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Serum Cystatin C Level in Adult Obese and Overweight Subjects in Delta State

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Abstract

Cystatin C has been identified as a marker of renal function and incriminated in the pathogenesis of atherosclerosis. Obesity has been identified as a chronic low grade inflammatory state thereby predisposes individuals to atherosclerosis. The aim of this study is to evaluate the cystatin C levels of adult obese and overweight subjects in Delta State, Nigeria. Four hundred and fifty four apparently healthy volunteers were recruited for this study. These consist of one hundred and seventy eight (178) males {they were categorized into Obese (n=90)], Overweight (n=50) and Normal weight (n=40)]} and two hundred and seventy six (276) females {they were categorized into Obese (n=160)], Overweight (n=66)] and Normal weight (n=48)} with age 18-70 years. Our results shows a significant higher cystatin C level in obese subjects when compared with overweight and normal weight individuals. Also, there was a significant higher cystatin C in overweight individuals when compared with normal weight individuals. Obese and overweight individuals are predisposed to impaired renal function and atherosclerosis with a high risk. We therefore recommend inclusion of cystatin C in the menu of test for the investigation of cardiac function in individuals.

Keywords

Cystatin C; Obesity; Overweight; Delta; ELISA

Introduction

Cystatin C is a non-glycosylated protein with cysteine proteinase inhibitor activity and considered as a marker of renal function due to its constant rate of production by all nucleated cells. Cystatin C is a superior biomarker of kidney function (Glomerular Filtration Rate, GFR) because it is not affected by age or gender and less affected with muscle mass [1], but has been observed to be affected by other non- glomerular filtration rate factors such as proteinuria, diabetes mellitus, blood pressure, Weight, Body Mass Index, White Blood Cells, hemoglobin as well as C-reactive protein [2]. Several studies have observed an association between obesity and cystatin C [3, 4] , reported that obesity and Percentage Body Fat (%BF) are associated with increased levels of cystatin C. Cystatin C has been linked to cardiovascular disease and it has been shown that, cystatin C independent of renal function is associated with insulin resistance and inflammation [5]. Obesity being a risk factor for cardiovascular disease as well as a chronic state of inflammation, need to be assessed for cystatin C. Therefore, this study sought to assess cystatin C in obese and overweight individuals in Delta State, Nigeria.

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Materials and Methods

Study Area: This study was carried out in Delta State located in the Niger-Delta region south-south, Nigeria with mineral oil deposit, with a population of about 4,112445 and square kilometers of 17108 (National Bureau Statistic 2010). It has twenty five (25) local Government areas with its inhabitants' mainly farmers, traders and civil servants.

Ethical Clearance

The study was conducted according to the Nigerian National Code for Health Research Ethics and the Declaration of Helsinki. Ethical approval was obtained from the Delta State Ministry of Health, Asaba Health Research Ethics Committee. Participants were informed about the study and consent obtained before participating in the study.

Study Population

A total of Four hundred and Fifty four (454) apparently healthy subjects were recruited for this study. This was determined using sample size formula [6] and a prevalence of 14% [7]. One hundred and seventy eight (178) were males categorized into Obese (n=90), Overweight (n=50) and Normal weight (n=40). Two hundred and seventy six (276) are females categorized into Obese (n=160), Overweight (n=66) and Normal weight (n=48).All participants were within the age 18-70 years and recruited in Asaba, Agbor, Sapele, Ughelli and Warri using multi- stage random sampling method.

Inclusion and Exclusion Criteria

Inclusion criteria include adult individuals aged 18 - 70 years who gave informed consent and are not sick of any known disease. The exclusion criteria include critically ill patients, pregnant women, intra-abdominal masses, renal disease, Liver disease, Known hypertensive, Known Diabetes. The subjects were randomly selected using every subject that fell on an even number and were screened for obesity using body mass index

Anthropometric Measurement

Height of the participants' were measured by asking participants to take off his/her shoes, hats or head ties and stand with back to the tape measure then hold their head in a position where he/she can look straight at a spot, head high, on the opposite wall. A flat rule was placed on the participant's head, so that the hair (if present) was pressed flat. Height was measured to the nearest centimeter, at the level where the flat rule touched the rigid tape. Weight of participants' were measured by asking participants to remove heavy outer garments, empty their pockets and step on a weighing scale, which was placed on a hard, even surface. Weight was measured using a standiometer. Body mass index was calculated as a ratio of an individual's weight (kg)/height (m2). Body-mass index categories were defined using the WHO cut points in units of kg/m2,normal weight = 18.5 - < 25, overweight = 25 - < 30 and obese ≥ 30.Blood pressure was measured in mm Hg, in the sitting position after 10 minutes rest.

Collection of Samples

5mls of fasting venous blood samples were collected from subjects aseptically by venepuncture into plain sample containers with minimum stasis. The blood was allowed to clot and spun at 3, 000 revolution per minute for ten (10) minutes. The serum was collected for analysis of cystatin C.

Biochemical Analysis

The estimation of cystatin C was carried out using enzyme linked immune-absorbent assay (ELISA) on a solid phase direct sandwich method using reagent by DRG Diagnostics, Germany.

Statistical Analysis

Data was analysed with Statistical Package for Social Sciences (SPSS) version 21 using ANOVA and student "t" test. Statistical level of significance was set at <0.05.

Results

The obese individuals show higher ($P<0.01$) BMI and cystatin C levels when compared with overweight and normal weight individuals. Also, the overweight show a higher ($P<0.01$) BMI and cystatin C but no difference ($P>0.05$) in age when compared with normal weight subjects as depicted in table 1.

Table 1: Comparison of obese, overweight and normal weight individual

Parameters	Obese (A)	Overweight (B)	Normal Weight (C)	F	P	Post Hoc Test		
						AvB	AvC	BvC
Age (Yrs)	42.39±11.00	41.25±13.15	35.69±16.79	3.754	0.024*	0.519†	0.007*	0.050†
Weight (Kg)	97.67±14.10	80.71±11.46	61.77±11.55	96.14	0.000*	0.000*	0.000*	0.000*
Height (M)	164.72±9.80	169.79±9.87	163.77±11.97	6.291	0.002*	0.001*	0.647†	0.012*
BMI(kg/m^2)	35.56±4.61	27.86±1.34	22.62±1.17	178.691	0.000*	0.000*	0.000*	0.000*
Cystatin C(ng/ml)	2.44±0.73	1.55±0.53	0.86±0.10	93.053	0.000*	0.000*	0.000*	0.000*

***Significant †Not Significant**

Table II shows that obese male subjects had lower (P<0.01) BMI (33.86±3.17) thanfemale obese subjects (36.48±5.00), 2.37 ±0.76) but no gender difference (P>0.05) in cystatin C of the obese subjects.

Table 2: Gender comparison of BMI and cystatin C of obese subjects.

Parameters	Obese Male	Obese Female	t value	P value
Weight (kg)	101.02±16.67	95.88±13.72	2.599	0.100*
Height (m)	169.81±12.00	161.98±7.04	6.457	0.000*
BMI (kg/m^2)	33.86±3.17	36.48±5.00	-4.393	0.000*
Cystatin C (ng/ml)	2.37±0.76	2.47±0.71	-1.036	0.301†

***Significant †Not Significant**

Figure 1: Bar chart showing Cystatin C of male obese, overweight and normal weight subjects.

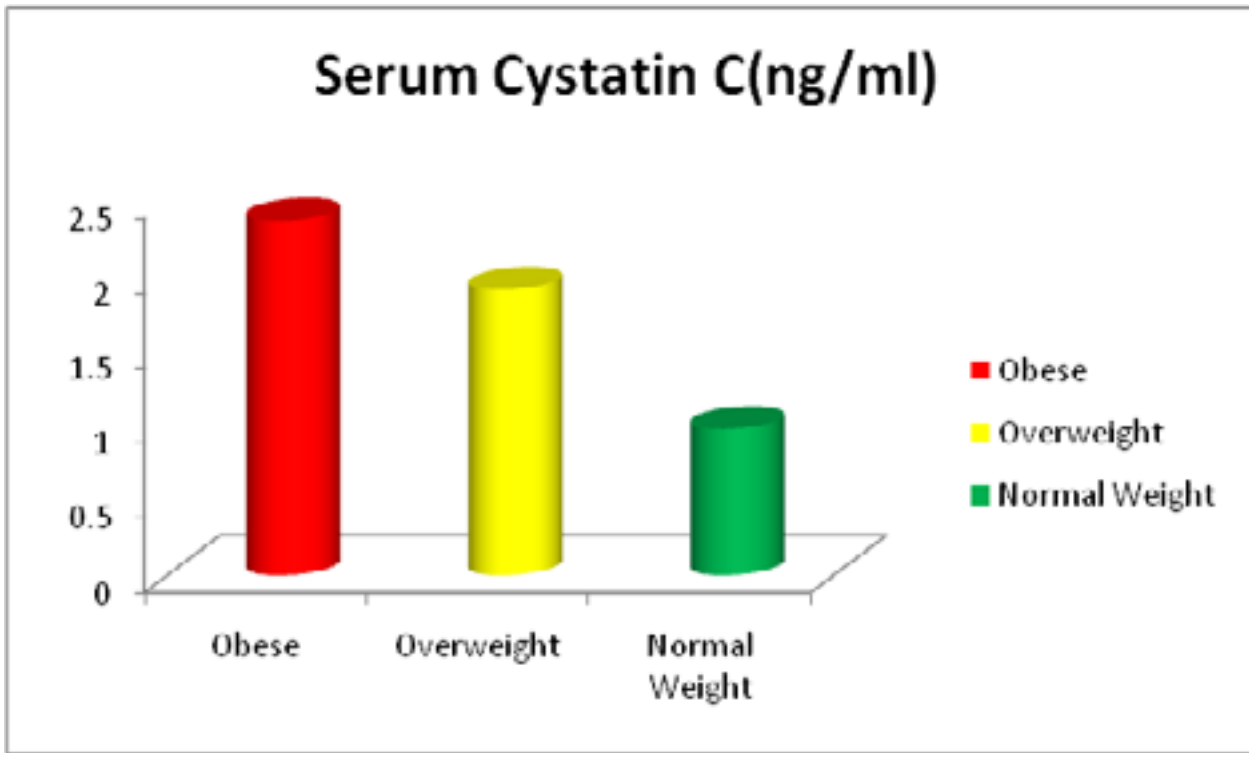
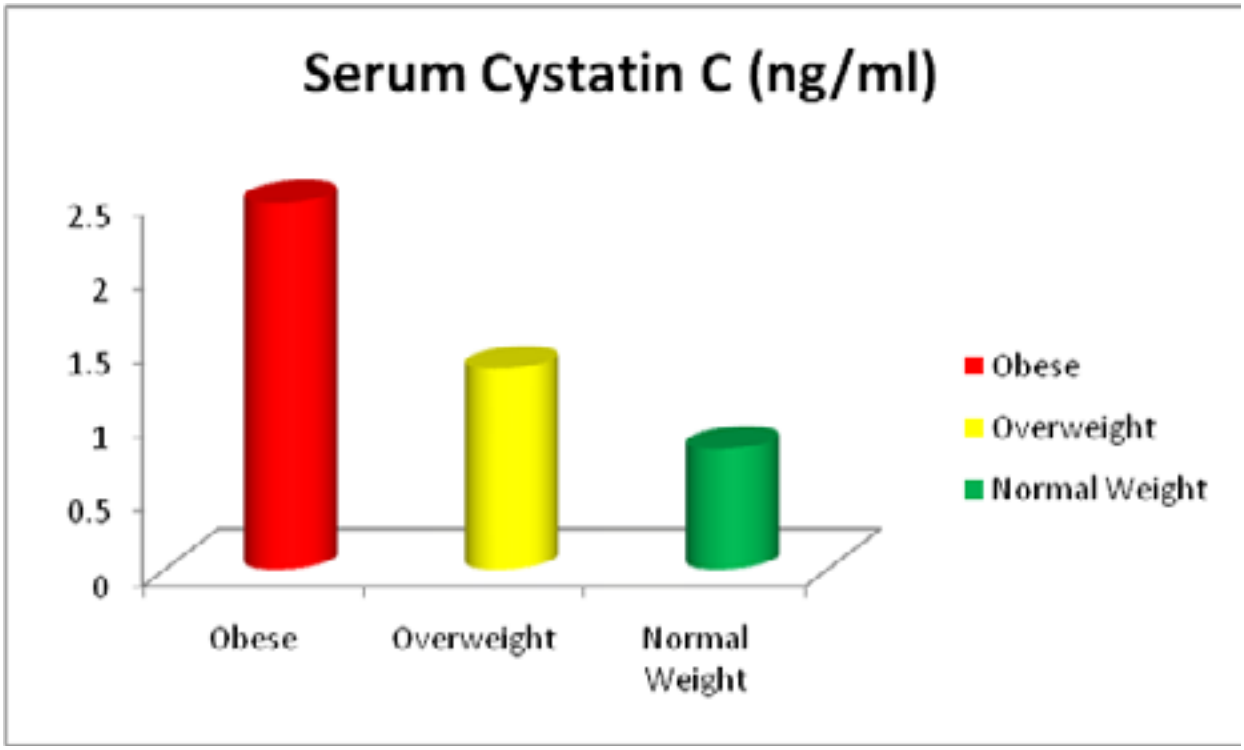


Figure 2: Bar Chart showingcystatin C of female obese, overweight and normal weight subjects.



Female overweight subjects had lower (P<0.01) BMI (27.33±1.39) and cystatin C (1.35±0.38) than male overweight subjects(28.80±0.41, 1.91±0.59) when compared as shown in table III.

Table 3:Gender Comparison of BMI and cystatin C of maleoverweight subjects

Parameters	Overweight Female	Overweight Male	t value	P value
Weight (kg)	74.06±8.22	92.70±4.50	9.368	0.000*
Height (m)	164.28±7.11	179.70±5.27	8.474	0.000*
BMI (kg/m^2)	27.33±1.39	28.80±0.41	4.580	0.000*
Cystatin C (ng/ml)	1.35±0.38	1.91±0.59	4.319	0.000*

***Significant**

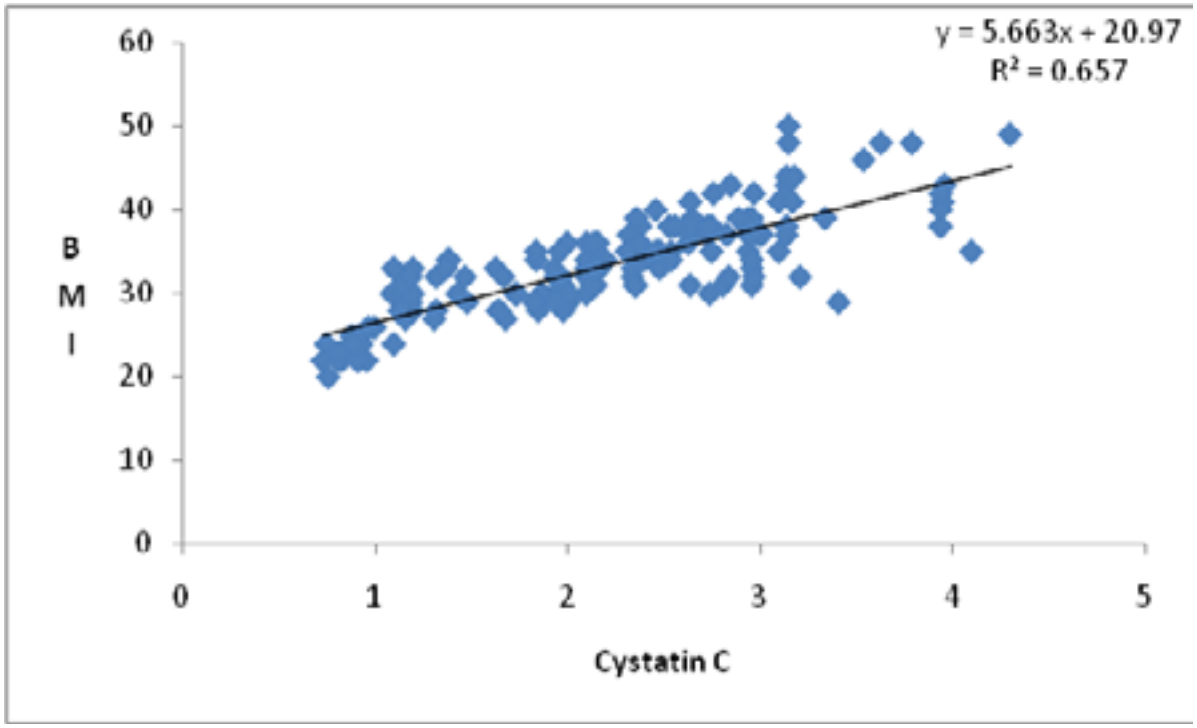
Table IV shows that male normal weight subjects had higher (P<0.01) cystatin C (0.98±0.08) than female normal weight subjects (0.81±0.06) but no gender difference (P>0.05) in BMI when compared.

Table 4:Gender comparison of BMI and cystatin C of normal weight subjects.

Parameters	Normal weight Male	Normal weight Female	t value	P value
Weight (kg)	74.00±10.28	56.33±7.13	5.086	0.000*
Height (m)	176.25±2.96	158.22±10.07	4.920	0.000*
BMI (kg/m^2)	23.00±1.07	22.44±1.20	1.124	0.272†
Cystatin C (ng/ml)	0.98±0.08	0.81±0.06	5.647	0.000*

***Significant †Not Significant**

Figure 3: Correlation of BMI and serum cystatin C



Discussion

The result of our study shows a statistically significant higher serum cystatin C in obese individuals when compared with overweight and normal weight individuals. Also, there was a significant higher cystatin C in overweight when compared with normal weight individual. There was a strong positive correlation between body mass index and cystatin C. This implies that weight gain increases the concentration of cystatin C. This is in accordance with earlier studies by [3, 8] but in contrast with the report of [9] who did similar work on cystatin C. Higher level of cystatin C in obese individuals may be attributed to the influence of body mass index because cystatin C is produced by all nucleated cells including adiposities which are abundant in obese and overweight individuals. Our result also reveals no gender difference among the obese subjects. Conversely, the male overweight and normal weight shows a higher cystatin C levels than the female overweight and normal weight subjects when compared. This is in tandem with previous reports [10, 11] but in contrast with the report of [12]. The gender difference observed in overweight and normal weight may be attributed to the higher BMI observed in overweight and normal weight male in this study [13], observed that cystatin C levels are influence by age, weight as well as C-reactive protein which is a marker of inflammation [14] reported that cystatin C is a stronger predictor in the assessment of risk associated with renal mortality and cardiovascular events than creatinine. They classified the risk associated with cystatin C concentration to be low risk (<1.0mg/l), Intermediate risk (1.0-1.28mg/l) and high risk (>1.28mg/l). This therefore implies that the obese and overweight individuals are at a higher risk with cystatin C values of 2.44±0.73 and1.55±0.53 respectively. The normal weight individuals are at low risk level with cystatin C level of 0.86±0.10. Conclusively, obese subjects have been found to be predisposes to renal diseases as well as cardiovascular episode as a result of higher values of cystatin C observed in them. It is therefore pertinent to add cystatin C as a baseline test to prevent morbidity and mortality arising from cardiovascular events in developing countries like Nigeria.

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