



Antioxidant-Rich Chocolate can Improve Health

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Currently, millions of chocolates are consumed worldwide for pleasure, leaving aside their potential benefit or harm to health. For now, it is known that saturated fat food and, in some cases, sugar food, which contributes to the growing number of obese people. On the other hand, the amount of antioxidants present in cocoa could slow down the accelerated advance of cellular aging. On the latter, a lot of scientific and popular literature is promoting the growth of a market segment not only eager for pleasure but also concerned about its health.

Now, what aspects must be considered for chocolate to be an interesting source of antioxidants.

According to studies, these aspects would be: 1) cocoa as raw material, 2) the composition of chocolate, and 3) the heat treatment in its processing.

Antioxidants can be expressed as antioxidant capacity or its equivalents, polyphenol content (expressed as GAE or CE), flavonoids (expressed as CAE), flavanols, among others. The antioxidant content in cocoa varies according to the origin and the varietal. In a Polish study [1], it was found that factors such as cultivation, maturity, climatic conditions for growth, harvest and storage times after harvest influence the content of polyphenols in cocoa beans, even finding differences of polyphenolic compounds in the same varietal; for example, significant differences were found for the Peruvian cocoa bean from San Martin, between the CCN 51 and ICS 6, 39.08 and 32.72 mg GAE/g cocoa varieties respectively [2]. Peruvian cocoa from Piura [3], Venezuelan [4] and Ecuador-

ian [5], reached contents of 51.3-56.5, 33.9-44.6 and 38.4-50.0 mg GAE/g of cocoa respectively. Significant differences in FRAP antioxidant capacity were found in cocoa and defatted cocoa, 337.42 and 411.15 mM equivalent to Trolox/g of cocoa respectively [3], this finding indicated the high presence of antioxidants in fat-free cocoa.

Regarding the composition of chocolate, considering the general classification, dark chocolate is the one with the highest content of cocoa derivatives than milk and white, which reach 5.79, 1.60 and 1.26 mg EC/g of chocolate, respectively [6]. Dark chocolate contains cocoa nib, cocoa paste (liquor), cocoa butter and cocoa powder (natural or alkalized) and complements its formulation with sucrose; milk chocolate: sucrose, milk powder and cocoa derivatives such as cocoa paste and cocoa powder [7]. White chocolate contains cocoa butter, milk powder and sucrose [8]. A dark chocolate 70%-cocoa contains 4.34-4.57 mg GAE/g of chocolate (1.37-1.29 mg EC/g of chocolate) [9] as polyphenols [10].

The heat treatment through which the cocoa passes in the different significant unit operations in the post-harvest (fermentation and drying) and in the process of making the chocolate (roasting, grinding, alkalizing, conching, stored in tanks) has an effect on the content of antioxidants. For example, a study reported a 23% decrease in the content of polyphenols and antioxidant capacity due to the effect of roasting (160 °C) in the production of dark chocolate with fermented and dry cocoa beans [11]; as well as the direct correlation between polyphenol content and antioxidant activity. An-

other study concluded a loss of polyphenols of 52.66 and 59.66% for CCN 51 and ICS 6 cocoa beans due to the effect of roasting, respectively [2]. A dark chocolate 50%-cocoa (A and B) processed from different factories (A and B) recorded significant differences in antioxidant content (A = 5.39 mg GAE/g and B = 2.74 mg GAE/g and A = 1.99 mg EC/g and B = 1.04 mg CE/g) due to the effect of heat treatment [9].

In conclusion, the segment of the market that consumes chocolate for pleasure and health, would benefit and grow even more if chocolates with a higher proportion of cocoa derivatives in their formulation, from varieties that, apart from their sensory quality, contain greater amount of antioxidants [12], and greater control over the effect of heat treatment to decrease the loss of antioxidant capacity. Also, advertising would have a better impact if the presence of antioxidant compounds in the product and its health benefits were highlighted, for example, advertising on the packaging, with which the consumer could be informed of the content of polyphenols, flavanols and flavonoids.

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