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Can coffee increase your metabolism and help you burn fat?

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Introduction

Caffeine is the most widely consumed behaviorally active substance in the world. Caffeine produces its behavioral effects through adenosine receptor antagonism and subsequent changes in many neurotransmitter systems. This results in increased alertness, and caffeine maybe especially beneficial in low arousal situations (e.g., working at night, prolonged work, or sleep deprivation). It improves performance on tasks that are impaired when alertness is low (vigilance and sustained response). Such effects largely reflect increased turnover of central noradrenaline. In addition, it increases the speed of encoding and response to new stimuli, an effect that probably reflects changes in cholinergic functioning. More complex cognitive tasks show less consistent effects of caffeine, which is again consistent with its arousal-increasing effect. Beneficial effect shave been observed in simulations of real-life activities such as driving and in interpolated task used in the field. Similarly, there is some evidence that regular consumption of caffeine has benefits, although this may depend on age. In terms of negative effects, there is little convincing evidence that caffeine produces major health problems. Sleep may be impaired if large doses are ingested late at night. Mental health problems (e.g., anxiety) have also been observed when very large doses are consumed or caffeine is given to those with existing psychopathology. Caffeine is not a typical drug of dependence and many of the withdrawal effects appear to be weak or transient. Overall, evidence shows that levels of caffeine consumed by most people have largely positive effects on behavior. The next section briefly describes sources of caffeine, metabolism of caffeine, results from animal studies, and our knowledge of underlying CNS mechanisms. [(1)]

Source of Caffeine

Caffeine occurs naturally in dietary sources (food and drinks), is added to a number of products, and is present in certain medications. The major sources of caffeine vary from country to country and across different age groups. For example, in many Asian countries tea is the caffeine-containing beverage of choice, whereas in North America and many European countries coffee is the major source of caffeine. Cola beverages and energy drinks also contain caffeine and are popular world-wide and are often the major source of caffeine in younger groups. Caffeine is also added to many analgesics, and caffeine pills are sold in pharmacies as stimulants. Small amounts are also present in chocolate products (both drinks and chocolate bars). When caffeine is added to a product, the amount that is present is constant. However, where caffeine occurs in natural products, such as coffee or tea, the growing conditions, plant variety, processing and storage, and the method of preparation increase variability in the caffeine concentration of the final beverage. For example, coffee prepared by the drip method may contain more than 100 mg caffeine per cup, whereas instant (soluble) coffee contains ca. 60 mg per cup. Tea contains less caffeine than coffee (ca. 40mg of caffeine) and most cola have 30 to 40 mg caffeine. [(2)]

CAFFEINE ABSORPTION, DISTRIBUTION, AND PHARMACOKINETICS

Caffeine (1,3,7-trimethylxanthine) is one member of a class of naturally occurring substances termed methylxanthines. Absorption from the gastrointestinal tract is rapid and reaches 99% inhuman ca. 45 min after ingestion. The hydrophobic properties of caffeine allow its passage through all

biological membranes and there is no blood-brain barrier to caffeine. The time for peak plasma concentration is variable (15 to 120 min) and caffeine half-lives range from 2.5 to 4.5 h. Caffeine half-life is reduced by 30 to 50% in smokers and is approximately doubled in those taking oral contraceptives. [3]

Metabolisms

Oral absorption of caffeine is rapid and complete. Only a small fraction (1-4%) of caffeine is excreted unchanged in the urine. Caffeine is extensively metabolized by the liver. [4] Evidence to support hepatic metabolism includes in vitro studies demonstrating biotransformation of caffeine by human liver microsomes, observations of impaired clearance of caffeine in people with liver disease, and the well-known effects of inducers and inhibitors of hepatic microsomal enzymes on caffeine metabolism. [5] Since caffeine is completely bioavailable [6], the extent of extraction from the blood in each pass through the liver must be low (Le., a low-extraction drug). Caffeine is bound to plasma proteins (presumably albumin) with binding reported to range from 10 to 35%. [7]

Mode of Action

Physiological concentrations of caffeine are normally less than 70µmol/L; plasma concentrationsof20to50µmol/L are common. However, the concentrations employed in most in vitro investigations ranged from 500 to 5000µmol/L. The physiological significance of such studies is not clear. While several modes of action for caffeine have been identified, the only one that is important, within the physiological concentration range of caffeine is inhibition of adenosine receptors. Caffeine is very similar in structure to adenosine and

can bind to cell membrane receptors for adenosine, thus blocking their action. Adenosine receptors are found in most tissues, including the brain, heart, smooth muscle, adipocytes and skeletal muscle (although the nature of these receptors in skeletal muscle is poorly understood). The ubiquitous nature and varied types of adenosine receptor facilitates caffeine simultaneously affecting a variety of tissues, resulting in a wide range of often interacting responses. This issue is not discussed in detail here, since it has received much attention in other publications. [8] Nonetheless, such interacting responses complicate the ability to establish which tissues are affected (and which responses occur) first, and which are critical to the ergogenic nature of caffeine. Caffeine may also have intracellular actions, but it is not clear whether these are direct effects on enzymes or due to post-receptor events. In addition, caffeine is known to stimulate the secretion of adrenaline (epinephrine). This response could produce a number of secondary metabolic changes that could promote an ergogenic action. It also creates a situation in which it is difficult to attribute any one response to an action of caffeine on a specific tissue. For example, an apparently straight-forward response, such as increasing adrenaline levels, could be due to stimulation of various brain areas, direct stimulation of the adrenal medulla, or reaction to cardiovascular changes induced by caffeine. One can study animal models and individual tissues in isolation, but the responses one observes in an integrated organism could be very different. In this review, attempts are made to concentrate, in an integrated fashion, on the responses of humans to physiological doses of caffeine. [9]

Forms of Caffeine and Related Compounds

Coffee, tea and other caffeine containing beverages are consumed by most adults in the world. In some countries, children and even infants ingest caffeine-containing beverages and foods.Ingeneral, society would not approve of a young athlete using a steroid drug or a stimulant, but we don't react negatively to anyone drinking coffee, tea or a cola beverage. Despite caffeinated beverages being a common element in our food, caffeine isn't a typical nutrient and is not essential for health. Furthermore, the commercial world is rapidly changing and expanding the availability of caffeine to allages.Thereare now energy drinks and gels that are promoted for their caffeine content. Similarly, a wide range of bottled waters and even alcoholic beverages that contain caffeine are now sold. [(10)]

Fat Oxidation

Does caffeine enhance fat metabolism? Even if it does, fat oxidation is trivial in some situations when caffeine is ergogenic, such as in short term, intense activity and in resistance activity. In addition, the studies showing that caffeine did not de-crease respiratory exchange ratio (RER) and/or in-crease plasma FFA levels probably outnumber those that found the 'expected' result. In 12 different studies in the author's laboratory, no decrease in RER following caffeine ingestion was observed. In only6 of these studies were circulating FFA levels in-creased (mainly at rest before exercise). Yet, in the9 studies in which endurance was measured, caffeine was ergogenic in 8 (only when Wingate tests were examined was an ergogenic effect not found).Furthermore, Ragusa et al. reported that theophylline failed to alter either the rate of appearance (Ra) or disappearance (Rd) for FFAs or glycerol. In another study, while caffeine

ingestion increased arterial FFA levels, net uptake of FFAs by the exercising leg was not enhanced (fig. 1) and whole-body RER was not altered. Thus, in a wide variety of circumstances, there is little support for the theory that caffeine increases fat oxidation, even though it may well promote adipose tissue lipogenesis atrest.There are considerable data demonstrating that caffeine increases adrenaline levels ,and a recent study showed that leg sympathetic stimulation was increased by caffeine. However, FFA mobilization occurs even in tetraplegics when there is no increase in catecholamine levels. The author speculates that the following scenario occurs with fat metabolism: caffeine antagonisesA1receptors of adipocytes and this enhances lipolysis (this may be supplemented with increased sympathetic activity resulting in adrenergicβ-receptor stimulation); the elevation of FFA levels results in increased hepatic uptake of FFAs, some of which are oxidized or esterified to triglycerides; the excess FFAs form ketone bodies, which are released and cleared by several tissues, including skeletal muscle. (11)

Coffee is low in calories

When trying to lose weight, you have to create a calorie deficit. You can do this either by increasing physical activity or consuming fewer calories. An easy way to reduce calorie intake is to choose lower-calorie beverages. For example, replacing just 1 cup (240 ml) of a high-calorie, sugar-sweetened beverage with the same amount of water may lead to over 4 pounds (1.9 kg) of weight loss over 6 months. By itself, coffee is a very-low-calorie beverage. In fact, 1 cup (240 ml) of brewed coffee has only 2 calories. However, coffee only contains this minuscule number of calories if you drink it black without adding sugar, milk, or any other ingredients. If you're attempting to reduce your total calorie

intake, replacing high-calorie beverages such as soda, juice, or chocolate milk with plain coffee may be a good place to start. [12]

Caffeine may boost metabolism

Caffeine is a natural stimulant commonly found in coffee, tea, and soda. Per serving, coffee typically contains the highest amount of caffeine of these three beverages. One cup (240 ml) of brewed coffee offers about 95 mg of caffeine. Still, the caffeine content varies depending on the type of bean, roasting style, and preparation. Caffeine may improve your metabolism a measure of how many calories your body burns each day. This is one reason why caffeine is included in many weight loss supplements. However, large doses of caffeine may be required to significantly influence metabolism. For example, one study found that a caffeine dose of 4.5 mg per pound of body weight (10 mg per kg) increased metabolism by up to 13%. [12]

This would equal 680 mg of caffeine a whopping 7 cups (1,660 ml) of coffee for someone who weighs 150 pounds (68 kg). Still, some research shows that regular caffeine intake may improve body weight maintenance and weight loss. In one study, an increase in caffeine intake was associated with less weight gain over 12 years. Yet, the participants who consumed the most caffeine were only about 1 pound (0.4–0.5 kg) lighter than those with lower caffeine intakes. A different study looked at people who successfully lost weight. Those who consumed the most coffee and caffeine were more successful at maintaining their weight loss over time.

Obesity and coffee

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. Obesity and overweight is one of the chronic diseases that would have increased mortality, 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 . Obesity is an excessive accumulation of adipose tissue in the body so the secretion of pro-inflammatory responses increased in chronic period. 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. 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. 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. 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. 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. 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. Strategy complementer 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.

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. Kafein is a major stimulant of coffee and related to weight loss and reduced risk of metabolic syndrome. 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.

Consumption of caffeine will stimulate thermogenesis in 2 ways:

• 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. 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. Be sides an increase in free fatty acid and lipid oxidation. Caffeine is an antagonist which inhibits the action of adenosine against lipolysis by adenyl cyclase.

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 affects the total fat thus

affecting the body's metabolic effects such as satiety, thermogenesis and fat oxidation (Figure 1).

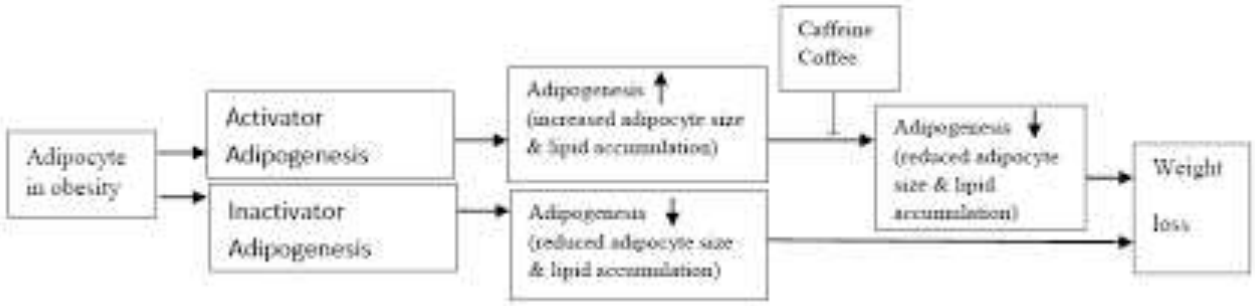

Figure 1 Mechanism of coffee as inhibitor adipogenesis use in obesity.

Lipolysis

Lipolysis is another indicator of lipid metabolism, and greater lipolysis has frequently been observed after caffeine or coffee intake by human subjects. Investigators have used either plasma free fatty acids (FFA) or glycerol assays as indicators of lipolysis, and glycerol is considered the more reliable indicator. Several human studies found that an acute increase in lipolysis resulted from ingestion of caffeine, ground caffeinated coffee and instant caffeinated coffee. No increase in lipolysis was found after ingestion of decaffeinated coffee, instant decaffeinated coffee or ground decaffeinated coffee; these results derive from only one human study for each type of decaffeinated coffee. (14)

Physical activity

Caffeine or coffee could also cause weight loss by inducing increases in physical activity. First, caffeine or other coffee compounds may stimulate a spontaneously higher rate of physical activity. Caffeine has been found to increase motor activity in rodents at doses between 3 and 30 mg/kg and to reduce motor activity at higher doses. No exercise activity thermogenesis was

found to consume up to 350 kcal/d in humans, and Bracco et al (44) found that spontaneous physical activity did not increase in humans who drank 5 cups instant caffeinated coffee/d, as assessed by a radar motion-detection system. It is possible that the physical activity response is biphasic in humans, as it has been found to be in rodents, and that the caffeine dose used by Bracco et al was high enough to induce decreases in physical activity. Second, there is abundant evidence that ingestion of caffeine by human subjects improves exercise performance, which could lead them to increase their level of physical activity. Caffeine, but not coffee, has been shown to have an ergogenic effect—ie, to increase endurance, speed, power output, or all 3 in human exercise activities lasting from 1 min to 2 h. This finding suggests that there are no caffeine compounds in coffee that counteract the ergogenic effects of caffeine. [15]

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