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AN OVERVIEW ON CHOCOLATE IN HUMAN HEALTH

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ABSTRACT

For ages, chocolate/cocoa has been prized for its flavor and potential health benefits. Chocolate was formerly chastised for its fat content, and its intake was considered a sin rather than a cure for acne, cavities, obesity, high blood pressure, coronary artery disease, and diabetes. As a result, many doctors tended to caution patients about the health risks of eating excessive quantities of chocolate. The discovery of physiologically active phenolic chemicals in cocoa has altered this view and sparked study into its impact on aging, oxidative stress, blood pressure control, and atherosclerosis. Chocolate is being praised for its high antioxidant content. In many research, however, conflicting findings and methodological problems have made it difficult for health experts and the general public to comprehend the current data on chocolate's health effects. The goal of this review is to evaluate studies on the advantages and dangers of chocolate intake over the past decade.

KEYWORDS: *Chocolate, Cocoa, Flavonoids, Polyphenols, Theobroma Cacao.*

1. INTRODUCTION

In the 16th century, chocolate was introduced to Europe. The contemporary chocolate business has evolved since then, and cocoa beans are now handled in a variety of methods. Chocolate is the most widely desired food in the planet. It was formerly believed to be a luxury item, but it is today considered a medication.

1.1 History:

Chocolate originated in Mexico, where the cacao tree was cultivated by the Mayas, Incas, and Aztecs. It was formerly thought to be an aphrodisiac, available exclusively to the wealthy and powerful. Due to its exorbitant cost, chocolate was eventually supplanted as the primary beverage by coffee and tea. Chocolate, on the other hand, eventually became a popular delicacy in most industrialized nations, including Europe and North America. Cocoa is now mostly cultivated in West Africa, Indonesia, and Sri Lanka[1]–[3].

It was formerly thought to be the drink of Gods because of its health benefits, a connection that gave birth to the scientific name of the cocoa tree, Theobroma cacao, derived from the Greek words theo (God) and broma (fruit) (drink). Carl Von Linné (1707–1778), a Swedish scientist, gave the tree its credit. In reality, this term is indicative of chocolate's social, religious, and economic significance in both New and Old World civilizations. In American English, the tree and its dried seeds are referred to as ‘cacao' before being processed; after processing, such as roasting and grinding, the word ‘cocoa' is used. The term "chocolate" refers to a meal made from roasted cacao seeds. The chemical composition of chocolate is shown in Figure 1.

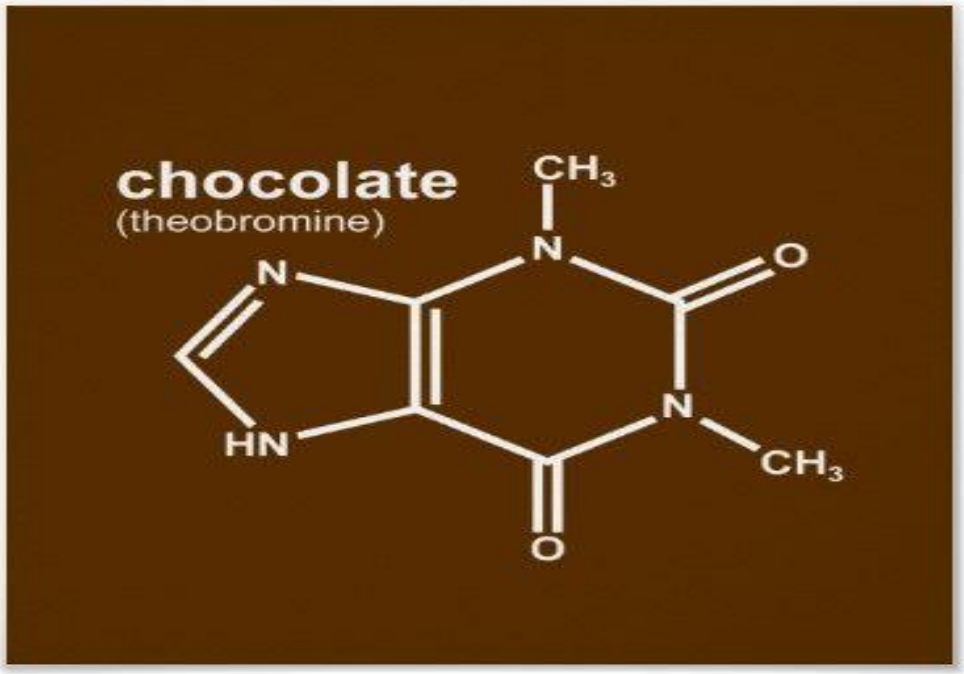

Figure 1: Illustrates the chemical compound of chocolate[4]**.**

1.2 Chemical compounds of chocolate that may affect human health:

Several writers have praised chocolate's nutritional properties, and some have even referred to it as a "complete meal." The following are some of the most important compounds present in chocolate.

a. Fats:

Cocoa butter, which includes about 33% oleic acid (monounsaturated), 25% palmitic acid (saturated), and 33% stearic acid, is the most common fat found in dark chocolate (saturated). The fatty acid oleic acid has a beneficial impact on lipid levels. 5 Total cholesterol and low-density lipoprotein levels are negatively affected by saturated fats. Regardless of whether it is a saturated fat or not, stearic acid may have no impact on lipid levels or may raise them. The difference in stearic acid absorption between cocoa-derived and animal-derived sources may be due to the distinct nature of cocoa-derived stearic acid. Few studies, however, have ruled out this possibility[5]–[7].

b. Antioxidants:

Cocoa butter, which includes about 33% oleic acid (monounsaturated), 25% palmitic acid (saturated), and 33% stearic acid, is the most common fat found in dark chocolate (saturated). The fatty acid oleic acid has a beneficial impact on lipid levels. 5 Total cholesterol and low-density lipoprotein levels are negatively affected by saturated fats. Regardless of whether it is a saturated fat or not, stearic acid may have no impact on lipid levels or may raise them. The difference in stearic acid absorption between cocoa-derived and animal-derived sources may be due to the distinct nature of cocoa-derived stearic acid. Few studies, however, have ruled out this possibility.

c. Nitrogenous compounds:

Proteins as well as the methylxanthinestheobromine and caffeine are among cacao's nitrogenous components. They're stimulants for the central nervous system, diuretics, and smooth muscle relaxants.

1.3 Minerals and other properties:

Minerals such as potassium, phosphorus, copper, iron, zinc, and magnesium are also found in cocoa mass, which enhance the health advantages of chocolate. Despite the presence of the stimulants caffeine and theobromine in chocolate, it also includes valeric acid, which works as a stress reliever.

1.4 Potential Health Benefits of Chocolate Consumption:

Regular use of cocoa is thought to be inversely related to the risk of cardiovascular disease. The possible anti-pathogenic effects of cocoa have piqued people's attention in the last decade. A variety of possible pathways via which cocoa may exert its health-promoting benefits have been suggested, but they are still being disputed. A few of them are covered in this article.

1.5 Cocoa and cardiovascular diseases:

Numerous studies have indicated that cocoa may be helpful in the treatment of cardiovascular disorders (CVD). Zomer et al. have found that consuming dark chocolate on a regular basis may be an effective cardiovascular preventative approach in individuals with metabolic illness. The following are some of the possible mechanisms involved in cocoa's positive benefits[8].

1.6 Rich source of antioxidants:

In the development of atherosclerosis, oxidative stress and decreased antioxidant defenses play a key role. Chocolate is the third most antioxidant-rich food in the United States. Chocolate's antioxidants have been proven to prevent plasma lipid oxidation. However, there is a research that refutes chocolate's direct antioxidant capability, claiming that the significant rise in plasma total antioxidative capacity seen after eating flavonol-rich foods is most likely attributable to elevated uric acid levels caused by fructose metabolism, rather than flavonols.

1.7 Blood pressure lowering effects:

In the Netherlands, males aged 65 to 84 were recruited for a large-scale, longer-term research. When the participants first participated in the research, they were questioned about their food consumption, and then again at five-year intervals. Men who drank cocoa on a daily basis had substantially lower blood pressure than those who did not during the following 15 years. Dark chocolate bars were shown to lower systolic blood pressure in healthy individuals as well as young and elderly hypertension patients after 15 days of consumption.

1.8 Effects on blood vessels and nitric oxide:

The precise mechanism behind chocolate's antihypertensive benefits is unknown, although it may include enhanced nitric oxide (NO) bioavailability, flavonol-induced inhibition of angiotensin converting enzyme, and stearic acid-based diastolic blood pressure decrease.

1.9 Inhibits platelet activation:

Another typical aspect of atherosclerotic lesions is platelet dysfunction. Cocoa has aspirin-like effects on platelet function, and the combined effects of cocoa and aspirin are cumulative, implying that cocoa may help avoid clots. Platelets are affected in two ways by chocolate. It not only lowers platelet aggregation, but it also lowers platelet adhesion[9], [10].When compared to a group that consumed low-procyanidin chocolate, consumption of high-procyanidin chocolate substantially reduced leukotriene levels and raised prostacyclin levels.

a. Antidiabetic effects:

To increase insulin sensitivity in diabetics, a variety of methods have been explored. In endothelial cells, NO bioavailability has a role in insulin sensitivity. As a result, flavonol may help to lower insulin resistance by increasing NO bioavailability. With healthy individuals and hypertension patients, flavonol-rich chocolate consumption resulted in a decrease in insulin resistance and an improvement in insulin sensitivity. Another research found that eating flavonol-rich chocolate improved glucose and insulin responses to an oral glucose tolerance test in hypertensive individuals with impaired glucose tolerance.

b. Antistress effects:

There are several bioactive compounds in chocolate that promote alertness. A study in Switzerland also confirmed that chocolate alleviates stress. Following 14 days of dark chocolate ingestion, stress parameters in the adults exhibiting high anxiety profiles became comparable with the low-stress subjects. Chocolate affects stress levels by prompting serotonin production which is a calming neurotransmitter.

c. Anti-obese effects:

Chocolate has many bioactive chemicals that enhance alertness. Chocolate also relieves tension, according to a research conducted in Switzerland. Stress indicators in individuals with high anxiety profiles were similar to those in low-stress participants after 14 days of dark chocolate consumption. Chocolate reduces stress by triggering the synthesis of serotonin, a relaxing neurotransmitter.

d. Effects on the neurons:

A new research of young, healthy individuals utilizing magnetic resonance imaging discovered that cocoa consumption increases cerebral blood flow, indicating that cocoa may help cure diseases like dementia and stroke. Chocolate consumption was also linked to improved cognitive function, according to Nurk et al. Larsson et al. looked at the link between chocolate intake and the risk of stroke in males and found that eating chocolate every day lowers the chance of a stroke attack. Chocolate increases cerebral blood flow, according to Walters et al.

e. Antitumour effects:

Cocoa seems to prevent the development of malignant cells in vitro, according to a few studies. At this time, the precise mechanisms of anticancer action are unknown. On the other hand, other research indicate that eating too much chocolate increases the risk of cancer. To explore the processes involved in cocoa activities and to justify cocoa's use as a cancer preventive and treatment therapy, further preclinical and clinical studies are required.

f. Anti-inflammatory effects:

By attaching directly to the active sites of lipoxygenase enzymes, chocolate suppresses lipoxygenase pathways.

1.10 Cocoa and exercise recovery:

Chocolate supplementation before exercise has been shown to hasten the recovery of post-exercise physiological and metabolic alterations. When compared to the glucose levels of placebos, plasma glucose levels of participants rose substantially 15 minutes after chocolate consumption and remained at fairly high levels until 30 minutes after an hour of jogging.

1.11 Potential Health Challenges of Chocolate Consumption:

Surprisingly, there is little research on the negative consequences of chocolate, despite the abundance of studies extolling its advantages. One of chocolate's components, theobromine, is thought to induce heartburn by relaxing the oesophageal sphincter muscle, allowing stomach acidic contents to enter the oesophagus. Children's allergic responses to chocolate have been reported in a few studies.

2. DISCUSSION

Chocolate is a liquid, solid, or paste produced from roasted and powdered cacao pods that may be consumed on its own or used as a flavoring ingredient in other dishes. Cacao has been eaten in some form since the Olmec civilisation (19th-11th century BCE), and chocolate drinks were produced by the majority of Mesoamerican peoples, including the Maya and Aztecs.The cacao tree's seeds have a strong bitter flavor that must be fermented to bring out the flavor. The beans

are dried, cleaned, and roasted after fermentation. The shell is removed to provide cocoa nibs, which are subsequently crushed into cocoa mass, which is raw chocolate. Chocolate liquor is made from cocoa material that has been liquefied by heat. It's also possible to chill the liquor and separate it into its two components: cocoa solids and cocoa butter. Baking chocolate, often known as bitter chocolate, is made out of various amounts of cocoa solids and cocoa butter, with no additional sugar. Dutch cocoa is made from powdered baking cocoa, which has more fiber than cocoa butter and may be processed with alkali. Sweet chocolate, which is made out of cocoa solids, cocoa butter or additional vegetable oils, and sugar, accounts for the majority of chocolate eaten today. Milk chocolate is delicious chocolate with milk powder or condensed milk added to it. There are no cocoa solids in white chocolate, just cocoa butter, sugar, and milk.

3. CONCLUSION

The bulk of research touting chocolate's health advantages are small-scale and funded/conducted by chocolate producers, whose personal interests cannot be overlooked. This necessitates careful evaluation of the findings' implications, since there is a risk of study bias. Before doctors may confidently suggest ‘a chocolate a day' to their patients, further large-scale observational and/or interventional research from non-biased sources are required.

Furthermore, the polyphenol content of the items utilized in controlled trials is typically considerably greater than that of most commercially available goods. Because flavonols have a bitter flavor, producers have developed cocoa processing methods that remove the bitterness along with the flavonoids. Cocoa processing may result in the loss of up to 90% of the flavonoids. As a result, it must be determined if consuming goods with reduced polyphenol concentration is linked to any health advantages in people.

REFERENCES:

1. A. Konstantas, H. K. Jeswani, L. Stamford, and A. Azapagic, “Environmental impacts of chocolate production and consumption in the UK,” *Food Res. Int.*, 2018, doi: 10.1016/j.foodres.2018.02.042.
2. C. D. Di Mattia, G. Sacchetti, D. Mastrocola, and M. Serafini, “From cocoa to chocolate: The impact of processing on in vitro antioxidant activity and the effects of chocolate on antioxidant markers in vivo,” *Frontiers in Immunology*. 2017, doi: 10.3389/fimmu.2017.01207.
3. M. Mirković, S. Seratlić, K. Kilcawley, D. Mannion, N. Mirković, and Z. Radulović, “The sensory quality and volatile profile of dark chocolate enriched with encapsulated probiotic lactobacillus plantarum bacteria,” *Sensors (Switzerland)*, 2018, doi: 10.3390/s18082570.
4. “Chocolate.” https://in.pinterest.com/pin/185140234654003267/.
5. I. M. da V. Moreira, L. de F. Vilela, C. Santos, N. Lima, and R. F. Schwan, “Volatile compounds and protein profiles analyses of fermented cocoa beans and chocolates from different hybrids cultivated in Brazil,” *Food Res. Int.*, 2018, doi: 10.1016/j.foodres.2018.04.012.
6. B. P. Meier, S. W. Noll, and O. J. Molokwu, “The sweet life: The effect of mindful chocolate consumption on mood,” *Appetite*, 2017, doi: 10.1016/j.appet.2016.09.018.

7. E. Tuenter, K. Foubert, and L. Pieters, "Mood Components in Cocoa and Chocolate: The Mood Pyramid," *Planta Medica*. 2018, doi: 10.1055/a-0588-5534.

8. A. G. T. Menezes *et al.*, "Investigation of chocolate produced from four different Brazilian varieties of cocoa (Theobroma cacao L.) inoculated with Saccharomyces cerevisiae," *Food Res. Int.*, 2016, doi: 10.1016/j.foodres.2015.12.036.

9. V. Glicerina, F. Balestra, M. Dalla Rosa, and S. Romani, "Microstructural and rheological characteristics of dark, milk and white chocolate: A comparative study," *J. Food Eng.*, 2016, doi: 10.1016/j.jfoodeng.2015.08.011.

10. C. Delbaere, D. Van de Walle, F. Depypere, X. Gellynck, and K. Dewettinck, "Relationship between chocolate microstructure, oil migration, and fat bloom in filled chocolates," *European Journal of Lipid Science and Technology*. 2016, doi: 10.1002/ejlt.201600164.