

# The Mental and Nutritional Merits of Chocolate

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## ABSTRACT

Chocolate is the most commonly craved food in America (9). I have examined how chocolate affects brain chemistry in a positive way and which kinds of chocolate have more health benefits. Chocolate's sensory components, biologically active substances, and nutritive properties all add up to one thing: chocolate is tasty and makes people feel good when they eat it. I have researched peer-reviewed literature to find details of what is in chocolate and how it affects our mood in a positive way, and whether or not certain kinds of chocolate are better for the body than others. The studies I looked at showed that evidence is building that chocolate might be better for you than people think. Dark chocolate, especially, appears to have ingredients that may reduce blood pressure and the risk of heart problems. If this is so, perhaps the guilt brought on my indulging in chocolate cravings will turn out to be unnecessary, and recommended daily values of chocolate might be in the future.

## INTRODUCTION

Research shows that 97 percent of women and 68 percent of men report an intense desire for certain substances, also known as a craving (9). The most commonly craved foods reported are sweet and fatty foods. Forty percent of women and 15 percent of men desire chocolate, making it the most frequently craved food (9). Recent scientific studies have tried to determine what compounds found in chocolate promote health and why it is so pleasurable to eat. One of the main molecules recent media has focused on are polyphenolic compounds called flavanols (Table 1). Polyphenols are micronutrients that have come into the public view lately because they are abundant in our diet and appear to have properties that help prevent certain diseases. Monomer flavanols called such as catechins are abundant in dark chocolate, green tea, and other foods (4).

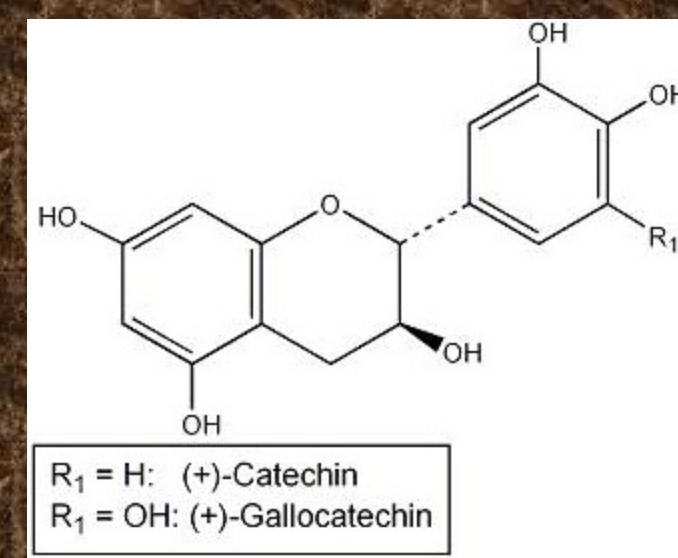
Caffeine and other substances have long been examined in relationship to chocolate. Are these the chemical compounds that make chocolate so good to eat? What other possibilities are there for why we crave chocolate so much? Research has shown that the only food that can satiate a chocolate craving is milk or dark chocolate (1). This indicates that chocolate may have unique components that set it apart from all other sweet and fatty foods. My hypothesis is that chocolate has certain properties that can have positive effects on mood, and that chocolate cravings may be a result of these pleasurable affects.

## METHOD

I examined research done and published in peer reviewed literature. The source I consulted gave me information on the compounds and chocolate, such as possible psychoactive ingredients. Other studies I looked at examined the health benefits, specifically in relation to heart disease and circulation. I focused on the components in chocolate that have an effect on mood in a positive way, why people crave chocolate, and the possibility that chocolate is a more nutritious food than the general public believes.

TABLE 1: Chemical Structures of Molecules Found in Chocolate (2, 3, 4)

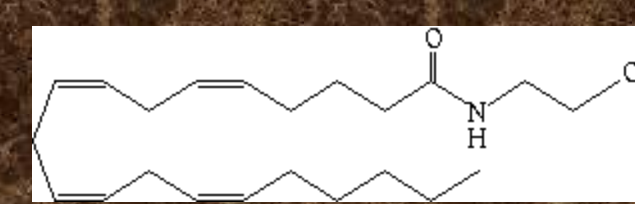
### Flavonoids:



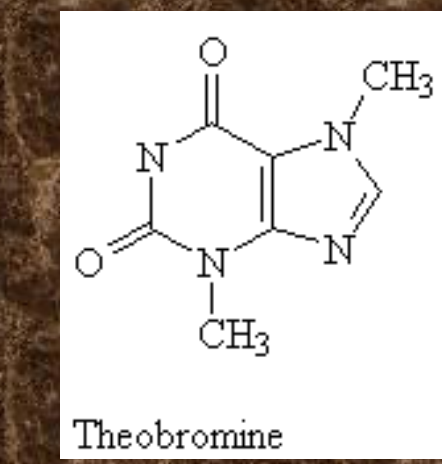
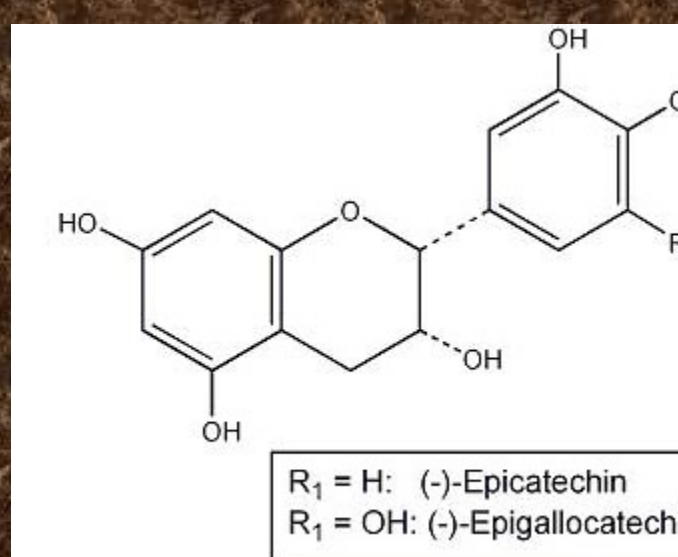
### Methylxanthines:



### Cannabinoid-like Fatty Acids:



Anandamide



Theobromine

TABLE 2: A complicated view of the compounds in chocolate. (1)

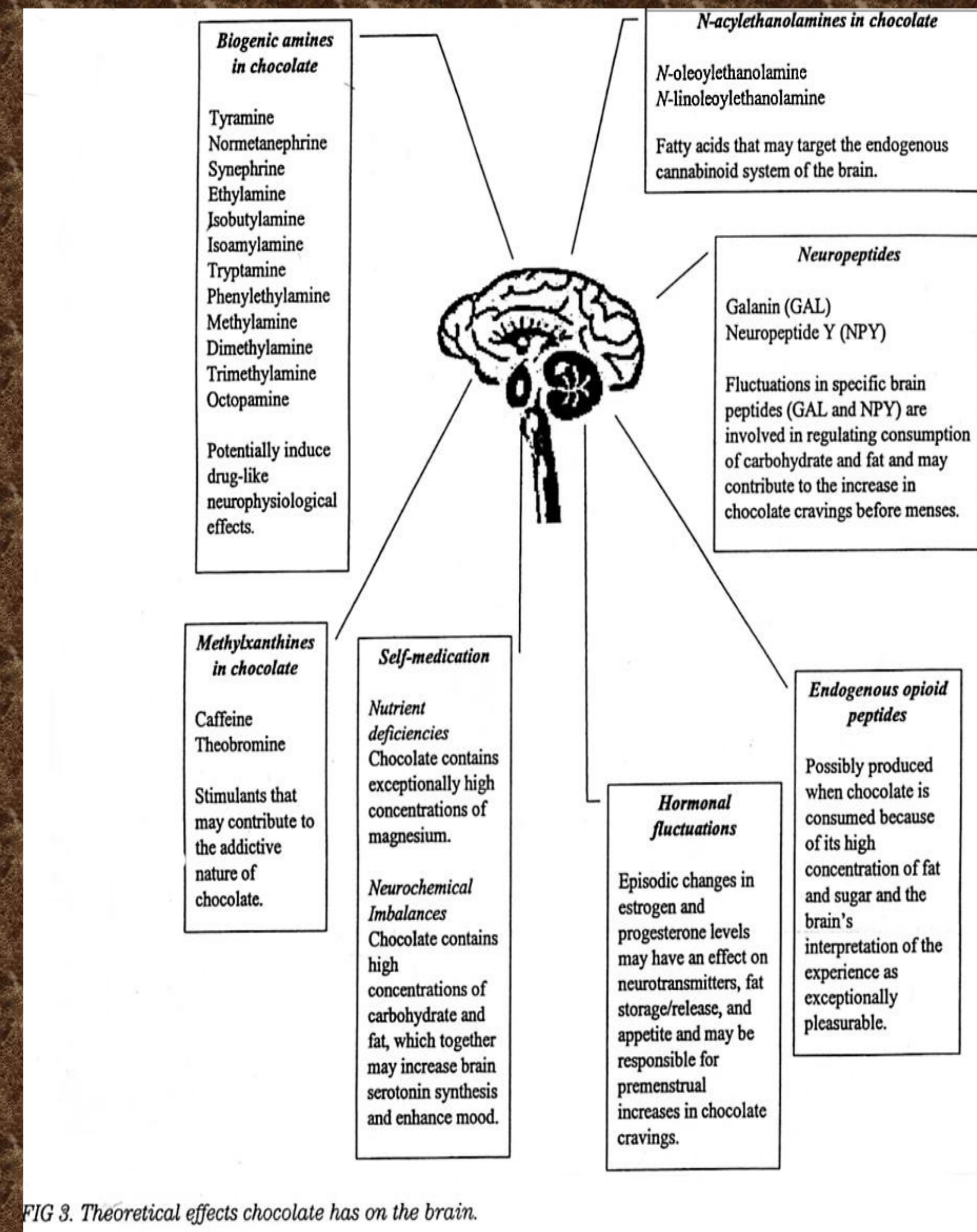


FIG 3. Theoretical effects chocolate has on the brain.

TABLE 3: A breakdown of the biologically active compounds in chocolate.

Active Ingredient	Common Name	Physiological/Biochemical Affect	Mood and/or Health Benefits
flavanoids (polyphenol compounds): ~catechin ~epicatechin ~procyanidins		protein-binding properties	Prevent LDL oxidation, high antioxidant activity, lower risk of heart disease
<b>Biogenic Amines:</b>			
<i>Tyramine</i>			Arousing, possibly raises blood pressure
<i>Phenylethylamine</i>	PEA	neuromodulator of brain synapses, help in dopamenergic, noradrenergic potential	modulator of mood, aid in alleviating some depression symptoms
<b>Methylxanthines:</b>			
<i>Caffeine</i>	Caffeine	catalyzes release of epinephrine, etc. from adrenal glands	stimulation, behavioral changes, addictive
<i>Theobromine</i>			less stimulation than caffeine, but similar affects
<b>Cannabinoid-like Fatty Acids:</b>			
<i>Anandamide</i>	translation: "internal bliss"	lipoprotein, activates cannabinoid receptors	similar to affects of cannabinoid drugs: euphoria, heightened sensitivity
<i>N-acylethanolamines</i> (3 different kinds):		Preserve and block the breakdown of anandamide	
<b>Endogenous Opioid Peptides</b>			Possible involvement in pleasurable chocolate experience

## RESULTS

Forty percent of women and 15 percent of men experience chocolate cravings, making it the most desired food in America (9). Chocolate's sensory characteristics, pharmacological ingredients, and biologically active substances combine to make eating it a pleasurable experience.

In a study done by Michener and Rozin (1) evidence produced showed that chocolate may be innately appealing because of its texture, scent, and taste. They found that when subjects who craved chocolate were given white chocolate, which has slightly different olfactory characteristics, their cravings were reduced far less than when subjects were given milk chocolate (1). This is supported by the fact that 77 percent of females and 75 percent of male chocolate cravers report that no other non-chocolate food can satiate their cocoa cravings (6).

Chocolate has a high concentration of fats and sugars that contribute to the sensory rewards that chocolate gives. Cocoa butter, specifically, is a fat that melts at body temperature and has a distinct scent, creates an overall pleasant sensation in the body (6). One theory of why foods high in sweet and fatty foods suggests the opioid peptide system influences desire and intake of these foods (9).

Pharmacological components of chocolate, such as biological amines, methylxanthines, and cannabinoid-like fatty acids also react together to produce alterations in brain chemistry that make consumption of chocolate a rewarding experience. Table 2 shows the complicated interaction of all these components and other active substances (1). Though the caption reads that the effects are "theoretical," recent research is showing that these effects are actually credible (6). Table three breaks down these components and describes briefly the physiological and biochemical affects of each substance, as well as health and mood benefits associated with the active ingredients.

Other possible influences on desire for chocolate and its pleasurable effects include hormones and neurochemical mechanisms. The opioid peptide system and specific brain peptides may be involved in overall craving patterns and hormonal fluctuations that cause women to crave chocolate more than men (1).

Dark chocolate appears to have health benefits as well as mood lifting components. A study done by Wan et. all (8) performed a study to examine the link between dark chocolate and cocoa consumption and LDL ("bad" cholesterol) oxidation and platelet function. The study looked at the nutritional value of flavanoids, polyphenol compounds with antioxidant properties, which are found abundantly in chocolate. The study showed that those who consumed dark chocolate or cocoa showed reduced LDL susceptibility and increased platelet function. These two factors support the hypothesis that dark chocolate and cocoa can lower the risk of heart disease (8).

## DISCUSSION

Chocolate's sensory characteristics, pharmacological ingredients, and biologically active substances combine to make eating it a pleasurable and healthy experience.

Research supporting the perceived and actual mental and nutritional merits of chocolate indicate that those who indulge in their cocoa cravings may not need to feel guilty about harming themselves. Chocolate provides sensory stimulation, mood enhancement, and may even reduce the risk of cardiovascular disease. The significance of these discoveries may affect the future of chocolate in our diets. Because of chocolate's mood lifting qualities, it is possible that chocolate could be recommended as a healthy and pleasant way of relieving symptoms associated with mild depression. Chocolate's pharmacological ingredients include substances that can raise levels of serotonin and dopamine, two brain chemicals that are involved in depression. While I have not found that cocoa products are a cure for depression, and clinical depression is a much more serious problem than chocolate is likely to solve, perhaps consumption of chocolate once a day would create an overall, long-term, positive effect on mood. Would a daily value of chocolate be beneficial? Based on the research I have done, I think there is evidence that would support a recommendation for a regular intake of chocolate products.

However, there are facts to keep in mind when approaching the subject of chocolate consumption. Because some substances in chocolate, such as caffeine and cannabinoid-like fatty acids, have addictive qualities, too much chocolate could result in mental or physical reliance on chocolate. Cocoa products are high in fats and sugars, which, in excess, can have negative health effects. People who are at risk or have diseases like diabetes or already have heart problems are more likely to experience problems because of this.

Keeping these things in mind, it still appears that chocolate in moderation has positive effects on mood and health. The most significant suggestion I have based on my research is that the guilt and self-loathing some people experience when they indulge in their chocolate desires isn't needed. I believe that chocolate consumption, especially dark chocolate, is a good thing and that it may just make you feel better, mentally and physically.

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