

# Underlying Mechanism of Coffee as Inhibitor Adipogenesis for Complementary Medicine Use in Obesity

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## Abstract

**Introduction:** Obesity is a problem that affects the world community for early mortality. Coffee is the favorite drink that contains caffeine and the main form has been consumed since the days of our ancestors. Caffeine was considered to have a negative effect on health, but the most current studies prove that caffeine is beneficial to health, as well as in the treatment of obesity, but not much is understood about the mechanism of action of caffeine for obesity. The purpose of this paper to discuss the mechanism of weight loss in the form of coffee contains caffeine.

**Method:** Systematic review.

**Result:** Caffeine of coffee has properties as an inhibitor of adipogenesis.

**Discussion:** Caffeine has thermogenesis effect which can reduce the size and number of adipose cells so that the accumulation of adipose tissue will be reduced. Finally, the weight will come down and achieved improvement of organ function and adipose tissue.

**Conclusion:** Caffeine coffee potentially loses weight obese due to their properties as an inhibitor of adipogenesis of caffeine of coffee.

**Keywords:** Coffee; Caffeine; Inhibitor adipogenesis; Obesity

## Introduction

Complementary medicine is a term for non-conventional medicine in several countries. WHO uses traditional medicine strategy in 2014-2023 to support the improvement of public health services world [1]. Obesity and overweight is one of the chronic diseases that would have increased mortality [2], especially in the country - a country whose population is obese and many overweight. Mortality in obesity is due to the onset of cardiovascular disease and insulin resistance so that the person is suffering from diabetes mellitus. Area subcutan, retroperitoneal and visceral is an area in which the distribution of adipose tissue more distributed. The third area of distribution of the adipose tissue is characteristic of the distribution of adipose tissue of obese abdominal. Risiko atherogenic that cause insulin resistance associated with abdominal obesity. Atherogenic risk, diabetogenic and hypertensiogenic associated with visceral fat distribution in the area because of the accumulation of visceral adipose tissue area further facilitates an increase in free fatty acids to the liver via the portal vein [3].

Obesity is an excessive accumulation of adipose tissue in the body so the secretion of pro-inflammatory responses increased in chronic period [4,5]. Adipose tissue is the tissue that reflects the body's immune system and is one of the endocrine organs. Excessive immune response due to increased secretion of chronic inflammatory response will cause damage to organs and tissues of individuals with obesity leading to diabetes mellitus [6,7].

Complementary medicine is given to prevention and management of some chronic diseases. Products used include complementary medicine made from herbs that contain parts of plants or plant active ingredients, but some countries do not always use materials containing parts of plants [1]. Management of chronic diseases such as obesity and diabetes mellitus begins with attention to diet so that the management did not experience weight gain that resulted in the number and size of adipose cells which continue to multiply.

Public health care efforts in the weight loss program that focuses on obesity or overweight people to eat healthy and increase the activity of exercise, had failed during the past 30 years. This triggered a new development to prioritize programs increased physical activity to manage weight [8]. Obesity and overweight patients who experienced weight loss of 5-10% of the total weight will benefit the health and improve the risk of cardiovascular disease marked by improvements in blood pressure, blood cholesterol levels and blood sugar [4,9]. The use of herbs has increased due to the cost and side effects that are used for herbal treatment is lower than the cost and side effects incurred for the treatment of non-herbal [1,10]. The results of a recent study state that in addition to herbs, consumption of vegetables and fruits will reduce the risk of chronic disease because it contains antioxidants like polifenol. Antioksidan will reduce oxidative stress. In fact, coffee included beverages containing high levels of antioxidants [11,12]. Strategy complemer medicine should be improved in the management of various diseases because of this strategy is prioritizing the management of food consumption in order to prevent an increase in oxidative stress [13,14].

Coffee is one beverage that mainly contains caffeine and proved unable to lose weight due to the effects of caffeine work, one of them as a stimulant. An epidemiological study proves that coffee consumption reduces weight gain in obese men [15]. Kafein is a major stimulant of

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coffee and related to weight loss and reduced risk of metabolic syndrome [16]. Consumption of coffee helps the lipid metabolism by increasing thermogenesis as part of an increase in fat oxidation. Caffeine shows antiobesity effect by reducing the size of adipose tissue and cell number of adipocytes, increased heat production from adipose tissue and basal metabolic rate of the body. Caffeine could inhibit cell proliferation and differentiation of adipocytes through inhibition adipogenik related factors [17]. The results of long-term studies have shown that caffeine reduces adipose pad size and the number of cells of adipocytes (Table 1) [18,19].

Consumption of caffeine will stimulate thermogenesis in 2 ways [20]:

- Inhibiting the enzyme phosphodiesterase. Barriers against the action of the enzyme phosphodiesterase will lead to cyclic adenosine monophosphate (cAMP) is not capable of performing hydrolysis to AMP that increased cAMP levels. Increased levels of cAMP will lead to increased activity of the

central nervous system so hormone sensitive lipase inactive to active, ultimately encourage lipolysis.

- Through stimulation cycles substrate is Cori cycle and FFA triglyceride cycle [20]. Their Cori cycle may be the answer to why the people who consume coffee will feel the increase in body fitness. Lactate in the muscles will be moved to the liver. Lactate in the liver then be converted into pyruvate, then pyruvate is converted into glucose by the enzyme lactate dehydrogenase, and glucose eventually sent back to the muscle blood circulation. Besides an increase in free fatty acid and lipid oxidation. Caffeine is an antagonist which inhibits the action of adenosine against lipolysis by adenylyl cyclase [21]. Caffeine increases energy expenditure by 4-5% and 10-16% of fat oxidation through activation of the sympathetic nervous system that is involved in regulation of lipolysis in white adipose tissue and affect the total fat thus affecting the body's metabolic effects such as satiety, thermogenesis and fat oxidation (Figure 1) [20].

Authors	Designs	Samples	Outcome	Measurements	Results
Acheson et al. [21]	Experimental study	8 healthy male volunteers, approved by the ethical committee of the Faculty of Medicine, Lausanne University.	Biological mechanisms of lipolytic effect of caffeine and the influence of caffeine are mediated via Sympathetic nervous system	Plasma and urine samples, breath samples, stable isotope analysis	Sympathetic nervous system is mediator for activating caffeine.
Hiroshi et al. [22]	Experimental study	Male ddy mice were fed a standard diet containing green coffee bean extract and its components (caffeine and chlorogenic acid) for 14 days	Effect of green coffee bean extract on fat accumulation in mice	-Measurements of mice body weight and visceral fats, hepatic TG, serum TG, hepatic carnitine palmitoyl transferase	Green coffee bean extra suppress body weight gain and visceral fat accumulation in mice. (Caffeine suppress fat absorption, chlorogenic acid enhances fat metabolism in the liver)
Shu Hui Su et al. [23]	Experimental study	Primary rat adipose derived stem cells (ADSCs) and a mouse bone marrow stromal cell line in vitro	Effect of caffeine on adipogenesis	Oil red O, Nila Red Staining and FACScan flow cytometry	Caffeine was able to inhibit adipogenic differentiation of ADSCs and M2-10B4 cells
Su Jin Song et al. [24]	Experimental study	48 male C57BL/6N mice	Mechanisms of weight loss product from green coffee bean extract	HPLC analysis of green coffee bean extract, histological and biochemical anlysis, oral glucose tolerance test, RT-PCR, Western Blood Analysis	Green coffee bean extract reduces visceral fat –pad accumulation
Hujuan et al. [25]	EEperimental study	Eight week old male C57BL6 mice were fed for 9 weeks ad lib on normal diet, high fat diet, high fat diet of coffee containing 2% caffeine, decaffeine, unroasted caffeinated green coffee	Molecular mechanisms in the ameliorative effects of coffee on skeletal muscle gene expression profiles in obese animal model	Extract Total RNA and protein from skeletal muscle were subjected to microarray (Mouse genom 2.0, Affymetric) and western blotting analyses	Positive effect of coffee consumption on the prevention of obesity

Table 1: The mechanism of coffee as complementary medicine in obesity.

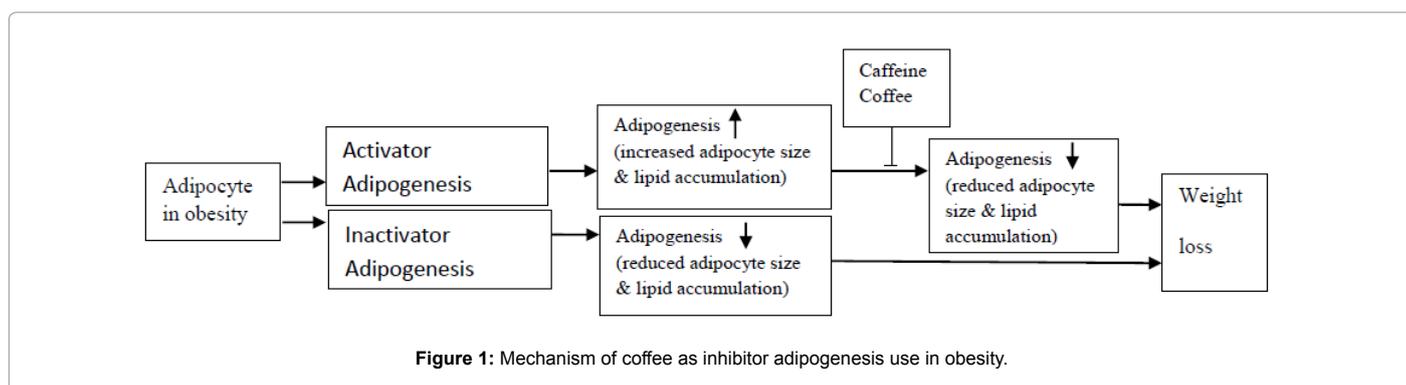


Figure 1: Mechanism of coffee as inhibitor adipogenesis use in obesity.

## Conclusion

The caffeine content is an inhibitor of adipogenesis so as to inhibit the adipogenesis adipose cells that cause smaller size and weight reduction. The benefits of coffee consumption on weight is increasing satiety and increase metabolism which helps maintain body weight and weight loss in people who are less physical activity.

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