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Comparison of Superoxide Dismutase Levels in Obese with Metabolic Syndrome and Obesity Non Metabolic Syndrome

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Abstract : Obesity is principal causative factor in the development of metabolic syndrome and oxidative stress plays critical roles in the pathogenesis of various diseases. Fat accumulation correlated with systemic oxidative stress in humans. Superoxide dismutase is an enzyme that overcomes the oxidative stress in the human body. Because of the importance of the role of enzymes superoxide dismutase in dealing with oxidative stress and increase oxidative stress in obesity this study aimed to analyze the comparison of superoxide dismutase levels in obese with metabolic syndrome and obese non metabolic syndrome. The sample population is obese adults, then we examined the weight, height, waist size, blood pressure, laboratory tests such as blood sugar levels and lipid profile of sample population to separate obese with metabolic syndrome and obese non metabolic syndrome. After we determined each group we measured stress oxidative levels in blood in obese with metabolic syndrome and obese non metabolic syndrome by Spectrophotometric assay method. With statistical analysis using T test found that there was significant difference of superoxide dismutase levels between obese with metabolic syndrome and obese without metabolic syndrome ($p<0.005$).
Key words : obesity, metabolic syndrome, superoxide dismutase.

Introduction

The incidence of obesity increase rapidly as a result of inactive lifestyle. The energy that used for daily activity decrease parallels along with advances in technology. Based on WHO data there are 1.6 billion adults with overweight and 400 million among them are obese[1]. Based on research data Riset Kesehatan Dasar in 2007[2], obesity prevalence in Indonesia generally in the population aged ≥ 15 years old is 10.3% (men 13.9% and women 23.8%)[3]. An individual determined as obese based on Body Mass Index (BMI) it is a simple index of weight–height relationship calculated as weight in (kg) divided by height in (m) squared. One is categorized as obese I when the BMI 25-29,9 and obese II when the BMI >30 (4). Metabolic syndrome is acondition that characterized by visceral obesity, increasing trygliceride levels and glucose and decreasing *High Density Lipoprotein* (HDL) and hypertension that can cause a greater risk incidence of type 2 DM and cardiovascular disease.[4,5]Prevalences of metabolic syndrome varies greatly it is caused by uniformity criterias that used to determine, ethnic difference, sex and age.It can be confirmed that metabolic syndrome likely to increase parallels with obesity or central obesity prevalences.[6,7,8]

Obesity is associated with macrophage accumulation in adipose tissue is one of the most common chronic conditions worldwide and is associated with not only metabolic dysfunction but also increased levels of oxidative stress in vivo[9]. It was due to obesity adipose tissue increasingly wide. Anti oxidantsdefense system for living organism uses scavenger free radicals produced during normal metabolic processes. Saveral oxidative enzyme such as, gluthationeperoxide ,superoxidedismutases (SOD), catalaseare involved in limiting oxidative damage.. SOD catalyze the dismutation of superoxide into oxygen and hydrogen peroxide[10]. Thus, they are as an important antioxidant defense in nearly all cells exposed to oxygen. Superoxide dismutase is believed to play a major role in the metabolism of reactive oxygen species (ROS). It is the first enzyme involved in the destruction of superoxide (O_2^-) anion radicals. It converts O_2^- into hydrogen peroxide (H_2O_2).[11]

Material and methods

This study involved 40 obesity subjects, all of whom were in good health. All subjects gave informed consent. This research was approved by Health Research Ethical Committee, Medical Faculty of Sumatera Utara/HAM General Hospital. The inclusion criteria were the obesity people without medical history of diabetes or malignant disease. Subjects divide two groups, one group is obesity with metabolic syndrome and other group is obesity without metabolic syndrome. Each group consisted of 20 subjects.To determine whether the subject of the metabolic syndrome so examination of weight, height, waist size, blood pressure, laboratory tests such as blood sugar levels and lipid profile. Average age samples of obesity with metabolic syndrome 43.9±11.3 years and average age sample of obesity non metabolic syndrome 34.55±10.8 years..

Assays

All the samples we examined superoxide dismutase level in the serum by Spectrophotometric assay method. Collect plasm with EDTA using standard protocols. The erythrocyte pellet can be lysed in 5x volume of cold dH_2O, centrifuge at 12,000 g for 5 min to pellet the erythtrocyte membranes. Dilute plasm 1:5, red cell lysate 1:100 prior to SOD assay. Immediately read OD $_{440nm}$ (OD 420-460 nm) (OD_o). Incubate for 60 min at room temperature (25^oC) in the dark. Read OD 440nm again (OD_{60}).

Stastical Analysis.

Statisical analysis was done using Microstat Statistical programme on an IBM compatible computer. T-tes was use compare T test found that there was significant difference of superoxide dismutase levels between obese with metabolic syndrome and obese without metabolic syndrome ($p<0.005$).

Results

The characteristics of the subjects of this research are shown in Table 1.Subjects in this research were not 20 years old . Body Mass Index (BMI) in the samples used in both obesity with metabolic syndrome and obesity non metabolic syndrome is >27, in this research the waist size of the samples at the obesity with metabolic syndrome found from 89- 119 cm and waist size of the obesity non metabolic syndrome found 97-117cm. Fasting Blood Gucose (FBG) in the obesity non metabolic syndrome samples were normal but the obesity with metabolic syndrome range from low to the moderately elevated range. Profile lipid like HDL value of the samples of obesity with metabolic syndrome range 34-60 mg/dL and HDL value of the samples of obesity non metabolic syndrome range 46-162 mg/dL. Trigliseride value of the samples of obesity with metabolic syndrome range 91-452 mg/dL and obesity non metabolic syndrome was 46-162mg/dL . Dividing sample group in to obesity with metabolic syndrome and obesity non metabolic syndrome base on 3 criteria from 5 criteria, that are WS>102 cm at male and >88 at female, trigliseride levels≥ 150mg/dL, HDL <40mg/dL at male and <50 mg/dL at female, Blood Pressure (BP) ≥130/85 Hg, so can be categorized as obesity with metabolic syndrome or obesity non metabolic syndrome. The result of measuring superoxide dismutase was found the lower value at obesity with metabolic syndrome was 3.62 ng/ml and the highest value at obesity with metabolic syndrome was 9.83 ng/ml and the lower value at obesity non metabolic syndrome was 3.62 ng/ml and the highest was 52.10 ng/ml.

Table 1.Baseline characteristic of the 40 samples

	Obesity with metabolic syndrome	**Obesity non metabolic syndrome**
Age	43.9±11.3	34.55±10.8
BMI	33.86±5.0	31.75±4.0
Waist size	107±10	104±15
FBG	101.85± 50.8	88.49±7.2
HDL	63.2±23.85	46.05 ±6.99
Trig	193.15±88.59	91.9±32.81
Sistole	139.85 ± 16.3	123 ± 155
Diastole	87± 8.4	81.3 ±9.1
Superoxide dismutase	5,09 ±1,46	7,52±10.73

This study aimed to analyze the comparison of Superoxide dismutase levels in obese with metabolic syndrome and obese non metabolic syndrome, so we used the statistical analysis with T test found that there was significant difference of superoxide dismutase levels between obese with metabolic syndrome and obese without metabolic syndrome ($p<0.005$).This study superoxide dismutase value was highest at obesity without metabolic syndrome but the lower value we found both of them . Normal value superoxide dismutase range 0.05 -3ng/ml. SOD is considered the first enzyme in defense against oxidative stress produced by normal metabolism.

Discussion

A previous animal study of antioxidatives enzymes in *ob/ob* mice showed that copper-zinc SOD activity were 30% lower than in control mice[12]. Additionally, erythrocyte SOD activity in obese individuals was significantly lower than in normal –weight population[13]. In the research by Tungtrocgchitr et al, SOD activity were lower in overweight group than in control group.[14] The research by Parise et all observed that unilateral resistance exercise was an adequate stimulus for increasing antioxidant enzyme activity and may have suppressed increasing in reactive oxygen species and carbonyl levels[15]

In the research by Turk HM et all, elevated SOD activity at Type 2 Diabetes Mellitus compare healthy normal population. And The research by Sabrina Serpillonet all assessstress oxidative level by estimate O_2^- and H_2O_2 product in the mice's cardiac , in obese mice's cardiac found higher O_2^-than lean, but H_2O_2 did not find different. This research assess that activity of Superoxide dismutase lower at obese mice than lean.As we know that the compound like O_2^- and H_2O_2 are free radical that will be eliminated by superoxide dismutase enzyme[16,17]. The other research by Isgowa A et all at metabolic syndrome samples found that activity from superoxide dismutase negative correlation with body mass index (BMI)[18] . and the research by Brown Holy et all showed that type 2 Diabetes mellitus is associated with decreased antioxidants status as the levels of the antioxidants enzyme SOD[19].

So many studies prove oxidative stress plays an important role in the development of obesity and obesity- associated metabolic disorder..This study aimed to analyze the comparison of Superoxide dismutase levels in obese with metabolic syndrome and obese non metabolic syndrome, superoxide dismutase value was highest at obesity without metabolic syndrome but the lower value we found both of them. As we know that oxidative stress increase at obesity and so Superoxide dismutase enzyme primarily responsible for the maintenance of oxidation reduction homeostasis.Superoxidedismutase defense system for living organism uses scavenger free radicals produced during normal metabolic processes.

Conclusion

The result this study shows that there was significant difference of superoxide dismutase levels between obese with metabolic syndrome and obese without metabolic syndrome ($p<0.005$).

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