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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, contributing 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. Here we update previous meta-analyses on the effect of cocoa on blood pressure.

Objectives

To assess the effects on blood pressure of chocolate or cocoa products versus low-flavanol products or placebo in adults with or without hypertension when consumed for two weeks or longer.

Search methods

This is an updated version of the review initially published in 2012. In this updated version, we searched the following electronic databases from inception to November 2016: Cochrane Hypertension Group Specialised Register, CENTRAL, MEDLINE and Embase. We also searched international trial registries, and the reference lists of review articles and included trials.

Selection criteria

Randomised controlled trials (RCTs) 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 review authors independently extracted data and assessed the risks of bias in each trial. We conducted random-effects meta-analyses on the included studies using Review Manager 5. We explored heterogeneity with subgroup analyses by baseline blood pressure, flavanol content of control group, blinding, age and duration. Sensitivity analyses explored the influence of unusual study design.

Main results

Thirty-five trials (including 40 treatment comparisons) met the inclusion criteria. Of these, we added 17 trials (20 treatment comparisons) to the 18 trials (20 treatment comparisons) in the previous version of this updated review.

Trials provided participants with 30 to 1218 mg of flavanols (mean = 670 mg) in 1.4 to 105 grams of cocoa products per day in the active intervention group. The control group received either a flavanol-free product (n = 26 treatment comparisons) or a low-flavanol-containing cocoa powder (range 6.4 to 88 mg flavanols (mean = 55 mg, 13 treatment comparisons; 259 mg, 1 trial).

Meta-analyses of the 40 treatment comparisons involving 1804 mainly healthy participants revealed a small but statistically significant blood pressure-reducing effect of flavanol-rich cocoa products compared with control in trials of two to 18 weeks duration (mean nine weeks):

Mean difference systolic blood pressure (SBP) (95% confidence interval (CI): -1.76 (-3.09 to -0.43) mmHg, $P = 0.009$, $n = 40$ treatment comparisons, 1804 participants);

Mean difference diastolic blood pressure (DBP) (95% CI): -1.76 (-2.57 to -0.94) mmHg, $P < 0.001$, $n = 39$ treatment comparisons, 1772 participants.

Baseline blood pressure may play a role in the effect of cocoa on blood pressure. While systolic blood pressure was reduced significantly by 4 mmHg in hypertensive people ($n = 9$ treatment comparisons, 401 participants), and tended to be lowered in prehypertensive people ($n = 8$ treatment comparisons, 340 participants), there was no significant difference in normotensive people ($n = 23$ treatment comparisons, 1063 participants); however, the test for subgroup differences was of borderline significance ($P = 0.08$; $I^2 = 60\%$), requiring further research to confirm the findings.

Subgroup meta-analysis by blinding suggested a trend towards greater blood pressure reduction in unblinded trials compared to double-blinded trials, albeit statistically not significant. Further research is needed to confirm whether participant expectation may influence blood pressure results. Subgroup analysis by type of control (flavanol-free versus low-flavanol control) did not reveal a significant difference.

Whether the age of participants plays a role in the effect of cocoa on blood pressure, with younger participants responding with greater blood pressure reduction, needs to be further investigated.

Sensitivity analysis excluding trials with authors employed by trials sponsoring industry (33 trials, 1482 participants) revealed a small reduction in effect size, indicating some reporting bias.

Due to the remaining heterogeneity, which we could not explain in terms of blinding, flavanol content of the control groups, age of participants, or study duration, we downgraded the quality of the evidence from high to moderate.

Results of subgroup analyses should be interpreted with caution and need to be confirmed or refuted in trials using direct randomised comparisons.

Generally, cocoa products were highly tolerable, with adverse effects including gastrointestinal complaints and nausea being reported by 1% of participants in the active cocoa intervention group and 0.4% of participants in the control groups (moderate-quality evidence).

Authors' conclusions

This review provides moderate-quality evidence that flavanol-rich chocolate and cocoa products cause a small (2 mmHg) blood pressure-lowering effect in mainly healthy adults in the short term.

These findings are limited by the heterogeneity between trials, which could not be explained by prespecified subgroup analyses, including blinding, flavanol content of the control groups, age of participants, or study duration. However, baseline blood pressure may play a role in the effect of cocoa on blood pressure; subgroup analysis of trials with (pre)hypertensive participants revealed a greater blood pressure-reducing effect of cocoa compared to normotensive participants with borderline significance.

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

Review question

We assessed the effect of cocoa products on blood pressure in adults when consumed daily for at least two weeks. We found 35 studies, covering 40 treatment comparisons.

Background

Dark chocolate and cocoa products are rich in chemical compounds called flavanols. Flavanols have attracted interest as they might help to reduce blood pressure, a known risk factor for cardiovascular disease (disorders of the heart and blood vessels). The blood pressure-lowering properties of flavanols are thought to be related to widening of the blood vessels, caused by nitric oxide.

Study characteristics

Studies were short, mostly between two and 12 weeks, with only one of 18 weeks. The studies involved 1804 mainly healthy adults. They provided participants with 30 to 1218 mg of flavanols (average of 670 mg) in 1.4 to 105 grams of cocoa products per day in the active

intervention group. Seven of the studies were funded by companies with a commercial interest in their results, and the reported effect was slightly larger in these studies, indicating possible bias. The evidence is current to November 2016.

Key results

Meta-analysis of 40 treatment comparisons revealed a small but statistically significant lowering of blood pressure (systolic and diastolic) of 1.8 mmHg. This small reduction in blood pressure might complement other treatment options and might contribute to reducing the risk of cardiovascular disease.

We investigated whether participants' blood pressure at the start of the study, their age, an awareness of group allocation (active or control), the flavanol content used in the control group, or how long the study lasted may explain variations between trials. While blood pressure status (high blood pressure or normal blood pressure) is a likely factor in the effect size of cocoa on blood pressure, the impact of other factors needs to be confirmed or rejected in further trials.

Side effects including digestive complaints and dislike of the trial product were reported by only 1% of people in the active cocoa intervention group and 0.4% of people in the control groups.

Longer-term trials are needed to establish whether regularly eating flavanol-rich cocoa products has a beneficial effect on blood pressure and cardiovascular health over time, and whether there are any side effects of long-term use of cocoa products on a daily basis.

Quality of evidence

The evidence is of moderate quality. We were unable to identify any randomised controlled trials that tested the effect of long-term daily use of cocoa products on blood pressure, and there were no trials that measured the health consequences of high blood pressure, such as heart attacks or strokes.