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Levels of Inflammatory Markers and Lipid Profile in Obese Young Adults

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ABSTRACT

Nourishment in fetal life effects metabolism, growth, and development of nervous system and may lead to major illness courses such as hypertension, obesity, diabetes and cardiovascular disorders. Obesity is a low-standard systemic inflammatory ailment. Central adiposity measured through skin folds, waist to hip ratio (WHR) and waist circumference (WC) is closely associated with unfavorable lipids and lipoproteins. C-reactive protein (CRP) and fibrinogen are essential biomarkers of inflammation. In the present study, two groups: obese (n=35) and normal (n=25), were considered. CRP was determined quantitatively by ELISA and plasma fibrinogen by Clauss method. Serum lipid profile for low density lipoproteins, cholesterol, triglycerides and high density lipoproteins was measured by commercially available kits. Anthropometric parameters including waist to height ratio (WHtR), waist circumference, diastolic blood pressure (DBP), systolic blood pressure (SBP), fasting glycemia and pulse rate showed significant increase, whereas, Waist to hip ratio (WHR) showed non-significant decrease. CRP and fibrinogen were observed to be significantly high in obese subjects. Cholesterol, triglycerides, VLDL, LDL-C levels were significantly elevated whereas HDL-C and HDL/LDL ratio were found to be significantly reduced in obese subjects when compared with controls. It is concluded that obese group having higher level of adiposity may face far ranging negative effects on health.

Key Words: CRP, inflammatory marker, hypertension, lipid profile, obesity

INTRODUCTION

Unnecessary or abnormal amassing and spread of white adipose tissue (WAT) known as obesity, proves to be a chief risk factor for several chronic diseases (Calder *et al.,* 2011; Codoner-Franch *et al.,* 2011; Snel *et al.,* 2012; Wonisch *et al.,* 2012). The basic cause of obesity is a consequence of combined effect of genetic factors, diet, bodily activity and the atmosphere (Biro & Wien, 2010). In obesity numerous metabolic and endocrine paths become deregulated. Damaged tolerance of glucose, increased insulin resistance, prolonged low-grade inflammation, imbalance of adipocyte derived hormones (Bray *et al.,* 2004; Hursting *et al.,* 2007; Shoelson *et al.,* 2007) and conversion of colonic adenoma cells to adenocarcinoma cells (Xu *et al*., 2003; Shoelson *et al*., 2007) are a few of many disorders in obese person. Obesity, mostly abdominal obesity, links with hypertension. Hypertension is caused by rising sodium reabsorption in kidney, unbalancing pressure natriuresis and volume expansion in obese persons (Wofford & Hall, 2004). Obesity is also involved in pathogenesis of congestive heart failure, coronary artery disease (CAD), arrhythmias, stroke and abrupt cardiac death (Poirier *et al.,* 2006). Central adiposity measured through skin folds, waist to hip ratio (WHR) and waist circumference (WC) is closely associated with unfavorable lipids and lipoproteins (Freedman *et al*., 1999). Obesity-linked inflammation is a long-lasting unmitigated inflammation with hazardous consequences (Makowski *et al.,* 2004; Brunn *et al*., 2005; Christiansen, 2005; Ferrante, 2007; Hotamisligil & Erbay, 2008).

Inflammation constituent pathogen response eventually leads to increased circulating inflammatory cytokines, raised level of acute phase proteins like C-reactive protein, recruitment of leukocytes to inflamed tissues, leukocytes activation and reparative tissue responses generation e.g. fibrosis (Spencer *et al.*, 2010). Fibrinogen and hs-CRP (highly sensitive-CRP) are regarded as essential biomarkers of inflammation (Kannel *et al.,* 1990) and are regarded as sensitive and complex indicators of the metabolic anomalies linked with body fat thus playing a role in cardiovascular risk (Du Clos, 2000) elevated risk of myocardial infarction, ischemic stroke and peripheral arterial ailment (Kuller *et al*., 1996; Ridker *et al*., 1997; Ridker *et al*., 1998; Koenig *et al*., 1999). CRP is extremely conserved molecule and a member of protein family, pentraxin (Du Clos, 2000). Numerous cytokines and bioactive mediators such as interleukin 6 (IL-6), leptin, adiponectin and tumor necrosis factor-α (TNF-α) are released by adipose tissue that ultimately contributes to elevation of CRP leading to inflammation (Lau *et al.*, 2005). The production of CRP is stimulated by IL-6, a pro inflammatory cytokine, in the liver (Banks *et al.*, 1995) and increases quickly in response to trauma,

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inflammation and infection and falls with the recovery (Cook *et al*., 2000). Numerous studies show that elevated level of CRP is linked with prevalence of hypertension in middle-aged grown-ups (Sesso *et al*., 2003; Niskanen *et al*., 2004). Endoplasmic reticulum plays a considerable role in balancing and constructing new molecules of lipids, intracellular proteins and sterol and is also a major producer of inflammatory and metabolic signals. The surplus nutrients cause Endoplasmic reticulum stress that leads to insulin resistance and inflammation elevation (Zhang *et al.,* 1997; Gregor & Hotamisligil, 2007; Boden *et al*., 2008; Lai *et al*., 2008; Boden, 2009).

The present study was therefore carried out to determine the changes in lipid profile (triglycerides, cholesterol, low density lipoprotein and high density lipoprotein cholesterol) and inflammatory markers (CRP and fibrinogen) with increase in body weight considering the scale of future risk of cardiovascular disorders, hypertension and diabetes type II in obese young adults.

MATERIALS AND METHODS

The complete information about the subjects was collected. It included height, weight, waist circumference, and waist to hip ratio. The information was utilized to calculate BMI (body mass index) and waist to height ratio. The study excluded subjects with cardiopulmonary diseases, diabetes mellitus, cigarette smokers, drug addicts and others with any history of acute or chronic infections or recent hospitalization. Healthy subjects (21-27 years) of both genders were selected including obese subjects with BMI >29.9 kg/m^2 (n=35) and controls with BMI 25- 29.9 kg/m^2 (n=25). Anthropometric parameters including diastolic blood pressure (DBP), systolic blood pressure (SBP), pulse rate, fasting glycemia, body mass index (BMI), waist to hip ratio (WHR), waist circumference and waist to height ratio (WHtR) were determined. Mercury sphygmomanometer was used to measure BP. Subjects were sampled for blood following 12 hour overnight fast and proceed for serum and plasma.

Fasting glycemia and serum lipid profile were analyzed by commercially available kits using clinical chemistry analyzer. C - reactive protein was measured by ELISA kit using ELISA reader. Plasma Fibrinogen was analyzed using Clauss method (Mackie *et al*., 2003).

Statistical analysis

To assess the variations, comparison was made between control and obese groups. Confidence level of 95% and two tailed unpaired t test at $p< 0.05$ was applied to analyze the alterations between the comparable groups.

RESULTS

Waist circumference, waist to hip ratio (WHR), body mass index, waist to height ratio (WHtR), systolic blood pressure, diastolic blood pressure, fasting glycemia, cholesterol, very low density lipoproteins (VLDL), triglycerides (TG), low density lipoprotein cholesterol (LDL-C), fibrinogen and C - reactive protein showed marked elevation whereas high density lipoprotein cholesterol (HDL-C) and HDL/LDL showed significant decline. Waist to hip ratio (WHR) and pulse rate showed non-significant increase. The detailed values and the percentage differences between obese and controls are tabulated below (Table I).

DISCUSSION

The energy intake together with limited expenditure is the major factor underlying the obesity epidemic (Biro & Wien, 2010). A number of factors are released by adipose tissue which ultimately contribute to systemic inflammation (Lyon *et al.*, 2003). Inflammatory response may be harmful to the host if not regulated properly and may cause diseases and conditions with clear chronic inflammatory origin (Rolland-Cachera, 1993). The increase of body weight and adiposity, in particular central depots in childhood and adolescence are associated with changes in the metabolic profile and cardiovascular problems, even during adolescence or early adult life (Freedman *et al*., 2001).

In our study, the obese subjects with significantly higher BMI were chosen for experimentation. A significantly higher waist to hip ratio was observed in obese group. A higher waist to height ratio and waist to hip ratio is an indicative of large amount of abdominal visceral fat. A non-significant increase was observed in pulse rate, diastolic blood pressure (DBP) and systolic blood pressure (SBP) in obese group as compared to control group.

The level of fasting glycemia was found to be significantly higher in obese group as compared to normal individuals. Glucose utilization is reduced by increase in free fatty acids in muscle tissue and increased gluconeogenesis in the liver, a situation that could speed up insulin resistance, glucose intolerance and ultimately type II diabetes mellitus (T2DM) (Zhang *et al.,* 1997; Thomson & Espositos, 1999).

Table I: Average levels of anthropometric parameters, lipid profile and inflammatory markers in control and obese groups. Values are mean ± SEM.

PARAMETERS	Controls (n=21)	Obese (n= 15)	t-value	p-value	Percentage difference between control and obese groups
Waist circumferences (cm)	80.42 ± 1.21	94.15 ± 1.20	7.719	0.4640	17↑***
Waist to hip ratio	0.85 ± 0.01	0.85 ± 0.01	0.1276	0.0007	1↓
Body mass index (Kg/m^2)	20.93 ± 0.34	30.75 ± 0.20	21.66	<0.001	46↑***
Waist to height ratio	0.48 ± 0.01	0.58±0.01	6.613	<0.001	18↑***
Systolic blood pressure (mmHg)	114.71 ± 1.71	125.50 ± 2.25	3.903	0.0004	9↑***
Diastolic blood pressure (mmHg)	74.76± 1.40	82.33 ± 1.41	3.707	0.0007	10↑***
Pulse rate (per minute)	85.00 ± 3.37	90.41 ± 2.54	1.192	0.2416	6↑
Fasting glycemia (mg/dl)	90.01±1.68	97.81±2.67	2.598	0.0138	8↑*
Cholesterol (mg/dl)	171.90 ± 5.89	201.31 ± 8.69	2.916	0.0062	17↑**
Triglycerides (mg/dl)	83.29 ± 5.05	151.41 ± 15.27	4.809	<0.001	81↑***
HDL-C (mg/dl)	50.86 ± 2.57	40.73 ± 2.16	2.852	0.0073	20↓**
LDL-C (mg/dl)	150.71 ± 5.79	181.40 ± 8.78	3.046	0.0045	20↑**
HDL/LDL	0.34 ±0.01	0.23 ± 0.01	5.427	<0.001	33↓***
VLDL (mg/dl)	16.65 ± 1.00	30.28 ± 3.05	4.809	<0.001	81↑***
C-Reactive protein (mg/dl)	0.19 ± 0.01	0.32 ± 0.01	5.498	<0.001	15↑***
Fibrinogen (mg/dl)	202.61 ± 14.55	323.50 ± 25.33	4.409	<0.001	75↑***

*, **, *** Significant at $p < 0.05$, 0.01, 0.001, respectively. ↑,↓ Increase, decrease.

Obese group showed a significant increase in cholesterol level when compared with controls. An extraordinary ingestion of total calories could excite catabolism of LDL somewhere else than adipose tissue. The whole metabolism of lipids and lipoproteins may be amplified in obesity as revealed by high synthesis rates of cholesterol and VLDL-TG (Grundy, 1980).

Triglyceride level of obese was found to be significantly higher than controls. Earlier studies described that surplus body fat was linked with increased plasma triglyceride levels (Després *et al*., 1990). Higher blood triglycerides may cause glomerular cell production and matrix amassing that may lead to loss of nephron function and eventually to decreased renal excretion of uric acid and therefore hyperuricaemia (Bonora *et al*., 1996).

The results suggested that VLDL was elevated in obese as compared to controls. Higher plasma glucose concentrations may contribute

directly to enhance VLDL (Taskinen, 2003).

The level of HDL-C was considerably low in obese when compared with controls. A damaged lipoprotein lipase activity and higher cholesteryl ester transfer protein (CETP) mediated lipid exchange result in decreased HDL-C in obesity (Vinik, 2005). Furthermore TG rich HDL-C set up is a better substrate for hepatic lipase causing more lowering in HDL-C levels. Impairment of adiponectin may also be linked with abnormal HDL-C metabolism in obesity (Bamba & Rader, 2007).

In our study, elevated level of C- reactive protein was observed in obese subjects. This predicts that the subjects are at low future risk of hypertension, cardiovascular disease and T2DM. CRP is expressed and released by liver as it removes visceral adipose tissue and distributes triacylglycerol and free fatty acids to produce raised cytokine secretion and encourage an inflammatory milieu (Brooks *et al*., 2010). A self-regulating relationship between CRP and obesity was observed in young men and women (Williams, 2004).

A considerably higher level of fibrinogen was noticed in obese young adults indicating that these subjects are at future risk of obesity morbidities. The best indicators of fibrinogen are elevated Low density lipoprotein cholesterol (LDL-C) levels. The positive association between body fat, metabolic irregularities and acute-phase reactants levels supports the idea that adipose tissue might be a common originator of both low-level inflammatory state and metabolic irregularities (Bo *et al.*, 2004).

The present study suggests that obese subjects are at high risk of morbidities. As obesity is now-a-days spreading epidemiologically and causing life threatening hazards to health, there is a need to elaborate the study on a large scale and to introduce measure to reduce obesity in our population.

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