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The cardiometabolic benefits of flavonoids and dark chocolate intake in patients at risk

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ABSTRACT

Scientific research proves that the cardiac and the metabolic functions are improved by the consumption of flavonoids, natural elements found in cocoa. The dark chocolate is the main alimentary compound rich in flavonoids, and for this reason it can be used to prevent some cardiometabolic disorders. This study aims to demonstrate the relationship between chocolate consumption and the cardiometabolic disorders risk in 85 patients hospitalized in Internal Medicine Unit of Emergency Hospital “St. Apostle Andrew” of Constanta. Patients were split according to the quantity of the dark chocolate consumption into 2 groups. The study groups were matched by the demographic parameters, the BMI, the physical activity and other risk factors (fats, saturated lipids, etc). We found that the daily consumption of dark chocolate, with content of cocoa > 35% according to European recommendations, had cardiometabolic benefits. The risk of coronary heart disease was reduced with 23% by the daily dark chocolate intake. The cardiovascular disease mortality and the risk of any cardiovascular disease were decreased with 19%, respectively with 38%. The risk of incident diabetes decreased with 28% after daily dark chocolate consumption, regardless the gender of patients. The number of ischemic cerebral events was

reduced with 32%. In summary, the daily consumption of dark chocolate rich in flavonoids decreases the cardiometabolic disorders in patients at risk [1].

Keywords: flavonoids, dark chocolate, prevention, cardiometabolic risk

Introduction

According to the WHO, in the next 15 years approximately 23.6 million people will die from cardiovascular disorders [2,3] and a fifth of the Globe population will develop a metabolic syndrome [4,5]. Lifestyle factors involved in the genesis, prevention, and control of cardiometabolic disorders are the main targets to prevent the onset of cardiometabolic disorders. Large meta-analysis and cohort studies concluded that the diet and the physical activity are the most protective factors to reduce the cardiometabolic disturbances risk. Cocoa products containing flavonoids proved protective action against cardiometabolic disorders [6] due to the antioxidant, antihypertensive, anti-atherogenic, anti-thrombotic and anti-inflammatory effects. The influence on insulin sensitivity, vascular endothelial function, and activation of nitric oxide make the flavonoids also protective [6-13,14].

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The beneficial effects of flavonoids have been extensively studied, results of reviews and meta-analyses supporting the positive role of cocoa on blood pressure by increasing the formation of endothelial nitric oxide involved in vasodilatation, on cholesterol levels, on atherosclerosis and insulin resistance [14,15-21]. Still, it remains unclear whether chocolate consumption is related to reductions in hard cardiovascular outcomes (such as myocardial infarction and stroke) or has just an intermediate effect on cardiometabolic disorders.

Aim

Starting from the hypothesis that chocolate might reduce the risk of severe cardiometabolic disturbances, we aimed to assess if there is any association between everyday dark chocolate intake and the risk for severe cardiometabolic disorders, in patients from geographic area of Constanta County.

Material and method

We studied 85 patients hospitalized between 2007 and 2008 in Internal Medicine Unit of Clinical Emergency Hospital “St. Apostle Andrew” of Constanta County. In order to calculate the relative risk of cardiometabolic disturbances in our patients, the study period lasted 5 years. We divided our patients into two groups according to chocolate consumption during the study period: never or more than once per day. Patients from the study groups were matched by the demographic parameters, the BMI, the physical activity and other risk factors (fats, saturated lipids, etc) and were examined every 6 months regarding the presence of criteria for cardiometabolic disturbances.

The diagnosis of diabetes mellitus was done

according to criteria of the American Diabetes Association (ADA) [22]: a fasting plasma glucose (FPG) level of 126 mg/dL (7.0 mmol/L) or higher, or a 2-hour plasma glucose level of 200 mg/dL (11.1 mmol/L) or higher during a 75-g oral glucose tolerance test (OGTT), or a random plasma glucose of 200 mg/dL (11.1 mmol/L) or higher in a patient with classic symptoms of hyperglycemia or hyperglycemic crisis. Patients were also explored biologically regarding lipid profile: total cholesterol, LDL-cholesterol, HDL-cholesterol and triglycerides were noted.

To assess the cardiovascular disturbances, our patients were explored using following parameters: electrocardiogram (ECG), X-rays, echocardiogram, blood tests, coronary angiography, radionuclide tests, magnetic resonance imaging (MRI) scans, computed tomography (CT) scans.

All types of chocolate consumption were reported: dark, sweet, milk or white chocolate. We compared the risk of cardiometabolic diseases between the two groups.

Results

Our patients had following demographic data, as shown in Table I.

Our study results showed that only everyday dark chocolate, with content of cocoa > 35% according to European rules, had cardiometabolic benefits.

The cardiovascular diseases and diabetes mellitus were more frequent common in patients who never consumed dark chocolate. 11, respectively 16 patients from 37 patients who consumed dark chocolate had cardiovascular or glucose disturbances compared to 16, respectively 15 patients who never consumed cocoa ($p=0.0341$, respectively, $p=0.0228$).

Table I. Patient and disease characteristics at baseline

	Every day dark chocolate intake (group I) n = 46	No chocolate intake (group II) n = 39
Median age, years (min–max)	54 (19–84)	53 (18–78)
Male, n (%)	21 (45.65)	14 (35.89)
Ethnicity, n/N (%)	38/46 (82.60) 8/46 (17.39)	28/39 (71.79) 11/39 (28.20)
Comorbidities, n (%)*	37 (80.43)	33 (84.61)
Cardiovascular diseases, n/N (%)	11/37(29.72)	16/33 (48.48)
Diabetes mellitus n/N (%)	16/37 (43.24)	15/33 (45.45)
Cardiometabolic diseases, n/N (%)	10/37(27.02)	12/39 (30.76)

Comparing the overall cardiometabolic risk between the two studied patient groups, our results showed also a smaller risk in patients consuming dark chocolate ($p=0.0474$).

Over the study period, every day dark chocolate intake reduced the risk of coronary heart disease with 23% (RR 0.56; 95% CI 0.23–0.71), of cardiovascular disease mortality with 19% (RR 0.54; 95% CI 0.37–0.80) and the risk of any cardiovascular disease with 38% (RR 0.70; 95% CI 0.48–0.93).

Every day dark chocolate consumption also showed reduction of the risk of diabetes in 28%, regardless the gender of patients (RR 0.90; 95% CI 0.46–0.93) and stroke in 32% (RR 0.71; 95% CI 0.52–1.98).

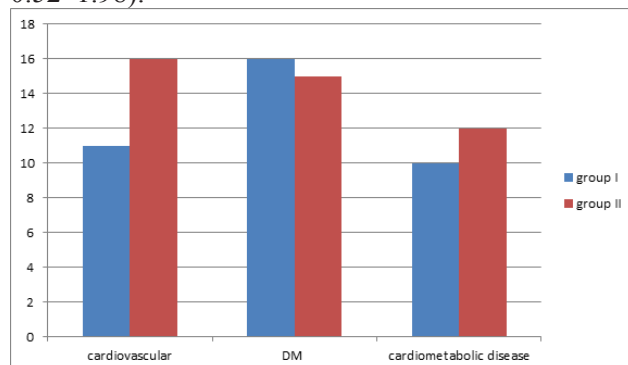


Figure 1 - Comparison of cardiovascular, DM and overall cardiometabolic risk between patient groups.

Discussions

The debate from literature regarding the benefit of dark chocolate on cardiovascular and metabolic systems still challenges the physicians to study the subject. The pros argument is the high content of cocoa bean in flavonoids, nutrients protecting from environmental toxins and repairing cellular damage produced by antioxidant. Antioxidants confer cells resistance in front of free radicals damage produced by the oxidative processes and from environmental contaminants. Usually, the human body lacks of antioxidants and become susceptible to damage by free radicals. Flavonoids from cocoa have antioxidant qualities on vascular health, lowering the blood pressure, improving the blood flow to the brain and heart, making the blood platelets less sticky and preventing the clotting [14,15-21,23]. Beside the cocoa, the flavonoids are found in variety beverages like tea, peanuts, apples, onions, cranberries and red wine. These days, it still remains the question if all types of chocolate are healthy. During the process of chocolate production, fermentation, alkalizing and roasting make the flavonoids to disappear. Most commercial chocolates are highly processed. Although it was once believed that dark chocolate contained the highest levels of flavonoids, recent studies indicates that the good effect can be lost, because the dark chocolate is highly processed. The major chocolate manufacturers are trying to keep the flavonoids chocolates. Another question raised over the benefit of dark chocolate on cardiovascular and metabolic systems refers to chocolate fats. The fats from chocolate come from cocoa butter and are represented by equal amounts of oleic acid (a monounsaturated fat), stearic and palmitic acids. The palmitic acid is a saturated fat. The saturated fats produce an increase in LDL cholesterol and the heart disease risk. Although palmitic acid affects the cholesterol levels, it only makes up 1/3rd of the fat calories in chocolate. The stearic acid appears to have a neutral effect on cholesterol [24].

Our study results are showing benefits of everyday dark chocolate on cardiometabolic system.

The reduction of coronary heart disease with 23%, the risk of any cardiovascular disease with 38%, the cardiovascular global mortality with 19% and the risk of diabetes mellitus with 28% are positive arguments for dark chocolate everyday intake.

Conclusions

Daily dark chocolate and flavonoids consumption decreases the cardiometabolic disorders risk and mortality in patients of Constanta County.

References

1. Suceveanu A.I., Suceveanu A., Mazilu L., Parepa I. & Catrinoiu D. (2012). Dark chocolate decreases the cardiometabolic risk in patients of the Constanta County. EuroPREvent 2012, 3-5 mai, Dublin, Ireland, Publicat în *European Journal of Cardiovascular Prevention & Rehabilitation (EJCPR)* (Suppl). Print ISSN 1741-8267, Online ISSN 1741-8275
2. American Heart Association. (2010). *Heart disease and stroke statistics 2010 update: a report from the American Heart Association*. *Circulation*. 121, 46-215.
3. World Health Organization. Cardiovascular diseases (2011). Fact sheet No 317. www.who.int/mediacentre/factsheets/fs317/fr/index.html.
4. Ogbera A.O. (2010). *Prevalence and gender distribution of the metabolic syndrome*. *Diabetol Metab Syndr*. 2,1.
5. World Health Organization. (2009). 2008-2013 action plan for the global strategy for the prevention and control of non-communicable diseases. Retrieved from http://whqlibdoc.who.int/publications/2009/9789241597418_eng.pdf.
6. Corti R., Flammer A.J., Hollenberg N.K. & Luscher TF (2009). Cocoa and cardiovascular health. *Circulation*. 119, 1433-42.
7. Balzer J., Heiss C., Schroeter H., Brouzos P., Kleinbongard P. & Matern S. (2006) Flavanols and cardiovascular health: effects on the circulating NO pool in humans. *J Cardiovasc Pharmacol*. 47(2), S122-7.
8. Buijsse B., Feskens E.J.M., Kok F.J. & Kromhout D. (2006). Cocoa intake, blood pressure, and cardiovascular mortality: the Zutphen Elderly Study. *Arch Intern Med*. 166, 411-417.
9. Buijsse B., Feskens E.J., Kok F.J. & Kromhout D. (2006). Cocoa intake in relation to blood pressure and cardiovascular mortality in elderly men. *Circulation*. 113, 303.
10. Buijsse B., Weikert C., Drogan D., Bergmann M. & Boeing H. (2010). Chocolate consumption in relation to blood pressure and risk of cardiovascular disease in German adults. *Eur Heart J*. 31, 1616-1623.
11. Djousse L., Hopkins P.N., Arnett D.K., Pankow J.S., Borecki I. & North K.E. (2011). Chocolate consumption is inversely associated with calcified atherosclerotic plaque in the coronary arteries: the NHLBI Family Heart Study. *Clin Nutr*. 30,182-187.
12. Faridi Z., Njike V.Y., Dutta S, Ali A. & Katz D.L. (2008) Acute dark chocolate and cocoa ingestion and endothelial function: a randomized controlled crossover trial. *Am J Clin Nutr*. 88, 58-63.
13. Grassi D., Desideri G., Necozione S., Lippi C., Casale R. & Properzi I. (2008). Blood pressure is reduced and insulin sensitivity increased in glucose-intolerant, hypertensive subjects after 15 days of consuming high-polyphenol dark chocolate. *J Nutr*. 138, 1671-1676.
14. Ried K., Sullivan T., Fakler P., Frank O.R. & Stocks N.P. (2010). Does chocolate reduce blood pressure? A meta-analysis. *BMC Med*. 8, 39.
15. Oba S., Nagata C., Nakamura K., Fujii K., Kawachi T. & Takatsuka N. (2010). Consumption of coffee, green tea, oolong tea, black tea, chocolate snacks and the caffeine content in relation to risk of diabetes in Japanese men and women. *Br J Nutr*. 103,453-459.

16. Buitrago-Lopez A., Sanderson J., Johnson L., Warnakula S., Wood A., Di Angelantonio E. & Franco O.H. (2011) Chocolate consumption and cardiometabolic disorders: systematic review and meta-analysis. *BMJ*. 343: d4488.
17. Desch S., Schmidt J., Kobler D., Sonnabend M., Eitel I. & Sareban M. (2010). *Effect of cocoa products on blood pressure: systematic review and meta-analysis*. *Am J Hypertens*. 23, 97-103.
18. Ding E.L., Hutfless S.M., Ding X. & Girotra S. (2006). *Chocolate and prevention of cardiovascular disease: a systematic review*. *Nutr Metab*. 3, 2.
19. Grassi D., Lippi C., Necozione S., Desideri G. & Ferri C. (2005). *Short-term administration of dark chocolate is followed by a significant increase in insulin sensitivity and a decrease in blood pressure in healthy persons*. *Am J Clin Nutr*. 81, 611-614.
20. Grassi D., Necozione S., Lippi C., Croce G., Valeri L. & Pasqualetti P. (2005). *Cocoa reduces blood pressure and insulin resistance and improves endothelium-dependent vasodilation in hypertensives*. *Hypertension*. 46, 398-405.
21. Hooper L., Kroon P.A., Rimm E.B., Cohn J.S., Harvey I. & Le Cornu K.A. (2008). *Flavonoids, flavonoid-rich foods, and cardiovascular risk: a meta-analysis of randomized controlled trials*. *Am J Clin Nutr*. 88, 38-50.
22. Adams L.A. & Feldstein A.E. (2010). *Nonalcoholic steatohepatitis: risk factors and diagnosis*. *Expert Rev Gastroenterol Hepatol*. 4, 623-635.
23. Ried K., Sullivan T.R., Fakler P., Frank O.R. & Stocks N.P. (2012) *Effect of cocoa on blood pressure*. *Cochrane Database of Systematic Reviews*, Issue 8, 1-80
24. Jia L., Liu X., Bai Y.Y., Li S.H., Sun K. & He C. (2010). *Short-term effect of cocoa product consumption on lipid profile: a meta-analysis of randomized controlled trials*. *Am J Clin Nutr*. 92, 218-25.