

Concord grape juice supplementation reduces blood pressure in Korean hypertensive men: Double-blind, placebo controlled intervention trial

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Abstract. Many of the flavonoids found in grapes and grape products such as juice or wine have been known to exert antioxidant, anti-inflammatory, platelet inhibitory and arterial relaxing effects either *in vitro*, in animal studies and in human trials. This study was designed to test the effect of Concord grape juice consumption on altering blood pressure in hypertensive patients. Forty subjects were given 5.5 ml/kg body weight/day of either Concord grape juice (CGJ) or a calorie-matched placebo drink every day for 8 weeks. Blood pressure (BP) was measured on weeks 0, 4 and 8. Compared to baseline, in the CGJ group systolic BP was reduced on average by 7.2 mm Hg ($p = 0.005$) and diastolic BP was reduced on average by 6.2 mm Hg ($p = 0.001$) at the end of 8 weeks. Comparable changes in the group getting the placebo product were -3.5 mm Hg (NS) and -3.2 mm Hg ($p = 0.05$) Consuming Concord grape juice, which is high in polyphenolic compounds, may favorably affect BP in hypertensive individuals.

Keywords: Grape juice, double-blind, placebo-controlled, DNA damage, comet assay

1. Introduction

Direct positive relationship between high blood pressure (BP) and cardiovascular disease (CVD) risk has long been recognized. Observational studies have demonstrated lowering SBP reduces CVD mortality in middle-aged patients with elevated baseline levels [3]. Importantly, current treatment guides for hypertensives emphasize lifestyle modifications such as regular exercise, weight loss and dietary changes as the initial therapeutic approach [5]. With the exception of a few studies in which researchers investigated the caffeine effect or calcium rich diet effect on blood pressure reduction [1] not many studies have tried to investigate the effect of supplementing a natural food product (as part of daily food intake) on lowering blood pressure in sub-clinical, middle-aged hypertensives.

Grapes and grape products have been shown to have beneficial effect on reducing cardiovascular risks, possibly due to the high content of polyphenols. A variety of human and animal interventions have

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shown that these compounds may inhibit the development of atherosclerosis in multiple ways. One of the possible mechanisms would be that polyphenols enhance platelet and endothelial production of nitric oxide [2]. The result of these previous studies encouraged researchers to justify further research grape product consumption on lowering blood pressure. Therefore, this study was aimed to specifically assess the effect of Concord grape juice on blood pressure of the middle-aged hypertensive men and was achieved by comparing Concord grape juice with an iso-caloric control drink specifically formulated for research purpose only (both products supplied by Welch Foods Inc, USA).

2. Methods

Men with mild isolated hypertension (systolic BP > 130 mm Hg and diastolic BP > 90 mm Hg) were included in this double-blind, placebo-controlled trial. All the subjects were placed on grape-free (including any grape products) diet for one week before the trial. Subjects were instructed to consume 5.5 ml/kg body weight/day split over two servings per day, for 8 weeks. The test products were either Concord Grape Juice (CGJ) or a zero-juice, calorie-matched control drink (Placebo). Placebo was formulated to look smell and taste like CGJ, and it had sugars (glucose and fructose) and acids (tartaric and malic) to mimic CGJ. Phenol content (Folins Method) of the two products was 2108 mg/L (885 mg/day) for CGJ and 0 mg/L (0 mg/day) for Placebo.

Participants were instructed to maintain their same total energy intake throughout the study period. Blood pressure was measured with participants in seated position using an automatic blood pressure monitor (Model T4, Omron, Tokyo, Japan) on weeks 0, 4 and 8. To eliminate inter-observer bias, the BP measurements for each individual were taken by the same trained observer who was unaware of subject groups. All subjects provided written informed consent before participation. Body weight was determined to the 0.1 kg using a balance scale and height (without shoes) was measured using a wall-mounted stadiometer. Statistical differences between baseline and changes over the 2-month intervention periods were assessed by Student's t-test and paired t-test using SPSS for Windows version 10.0). Data are presented as Mean \pm SEM. Statistical significance was set at $p < 0.05$.

3. Results and discussion

Results are shown in Table 1. The characteristics at baseline did not differ between Placebo and CGJ. Blood pressure was significantly reduced in both systolic and diastolic BP only in the Concord grape juice supplemented group. DBP was significantly reduced in the Placebo group, but the change (-3.2 mm Hg) was smaller than the DBP change in the CGJ group (-6.2 mm Hg).

A series of experiments showed that flavonoids in purple grape juice and red wine increase the production of nitric oxide (NO) by endothelial cells which cause relaxation of the adjacent vascular smooth muscle cells in animal model [2]. These studies have provided a link to the flavonoids in purple grape juice and improvements in endothelial function. Several studies have done in patients with coronary or other arterial vascular disease, showing that they have impaired endothelial function in their coronary and also in their brachial arteries [8]. Hypotensive effects of grape juice may be explained also by inhibitory effect of angiotensin converting enzyme (ACE) activity through increased availability of the vasodilator nitric oxide [4]. In a previous report published by our laboratory [7], we also found that 8 weeks of grape juice supplementation reduced both SBP and DBP in normotensive subjects. Our result intrigued us to further investigate grape juice effect on regulating blood pressure in people with

Table 1
Demographic, anthropometric and blood pressure measurements at the beginning and end of juice supplementation

	Placebo (<i>n</i> = 19)		CGJ (<i>n</i> = 21)	
	0 wk	8 wks	0 wk	8 wks
Age (yrs)	46 ± 2		43 ± 2	
SBP (mm Hg)	147.5 ± 3.8	144.0 ± 4.5	145.5 ± 3.2	138.3 ± 3.7 ¹
DBP (mm Hg)	94.0 ± 3.5	90.8 ± 2.6 ²	93.9 ± 2.5	87.7 ± 2.7 ³
BMI (kg/m ²)	26.2 ± 0.6	26.4 ± 0.6	26.5 ± 0.7	26.5 ± 0.7
Weight (kg)	76 ± 1.9	76.7 ± 2.0	75.6 ± 2.7	75.7 ± 2.7
Waist/Hip Ratio	0.92 ± 0.01	0.92 ± 0.01	0.90 ± 0.01	0.90 ± 0.01
No.of Smokers	<i>S</i> = 6, <i>NS</i> = 13		<i>S</i> = 6, <i>NS</i> = 15	
Packyears ⁴	23 ± 6.2		14 ± 3.8	

Values are Mean ± SEM.

¹*p* = 0.005 by paired t-test.

²*p* = 0.049 by paired t-test.

³*p* = 0.001 by paired t-test.

⁴Packyears = (cigarettes smoked/day × years smoked)/20; for smokers.

hypertension. The effect of Concord grape juice consumption on blood pressure, though modest (~ 5%), showed a significant (*p* < 0.005) reduction in both systolic (−7.2 mm Hg) and diastolic (−6.2 mm Hg) blood pressure. The U.S. National High Blood Pressure Education Program estimates that lowering SBP by 5 mm Hg would result in a 14% drop in deaths from stroke, a 9% drop in heart disease deaths, and a 7% drop in overall mortality [6]. We thus suggest that moderate Concord grape juice consumption can offer a wide protection against variety of age-related diseases, including hypertension.

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