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[Intervention Review]

Effect of cocoa on blood pressure

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ABSTRACT

Background

High blood pressure is an important risk factor for cardiovascular disease attributing to about 50% of cardiovascular events worldwide and 37% of cardiovascular related deaths in Western populations. Epidemiological studies suggest that cocoa rich products reduce the risk of cardiovascular disease. Flavanols found in cocoa have been shown to increase the formation of endothelial nitric oxide which promotes vasodilation and therefore blood pressure reduction. Previous meta-analyses have shown that cocoa-rich foods may reduce blood pressure. Recently additional trials had conflicting results.

Objectives

To determine the effect of flavanol-rich chocolate or cocoa products on blood pressure in people with or without hypertension.

Search methods

We searched the following electronic databases from inception to November 2011: Cochrane Hypertension Group Specialised Register, CENTRAL, MEDLINE and EMBASE. In addition we searched international trial registries, and the reference lists of review articles and included trials.

Selection criteria

Randomised controlled trials (RCT) investigating the effects of chocolate or cocoa products on systolic and diastolic blood pressure in adults for a minimum of two weeks duration.

Data collection and analysis

Two authors independently extracted data and assessed the risk of bias in each trial in consultation with a third author. Random effects meta-analyses on all studies fitting the inclusion criteria were conducted using Review Manager version 5.1 and Stata version 12. Heterogeneity was explored by subgroup analyses and univariate meta-regression analysis of several variables including dosage of flavanol content (total or monomers) in chocolate or cocoa products, blinding, baseline blood pressure, theobromine content, sugar content, body-mass-index (BMI), duration and age.

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Main results

Twenty studies met the inclusion criteria. Meta-analyses of the 20 studies involving 856 mainly healthy participants revealed a statistically significant blood pressure reducing effect of flavanol-rich cocoa products compared with control in short-term trials of 2-18 weeks duration:

Mean difference SBP (95%CI): -2.77 (-4.72, -0.82) mm Hg, $p=0.005$, $n=20$;

mean difference DBP (95%CI): - 2.20 (-3.46, -0.93) mm Hg, $p=0.006$, $n=19$ available for DBP.

Trials provided participants with 30-1080 mg of flavanols (mean=545.5 mg) in 3.6-105 g of cocoa products per day in the active intervention group. In half of the trials ($n=10$) the active group consumed 500-750 mg of flavanols per day. The control group received either a flavanol-free product ($n=12$) or a low-flavanol containing cocoa powder (6.4 and 41 mg flavanols, $n=8$). Subgroup meta-analysis of trials with a flavanol-free control group revealed a significant blood pressure reducing effect, in contrast to trials using a low-flavanol product in the control group. This analysis may have been confounded by trial duration and the level of blinding of participants.

Trial duration was short (mean 4.4 weeks, range 2-8 weeks, $n=19$, and one trial of 18 weeks). A significant blood pressure reducing effect was evident in trials of 2 weeks duration ($n=9$), but not in trials of >2 weeks duration ($n=11$). It is important to note that seven out of the nine trials (78%) of 2 weeks duration also had a flavanol-free control group. Therefore, subgroup analysis by duration might be confounded by flavanol dosage used in the control groups, and the level of blinding of participants.

Adverse effects including gastrointestinal complaints and distaste of the trial product were reported by 5% of patients in the active cocoa intervention group and 1% of patients in the control groups.

Authors' conclusions

Flavanol-rich chocolate and cocoa products may have a small but statistically significant effect in lowering blood pressure by 2-3 mm Hg in the short term.

Our findings are limited by the heterogeneity between trials, which was explored by univariate meta-regression and subgroup analyses. Subgroup meta-analysis of trials using a flavanol-free control group revealed a significant blood pressure reducing effect of cocoa, whereas analysis of trials using a low-flavanol control product did not. While it appears that shorter trials of 2 weeks duration were more effective, analysis may be confounded by type of control and unblinding of participants, as the majority of 2-week trials also used a flavanol-free control and unblinding of participants. Results of these and other subgroup analyses based on, for example, age of participants, should be interpreted with caution and need to be confirmed or refuted in trials using direct randomized comparison.

Long-term trials investigating the effect of cocoa products are needed to determine whether or not blood pressure is reduced on a chronic basis by daily ingestion of cocoa. Furthermore, long-term trials investigating the effect of cocoa on clinical outcomes are also needed to assess whether cocoa has an effect on cardiovascular events and to assess potential adverse effects associated with chronic ingestion of cocoa products.

PLAIN LANGUAGE SUMMARY

Effect of cocoa on blood pressure

Flavanols found in cocoa have been associated with blood pressure lowering properties due to their stimulation of nitric oxide dependent vasodilation. In this review we assessed the effect of cocoa products on blood pressure in adults when consumed daily for a minimum of two weeks.

Meta-analysis of 20 studies involving 856 mainly healthy participants revealed a small but statistically significant blood pressure reducing effect of -2.8 mm Hg systolic and -2.2 mm Hg diastolic.

Trials were of short duration, all but one trial were between two and eight weeks long ($n=1$ of 18 weeks). While a significant effect with trials of two weeks duration ($n=9$) was evident, it was not with trials of longer duration ($n=11$). It is not clear whether this result is directly attributable to the trial length or may be due to another factor such as the type of control group used in the shorter trials or the level of blinding of participants to the treatment. While analysis of trials using a flavanol free control group indicated a significant effect on blood pressure, analysis of trials using a low flavanol control group did not.

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Adverse effects including gastrointestinal complaints and distaste of the trial product were reported by 5% of patients in the active cocoa intervention group and 1% of patients in the control groups.

Although we did further analyses and explored other subgroups for an effect (including by age, body mass index and baseline blood pressure; sugar content of the cocoa product), the results of all subgroup analyses, and any measured association of effect, need to be tested, and confirmed or refuted, in further trials.

The small reduction in blood pressure of about 2-3 mm Hg observed in the pooled trials overall might complement other treatment options and might contribute to reducing the risk of cardiovascular disease. However, we were unable to identify any randomized, controlled trials that tested the effect of long-term daily ingestion of cocoa products on blood pressure and there were no trials that measured an effect on clinical outcomes related to high blood pressure such as heart attacks or strokes.

More trials in which the intake of low flavanol dosages are compared with flavanol-free controls are required to test whether low dosages are effective in reducing blood pressure. In addition, longer term trials are needed to elucidate whether regular consumption of flavanol-rich cocoa products has a beneficial effect on blood pressure and cardiovascular health over time, and whether there are any potential adverse effects of long-term ingestion of cocoa products on a daily basis.