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Acute Effect of Drinking Cold Hibiscus Beverage on Blood Pressure in Adult Females: A Randomized Controlled Trial

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ABSTRACT

Objectives: *to test the acute effect of cold Hibiscus beverage on blood pressure and heart rate readings compared to both boiled Hibiscus and placebo beverages.* ***Methods****: This double blind randomized control clinical trial was performed at Al Madinah, Saudi Arabia. Three hundred adult females aged 39.20 ± 8.71 years were randomized to receive either cold, boiled hibiscus or placebo beverages. The primary outcome measure was the acute effect of the different beverages on the systolic, diastolic blood pressure (SBP, DBP) and heart rate (HR) in both supine and erect positions within 15 and 30 minutes.* ***Results****: The 3 groups showed normal baseline blood pressure readings with significantly lower blood pressure among placebo group (p=0.022 for SBP and p=0.011 for DBP). Only in the cold Hibiscus group, the basal SBP (119.87 mmHg) dropped significantly to 114.29 mmHg after 15 minutes (p=0.00) and to 115.47 mmHg after 30 minutes (p=0.00) and the basal DBP (77.27 mmHg) dropped significantly to 74.31 mmHg after 15 minutes (p=0.00) and to 74.48 mmHg after 30 minutes (p=0.00). Comparing the effects of the three beverages, the cold Hibiscus beverage significantly lowered the SBP by 5.57±10.76 mmHg and the mean blood pressure by 3.88±7.56 mmHg after 15 minutes (p=0.00) and lowered the mean blood pressure significantly by 3.43±6.98 (p=0.007) after 30 minutes. The three beverages had similar comparable effects on HR and postural changes.* ***Conclusion****: in adult females with normal baseline blood pressure readings cold but not boiled Hibiscus beverage lowers the blood pressure acutely and safely BUT limited to 15 minutes.*

Keywords: *Hibiscus Beverage, Acute Effect, Blood Pressure*

INTRODUCTION

Essential hypertension is among the most common disease all over the world with high incidence in Saudi Arabia. Hypertension is considered the major risk factor of may serious outcomes including heart failure, myocardial infarction, cerebrovascular strokes, aortic aneurysm, and chronic kidney disease.

Therapeutic guidelines of hypertension stress on medical nutrition therapy that is best expressed by DASH (dietary approaches to stop hypertension) (1). There is an evidence of antihypertensive effects of some herpes and plants like Hibiscus. Hot and cold Hibiscus tea (karkadé, rosella) is an inexpensive herbal tea made from deep magenta-coloured sepals of the Hibiscus sabdariffa flower. In some countries, it is often an ingredient in mixed herbal teas. This beverage contains flavonoids and phenolic acids which are strong antioxidants. The rich antioxidants contents in

hibiscus has many health benefits as they detoxify free radicals and protect cells from lipid peroxidation, a process that underlies most chronic diseases (2).

Hibiscus is known worldwide as a mild medicine. Both animal and human studies show that the consumption of this herbal medication is useful for hypertension and hypercholesterolemia as well as atherosclerosis without any side effects (2-6).

Traditionally, Arab people believe in the effect of cold but not hot hibiscus beverage as an effective antihypertensive natural medication especially at time of high blood pressure assuming an acute effect. We hypothesized that cold hibiscus has an acute lowering effect on blood pressure. Therefore we conduct this study to test the acute effect of cold Hibiscus beverage on blood pressure and heart rate readings compared to both boiled Hibiscus and placebo beverages.

METHODOLOGY

This double blind Randomized control clinical trial (RCT) was ethically approved by the dean of the college of medicine at Taibah University, Al Madinah, Saudi Arabia. It included 300 adult females aged 39.20 ± 8.71 years of any nationality and with any initial blood pressure readings. All participants gave written consent to participate. Exclusion criteria included females who were taking antihypertensive or cardiovascular drugs at the day of the test, and females who were unable to wait inactive for half an hour (the duration of the test).

Sample size of 300 participants was calculated using online calculator with confidence level of 95% and confidence interval of 5.66 %. Participants were selected randomly according to the inclusion and exclusion criteria. They were randomized to receive one of three prepared beverages. Two researchers at a time were responsible for preparing the 3 beverages marked as A, B, C. The remaining researchers, the participants as well as the statisticians were blinded to nature of the beverages till the end of data collection and analysis. Some participants could identify the nature of the beverages by taste however they were blind to the way of preparation (cold versus boiled Hibiscus).

The first beverage was prepared by boiling one liter of water (5 glasses) then 10 grams of Hibiscus were added (5 bags, 2 g each) to the hot water (10 g/liter). seven tablespoons of sugar were added to sweeten the beverage. The beverage was allowed to cool in the refrigerator till become semi-ice. Each participant was asked to drink one glass of any of the 3 beverages in from of him. The second beverage was prepared similarly except the water was used without prior boiling. The third placebo drink will be prepared similarly using added Flavor of cranberry juice on the cold water (without any active substance) instead of hibiscus. After explaining the trial to the participants, clinical data were collected. During the trial, the participants rest for 5 minutes before the first blood pressure and heart rate measurements at both the sitting and standing positions.

The researchers allowed each participant to choose one glass out of the 3 different beverages (A, B, C) at random. Each glass contained 200 ml of Hibiscus (2g) or placebo. Researchers recorded any side effects of the beverages for half an hour while the participants were resting physically and mentally. They measured blood pressure in both supine and erect positions after 15 and 30 minutes using mercurial sphygmomanometer. Also heart rate is measured at the same intervals using manual method (on radial artery) Mean blood pressure was calculated for the 3 blood pressure readings according to the following equation: diastolic blood pressure + 1/3(systolic – diastolic blood pressure). The primary outcome measure was the acute effect of the different beverages on the blood pressure and

heart rate in both supine and erect positions within 15 and 30 minutes. This study was conducted from September till December 2012.

Statistical analysis

Statistical evaluation of all data was done using SPSS software for windows (Statistical Package for Social Sciences version 17, USA). Quantitative data were presented as mean and standard deviation and categorical data as percentages. Comparison between blood pressure readings at basal level, 15 and 30 minutes after the beverage drinking was performed by paired samples T test. Comparison between the 3 different groups was done by one way ANOVA. Excel was used for constructing the figures. All tests were two tailed and considered significant when $p < 0.05$.

RESULTS

The 3 different female groups were matched for age, marital status, smoking, past history of pregnancy induced hypertension, hypertension, diabetes, cardiac diseases, family history of hypertension or cardiac diseases and history of Hibiscus use (Table 1).

Table 1. Clinical data of the 3 different groups

	Group	Mean ± SD	F	P
Age: years	A	37.8958±7.82503	1.652	.193
	B	39.6300±9.38692		
	C	40.0303±8.78014		
Marital status: married n(%)	A	71(73.2)	.696	.500
	B	77(75.5%)		
	C	84(83.2%)		
Smoking history n(%)	A	1(1%)	.175	.839
	B	2(2%)		
	C	2(2%)		
Past history of pregnancy induced hypertension n(%)	A	7(7.2%)	2.129	.121
	B	16(15.7%)		
	C	16(15.8%)		
Past history of hypertension n(%)	A	10(10.3%)	.909	.404
	B	15(14.7%)		
	C	17(16.8%)		
Past history of diabetes. n(%)	A	7(7.2%)	.005	.995
	B	7(6.9%)		
	C	7(6.9%)		
Past history of cardiac diseases. n(%)	A	3(3.1%)	1.903	.151
	B	6(5.9%)		
	C	1(1%)		
Family history of hypertension n(%)	A	54(55.7%)	1.422	.243
	B	63(61.8%)		
	C	68(67.3%)		
Family history of cardiac diseases n(%)	A	29(29.9%)	.840	.433
	B	36(35.3%)		
	C	39(38.6%)		
Hibiscus use n(%)	A	3(3.1%)	.393	.676
	B	3(3.2%)		
	C	2(2%)		

A: placebo, B: Boiled Hibiscus and C: Cold Hibiscus

The 3 groups showed normal baseline blood pressure however, they were not matched for the basal systolic, diastolic and mean blood pressure readings with significantly lower blood pressure among the group who received the placebo beverages compared to other groups (p=0.022 for systolic, p=0,.011 for diastolic and p=0.002 for mean blood pressure). The 3 groups were matched for basal heart rate and orthostatic changes in both blood pressure and heart rate (Table 2). Only in the cold Hibiscus group, the basal SBP (119.87 mmHg) dropped significantly to 114.29 mmHg after 15 minutes (p=0.00) and to 115.47 mmHg after 30 minutes (p=0.00) and the basal DBP (77.27mmHg) dropped significantly to 74.31 mmHg after 15 minutes (p=0.00) and to 74.48 mmHg after 30 minutes (p=0.00). There were no significant postural changes or heart rate changes in all groups. Comparing the effects of the three beverages, the cold Hibiscus beverage significantly lowered the systolic pressure by 5.57±10.76 mmHg and the mean blood pressure by 3.88±7.56 mmHg after 15 minutes (p=0.00) (Table 3) and lowered the mean blood pressure significantly by 3.43±6.98 (p=0.007) (Table 4) after 30 minutes. The three beverages had similar comparable effects on heart rate and postural changes (Tables 4 and 5).

Table 2. Basal blood pressure and heart rate characteristics in the different groups

	Group	Mean ± SD	F	P
Systole blood pressure: mmHg	A	113.4948±16.500	3.878	.022
	B	119.6863±18.79		
	C	119.8713±19.3		
Diastole blood pressure: mmHg	A	72.7113±12.64	4.568	.011
	B	77.1569±11.30		
	C	77.27±12.2		
Mean blood pressure: mmHg	A	85.0330±14.06	6.161	.002
	B	90.9578±13.60		
	C	91.1861±14.16		
Heart rate: beats/min	A	74.3608±10.95	1.185	.307
	B	72.5294±9.058		
	C	72.5050±9.026		
Basal postural changes in systolic pressure: mmHg	A	.1649±6.112	.274	.761
	B	.7157±7.81		
	C	.8218±5.925		
Basal postural changes in diastolic pressure (mmHg)	A	.1546±5.76	.925	.398
	B	-.3137-±8.088		

	C	-8.7921-±89.855		
Basal postural changes in heart rate beats/min	A	-.1546-±6.081	1.048	.352
	B	-1.4706-±6.443		
	C	-.8515-±6.677		
Basal postural changes in mean pressure : mmHg	A	-.2598-±6.127	.301	.740
	B	.0735±7.003		
	C	.4535±6.231		

A: placebo, B: Boiled Hibiscus and C: Cold Hibiscus

Table 3. Effects of different beverages on blood pressure and heart rate after 15 min.

	Group	Mean ± SD	F	P
Effect on systolic pressure.: mmHg	A	.30±7.35	8.32	.000
	B	1.39±10.38		
	C	5.57±10.76		
Effect on diastolic pressure : mmHg	A	.79±7.22	1.84	.160
	B	1.42±9.73		
	C	2.96±7.35		
Effect on mean pressure : mmHg	A	.24±8.76	4.64	.010
	B	1.35±9.44		
	C	3.88±7.56		
Effect on heart rate: beats/min.	A	.82±8.42	1.17	.310
	B	-1.14-±10.45		
	C	-.97-±10.85		

A: placebo, B: Boiled Hibiscus and C: Cold Hibiscus

Table 4. Effect of different beverages on blood pressure and heart rate after 30 min.

	Group	Mean ± SD	f	P
Effect on systolic pressure: mmHg	A	.97±10.78	2.886	.057
	B	2.48±10.97		

	C	4.40±8.24		
Effect on diastolic pressure: mmHg	A	.06±7.80	3.016	.051
	B	1.078±8.46		
	C	2.79±7.46		
Effect on mean pressure: mmHg.	A	-.48-±9.21	5.076	.007
	B	1.08±9.70		
	C	3.43±6.98		
Effect on heart rate: beats/min.	A	.59±7.44	.711	.492
	B	-.60-±8.46		
	C	-.60-±8.26		

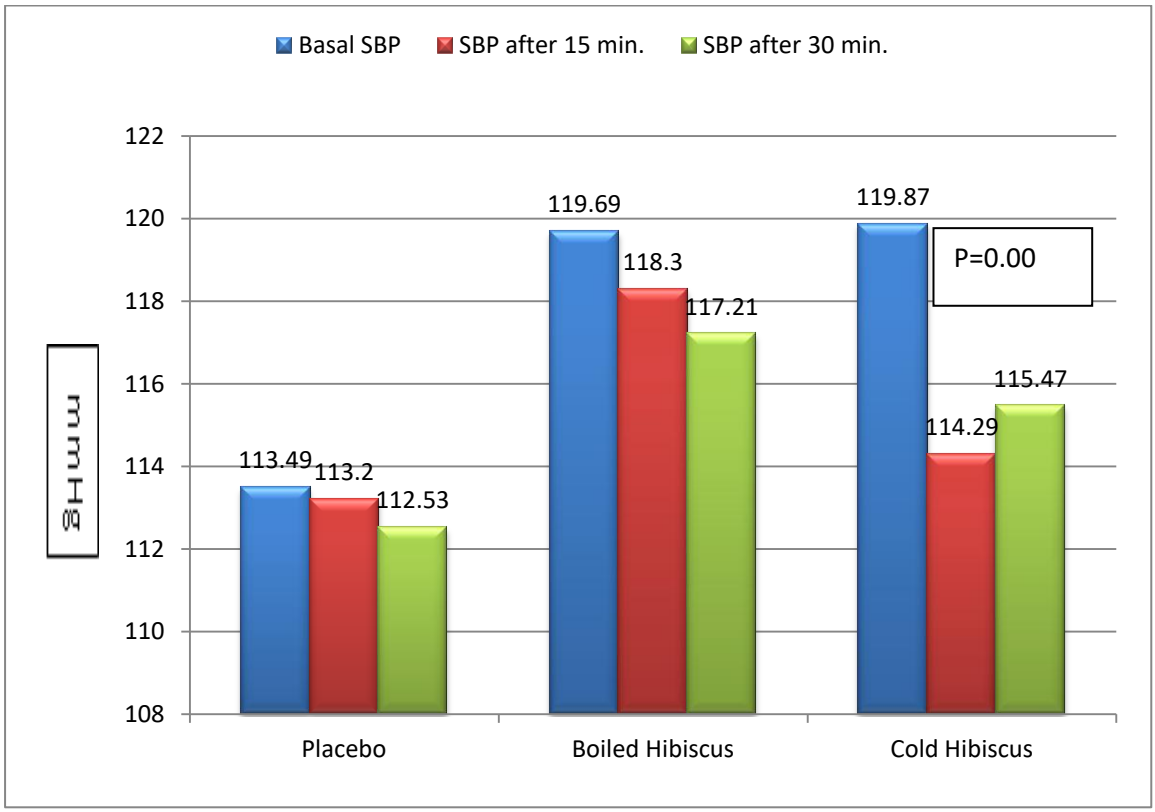
A: placebo, B: Boiled Hibiscus and C: Cold Hibiscus

Table 5. Postural effects of different beverages on blood pressure and heart rate after 15 min and 30 minutes.

VARIABLE	Group	Mean ± Std. Deviation	F	P
After 15 min.				
Postural changes in systolic pressure: mmHg	A	.04±6.33	1.029	.359
	B	1.61±7.58		
	C	1.39±10.45		
Postural changes in diastolic pressure: mmHg	A	-.95-±6.077	2.266	.106
	B	1.00±8.86		
	C	.94±6.80		
Postural changes in mean pressure: mmHg	A	-.49-±9.68	.565	.569
	B	.48±6.00		
	C	.41±5.25		
Postural changes in heart rate: mmHg	A	-.92-±5.63	.450	.638
	B	-1.25-±5.57		
	C	-.21-±11.27		
After 30 min				
Postural changes in systolic pressure mmHg	A	.08±7.69	.173	.841
	B	.61±6.07		
	C	.24±5.88		
Postural changes in diastolic pressure: mmHg	A	.11±5.22	1.487	.228
	B	-1.02-±5.46		
	C	.04±5.16		
Postural changes in mean pressure: mmHg	A	.21±4.66	.132	.877
	B	.40±10.38		
	C	-.11-±5.12		
Postural changes in heart rate: beats/min.	A	-.54-±3.84	.183	.833
	B	-.95-±5.13		
	C	-.99-±7.44		

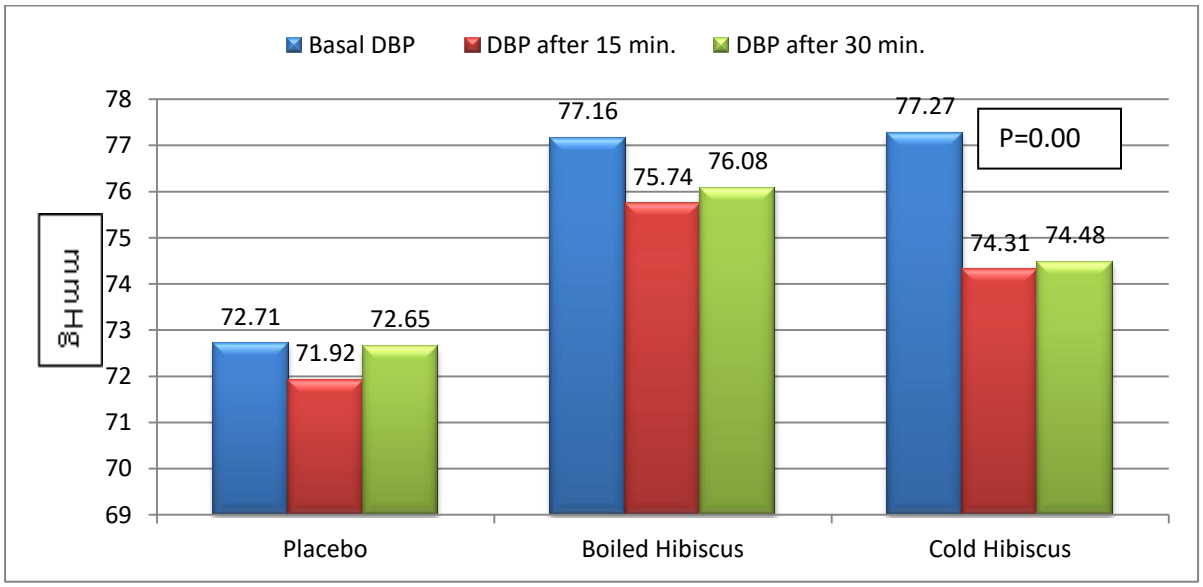
A: placebo, B: Boiled Hibiscus and C: Cold Hibiscus

Figure 1. The effect of different beverages on the systolic blood pressure among adult females.



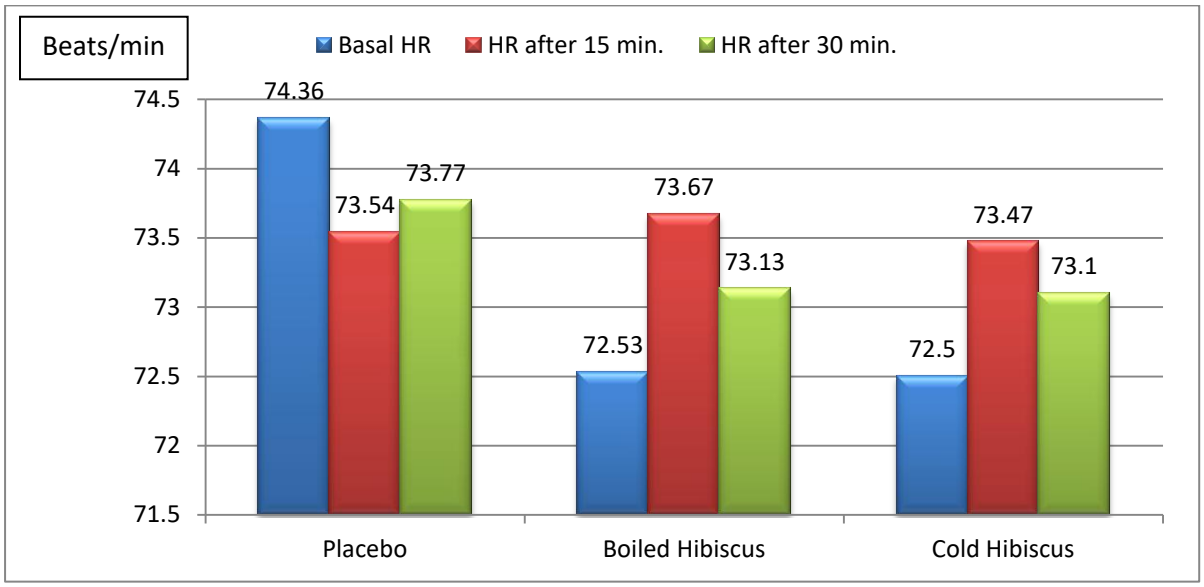
SBP: Systolic blood pressure.
P: significant difference between basal SBP and both SBP after 15 minutes and 30 minutes in cold hibiscus group only.

Figure 2. The effect of different beverages on the diastolic blood pressure among adult females.



DBP: Diastolic blood pressure. P: significant difference between basal DBP and both DBP after 15 minutes and 30 minutes in cold hibiscus group only.

Figure 3. The effect of different beverages on the heart rate among adult females.



P is > 0.05 for all comparisons. HR: Heart Rate.

DISCUSSION

Cold Hibiscus beverages acutely lowered the systolic blood pressure significantly by 5.57±10.76 mmHg after 15 min. and lowered the mean blood pressure significantly by 3.43±6.98 (p=0.007) after 30 minutes without significant changes in heart rate or postural changes or reported side effects among adult females. These results represent an ideal antihypertensive effect with acute lowering effects without either postural or heart rate changes. However this beneficial acute effect is limited to 15 minutes only.

To the best of our knowledge this is the first study of the acute effect of cold Hibiscus on blood pressure. The available evidence of the antihypertensive effects of Hibiscus beverage came from a number of clinical trials (2-6). The most important trial was performed by McKay and his coworkers in 2009 and included 65 subjects with pre-hypertension or mild hypertension. The reduction of the systolic blood pressure by 7.2 mm Hg was significant. The reduction was doubled in those with mean systolic blood pressure over 129 mm Hg (4). In contrast to McKay's study, we studied the acute effect and compared the boiled to the cold beverages. Compared to McKay's results, our findings of 5.57±10.76 mmHg lowering effect of cold hibiscus after 15 minutes only seems significant.

Our results enforce the dietary role in preventing and treating hypertension. It is known that The DASH diet lowers blood pressure by 11/6 mm Hg in hypertensive subjects after at least 2 weeks. If we combine the favorable acute effects of cold Hibiscus on blood pressure seen in our study, it will be reasonable to include it in the DASH diet which depends mainly on whole grain products, fish, poultry, and nuts with reduced sweets, added sugars, and sugar-containing beverages combined with low sodium content. (1) perhaps the main limitation here is the added sugars to the cold hibiscus if used frequently.

Hibiscus flowers is considered as a mild diuretic and its anthocyanins content is considered the active antihypertensive compounds, acting as angiotensin-converting enzyme (ACE) inhibitors. These antihypertensive mechanisms were proved in many trials. In one trial published in 2007 (5), Hibiscus lowered blood pressure to a lesser extent than lisinopril, a known ACE inhibitor and reduced plasma ACE activity and reduce serum sodium concentrations like any diuretic. In another trial, researchers found similar effects of Hibiscus and the ACE-inhibiting drug captopril on blood pressure (6). Therefore, the acute blood pressure lowering effects of cold Hibiscus without heart rate changes could be explained by its angiotensin-converting enzyme (ACE) inhibitor activity (5, 6) that could be destroyed by boiling the flowers. ACE inhibitors are known to decrease systemic vascular resistance with little change in heart rate in patients with essential hypertension (7) as well as in normal humans (8).

The main limitations of this study was that the studied groups were not matched for basal systolic, diastolic ands mean blood pressure readings with significantly lower blood pressure among the group who received the placebo beverages. This could represent bias in treatment randomization and could limit generalization of the results. However this limitation is overcome by showing the significant acute effect in cold beverage group compared to boiled hibiscus group with similar baseline blood pressure readings.

From this study we can conclude that drinking cold but not boiled Hibiscus beverage significantly lowers mainly the systolic blood pressure acutely and safely in adult females with normal baseline blood pressure. This acute effect is maximal within 15 minutes only. Further investigations are needed to test the nature of the active anti-hypertensive substances that are sensitive to boiling. Also further work is needed for the possible clinical application of this acute effect of cold hibiscus beverages. Examples include people with labile hypertension, pre-hypertension, symptomatic hypertension, or hypertensive patients as part of the DASH diet.

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