trimmer’s spring towards himself or herself either while lying flat or sitting up on the floor or carpeted hard surface.

Subject sits up with leg straight, leans his or her body backwards until completely lying back with head on floor. He/she returns to sitting position in harmonic fashion. The subject was advised to start slowly and work up to repetitions as she/he feels comfortable with harmoniously.

The subject was advised to lie flat on floor, extend his/her legs straight up in the air. He will be keeping his/her back on the floor and raise the lower legs without bending them. The subject was advised to sit erect with legs straight horizontally he/she raises handle to tummy height using arms only.

Finally, subject was advised to lie flat on the floor while he/she bends knees up to his/her chest. He/She makes a circular motion push feet up and then round towards the floor again. The different positions were observed for exercise period of 30 to 40 minutes (a video clip of the exercise procedure was shown to the subject before the commencement of the exercise).

Each subject was advised

(1) He/She to undergo the 4 phases of exercise between 30 and 40 minutes daily (either in the mornings or evenings).

(2) He/She to contact the researcher on cell phone anytime when he/she has any problems with the unit.

(3) There were regular cell phone calls made to each of the subjects by the research assistant to ensure compliance with exercise schedule.

(4) The research assistant called them on cell phone and sent s.m.s (Short Message Service) to them to keep return appointments every six weeks. This was done one or two days before appointment schedule.

The data obtained was analyzed using computer statistical programme package SPSS version 15.0. Probability value of **P** less than 0.05 was considered statistically significant.

RESULTS

Anthropometric Measurements

This is shown in Tables 1 and 2. The weight measurements of participants before, during and after 6 months of exercise are shown in Table 1.

The weight progressively reduced in all the groups. 73.28 ± 2.38 kg in OODP reduced to 71.52 ± 2.35kg after six months of exercise.

The P-values after statistical analysis are shown in the last column of the table. The levels of significance were also asterisked. The statistical analysis between the OODP and NONDP was significant (P < 0.05).

The post Hoc test for OODP versus NONDP, OODP versus NONDP was significant (p< 0.005) (±SEM). Same applied to ODP versus NONDP, OODP versus NONDP.

Table 2 showed the BMI measurements of the participants before, during and after 6 months of graded exercise.

The BMI reduced progressively in all the groups from onset to six months of graded exercise. The BMI reduction was higher in OODP where we have reduction of 29.30 ± 3.23 to 27.92 ± 3.23kg/m^2 after six months of exercise. In NONDP it reduced from 21.88 ± 2.78kg/m^2 to 21.18 ± 2.19 after six months of exercise.

The P-values are shown on the last column in the table. The level of significant is also shown in asterisk (±SEM). The statistical analyses are also shown in the table 2.

Table 1: Weight Measurements of Participants at 0, 6, 12, 18 and 24 weeks of exercise.

Variable	OODP	NODP	OONDP	NONDP	F	p
Weight (Onset, kg)	73.28±2.38	67.65±4.77	66.99±2.01	61.47±1.51[a]	3.120	0.030*
Weight (6 weeks, kg)	72.94±2.33	67.58±4.77	66.22±2.00	60.67±1.55[a]	3.398	0.021*
Weight (12 weeks, kg)	72.01±2.38	66.86±4.85	65.48±1.92	60.19±1.54[a]	3.087	0.031*
Weight (18 weeks, kg)	71.52±2.35	63.38±5.52	64.42±1.95	59.50±1.60[a]	2.602	0.057
Weight (24 weeks, kg)	71.52±2.35	63.38±5.52	64.42±1.95	59.50±1.60[a]	2.602	0.057
p'	0.000*	0.154	0.000*	0.000*		

[a]Significantly different from OODP (p<0.05) (± SEM for all values)

Table 2: BMI Measurements of Participants at 0, 6, 12, 18 and 24 weeks of exercise.

	OODP	NODP	OONDP	NONDP	F	p
BMI (Onset, kg/m^2)	29.30±3.23	22.99±1.50[a]	26.37±4.42[a,b]	21.88±2.78[a,c]	25.370	0.000*
BMI (6 weeks, kg/m^2)	28.73±3.36	22.84±1.47[a]	24.94±4.47[a,b]	22.03±2.13[a,c]	20.724	0.000*
BMI (12 weeks, kg/m^2)	28.32±3.29	22.52±1.45[a]	25.33±4.50[a,b]	21.58±2.10[a,c]	21.838	0.000*
BMI (18 weeks, kg/m^2)	27.92±3.23	22.26±1.47[a]	24.83±4.27[a,b]	21.19±2.19[a,c]	22.426	0.000*
BMI (24 weeks, kg/m^2)	27.92±3.23	22.26±1.46[a]	24.83±4.27[a,b]	21.18±2.19[a,c]	22.426	0.000*
p'	0.000*	0.000*	0.000*	0.087		

[a]Significantly different from OODP (p<0.05)
[b]Significantly different from NODP (p<0.05)
[c]Significantly different from OONDP (p<0.05)
[d]Significantly different from NONDP (p<0.05)
±SEM for all values.

DISCUSSION

In this study performed on 100 subjects aged more than18years, we documented variations in weights and BMI measurements in normoglycemic offsping of T2DM patient after six months of exercise. Insulin resistance is a major feature of type 2 diabetes. Our results clearly demonstrate that BMI is the strongest anthropometric index that associates with type 2 diabetes. This is consistent with our findings and previous studies also showed that the BMI is the best predictor of type 2 diabetes mellitus.[21,22] There is conflicting evidence on the index of obesity that best reflects diabetic risk whereas others have suggested that BMI is a better predictor.[21,22] Moreover, both types of obesity (central and overall obesity) may be independent predictors of diabetic risk.[23,24]

It was found that there is a relationship between diabetes and physical activity which was defined in occupational or moderate activity.[25] The inverse relationship can be seen in cross-sectional studies between physical activity and type 2 diabetes.[25,26,27] In this context, prospective studies have shown that physical activity can prevent type 2diabetes.[28,29] Overall, the evidence suggested an important role of physical activity in the prevention of type 2 diabetes. These parameter, weight and BMI should be used in routine practice for the follow up of patients with type 2 diabetes.

Lifestyle interventions such as diet, physical activity, weight loss, and smoking cessation are integral part of any diabetes management plan. Epidemiologic and intervention studies have shown significant improvements in the features of diabetic dyslipaedemia such as medical nutrition therapy and physical activity.[30,31]

Exercise is a major therapeutic modality in the treatment of diabetes mellitus.[32] Exercise training has been known to be effective in type 2 diabetes mellitus by increasing insulin sensitivity,[33] and regular exercise can strengthen antioxidant defenses and may reduce oxidative stress.[34] Exercises including yoga postures have been shown to play a role in preventing type 2 diabetes.[35] The yoga postures are slow rhythmic movements which emphasize the stimulation of the organs and glands by easy bending and extensions which do not over-stimulates muscles but concentrate on glandular stimulation.[36] A major benefit of non-exhaustive exercise such as yoga is to induce a mild oxidative stress that stimulates the expression of certain antioxidant enzymes. This is mediated by the activation of redox-sensitive signaling pathways.[37]

CONCLUSION

Our study, however, examine the anthropometric parameters of offspring of diabetes on graded exercise using tummy trimmer as exercise apparatus. In conclusion, graded exercise using tummy trimmer is an important tool which improves insulin sensitivity. It should be recommended for offspring of diabetes patients to delay or prevent the onset of diabetes mellitus.

ACKNOWLEGMENTS

We thank everybody who has one way or the other in contributing to the success of this article.

CONFLICT OF INTEREST

No conflict of interest.

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