A NOVEL DIETARY SUPPLEMENTHIGH IN OMEGA 3 FATTY ACIDS LOWERS BLOOD PRESSURE IN INDIVIDUALS WITH TYPE 2 DIABETES

D. Whitham 1,2 , M. Di Buono 1,2 , PM. Stavro 1,2 , JL. Sievenpiper 1,2 , RP. Bazinet 2 , V. Vuksan 1,2
Risk Factor Modification Centre, St. Michael's Hospital 1 ; Department of Nutritional Sciences, University of Toronto 2 Ontario, Canada

ABSTRACT

Background: Type 2 Diabetes is on the rise. Data from NHANES III indicates that 71% of individuals with type 2 diabetes have elevated blood pressure (BP). In addition, approximately 75% of deaths in people with diabetes are related to Cardiovascular Disease (CVD) . Management of traditional risk factors (TRF) may reduce but does not eliminate CVD events, indicating that TRF only partly explain the pathology of CVD in type 2 diabetes. Increasing evidence suggests that omega-3 fatty acids have beneficial effects on cardiovascular risk factors. The Lyon Diet Heart Study (LDHS) achieved a 65% decrease in CVD mortality when combining a plant source of omega-3 fats with a Mediterranean diet, despite no appreciable changes in TRF. Postulated mechanisms for the reduction in CVD mortality include changes in non-TRF, including inflammation, thrombosis, arrhythmias and the inhibition of atherosclerosis. Seeds from the plant sou rce Salvia hispanica alba (Salba) contain a high concentration of omega-3 fatty acids in addition to being a rich source of vegetable protein, calcium, fiber and antioxidants. This study examined whether the addition of Salba to the conventional treatment for diabetes is associated with improvement in TRF and non -TRF for CVD in people with Type 2 diabetes. Methods: In a randomized, single blind crossover design, 20 well controlled individuals with Type 2 diabetes (HbA 1C =6.8±0.9%; F=9; M=11; Age=64±8yrs; BMI=28±4kg/m 2) on a conventional diabetes diet (50:20:30%=CHO:PRO:FAT) received either addition of Salba or matched control supplement for 12 weeks separated by a 4 -week washout period. Fasting blood samples and blood pressure measurements were taken at weeks 0 and 12. Results: After adjustments for age, sex, body weight and use of BP medications, the consumption of Salba was inversely associated with systolic blood pressure (SBP) with no significant differences in lipids or meas ures of glycemic control. SBP decreased by 9.6 ±11 mm Hg ($p<0.001$) in the Salba group. C -Reactive Protein was significantly lower on the Salba diet compared to control ($p<0.05$). Von Wildebrand and Factor VIII improved on the Salba diet compared to control ($p=0.024$, $p=0.038$ respectively). Fibrinogen was decreased significantly from baseline on the Salba diet ($p<0.05$). Conclusions: We conclude that a seed high in omega-3 fatty acids and other nutrients may attenuate blood pressure and non -TRF for CVD in a high -risk population, thereby improving outcomes of diabetes treatment.

INTRODUCTION

Many studies have shown that diet can help prevent or treat chronic disease. Omega -3 fatty acids specifically from fish oils have been shown to lower triglycerides, blood pressure and reduce cardiovascular disease mortality. a-linolenic acid, the plant source of omega -3 fatty acids, is a precursor to the longer chain polyunsaturated fatty acids found in fish oils. The Lyon Diet Heart Study (LDHS) examined the effect of a typical Mediterranean diet combined with omega-3 fatty acids from plant origin and demonstrated a 65% reduction in cardiovascular disease mortality despite a lack of effect on lipids. This indi cates that non traditional risk factors for heart disease such as mark ers of inflammation, coagulation and endothelial dysfunction may be of great importance. In addition, it supports the possibility tha t plant sources of omega -3 fats may have similar health benefits to its longer chain counterparts. Salba seed (Salvia Hispanica alba) is an ancient seed that was first cultivated by the Aztecs and is still consumed as a functional food in parts of Mexico and South America today. Because Salba has been shown in acute studies to affect post prandial glycemia and is a high source of a-linolenic acid, vegetable protein, fiber and antioxidants, we investigated the effects of Salba seeds on measures of glycemic control and both traditional and non traditional risk factors for cardiovascular disease in people with type 2 diabetes.

COMPOSITION

Nutrient Profile of Salba seed (100g)

Energy (Kcals)	383
Total Fat (g)	28
PUFA (% of Fat)	86.2
Omega 3 (% of Fat)	67.1
MUFA (% of Fat)	6.0
SFA(% of Fat)	7.8
Total Carbohydrate (g)	40
Total Fiber (g)	36
Protein (g)	21
Calcium (mg)	800
Vitamin C (mg)	500
Potassium (mg)	694
Iron (mg)	7

Nutrient analysis was performed at the University of Guelph, Ontario

PROTOCOL

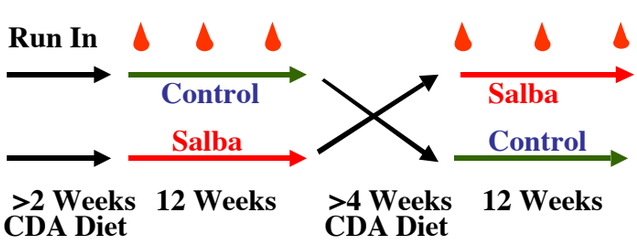
Subject Characteristics n=20

Characteristics	Mean ± SD
Age	64± 8 years
Males/Females	11/9
BMI	28± 4 kg/m^2
HbA 1C	6.8± 0.9 %
Aspirin	6
Blood Pressure Medications	11
OHA	16

BMI denotes Body Mass Index; OHA denotes Oral Hypoglycemic Agents. Data are mean ±SEM

STUDY DESIGN

Randomized, Single Blind Crossover Trial



DIET

Background/Run In Diet

50:20:30% = CHO:PRO:FAT

45:20:35% = CHO:PRO:FAT **54:21:25% = CHO:PRO:FAT**

RESULTS: DIET

Diet Comparison	Salba	Control	p value
Total energy intake (kcals)	1776	1870	NS
Total Fat, % of energy	35	25	p<0.001
Saturated Fat, %	10	7	NS
Monounsaturated Fat, %	10	8	p=0.01
Polyunsaturated Fat, %	12	6	p<0.001
Omega 3 Fat, g/d	10.2	1.1	p<0.001
Protein, % of energy	20	21	NS
Carbohydrate, % of energy45		54	p<0.001
Total Fiber, g/d	36	38	NS
Sodium, g/d	2.3	2.4	NS
Potassium, g/d	3.3	3.4	NS
Calcium, mg/d	957	841	NS
Magnesium, mg/d	404	424	NS

Diet analysis completed with ESHA Nutrient Analysis Software. Data are displayed as post intervention means. P values are for between treatment differences using repeated measures ANOVA adjusted with the Newman Keuls procedure.

RESULTS: SAFETY

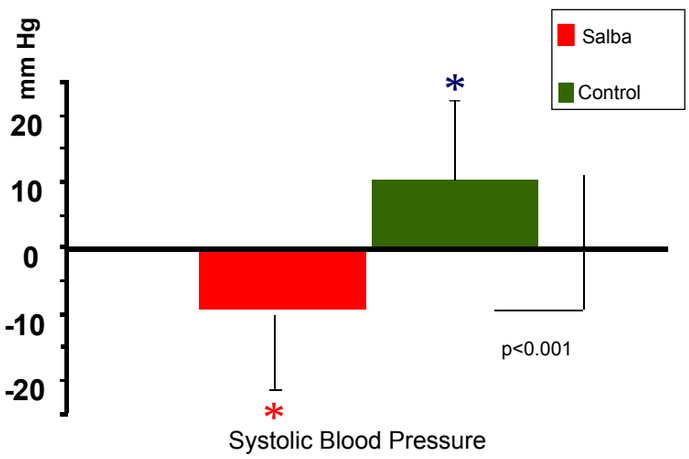
Safety	Salba	Control	p value
INR	1.01	1.00	NS
PT	11.3	11.2	NS
PTT	27.4	27.8	NS
ALT	29.4	26.4	NS
AST	25.2	23.1	NS
Urea	5.6	5.7	NS
Creatinine	78.4	78.1	NS

INR, PT and PTT denote markers of bleeding time. AST and ALT are liver enzymes. Urea and Creatinine are markers of kidney function. P values are for comparisons between treatment using repeated measures one way ANOVA adjusted with the Newman Keuls procedure. Data are displayed as mean post intervention results.

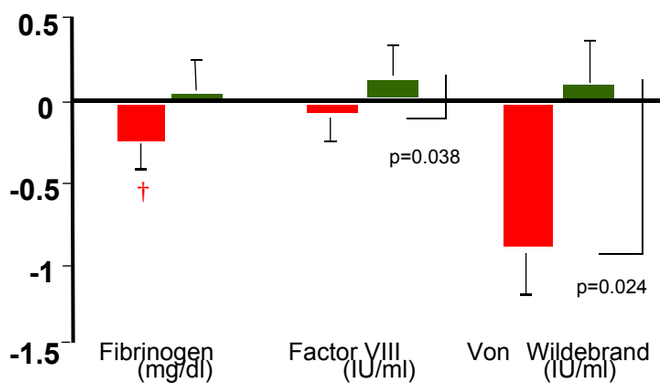
Compliance	Salba	Control
Intake % of supplement provided	78	73.4
Grams of Salba consumed/day	50.2	0
Weight (kg/m2)	80.82+/-16.37	81.17+/-16.59

Supplements were based on caloric intake to provide 25g of Salba /1000 kcals. Intake was assessed by weight of returned supplements. Data aremean±SEM.

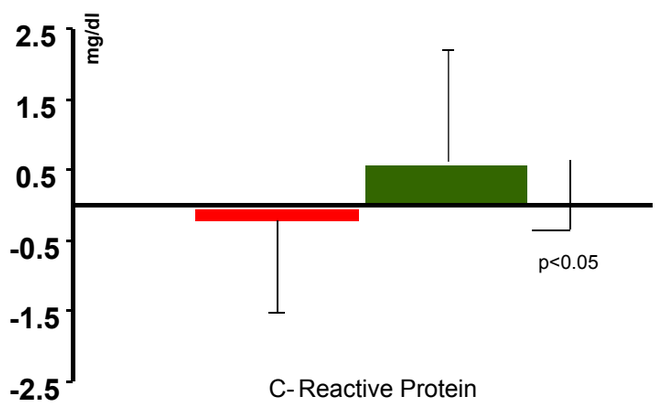
RESULTS:BLOOD PRESSURE



RESULTS: COAGULATION



RESULTS:INFLAMMATION



Data are displayed as mean change. P values represent between treatment differences. *,† indicate within treatment differences using GLM ANCOVA adjusted with the Newman Keuls procedure. (Age, Sex, BP meds, Weight) * = p<0.001 † = p<0.05