ANTHROPOMETRIC MEASUREMENTS ARE SIMPLE PREDICTORS FOR METABOLIC SYNDROME

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Abstract

This study aims to detect the correlation between the anthropometric measurements and related biochemical parameters. By measuring waist circumference, abdomen circumference, hips circumference, upper arm circumference and percentage of body fat and biochemical parameters plasma Triglycerides, Total cholesterol, High density lipoprotein cholesterol (HDL-C) ,Low density lipoprotein cholesterol(LDL-C),uric acid and calcium concentration.

A total of 200 apparently healthy adult Sudanese females aged 40-50 years were invited to participate in this study. They were selected according to their body mass index (BMI >30kg/m2) based on (WHO,1997). At (P<0.05) the level of total blood cholesterol, HDL-cholesterol and LDL-cholesterol in correlation to waist, hips abdomen, upper arm circumference and percentage of body fat were found to be positive with total cholesterol and LDL-cholesterol and negative with HDL-cholesterol the correlation coefficient were: (0.440,0.382,0.459,0.375,0.3770), (0.411,0.347,.417,0.337,0.325) and (0.411,0.043,0.417,0.043,0.056)respectively. Glucose level was correlated positively with waist, hips, abdomen, and upper arm circumference and body fat percentage with correlation coefficient (0.234,0.287,0.223,0.161,0.224). Uric acid and plasma calcium concentration were found to correlate negatively with waist, hips, abdomen, upper arm circumference and body fat percentage with correlation coefficient (0.084,0.059,0.087,0.101,0.80) and (0.017,0.059,0.026,0.078,0.053) respectively.

Anthropometric measurement can be used as simple predictor of metabolic syndrome

Keywords: Anthropometric measurement, metabolic syndrome, biochemical parameters

Introduction

Obesity can be defined as a disease of extensive fat accumulation and body fat distribution to the extend health and wellbeing are affected (WHO,1997).However, the degree of excess fat, its distribution within the body , duration of obesity are associated heath consequences vary between obese individuals.(Ishikawa-Takata*, et al.*, 2002&WHO,1997).

Women with high waist circumference generally provided greater risk compared to those who are overweight and obese as well as those with android obesity. For males, high waist circumference has greater risk of developing high triglyceride and high LDL-c. Android obese males had greater risk to high fasting blood sugar (FBS). The prevalence rate of metabolic syndrome is 0.28%, based on the number of individuals with the following characteristics: high FBS, hypertensive, android obese, with body mass index (BMI) of ≥25.0 and high WC.(Tanchoco, *et al.*, 2003).

Visceral obesity is closely linked to both insulin resistance and type 2 diabetes.(Nyholm, *et al*.,2004& Ko, *et al*., 1999& Ishikawa-Takata, *et al*.,2002).Hypertension.(Ko, *et al*., 1999& Ishikawa-Takata, *et al*.,2002).And hypercholesterolemia.(Ishikawa-Takata, *et al*.,2002).

Abdominal fat distribution is a significant predictor of cholesterol concentrations and the cholesterol/high-density lipoprotein-cholesterol (HDL-C) ratio, but only accounted for approximately 15% of the variability in these levels.(Kanaley, *et al*., 2001). These emphasize the importance of intra-abdominal obesity as a metabolic risk factor for cardiovascular disease associated with a high WHR.(Masuda, *et al*., 1993).The adverse effect of excess weight tend to be delayed, sometimes for ten years or longer.(Nyholm, *et al*., 2004).

Objective of this study is to detect the correlation between the anthropometric measurements and related biochemical parameters. By measuring the anthropometric measurements: waist circumference, abdomen circumference, hips circumference, upper arm circumference and percentage of body fat. And biochemical parameters plasma Triglycerides ,Total cholesterol, High density lipoprotein cholesterol (HDL-C) ,Low density lipoprotein cholesterol(LDL-C),uric acid and calcium concentration of obese Sudanese women aged 40-50 years.

Material and Methods

Study Area

This study was conducted in Wad Medani town capital of Gezira state. It is located about two hundred kilometers Southern Khartoum on the Blue Nile river west bank.

It is situated in the middle of the agricultural districts and represents the agricultural capital of Sudan.

Sampling:

Cluster sampling technique-probability from local inhabitants was invited to participate in this study. A total of 200 apparently healthy adult females aged 40-50 years were the subject

of this study. All participants were absence of medical illness as sub stained by medical history and physical examination. None had weight fluctuation more than 2kg during the last six months prior to testing and lived most of their lives in Sudan .The participants were selected according to their body mass index (BMI >30kg/m2). based on (WHO,1997).

Data collection was conducted during June-August 2011.

Blood samples

Serum separated by centrifuging blood for 10 minutes at 3000RPM.Then,decanted into 5ml plain plastic tube, labeled with date, name, time of collection, identification number of the volunteer participating in this study and stored frozen at –4Cfor biochemical analysis.

The tests were conducted in biochemistry laboratory, Faculty of Medicine, Gezira University. Quality assurance was conducted in Nasr Eldin Elwali Clinic and some samples were duplicated.

All biochemical parameters estimation was done by the researcher.

Determination of serum Total cholesterol, high density lipoprotein , Triglycerides, Uric acid and calcium

The above mentioned biochemical parameters were determined by using analysis kits (Linear Chemicals Company)**.** The absorbance and concentration of samples were read within one hour of the incubation, by digital colorimeter.

Determination of serum low density lipoprotein (LDL-cholesterol),

LDL cholesterol mg/dl =Total cholesterol –LDL-cholesterol

Methodology

Two hundred women 40-50 years old were invited to participate in this study. They were selected according to their body mass index (BMI >30kg/m2) based on (WHO,1997). Participants were instructed to come fasted in certain day to collect blood samples.

Data Analysis

The data was analyzed using Statistical Package for Social Sciences (SPSS), Windows version8x, 1997 SPSS, Inc, Chicago, IL, and USA.

Correlation-test was used.

Results

The relationship of triglyceride with waist, hips, abdomen, upper arm circumference and body fat percentage were found to be significant (the correlation co efficient were 0.534,0.535,0.461,0.494,0.515 respectively)

The level of total blood cholesterol, HDL-cholesterol and LDL-cholesterol in correlation to waist, hips abdomen, upper arm circumference and percentage of body fat were found to be positive with total cholesterol and LDL-cholesterol and negative with HDL-cholesterol the correlation coefficient

were:(0.440,0.382,0.459,0.375,0.3770),(0.411,0.347,.417,0.337,0.325) and (0.411,0.043,0.417,0.043,0.056)respectively.

The correlation analysis in this study showed that glucose level was inter correlated with waist, hips, abdomen, and upper arm circumference and body fat percentage with correlation coefficient (0.234,0.287,0.223,0.161,0.224).

The level of uric acid and plasma calcium concentration were found to correlate negatively in this study with waist, hips, abdomen, upper arm circumference and body fat percentage with correlation coefficient (0.084,0.059,0.087,0.101,0.80) and (0.017,0.059,0.026,0.078,0.053) respectively.

Table (1) the correlation between the anthropometric measurements and biochemical parameters

	Triglycerides Mg/dl	Total cholesterol Mg/dl	HDL-cholesterol-Mg/dl	LDL-cholesterol Mg/dl	Glucose Mg/dl	Uric acid Mg/dl	Calcium-Mg/dl
Waist C.(cm).	0.534	0.440	0.411	0.411	0.234	0.084	0.170
Hips C.(cm)	0.535	0.382	0.347	0.043	0.287	0.059	0.059
Abdomen C.(cm)	0.461	0.459	0.417	0.417	0.223	0.087	0.026
Upper arm C.(cm)	0.494	0.375	0.337	0.043	0.161	0.101	0.078
%body fat	0.515	0.377	0.325	0.056	0.224	0.800	0.530

Key
P<0.5
C. circumference

Discussion

The level of total blood cholesterol, HDL-cholesterol and LDL-cholesterol in correlation to BMI, waist, hips abdomen, upper arm circumference and percentage of body fat were found to be positive with total cholesterol and LDL-cholesterol and negative with HDL-cholesterol and BMI. This might be due to the direct pathogeneses of visceral adiposity. These matters of observation agreed with that obtained by Capuano, *et al*., (2003)& Schulte, *et al*., (2001)& Shelley, *et al* , (1998). Who reported that, HDL-cholesterol tended to decrease with increases in BMI in both sexes. These findings were similar to those obtained by Moreira-Andres, *et al*., (2004)& Hu, *et al*., (2000)& Rainwater, *et al*., (1999) and Masuda, *et al*.,(1993). Who cited that, WC is the main parameter associated with serum lipid levels. It positively related to triglycerides and negatively related to HDL -cholesterol. In both women and men there is an inverted U-shaped relationship between obesity and waist with LDL cholesterol. WHR is significantly associated with BMI, WC, gender, diabetes, and most LDL size measures. Significant positive

associations is found between WHR and , triglycerides A negative association is found between WHR and HDL-cholesterol and the ratio of HDL-cholesterol to total cholesterol.

The correlation analysis in this study showed that glucose level was interred correlated with waist, hips, abdomen, and upper arm circumference and body fat percentage. These inter-correlations can be explained by the direct association between body fat and its relation to insulin. Furthermore to glucose level. These relations appear to be potent with abdominal fat. These findings were on line to those obtained by Rebuffe-Scrive, *et al*.,(1987) Who noted that, Abdominal fat cells were more responsive to the antilipolytic effect of insulin. Both responsiveness and sensitivity to insulin were somewhat greater in the abdominal fat cells from men than from women

The levels of uric acid and plasma calcium concentration were found to correlate negatively in this study with waist, hips, abdomen, and upper arm circumference and body fat percentage. These might be as result of the effect of aging on hormone signals, sensitivity and reaction. And also, due to the dietary habits and body metabolism. These results agreed with that obtained by Kokkoris, and Pi-Sunyer,(2003)& Bjorntorp,1(996).Who documented that, Several endocrine abnormalities are reported in obesity. Some of these abnormalities are considered as causative factors for the development of obesity, whereas others are considered to be secondary effects of obesity and usually are restored after weight loss. Also these findings agreed with that obtained by Lin, *et al*., (2000). Who stated that, The risk factors for gout among either the general population or subjects with hyperuricemia were concentration of serum uric acid, alcohol consumption, and central obesity.

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Conclusion

Anthropometric measurement can be used as simple predictor of metabolic syndrome

References

[1] Bjorntorp, P.(1996). The regulation of adipose tissue distribution in humans. *Int J Obes Relat Metab Disord*. Apr;20(4):291-302.

[2] Capuano, V., Bambacaro, A., D'Arminio, T., Vecchio, G.and Cappuccio, L.(2003). Correlation between body mass index and others risk factors for cardiovascular disease in women compared with men *Monaldi Arch Chest* . Dec;60(4):295-300.

[3] Hu D., Hannah, J., Gray R.S., Jablonski, K.A., Henderson, J.A., Robbins, D.C., Lee, E.T., Welty, T.K. and Howard, B.V. (2000). Effects of obesity and body fat distribution on lipids and lipoproteins in nondiabetic American Indians: The Strong Heart Study. *Obes Res*. 5(6):411-21.

[4] Ishikawa-Takata, K. Ohta, T., Moritaki, K., Gotou ,T.and Inoue, S.(2002). Obesity, weight change and risks for hypertension, diabetes and hypercholesterolemia in Japanese men.*Eur J Clin Nutr*. Jul;56(7):601-7.

[5] Kanaley, J.A., Sames, C., Swisher, L., Swick, A.G., Ploutz-Snyder, L.L., Steppan, C.M., Sagendorf, K.S., Feiglin, D., Jaynes, E.B., Meyer, R.A.and Weinstock, R.S.(2001). Abdominal

fat distribution in pre- and postmenopausal women: The impact of physical activity, age, and menopausal status. *Metabolism*.Aug;50(8):976-82.

[6] Ko, G.T., Chan, J.C., Cockram, C.S.and Woo, J.(1999). Prediction of hypertension, diabetes, dyslipidaemia or albuminuria using simple anthropometric indexes in Hong Kong Chinese. *Int J Obes Relat Metab Disord*. Nov;23(11):1136-42.

[7] Ko, G.T., Chan, J.C.andCockram, C.S..(1999). Age, body mass index and 2-hour plasma glucose are the major determinants of blood pressure in Chinese women newly diagnosed to have glucose intolerance.*Int J Cardiol*.Apr 30;69(1):33-9.

[8] Kokkoris, P., and Pi-Sunyer, F.X.(2003). Obesity and endocrine disease. Endocrinol *Metab Clin North Am*. Dec;32(4):895-914.

[9] Kopelman, P.G.(2000).Obesity as medical problem.*Nature*,404:633-645.

[10] Masuda, T., Imai, K.and Komiya, S.(1993). Relationship of anthropometric indices of body fat to cardiovascular risk in Japanese women.*Ann Physiol Anthropol*. May;12(3):135-44.

[11] Moreira-Andres, M.N, del Canizo-Gomez FJ, Losa MA, Ferrando P, Gomez de la Camara A, Hawkins FG.(2004). Comparison of anthropometric parameters as predictors of serum lipids in premenopausal women. *J Endocrinol Invest*. Apr;27(4):340-7

[12] Nyholm, B., Nielsen, M.F., Kristensen, K., Nielsen, S., Ostergard, T., Pedersen, S.B., Christiansen ,T., Richelsen, B., Jensen, M.D.and Schmitz, O.(2004). Evidence of increased visceral obesity and reduced physical fitness in healthy insulin-resistant first-degree relatives of type 2 diabetic patients. *Eur J Endocrinol*. Feb;150(2):207-14

[13] Schulte, H., Von Eckardstein, A., Cullen, P.and Assmann, G.(2001). Obesity and cardiovascular risk. *Herz*. May;26(3):170-7.

[14] Shelley, J.M., Green, A., Smith, A.M., Dudley, E., Dennerstein, L., Hopper, J.and Burger, H.(1998) Relationship of endogenous sex hormones to lipids and blood pressure in mid-aged women. *Ann Epidemiol*. Jan;8(1):39-45.

[14] Rainwater, D.L., Mitchell, B.D,. Comuzzie, A.G.and Haffner, S.M.(1999). Relationship of low-density lipoprotein particle size and measures of adiposity. *Int J Obes Relat Metab Disord*. Feb;23(2):180-9

[15] Rebuffe-Scrive, M., Lonnroth, P., Marin, P., Wesslau, C., Bjorntorp, P.and Smith, U.(1987). Regional adipose tissue metabolism in men and postmenopausal women. *Int J Obes*. ;11(4):347-55.

[16] Tanchoco, C.C., Cruz, A.J., Duante, C.A., and Litonjua, A.D.(2003). Prevalence of metabolic syndrome among Filipino adults aged 20 years and over.*Asia Pac J Clin Nutr.* 12(3):271-6.

[17] World Heath Organization (1997). Report of aWHO consultation on obesity. Preventing and managing the Global Epidemic, Geneva :WHO