

# Benefits of Asam Gelugur (*Garcinia atroviridis*) Tea as a Source of Antioxidant Compounds on Malondialdehyde Levels in Adults with Obesity

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## Abstract

*Garcinia atroviridis* is one of the well-known plant grown in Indonesia that contains antioxidant compounds. Ingestion of *G. atroviridis* tea is expected to protect from oxidative stress. The aim of the this study was to evaluate the antioxidative benefit of *G. atroviridis* leaf tea on malondialdehyde levels of obese adults. This research recruited fifteen obese adults. All of the subjects were given *G. atroviridis* tea for a month. As a result, current study obtained statistically nonsignificant differences of post-test malondialdehyde levels compared with pre-test levels among all subjects. It can be concluded that *G. atroviridis* tea taken once daily for 30 days was not sufficient to decrease MDA levels significantly. Although anthropometric measures decreased significantly, the subjects were still in the criteria of obesity. In addition, the lifestyle factors that increases MDA should be avoided.

**Keywords:** malondialdehyde; *G. atroviridis*; obesity; oxidative stress.

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## 1. Introduction

Obesity is associated with oxidative stress which can be reduced with weight loss (regardless of exercise or surgery induced weight loss), caloric restriction or antioxidant rich diets. Oxidative stress levels are elevated in human obesity [1]. NADPH oxidase is the major source of ROS in adipocytes, augmented NADPH oxidase contributes to increase ROS production in adipose tissue in obesity, resulted increased levels of fatty acid in accumulated fat stimulate ROS production in adipose cells through the activation of NADPH oxidase. ROS downregulated adiponectin expression at the transcriptional level, hence treatment with antioxidants or inhibitors of ROS production might restore the dysregulation of adipocytokines. Increased oxidative stress in accumulated fat is an early instigator of metabolic syndrome and the redox state in adipose tissue is a potentially useful therapeutic target for obesity-associated metabolic syndrome [2]. Not only adiponectin, obesity also alters the adipokines balance produced by adipocytes, with elevated leptin, TNF- $\alpha$ , RBP4, resistin, and IL6. Changes in the balance contribute to impaired glucose tolerance and insulin resistance [3].

Triacylglycerol is a high concentrated deposit of metabolic energy. In mammals, the main location of TAG accumulation is in the cytoplasm of adipose cells. Adipose cells are devoted to the synthesis and storage of TAG, and mobilization into the fuel molecules [4]. In obesity, increased TNF- $\alpha$  released to the liver further increases the production of ROS during  $\beta$ -oxidation mitochondrial to FFA. Upregulation of FFA microsomal and peroxisomal oxidation will contribute to oxidative stress. Oxidative stress leads to lipid peroxidation in liver [5]. Excessive formation of ROS causes lipid peroxidation of cellular membranes, and causes release of TNF- $\alpha$  [6]. Preadipocyte and adipocyte in excessive adipose tissue is a source of proinflammatory cytokines (eg TNF- $\alpha$ , IL-1, IL-6), hence obesity is considered a chronic inflammatory state. Increased cytokine concentration is responsible for the increase in oxidative stress. The cytokine is a potent stimulator for producing ROS/RNS by macrophages and monocytes. TNF- $\alpha$  also increases the interaction of electrons with oxygen to produce superoxide anions [7]. Free radicals or ROS at high levels can cause direct damage to lipids. Lipid peroxidation is a process in which oxidants attack lipids containing carbon-carbon double bonds (s), resulting in the production of peroxy lipid radicals and hydroperoxide [8]. Lipids are the targets of oxidant compounds, which can initiate lipid peroxidation processes. In medium or high rate of lipid peroxidation, the extent of oxidative damage exceeds its repair capacity. Many studies have analyzed the danger effects of lipid oxidation in cell membranes [8], [9], [10], [11]. Lipid peroxidation is a chain reaction that results in multiple breakdown - molecules, such as malondialdehyde (MDA) and 4-HNE. Various biomarkers of lipid peroxidation exist, among which are malondialdehyde (MDA).

Antioxidants are defined as any substance which, if present in a lower concentration than the oxidized substrate, may delay or inhibit the oxidation of the substrate. The role of antioxidants is to prevent damage to cellular components that arise as a consequence of chemical reactions involving free radicals [12]. Human body requires antioxidants to reduce the effects of free radicals. Garcinia species are rich sources of mangostin, tannin, xanthone, isoflavone, flavones, and other bioactive substances [13], [14]. As a popular plant in Indonesia *G. atroviridis* (asam gelugur) is one source of exogenous natural antioxidants, this plant contains chemical compounds with many benefits. Study findings indicate the potential use of *G. atroviridis* leaves and fruits as a source of natural antioxidants [15] The leaves of Garcinia have higher antioxidant activity than their stems. It

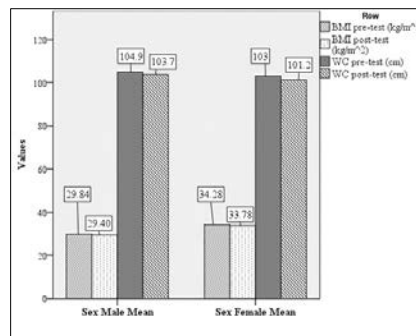
was shown that the total phenolic content showed a good correlation with the antioxidant activity [13],[16]. Based on these background, it is necessary to conduct a study about the effect of *G.atroviridis* tea produced in Indonesia on serum MDA levels of obese adults.

## 2. Materials and Methods

This research was conducted with pre and post test design. Fifteen obese adults were recruited. *G.atroviridis* leaf tea made from a sachet of *dried leaf* brewed in 200 ml water and taken by all subjects for a month. At the beginning of the study, waist circumference, body weight, and body height off all subjects were measured to determine anthropometric status and body mass index. All study subjects were educated about nutritious diet, recommended to avoid lifestyle with less activity, and walk at least three times a week. For the measurement of lipid indices, the procedure was similar to that described elsewhere and by Syukur and his colleagues[17]. The study was approved by Ethical Committee of Faculty of Medicine University of Andalas, Padang - Sumatra Barat.

## 3. Results

Figure 1 demonstrated pre-test measurement of body mass index and waist circumference compared with the post-test measurement, the BMI and WC measurements of subjects were significantly decreased with p value < 0.05.



**Figure 1:** Comparison between BMI and WC pre-test and post test of subjects.

The decrease of BMI and WC were found in male and female subjects (Table 1).

**Table 1:** Pre- and post-test measurements of waist circumference and body mass index

	Body Mass Index (kg/m <sup>2</sup> )	Waist Circumference (cm)
	(mean± SD)	(mean± SD)
	Pre-Test	Post-Test
Male	29,84 ± 3,16	29.40 ± 3.14
Female	34,28 ± 1,99	33.78 ± 1.94

Table 2 below shows the average pre-test FBG level is  $172.67 \pm 130.91$  mg / dL. The mean post-test FBG level is  $117.53 \pm 53.96$  mg / dL. Using the statistical test, FBG pre-test levels were found to be significantly different (p value 0.002) with post-test FBG.

**Table 2:** The influence of *G.atroviridis* tea on the levels of FBG, triglyceride and malondialdehyde

	Body Mass Index (kg/m <sup>2</sup> ) (mean $\pm$ SD)		p
	Pre-Test	Post-Test	
Fasting Blood Glucose (mg/dL)	$172.67 \pm 130.91$	$117.53 \pm 53.96$	0.002
Triglyceride levels (mg/dL)	$241.40 \pm 211.44$	$166.0 \pm 97.23$	0.04
Malondialdehyde levels ( $\mu$ mol/L)	$0.82 \pm 0.15$	$0.78 \pm 0.13$	0.23

There were significant clinical and statistical differences of pre-test FBG with post-test FBG. The results of this study are supported by a previous study which stated that *G.atroviridis* contains (-) - HCAs that act as ATP citrate lyase inhibitors [18,19]. The use of *G.atroviridis* was followed by a significant decrease in mean body weight compared with control without affect appetite [20]. This results supported by previous study which suggested that HCA may slow the absorption of enteral glucose. Besides, oral HCA supplementation significantly accelerated the speed of glycogen synthesis up to twofold in human skeletal muscle after exercise, and increased the synthesis rate of glycogen along with increased insulin sensitivity throughout the body [21].

In the table 2, the pre-test triglyceride level was  $241.40 \pm 211.44$  mg/dL and the post-test level was  $166.0 \pm 97.23$  mg/dL (p- value 0.04). Previous report stated that TG levels, and MDA LDL were closely correlated [22], while another study reported that *G.atroviridis* has been proven to be useful in lowering triglyceride levels [23]. However, significant decrease of TG levels obtained in this study was not accompanied with reduced in MDA levels. The type and amount of food consumed, and the smoking cigarettes by the subject in current research was not controlled. Besides, all of the lifestyle mentioned above may play role and influencing MDA levels.

Garcinia has antioxidant abilities against oxidative damage in *in vitro* system [24]. The proton-donating ability of *G. atroviridis* extracts which could serve as free radical inhibitor and act as a primary antioxidant. The reducing power of leaf extracts of *G.atroviridis* was superior to the fruit extracts. Previous study demonstrated that the leaves of *G.atroviridis* were rich in phenolics and higher concentrations obtained when extracted at 100°C for 15 min. The increased total phenolic concentrations in the leaf was proportional to increased antioxidant activities [15]. In current study, the pre-test MDA level was  $0.82 \pm 0.15$   $\mu$ mol / L and after thirty days, the post-test MDA level was  $0.78 \pm 0.13$   $\mu$ mol / L. Statistical analysis results obtained p value 0.23. Current study obtained a difference in pre-test and post-test MDA mean as much as 0.03  $\mu$ mol / L. Statistically, there was no significant difference between post-test with pre-test MDA. It is concluded that the clinical difference is very small, and not statistically significant. Many factors can affect MDA levels. It was already

known, as a targets of oxidant compounds, lipid can initiate lipid peroxidation processes, and the reaction results in production of molecules such as malondialdehyde. In increased rate of lipid peroxidation, as in obese state, the extent of oxidative damage was beyond the repair capacity and antioxidant available for reducing free radicals. Besides, the subject of this study was not fully supervised for their lifestyles, smoke behaviour, and food intake. Repeated anamnestic interview found that some subjects remained smoking cigarettes [24]. Hence, the limitations of this study consisted of unsupervised of food consumption and smoking cigarettes. It is advisable to extend the treatment period in order to observe more of the benefits of *g.atroviridis* tea on decreasing body mass index and MDA levels.

#### 4. Conclusion

This study concluded that once-daily consumption of Garcinia tea was not enough to significantly decrease the MDA levels despite the significant decrease in BMI, WC, as well as significant decline of FBG and TG levels. Eventhough the anthropometric measurements reduced significantly, the subjects were still in the criteria of obesity. In addition, we suggested to prolong treatment period, and avoid lifestyle behaviours that increases MDA.

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