Impact of Estrogen on Anthropometric Indices of Normal Menstruating and Menopausal Type-II Diabetic Females

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ABSTRACT

OBJECTIVE: To determine and compare the anthropometric measures between normal & Type-II Diabetic menstruating and menopausal women.

METHODOLOGY: A cross sectional study, conducted at the Physiology Department University of Sindh (UoS) from January to December 2019. The diabetic females were recruited from Liaquat medical hospital (LUH) Jamshoro/Hyderabad and menopausal women from society. The sample size was calculated by EP info Software. Total 200 females were included in this study. The purpose of study was explained and verbal and written consent was taken from all participants. After taking all anthropometric parameters, 3ml of blood was drawn for biochemical analysis, and stored in Laboratory at -20^0C. Results were entered and analyzed by SPSS 19.0 Version by applying ANOVA- Post hoc test for continuous variables.

RESULTS: The results of all Anthropometric parameters of Menstruating normal, menstruating diabetics, menopausal normal, menopausal diabetic were reported significant p. value (<0.001) except results of height and neck circumference which were insignificant.

CONCLUSION: Fluctuation of serum estrogen in pre and post-menopausal females were arbitrated to developed obesity and T2DM and also alter the anthropometric indices.

KEY WORDS: Diabetes Mellitus, Menopause, Estrogen.

INTRODUCTION

Diabetes Mellitus (DM) is the major cause of mortality and morbidity worldwide. According to the World Health Organization (WHO), DM will be the seventh leading cause of mortality by the year 2030[1]. DM is defined by absolute or virtual deficiencies in insulin secretion or insulin action, linked with chronic hyperglycaemia and disturbances in lipid, carbohydrate, and protein metabolism[2]. The frequency of Type 2 diabetes mellitus (T2DM) has been more common type of DM worldwide. The prevalence of T2DM in Sindh, Pakistan was found 16% in males whereas 11% in females[3]. T2DM commonly occurred due to dietary factors, endocrine disruptors and genetic factors[4].

Researchers thought that women are naturally protected against insulin resistance during their ovulatory life[5,6]. In menstruating women, the risk of developing obesity-related diseases is significantly lower than after menopause, indicating the significant role of the female oestrogen hormone in adipogenesis and adipose metabolism[7]. Menopause is the cessation of menstrual cycle in women. It represents a transitional phase in the natural biological woman's age, a natural event that marks the end of the fertility life of women[8]. Estrogen levels decline during and after menopause phase, which is associated with changes in body composition, increased total body fat and abdominal fat. During this phase, risk of obesity related impairments increases such as, glucose metabolism and insulin sensitivity[9,10].

While the relationship between menopausal age and cardiovascular disorder (CVD) risk is also well established, its association with T2DM, one of the major risk factors, remains unclear[7,11]. The aim of the study was to determine and compare the anthropometric measures between normal, T2 Diabetic menstruating and menopausal women, therefore fluctuation of serum Estrogen levels alter the morphology of females, and these might be more prone to develop to diabetes mellitus Type –II (T2DM).

METHODOLOGY

A cross-section comparative study, conducted at the department of physiology, Sindh University Jamshoro, with collaboration with Liaquat University Hospital (LUH) Jamshoro/ Hyderabad from January to December 2019. The sample size was calculated by EP info Software. Total 200 subjects were included in this study and divided into four groups, each group containing n=50. Group-A Menstruating normal as control, Group-B Menstruating diabetics, Group-C Menopausal normal, and Group-D Menopausal diabetic as case groups. Normal menstruating females with regular menstrual cycle, T2 Diabetic females, T2 Diabetic menopausal women with age of 40-60 years, were included in this study whereas females with other comorbidities with diabetes, hysterectomy and

females on medication except for diabetes were excluded from the study.

Eligible women were informed about the study verbally and also written consent was taken from all participants. Data was collected from known diabetic and non-diabetic females with complete general physical examination, structured questionnaire filling and blood samples were drawn according to standard protocols. 3ml of blood was collected into EDTA test tubes. HbA1C was determined by analyzer Celltac Alpha MEK-6500 by Nihon Kohden Germany whereas serum Estrogen was analyzed by Chemiluminescent immunoassay, in sterilized condition in LUMHS Research laboratory. Data was entered in Microsoft excel sheet and copied to data sheet on SPSS 19.0 (IBM, Incorporation, USA) and analyzed by applying ANOVA, Post-Hoc test for continuous variables.

RESULTS

Total 200 hundred females were included in the present study. The results were represented as (mean and Standard deviation) Table I and II. The age of non-diabetic menstruating was 44.32±2.98 years versus diabetic menstruating 46.2±1.31 years, whereas in menopausal non- diabetic females 56.93±2.62 years' versus in menopausal diabetic females 57.06±2.9 years with significant difference of p<0.001. The weight (kg) of study groups was shown significant (p<0.001), whereas height (cm) was insignificant with difference of p=0.056 as shown in Table-1 in respectively.

The mean BMI in diabetic menstruating was high 29.03±1.9 Kg/m^2 versus non-diabetic menstruating 25.8±2.5 Kg/m^2 whereas decreased in menopausal diabetic 27.4±2.15 Kg/m^2 versus diabetic menstruating 29.03±1.9 kg/m^2 with significant difference of p<0.001.

The waist circumference of diabetic menstruating females was high 87.6±5.4 versus non-diabetic menstruating 79.4±11.2 cm, whereas menopausal diabetic waist circumference was declined 86.9±5.96 cm as compared to menopausal non-diabetic 88.8±11.81cm(p<0.001). The Hip circumference (cm) and the waist/hip ratio% of menopausal diabetic women was decreased significantly as compared to other groups(p<0.001), as shown in Table I. The Mid-Upper Arm Circumference (MUAC) of diabetic menstruating females was increased 31±2.11 cm versus non-diabetic menstruating was 26.51±2.9 cm, whereas MUAC was decreased in menopausal diabetic females 26.26±2.91cm as compared to menopausal non- diabetic 28.9±4.56 cm , with significant difference of (p<0.001). The Waist/height ratio of non-diabetic menstruating 0.5±0.07%, in diabetic menstruating 0.57±0.03%, in menopausal non - diabetic 0.55±0.07%, whereas in menopausal diabetic 0.56±0.07%.

The neck circumference was insignificant in non-diabetic menstruating 33.63±2.3cm versus, diabetic menstruating 34.7±1.2 cm whereas menopausal non-diabetic 33.9±4.24cm versus menopausal diabetic 34.66±2.1 with insignificant difference of (p=0.057). The Thigh circumference of diabetic menstruating was increased 49.4±2.46 cm versus non-diabetic menstruating 43.46±5.56 cm, whereas menopausal diabetic was decreased 41.6±4.13cm versus menopausal non- diabetic 44.16±6.1cm. The fasting blood sugar of diabetic menstruating was high 156.3±25.6 mg/dl versus normal menstruating 86.6±8.5mg/dl, whereas menopausal diabetic fasting blood sugar was also higher than menopausal normal

TABLE I: COMPARISON OF ANTHROPOMETRIC PARAMETERS WITH FEMALES STUDY PARTICIPANTS

Variable	Group -A	Group-B	Group-C	Group-D	p-value
	Menstruating non -diabetic (n=50)	Menstruating diabetic (n=51)	Menopausal non-diabetic (n=50)	Menopausal Diabetic (n=50)	
Age (Years)	45.2±2.98	46.2±1.31	56.93±2.62	57.06±2.9	<0.005
Weight (Kg)	64.82±7.7	68.33±4.41	69.53±9.20	67.8±5.92	<0.001
Height (Cm)	158.53±5.3	156.23±4.3	159.09±4.74	156.8±5.05	=0.056
BMI (Kg/m^2)	25.8±2.5	29.03±1.9	27.5±2.97	27.4±2.15	<0.001
Waist circumference (Cm)	79.4±11.2	87.6±5.4	88.8±11.81	86.9±5.96	<0.001
Hip Circumference (Cm)	99.51±6.4	100.4±5.23	104.9±12.33	96.96±6.72	<0.001
Waist Hip Ratio (%)	0.8±0.07	0.87±0.04	0.84±0.07	0.89±0.04	=0.059
Waist Height ratio (%)	0.5±0.07	0.57±0.03	0.55±0.07	0.56±0.07	0.001
Neck circumference (Cm)	33.63±2.3	34.7±1.2	33.9±4.24	34.66±2.1	=0.057
MUAC (Cm)	26.51±2.9	31±2.11	28.9±4.56	26.26±2.91	<0.001
Thigh Circumference (Cm)	43.46±5.56	49.4±2.46	44.16±6.1	41.6±4.13	<0.001

TABLE II: COMPARISON OF BIOCHEMICAL PARAMETERS WITH FEMALES STUDY PARTICIPANTS

Variables	Menstruating Normal (n=50)	Menstruating Diabetes (n=50)	Menopausal Normal (n=50)	Menopausal Diabetes (n=50)	p-value
Fasting Blood Sugar (mg/dl)	86.6±8.5	156.3±25.6	95.2±9.8	188.9±38.7	<0.001
Random Blood Sugar (mg/dl)	124.5±15.6	215.3±23.4	175±19.5	218.3±21.6	<0.001
HbA1c (%)	4.1±1.5	6.8±2.6	4.9±2.1	7.6±3.6	<0.001
Serum Estrogen (pg/ml)	210±46.5	133±78.4	15.6±15.3	9.21±6.38	<0.001

188.9±38.7 mg/dl vs 95.2±9.8 mg/dl with significant difference of (p<0.001). The random blood sugar and HbA1c was also high in menstruating diabetic and menopausal diabetic females as compared to normal females with significant difference of (p<0.001) respectively. Whereas the serum estrogen was highly declined in menopausal diabetic than normal and menstruating diabetic females with significant difference of (p<0.001) as shown in Table II.

DISCUSSION

Diabetes Mellitus is a universal metabolic disorder increasing morbidity and mortality for centuries[12]. It manifests as disturbed metabolism with raised blood sugar due to absolute or relative deficiency or resistance to insulin[13,14]. The present study reveals that the anthropometric measurements were altered due to transition of normal healthy females towards menopausal state in their natural lifespan. Heianza Y et al.,[9] reported that menopause is associated with increased total body fat or abdominal fat and a decrease in lean body mass due to estrogen declined significantly, which in turn also linked with impairments in glucose metabolism and insulin sensitivity. In present study, the results show that as the age increased the BMI was increased and oestrogen was decreased significantly in menopausal T2 diabetics as compared with normal menstruating and normal menopausal females.

Lu J et al.[15] and Klisic A 2016[16] revealed that BMI is associated with early menopausal symptoms which may be susceptible with other metabolic disorders. These factors support our present study weight, height and BMI showing increased levels in the case group as compared with control group. Waist circumference also decreases in diabetic menopausal than the diabetic menstruating. So the decreased concentration of estrogen effects on waist circumference. Rettberg, JR 2014[17] reported that BMI is increased in menopause due to bioenergetics effect because of declined concentration of estrogen and may be susceptible with other metabolic disorders. These factors support our present study that estrogen declines as result of alteration in weight, height and BMI levels in menopausal diabetic females as compared with menstruating females. Aswathappa J 2013[18] revealed that NC, BMI, and central obesity are

Anthropometric biomarker of obesity and having strong association with Diabetics, but present study has shown no any significant increase in NC in diabetic menopause as compared to normal menstruating females.

Lizcano F 2014[19] systemic review analysed that Estrogen helps to integrate metabolic interaction and regulates adipocytes metabolism, but after menopause, risk of obesity and obesity related metabolic disorders increases. Eshtiaghi R 2010[20] reported that estrogenic signalling can have an important role in obesity development in menopausal women. Menopausal women are three times more likely to develop obesity and metabolic syndrome abnormalities than premenopausal women; these above results are consistent with our results.

Ayub N 2006[21] comparative study reported that leptin, a neuropeptide presents in adipocytes helps in the regulation of storage and regulation of fat in the body, having no significant associations between WHR and BMI in pre and post-menopausal females, but present study results shown significant inclined in BMI in diabetic menopausal females while insignificant in WHR among the groups.

CONCLUSION

Fluctuation of serum estrogen in pre and post-menopausal females were arbitrated to developed obesity and T2DM and also alter the anthropometric indices.

AUTHOR CONTRIBUTIONS

Ansari S: Study conception & design, drafting of manuscript
Warsi J: Data analysis
Laghari Z: Critical revision

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