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A DIETARY SUPPLEMENT WITH BEAN EXTRACT DECREASES BODY WEIGHT, BODY FAT, WAIST CIRCUMFERENCE AND BLOOD PRESSURE IN OVERWEIGHT AND OBESE SUBJECTS

G. Støa Birketvedt[1, 2] B. Langbakk[3] and J. Florholmen[1]

[1]Laboratory of Gastroenterology, Institute of Clinical Medicine, University of Tromsø, 9037 Tromsø, Norway; [2] Center for Hypertension and Cardiovascular Medicine, Lenox Hill Hospital, 210 East 64th street, 4th Floor, New York, NY 10021, USA; and [3]Department of Clinical Chemistry, University Hospital of Tromsø, Norway

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ABSTRACT: ***Dietary supplements have frequently been reported to decrease body weight in short-term studies, but few studies have examined dietary supplements and changes in body weight while testing the impact on blood pressure in long-term studies. The aim of this study was to evaluate the long-term effects of a dietary supplement of a white kidney bean extract on body weight, % body fat, waist circumference and systolic and diastolic blood pressures without changes in lifestyle. Sixty-two overweight and obese volunteers were randomized to receive either a dietary supplement or a placebo. Two capsules of the dietary supplement or the placebo were administered three times daily for 3 months during this double-blinded, randomized phase. Excretion of fat in feces was measured. The Supplement Group was then invited to participate in an open-label second phase for 9 months. At 12 months significant reductions were found in body weight, % body fat, waist circumference, and in systolic and in diastolic blood pressures. The bean extract significantly increased fat excretion in feces.***

KEY WORDS: Blood pressure, Obesity, Per cent body fat, Weight reduction

Corresponding Author: : Dr. Grethe Støa Birketvedt, Center for Hypertension and Cardiovascular Medicine, Lenox Hill Hospital, 210 East 64th street, 4th Floor, New York, NY 10021, USA; Fax: 212 702 7416; Email: gsb42nor@aol.com

INTRODUCTION

Diet, exercise and behavioral therapy have been studied in different weight-loss programs, and several dietary supplements have been reported to prevent overweight and obesity (Birketvedt et al., 2000; Alfieri et al., 1995; Boozer et al., 2001), as well as hypertension (Glore et al., 1994; Ludwig et al., 1999; Brown et al., 1999; Nelson et al., 1996; Alexander et al., 1999). The effects of a dietary fiber supplement to a hypoenergetic diet in the treatment of overweight, obesity and hypertension remain controversial (Liu et al., 1996; Bennett et al., 1996; Toeller et al., 1999). Critically reviewed, only a few controlled studies have shown a modest weight loss induced by dietary supplements (Saltzman et al., 1997; Kraemer et al., 1997; Rossner et al., 1987). There are even fewer reports of dietary supplements and their effects on blood pressure (Birketvedt et al., 2000; Ryttig et al., 1984) and coronary heart disease (Wolk et al., 1999). It is of interest to note that most studies of dietary supplements have been performed over short time spans, i.e. within 3 months or less (Bennett et al., 1996). Only a few studies have been performed over 12 months or more (Birketvedt et al., 2000; Ryttig et al., 1989).

The main goal of this study was to test the hypothesis that a water-soluble compound of an extract from the white kidney bean (phaseolus vulgaris) would preferentially induce reductions in body fat mass and waist circumference and thereby substantially reduce cardiovascular risk factors over the long term. The white kidney bean has a lipase activity that decreases the absorption of dietary fat caused by the inhibition of triglyceride hydrolysis (Wato et al., 2000; Takahashi et al., 1999; Cacobs and Miller. 1986). We reported recently (Birketvedt et al., 2002) that this white kidney bean extract improved the lipid profile in overweight and obese subjects, leading us to hypothesize that it may also decrease body weight, % body fat and blood pressure and therefore decrease cardiovascular risks.

The study was designed to describe the weight-reducing effect of the bean extract in a 3-month randomised, placebo-controlled phase. Further, it was designed to evaluate the long-term and dose-dependent effects of the bean extract on body weight, % body fat, waist circumference and blood pressure in an open-label, dosage level, randomised 9-month follow-up phase.

MATERIALS AND METHODS

Subjects were recruited through newspaper advertisements and letters to local physicians for participation in a weight

loss and blood pressure study. Sixty-two overweight and obese subjects, 41 women and 21 men, ages 22 to 66 years of age, with a body mass index (BMI= kg/m2) > 25 kg/m2 volunteered to participate in a randomised, placebo-controlled double-blind study with a bean extract dietary supplement for 3 months. All subjects gave their written consent. The supplement (Wellex) (LexMed ASA, Bergen, Norway) consists of a combination of an extract of northern white kidney bean (150 mg) (Phaseolus vulgaris) mixed with an extract of locust bean gum (25 mg) (Ceratonia siliqua). Subjects were randomised into two groups, equated for BMI (Table 3). The Supplement Group received the dietary supplement of the bean extract, and the Placebo Group received the placebo capsules, identical in appearance and taste with the test capsules, both prescribed as 2 capsules 3 times daily, 30 minutes before breakfast, lunch and dinner. After 3 months, 24 (7 males, 17 females, ages 22-60 years) of the 25 subjects in the Supplement Group volunteered to participate in a 9-month, open-label phase and signed the written consent form. The subjects were randomised, again equated for BMI to receive either 2 capsules (Low- Dose Group) or 4 capsules (High-Dose Group) of the dietary supplement three times daily.

Body weight, BMI, % body fat, waist circumference, hip circumference and systolic and diastolic blood pressures were measured at baseline, after 3 months and at the end of the 12-month study. Overnight fasting blood samples were drawn at baseline, after 3 months and at the end of the 12-month study period. The quality of the weight reduction was evaluated by measuring the amount of fat lost per kilogram. More than 70% of fat lost per kilogram was regarded as a qualitative weight reduction according to the Committee on Medical Aspects of Food Policy 1987 (Committee on Medical Aspects of Food Policy, 2002).

At baseline, 3 months and the end of the study, each subject underwent a physical examination by a specialist in General Practice. At each examination, blood pressure was measured twice with a mercury sphygmomanometer in standardised fashion, with the subject in a sitting position after 10 minutes of rest. Cuff size was adjusted to the circumference of the arm, and the arm was placed with the cuff at heart level. Systolic and diastolic blood pressures were defined according to Korotkoff sounds I and V. Two blood pressures were performed at baseline, then each week for 3 months and each month for the next 9 months; the mean of the two measurements from each visit was used in the analyses.

Height was measured to the nearest 0.1 cm and weight to the nearest 0.1 kg with a calibrated digital scale (subjects wore an examination gown and no shoes at each visit). The body composition measurements were carried out by the "near infrared light method" (Futrex 5000, Futrex Inc., Gaithersburg, MD, USA) (Stoa Birketvedt et al., 1995). To estimate skeletal frame size, breadths at the elbow (the distance between the lateral and medial epicondyles of the humerus) were measured using the Futrex 5000 cuff. Fat mass (FM) was calculated from the percentage of body fat to body weight. Waist was measured to the nearest 0.1 cm at the lowest point under the rib cage, and hip was measured to the nearest 0.1 cm at the spina iliaca anterior superior. These procedures were repeated every week for 3 months and once a month for the next 9 months.

To avoid confounding with the evaluation of the outcome parameters, the diet and the physical activity level of the subjects were maintained without change. Specifically, the subjects were asked at the start of the study to keep their exercise levels and diets unchanged throughout the study period. Compliance with this request was checked by the study investigator in the subjects' self reported diet journals and in a questionnaire at baseline, 3 months and at 12 months.

Daily energy intake was recorded for 5 days at baseline and at the end of the 3- and the 12-month study. Compliance with drug treatment was checked by returned dose packets; 80 % compliance was considered acceptable. At the end of the study, four subjects (two women and two men, ages 34 to 43 y) volunteered to consume three meals daily with a caloric intake of 1200 kcal, balanced between 15% protein, 55% carbohydrates, and 35% fat. Two capsules of the bean extract were administered 30 min before meals, three times daily. Faeces were collected for 3 days. After a subsequent washout period of 2 weeks, faeces were collected for another 3 days. The excretion of fat in faeces was measured (Henry RJ. 1964).

The study was conducted according to the declarations of Helsinki and Venice and with the approval of the local ethical committee of the Health Region North.

RESULTS

The 3-month period

Of the 62 subjects (31 in each group) randomised to receive either bean extract (Supplement Group) or placebo (Placebo Group), 6 subjects in the Supplement Group and 4 subjects in the Placebo Group were withdrawn from the 3-month study. Two subjects of the 6 subjects withdrawn from the Supplement group decreased their energy intake and lost 9 kg in two weeks; one person was unable to swallow the capsules; one person complained about constipation; one subjects got a throat infection and did not digest any capsules for 4 weeks; the sixth subject withdrew because of psoriatic arthritis that caused changes in energy expenditure. Of the 4 withdrawn subjects in the Placebo Group, one person was unable to swallow the capsules, one person got an infection, one person travelled for 4 weeks and left the capsules at home, and the fourth subject became pregnant. The remaining 52 subjects (n=25 in the Supplement Group; n=27 in the Placebo Group) completed the 3-month study according to the protocol (Table 1). The treatment was well tolerated. Only minor adverse events were observed (Table 2).

At baseline, there were no significant differences between the various anthropometric data of the two groups (Table 3). In the Supplement Group (n=25), there was a significant reduction in body weight of -3.2 ± 3.4 kg (mean ± SD), in BMI (-1.1 ± 1.1 kg/m2), in % body fat (-2.8 ± 3.0 %), in waist circumference (-3.7 ± 3.5 cm) (Figure 4), and in systolic (-5.6 ± 7.5 mmHg) and diastolic (-3.9 ± 6.4 mmHg) blood

Table 1. Frequency of withdrawals of overweight and obese subjects in a study with white kidney bean extract.

Intended to treat	Placebo 31	Wellex 31
Withdrawals	4	6
Withdrawals, male/female ratio	1/3	0/6
Withdrawals due to: 1. pregnancy 2. intercurrent disease, no medication for 4 weeks 3. traveling 4 weeks, no medication 4. couldn't swallow the capsules 5. inactivity due to psoriatic arthritis 6. constipation 7. changes in caloric intake	 1 1 1 1 	 1 1 1 1 2
Completed study according to the protocol	27	25

Table 2. Adverse events remotely, possibly or probably related to treatment of The white kidney bean extract.

	Placebo number	duration	Wellex number	duration
Overall adverse events	3	1-3 weeks	6	1-3 weeks
Soft stool	1	3 weeks	1	3 weeks
Flatulence	1	3 days	4	1-3 days
Constipation	1	3 days	1	3 days

Table 3. Characteristics of the overweight and obese subjects in the treatment group in a study with white kidney bean extract. Values expressed as number or mean ± SD.

	Placebo	Wellex
Male/female	12/15	9/16
Age (years)	44 ± 11	47 ± 11
Anthropometry		
Weight (kg)	103.6 ± 16.2	98.2 ± 15.2
Height (cm)	172.1 ± 8.7	167.7 ± 8.9
Body mass index (BMI)	35.0 ± 5.4	33.9 ± 3.4
% Body Fat	32.2 ± 6.1	33.0 ± 5.2
Waist circumference (cm)	112.8 ± 13.5	108.6 ± 12.2
Waist/hip ratio	0.932 ± 0.072	0.909 ± 0.097

No significant differences between groups.

pressures; a non-significant reduction in waist-hip ratio (-0.010 ± 0.026) during the 3-month treatment period (Table 4) was seen.

In the Placebo Group (n=27), no significant reductions in body weight (-0.2 ± 2.3 kg), in BMI (-0.03 ± 0.776 kg/m2), in % body fat (-0.3 ± 3.0 %), in waist circumference (-1.5 ± 2.8 cm), in waist-hip ratio (-0.008 ± 0.005), in systolic (-2.8 ± 7.8 mmHg) and diastolic (-1.7 ± 5.7 mmHg) blood pressures were observed after 3 months (Table 4).

The 9-month follow-up phase

Twenty-four of the 25 subjects in the Supplement Group (7 males, 17 females, ages 22-60 years) who volunteered to participate in the 9-month, open-label, follow-up study were randomised to a Low-Dose and a High-Dose group. At start of the open-label follow-up study, there were no significant differences in BMI between those randomised to the Low-Dose Group (34.0 ± 4.7 kg/m2, n=12) and to the High-Dose Group (33.8 ± 3.7 kg/m2, n=12); nor were there any differences between the groups regarding weight, % body fat, waist circumference, waist/hip ratio, or systolic and diastolic blood pressures (Table 5). All the subjects completed the 9-month follow-up study according to the protocol. The bean extract was well tolerated, and only a few and minor adverse events were noted.

During the 9-month follow-up study, there were additional significant reductions in body weight and body fat both in the Low-Dose Group (-8.1 ± 3.2 kg [mean ± SD] and -3.3 ± 3.1 %, respectively) and in the High-Dose Group (-5.9 ± 3.2 kg and -2.8 ± 2.5 %, respectively) (Table 5). However, there were no significant differences between the Low- and High-Dose Groups. This was rather unexpected and we have no explanation for this. Significant reductions were also observed in BMI, waist circumference and waist to hip ratio (WHR) in both treatment groups, but not between the groups (Table 5).

We did not find any weekly changes of caloric food intake or energy expenditure, checked in the diet journals and analysed at baseline, after 1 month, after 3 months and at 12 months. Two subjects increased their exercise and lost more than 15 pounds, and they were therefore withdrawn from the study.

DISCUSSION

In this study, we have demonstrated that a dietary supplement of bean extract reduces body weight, % body fat, waist circumference and blood pressure in a 3-month, randomised, placebo-controlled study, and these effects are not attenuated during a 9-month, open-label follow-up phase. In agreement with other reports (Saltzman et al., 1997; Kraemer et al., 1997; Rossner et al., 1987), the dietary supplement of this bean extract also reduced the body weight in the short term with a qualitative weight reduction of 70.5% fat. This study is also the first to report a weight reducing effect without any lifestyle changes for a period of 12 months.

The weight-reducing effect of this bean extract is most likely linked to the alpha-amylase inhibiting effect of the bean extract, Phaseolus vulgaris (Jacobs and Miller. 1986). The white kidney bean with its lipase activity is assumed to inhibit the

Table 4. Effect of a white kidney bean extract on anthropometric values in a 3-month study. Values expressed as mean ± SD.

	Body weight kg	BMI kg/m2	Body fat %	Waist cm	Waist/hip ratio	Systolic BP	Diastolic BP
Wellex							
Start	98.2±15.2	33.9±3.4	33.0±5.2	108.6±12.2	0.909±0.097	142.6±16.6	92.5±10.2
3 month	95.0±14.9*	32.9±3.3*	30.2±5.1*	104.8±12.1*	0.899±0.095	137.0±15.6*	88.6±8.6*
Placebo							
Start	103.6±16.2	35.0±5.4	32.2±6.1	112.8±13.5	0.932±0.072	141.5±15.6	90.9±9.7
3 month	103.4±15.9	35.0±5.3	31.9±5.8	111.4±13.8	0.925±0.067	138.7±14.6	89.3±8.1

** indicates significant difference from start value (p< 0.05).*

Table 5. Long-term effect of the kidney bean extract on anthropometric parameters in over-weight subjects in a 12-month study. *0-3 months: 2 capsules thrice daily (n=24), 3-12 months: low dose: 2 thrice daily (n=12); high dose: 4 capsules thrice daily (n=12). Values expressed as mean ± SD. n=12.*

	Body weight kg	BMI kg/m2	% Body fat	Waist cm	Waist/hip ratio	Systolic BP	Diastolic BP
Low-dose							
Start	98.8±14.5	34.0±4.7	33.3±4.8	108.3±12.0	0.923±0.100	140.4±14.1	89.4±11.2
3 month	94.8±14.0*	32.7±4.7*	31.6±5.3*	105.1±11.3*	0.916±0.106*	134.5±18.8*	85.5±10.4*
12 month	90.7±13.1*	31.3±4.4*	30.0±4.7*	102.5±9.6*	0.919±0.106*	132.1±12.0*	80.0±7.7*
High-dose							
Start	95.5±18.7	33.8±3.7	35.0±4.6	107.3±13,0	0.895±0.087	148.3±18.1	94.2±11.6
3 month	93.0±19.3*	32.9±3.8*	33.0±3.8*	103.8±13,7*	0.883±0.079*	141.7±13.4*	89.6±8.4*
12 month	89.6±18.2*	31.7±3.4*	32.2±2.6*	101.8±12,8*	0.882±0.081*	139.2±11.0*	84.2±7.9*

** indicates significant difference from start value (p< 0.05). For further details, see text.*

triglyceride hydrolysis (Birketvedt et al., 2002). White kidney bean has also been shown to modulate plasma apolipoproteins B-48 triglyceride-rich lipoproteins in healthy subjects during postprandial periods that may reflect the amount of fat loss (Harbis et al., 2001). This effect was also observed for our bean extract, where an increase of the faecal excretion of 2.8 g fat/24 hours was observed (Birketvedt et al., 2002). This concurs with other reports (Rigaud D et al., 1987).

During the 12 months of the study, the weight-reducing effect of the bean extract was not attenuated. So far we have little knowledge about the long-term effect of this bean extract on weight reduction. However, based on a study of the jejunal ultrastructure changes induced by kidney bean lectins in rats, no rebound mechanisms of actions of the bean extract appeared during the observation period (Rossi et al., 1984).

According to the Joint National Committee (JNC) guideline in diagnosing hypertension (Hyman et al., 2000), subjects are regarded hypertensive with a resting blood pressure above 140 mmHg systolic or above 90 mmHg diastolic. In our study, no subjects were diagnosed with hypertension, but according to the blood pressure recordings at baseline, 48 subjects met the JNC criteria as hypertensive. After 12 months, a significant reduction in blood pressure in the previously undiagnosed hypertensive patients took place. The reductions in systolic and diastolic blood pressure were interestingly not related to the weight loss alone, but to the high percentage (70.5%) of fat lost per lost kilogram of body weight. This effect is most likely due to the fat-reducing effect of the supplement and to the specific characteristics of its composition: a bean extract (phaseolus vulgaris) combined with a carob seed (Ceratonia siliqua). But these hypotheses await further studies.

In conclusion, this supplement of bean extract used without concomitant treatment with diet and exercise decreases body weight, % body fat, waist circumference and blood pressure in overweight and obese subjects in a long-term study. In the future, this combined bean extract may be a valuable choice for weight reduction.

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