THE EFFECTS OF DIETARY COCOA ON HIGH-FAT BREAKFAST-INDUCED POSTPRANDIAL GLUCOSE, LIPIDS, AND C-REACTIVE PROTEIN IN ADULTS WITH TYPE 2 DIABETES

[1] Jones M., [1]Newman E., [1]Betts N.M.,[2]Leyva M.J.,[2]Fu D-X., [2]Lyons T.J.,[1]Basu A.

[1]Department of Nutritional Sciences, Oklahoma State University, Stillwater, USA. [2]Section of Diabetes & Endocrinology, University of Oklahoma Health Sciences Center, Oklahoma City, USA.

Abstract

Dietary polyphenols have been reported to counteract meal-induced postprandial metabolic stress in a few clinical studies. Using a randomized crossover designed study in diabetes mellitus (T2DM), we investigated the postprandial effects of a cocoa beverage (960 mg total polyphenols) compared to that of a placebo beverage (110 mg total polyphenols). After consumption of a high-fat breakfast meal (50g fat, 766 kcal), blood draws and measurements were conducted at fasting, 0.5, 1, 2, 4 and 6 hours (h). After examining the data, HDL Cholesterol levels significantly improved in the cocoa compared to that of the placebo. Insulin and insulin resistance were higher at fasting times with the cocoa powder than the placebo. Glucose levels saw minimal changes between the cocoa powder and the placebo powder. C-Reactive proteins saw no change from the cocoa to the placebo. Overall, cocoa polyphenols were shown to exert modest but notable effects in high-fat breakfast induced postprandial lipids and insulin levels in diabetic participants.

Funded by The Hershey Company & NIH COBRE

Background

• Cocoa bean is one of the richest sources of polyphenols, which have been shown to reduce potential cardiovascular risks. (1)
• Type 2 diabetes has been associated with increased risk for cardiovascular disease. (2)
• High fat, highly refined foods cause postprandial dysmetabolism characterized by elevated glucose and lipids, especially in those with T2D. (3)
•. Few studies have used cocoa polyphenol intervention in participants with existing health issues. (4,5)
•The lack research of cocoa polyphenols and the T2D increase together contribute to necessity for this particular study. (6)

Objective

To evaluate the postprandial effects of polyphenol-containing cocoa beverage on glucose, C-reactive protein, and lipids in adults with type 2 diabetes, following a high-fat meal challenge.

Study Design

Patients identified with abdominal adiposity and type 2 diabetes
↓
Screening visit (check safety parameters, glucose, lipids)
↓
Randomized crossover controlled design
↙ ↘
LP high-fat breakfast + Cocoa Beverage | LP high-fat breakfast + Placebo beverage

2-day intervention phase (crossover) separated by 1 week
↓
Vascular measurements and blood draws at fasting, 30 min, 1, 2, 4, & 6 hr postprandial

LP-Low polyphenol

Composition of breakfast meal

- 2 scrambled eggs, 1 hash brown patty, 2 jr. size biscuits, 2 tsp butter
- 766 kcal
- 50g total fats
- 18.5g SFA; 465mg cholesterol

Table 1. Beverage Composition

	Cocoa	Placebo
Serving Size (g)	20	11.6
Calories	66.7	66
Fat (g)	4.7	5
Protein (g)	2.7	1.1
Carbohydrates (g)	9.6	4
Carb:Pro Ratio	3.6:1	3.6:1
Total Polyphenols (mg)	960	109.5
Total Flavanols (mg)	480	<0.1
PAC 1-10 (mg)	201	<0.001
Epicatechins (mg)	40	0
Catechins (mg)	17.8	0

Source: The Hershey Company, PA

Results

Table 2. Participant Baseline Characteristics[1] (n=18)

Age (yrs)	55.9 ± 3.18
Gender (m/f)	4/14
Height (inches)	66.7 ± 0.92
Weight (lbs)	222.1 ± 12.22
BMI (kg/m^2)	35.3 ± 2.0
Triglycerides (mg/dL)	139.8 ± 13.3
Total Cholesterol (mg/dL)	188.4 ± 11.2
HDL (mg/dL)	46.2 ± 2.5
LDL (mg/dL)	112.2 ± 11.4
CRP (mg/L)	5.3 ± 1.2
Fasting Glucose (mmol/L)	7.5 ± 0.9
HbA_{1C} (%)	8.2 ± 0.6
Insulin (µIU/mL)	14.8 ± 2.6
Insulin Resistance (HOMA-IR)	4.4 ± 0.8

[1]Values are means ± Standard Error

Table 3. C-Reactive Protein (mg/L) Means±SE

Time points	Cocoa	Placebo
Fasting	4.95±3.34	4.94±2.41
30 minutes	5.02±2.67	4.55±4.25
1 hour	5.01±4.44	5.17±3.21
2 hour	5.04±2.57	5.12±2.78
4 hours	4.94±4.21	4.77±3.51
6 hours	4.74±3.51	5.03±2.71

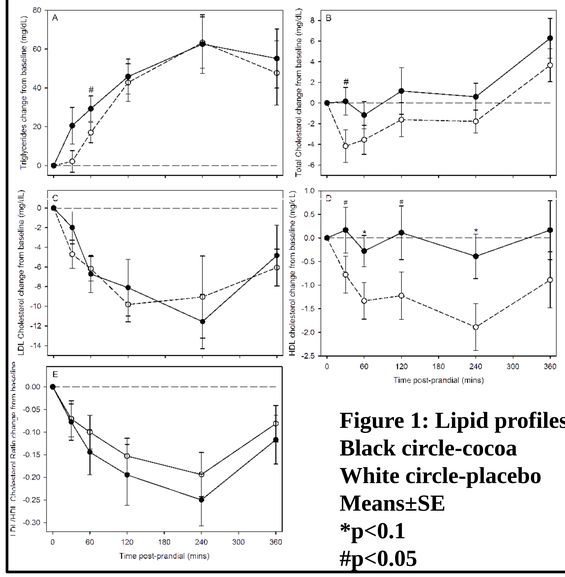

Figure 1: Lipid profiles
Black circle-cocoa
White circle-placebo
Means±SE
***p<0.1**
#p<0.05

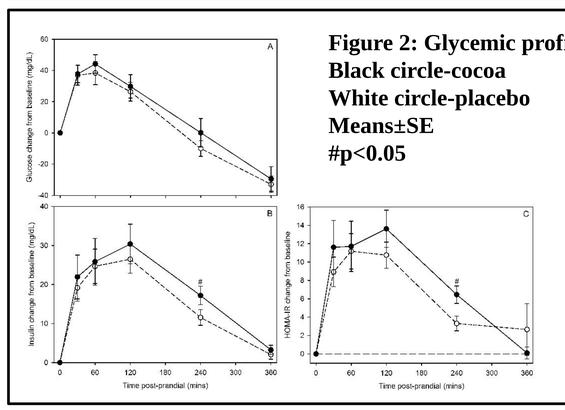

Figure 2: Glycemic profiles
Black circle-cocoa
White circle-placebo
Means±SE
#p<0.05

Conclusions

- HDL Cholesterol levels significantly improved in the cocoa compared to the placebo.
- Insulin and insulin resistance were higher at hour 4 in the cocoa than the placebo.
- Glucose levels saw minimal changes between cocoa vs. placebo.
- C- Reactive Protein did not change in the cocoa vs. placebo.
- No changes in systolic and diastolic blood pressure were recorded in the cocoa vs. placebo.

References

1. McShea, A. A. (2008) *Nutrition Reviews*
2. Fox, C. (2010) *Trends In Cardiovascular Medicine*
3. O'Keefe et al. (2008) *Journal Of The American College Of Cardiology*
4. Faridi, et al. (2008) *The American Journal Of Clinical Nutrition, 88*(1), 58-63.
5. Grassi, et al. (2005) *Hypertension, 46*(2), 398-405.