Short Term Effects of Coconut Water and Cocoa on Blood Pressure

T. Alleyne; A. Alleyne; D. Arrindell; N. Balleram; D. Cozier; R. Haywood; C. Humphrey; L. Pran; K. Rampersad; D. Reyes; S. Bahall; R. Holder; D. Ignacio S. Roache; C. Thomas and A. Shirley
Trinidad and Tobago

Carnival

Steel pan

Beautiful beaches

UWI St. Augustine, Trinidad
**Background:** Hypertension (high blood pressure)

- Definition: systolic blood pressure (BP) ≥ 140 mmHg, and/or diastolic BP ≥ 90 mmHg.
- Endemic in black population globally and in Caribbean.

**Globally PAHO estimates**

<table>
<thead>
<tr>
<th>30% Adult Blacks of African Descent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caribbean</td>
</tr>
</tbody>
</table>

**Caribbean**

55% of population over 40 years are hypertensive

2. PAHO 2011
Additional BP problems for Blacks

Compared to Caucasians Blacks: ¹

- Are twice as likely to be affected  > Have earlier age of onset
- Have more severe forms  > More difficult to control
- Respond poorly to some treatments (e.g.: ACE inhibitors & Beta Blockers)

Poorly Controlled Hypertension Causes: ²

- Kidney Disease  > Stroke
- Heart Disease  > Death

¹ Wilson et al, Hypertension 1991; Prineas et al, Hypertension in Blacks 1985
² PAHO 2011
Reasons for study

• Cost of prescription medication beyond many
• Dislike of life-long need for medication
• Many prefer traditional/folklore treatments

OBJECTIVE

To determine which, if any, folklore (traditional) treatments decreases blood pressure
Study 1- Method
Coconut water and Mauby

Considered Border-line hypertensive subjects:
  a) Not taking hypertensive drugs
  b) Taking hypertensive drugs but not well controlled
  c) Controls (Normal, non-hypertensive subjects)

Rejected: - diabetics; heart diseased; All chronically ill

Subjects Received 300 ml:

1) Coconut water OR 2) Mauby OR
3) Mixture of coconut water & mauby OR
4) Drinking water (± brown dye) as a control
Coconut being washed

Bottles being sterilised

Bottles being filled
For each subject the Blood Pressure:

- Was taken by same person
- Taken for 2 weeks before & then 2 weeks during treatment/drinks
- Took a minimum of 5 readings in each 2 week period
- Always taken on same days of week & approx. same time
- Subjects rested for 15 mins. before each reading was taken

Used the OMRON HEM-737 Digital BP Monitor

Machine approved for Research by British Heart Association
Results
BOTTLED WATER

BLOOD PRESSURE (BP) BEFORE AND DURING CONSUMPTION OF BOTTLED WATER

Alleyne et al. West Indian Med J 2005
COCONUT WATER

BLOOD PRESSURE (BP) BEFORE AND DURING CONSUMPTION OF COCONUT WATER

- **Syntolic**
  - Before
  - During

- **Diastolic**
  - Before
  - During

Participants:
- C2
- C6
- C7
- C9
- R3
- R9
- R11

Participant numbers:
- 6
- 8
- 17
- 7
- 15
- 9
- 9
MAUBY

BLOOD PRESSURE (BP) BEFORE AND DURING CONSUMPTION OF MAUBY

Alleyne et al. West Indian Med J 2005
COCONUT WATER / MAUBY MIXTURE

BLOOD PRESSURE (BP) BEFORE AND DURING CONSUMPTION OF COCONUT WATER-MAUBY MIXTURE

![Graph showing blood pressure before and during consumption of coconut water-mauby mixture]
Some Selected Subjects (i) C7: Changes Statistically insignificant **BUT**

<table>
<thead>
<tr>
<th>Blood Pressure</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest Systolic Before</td>
<td>139</td>
</tr>
<tr>
<td>Highest Systolic During</td>
<td>134</td>
</tr>
<tr>
<td>Lowest Systolic Before</td>
<td>123</td>
</tr>
<tr>
<td>Lowest Systolic During</td>
<td>120</td>
</tr>
<tr>
<td>Highest Diastolic Before</td>
<td>81</td>
</tr>
<tr>
<td>Highest Diastolic During</td>
<td>81</td>
</tr>
<tr>
<td>Lowest Diastolic Before</td>
<td>66</td>
</tr>
<tr>
<td>Lowest Diastolic During</td>
<td>67</td>
</tr>
</tbody>
</table>

S6; R4; R9
Behave similarly.

Alleyne et al. West Indian Med J 2005
CONCLUSIONS

• Both coconut water and mauby were effective in lowering BP (40-70% of subjects)

• BP decreases were larger when the two were administered as a mixture

• Indication that the effective dose is related to weight of the subject

• But what is the Mechanism of Action?
Preliminary ideas of The Mechanism

1. When the volume of coconut water was doubled (600 ml per day) Subjects complained of a LARGE increase in the amount of urine passed. The placebo (600 ml) did not have this effect.

Coconut water could be/contains a diuretic

2. Preliminary studies detected increase serum potassium in group taking coconut water.

Coconut water could be/contains a potassium sparing diuretic

3. More Preliminary Studies: Found that the BP of normal subjects returned to base line levels 30-60 min after exercise

BUT Not so for hypertensives.

If coconut water was consumed before exercise then the BP of hypertensives also returned to base line.

WHY???
Short Term Effects of Cocoa Consumption on Blood Pressure

• Regular/Long term (2 weeks or more) use of Cocoa/cocoa based products lower B.P \(^1\)

• Attributed to flavonoid content \(^2\)

• But flavonoid content varies with processing.

2 Objectives:

• Compare the flavonoid content of 7 popular brands of cocoa/cocoa based products.

• Determine whether one drink of such products has any short term effects on the blood pressure of hypertensive patients.

1. Taubert et al, JAMA 2007
2. Heis et al, JAMA 2003
Flavonoid Content

Top selling brands of cocoa/cocoa based commercial products were selected:

- Cadbury
- Chief
- Milo
- Nesquik
- Ovaltine
- Roma
- Richmond Valley

**Flavonoid Extraction**:  
Shake 0.5g of each product with 25ml Methanol-water, 50:50 v/v.  
Then with 25ml Acetone-water 70:30 v/v.

Deduce Flavonoid content from absorbance of extracts at 750nm against a Gallic acid Standard curve.

Ravellos et al
# Flavonoid Content

<table>
<thead>
<tr>
<th>BRAND</th>
<th>Total Flavonoid (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>372.399&lt;sup&gt;a±0.4&lt;/sup&gt;</td>
</tr>
<tr>
<td>B</td>
<td>334.609&lt;sup&gt;a±0.3&lt;/sup&gt;</td>
</tr>
<tr>
<td>C</td>
<td>294.315&lt;sup&gt;ab±0.5&lt;/sup&gt;</td>
</tr>
<tr>
<td>D</td>
<td>186.021&lt;sup&gt;bc±0.2&lt;/sup&gt;</td>
</tr>
<tr>
<td>E</td>
<td>98.463&lt;sup&gt;cd±0.2&lt;/sup&gt;</td>
</tr>
<tr>
<td>F</td>
<td>84.376&lt;sup&gt;cd±0.1&lt;/sup&gt;</td>
</tr>
<tr>
<td>G</td>
<td>67.429&lt;sup&gt;d±0.1&lt;/sup&gt;</td>
</tr>
</tbody>
</table>
Conclusion

Found: All 7 brands tested contained flavonoids.

This suggests all brands have potential health benefits

Four Brands had approximately 2-4 times the flavonoid content of the others tested.

Some companies may wish to review their production methods
Cocoa: Short term Effect on BP

Study Design:  A cross over study
Using Brand A  Or  Placebo

To determine if/how soon after cocoa consumption BP is lowered: By how much and for how long.

• 29 subjects were selected (15 female and 14 male) between the ages of 35-60 years

• Of these: 15 classified as hypertensive and 14 classified as normal
Patient monitoring

• Each patient was fitted with a Welch Allyn automatic blood pressure monitor for 12-hour periods for two or three days.

Exclusion criteria:

• Smokers
• Terminally ill persons
• Alcoholics
• Diabetics
• HIV positive persons
• Persons with CVD
## Patient Monitoring (12hrs)

- **Measurements** taken every 30 min. for 12 hrs from 8 am.
- **Cocoa** or placebo were taken 3 hrs after 1\textsuperscript{st} reading
- **Placebo** (water with green food dye)

<table>
<thead>
<tr>
<th>Patient category</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertensives not taking medication</td>
<td>CocoaPLACEBO at 11 am</td>
<td>Placebo/cocoa at 11 am</td>
<td>—</td>
</tr>
<tr>
<td>Non hypertensives</td>
<td>Cocoa/placebo at 11 am</td>
<td>Placebo/cocoa at 11 am</td>
<td>—</td>
</tr>
</tbody>
</table>
RESULTS

A typical hypertensive subject

Mean BP values
Conclusions

• A single cocoa drink lowered the blood pressure in hypertensives who normally took medication **AND** in those who did not take medication.

• A single drink did not appear to lower the blood pressure in non hypertensive subjects.

• Therefore cocoa has both a short term (an immediate) effect **AND** (from previous studies) a cumulative long term effect on BP. Most probably two different mechanisms are involved.
Thank you

The Cocoa team - Then year 2 Medical Students

Now All Young Doctors
Steelpan- Trinidad and Tobago’s National Instrument
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Extraction Method

7 brands of cocoa were selected:

- Cadbury
- Chief
- Milo
- Nesquik
- Ovaltine
- Richmond Valley
- Roma

1. 0.5g of each brand and add 25ml methyl-water (50:50 v/v)

2. shake for 1 hr. at 25 C; centrifuge for 15 min at 3000 x g; keep Supernatant
3. Add 25 ml acetone-water (70:30 v/v) to pellet and repeat ‘step 2’
4. Combined supernatants of steps 2 & 3 and treat with Folin’s Reagent
5. Deduce concentration by comparing absorbances against a gallic acid standard curve at 750 nm.
Methods contd.

Coconuts
- Wash
- Empty into 10L plastic containers via strainers
- Dispense into 300ml reusable bottles (sterilised before use)

Mauby
- 180ml commercial mauby / 5L commercial bottled water
- Dispense into 300ml bottles

Coconut Water-Mauby Mixture
- 180ml commercial mauby / 5L coconut water
- Dispense into 300ml bottles

Control/ Placebo
- Commercial bottled water (300ml)± dye