



Review On Inhibition Of Alpha-Amylase By Phaseolus Vulgaris

Shituja Zanzane*, Sakshi Gardade, Ashwini Dhole, Dipti Shete

Delonix Society's Baramati college of Pharmacy Barhanpur,

Baramati, Maharashtra, India 413102

ABSTRACT:

A popular food crop and medicinal plant, *Phaseolus vulgaris* (common bean) is well-known for its therapeutic benefits, which include helping people lose weight. Type 2 diabetes, osteoarthritis, and some types of cancer are among the many ailments that are exacerbated by obesity, a global health concern. Dietary techniques, such as reducing carbohydrate intake, exercise, and nutrition control are all part of managing obesity. α -amylase inhibitors (α -AI), including Alpha-AI1, are found in common beans, especially white kidney beans. They prevent the breakdown of starch, which lowers the absorption of glucose and helps people lose weight. *Phaseolus vulgaris* extracts (PVE) have demonstrated advantages in enhancing insulin sensitivity, lowering body weight, and regulating blood glucose levels. Clinical research, including randomized trials, has shown that PVE supplementation can reduce body weight and fat through mechanisms such as decreased fat conversion and suppression of glucose absorption.

Keywords:

obesity, α -amylase inhibitors, white kidney bean extract, weight loss, insulin resistance, α -AI1, clinical trial, metabolic syndrome.

Introduction

French bean, kidney bean, common bean, and bean are some of the names for *P. vulgaris*. Commonly referred to as in India

बँकलें Bakla ,Rajmah, Rajah[1]

The *Phaseolus vulgaris* L. common bean One of the earliest crops in the world to be grown is (Figure 1) Across the Americas, it is the primary grain legume[18] . with production exceeding that of goods for human consumption two times the significance of the second-ranking grain legume chickpeas.[2]

Phaseolus vulgaris is a highly popular food crop and medicinal plant in the world[15]. Well-liked due to its seed. An excerpt from it has been utilized as a therapeutic measure, such as to lose weight.(3)

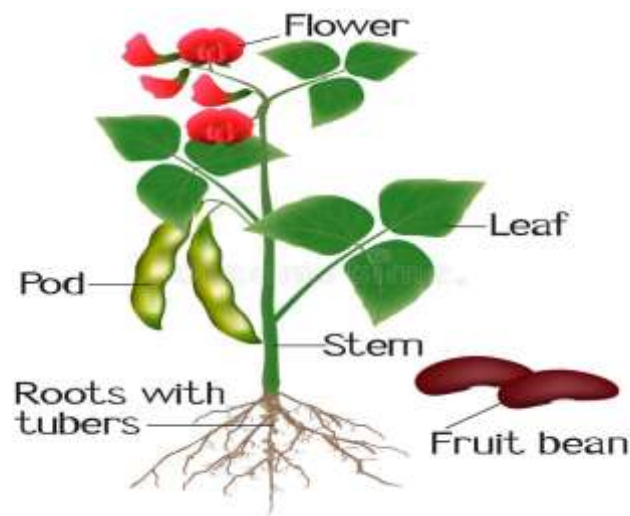


Fig.1: Common Bean plant

Weight loss

Obesity is a serious health risk since it raises the incidence of type 2 diabetes, musculoskeletal diseases (particularly osteoarthritis) and specific cancers (endometrial, the breast and the colon) At least 400 million persons worldwide were obese and almost 1.6 billion overweight in 2005, according to estimates from the World Health Organization (WHO)[30]. Additionally, according to WHO estimates, at least twenty million kids under five were oversized. More figures are anticipated for 2015. Expected to be overweight are 2.3 billion adults, and It is anticipated that 700 million people will be fat. Inadequate energy expenditure and intake are the root causes of increased body weight. A global trend in diet toward higher intake has been noted by the WHO. of high-fat and sugary, energy-dense foods nonetheless lacking in micronutrients, vitamins, and minerals.(4)

The two main pillars of managing excess weight are exercise and nutrition control. Various dietary strategies and techniques with varying ratios of There are recommended amounts of fats, proteins, and carbohydrates. For reducing weight Limiting saturated fats was the first piece of advice on weight loss. As anticipated, weight loss was not always the outcome of diets reduced in saturated fats. Reducing carbs, especially refined carbs, has been more popular recently as a strategy to lose weight and lower the risk of associated diseases.(5)

The majority of the calories in a diet come from carbohydrates. Carbohydrates are classified as sugars, starches, or fibers depending on the quantity of sugar units and the nature of their chemical bonds .Before being absorbed, starches must be converted by digestive enzymes into sugars. Amylase breaks down starch, a polysaccharide, during digestion to produce oligosaccharides, which glucosidase then breaks down into monosaccharides. Blocking the enzymes responsible for breaking down complex carbs can lower the amount of starch absorbed in the gastrointestinal system. Naturally occurring in common bean seeds are glycoproteins.(6)

Interfere with the alpha-amylase active site's hydrophobic interaction with starch, which leads to non-covalent binding. Only the alpha-amylase inhibitor Alpha-AI1 is pharmacological in humans, out of the three isoforms (Alpha-AI1, Alpha-AI2, and Alpha-AI3).(7,8 ,1) Alpha-AI1 is naturally present in white kidney beans (*Phaseolus vulgaris* L.), and research has indicated that white kidney bean extract (WKBE) lowers the amount of glucose absorbed from starchy diets.(9, 25)

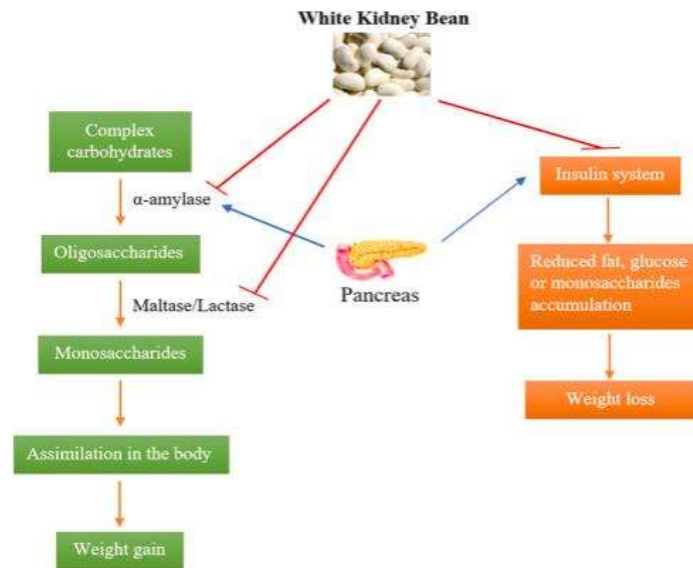


Fig 2: common mechanism of common bean

The PVE, also referred to as a "starch blocker," is abundant in phaseolin and traditional α -amylase inhibitors (α -AI). According to Moreno, Altabella, and Chrispeels (1990), α -AI is a naturally occurring bioactive component that belongs to the glycoside hydrolase class and exhibits anti-amylase action in humans. Reduced digestibility or longer digestion result from the α -AI interfering with complicated carbohydrate breakdown. According to Celeno et al. (2007), this results in a decrease in the amount of energy obtained from carbohydrates and the rate at which the body absorbs energy in the form of glucose. α -AI has the ability to suppress salivary and pancreatic amylase activity in the gastrointestinal system, hinder or postpone the breakdown and digestion of the primary carbohydrates in diet, and lessen the breakdown and absorption of starch. meals that include sugars, lowering blood sugar, blood pressure, and body weight fats (Song & Associates, 2016). Patients with diabetes benefit from diets that prevent blood glucose concentration increases. In individuals with obesity, there was a decrease in the conversion of sugar to fat, a delay in intestinal emptying, and a reduction in fat intake, all of which contributed to a decrease in body weight. Diabetes, arteriosclerosis, hyperlipidemia, obesity, and hyperlipidemia could all be prevented or treated using α -AI.

According to a study on two varieties of *Phaseolus vulgaris* (black 8,025 and pinto Durango), phaseolus vulgaris polypeptide (molecular weight < 1 kDa) improved dyslipidemia, enhanced insulin production, and passed Akt signaling pathways. better insulin resistance and enhance glucose absorption (67%) (Toledo, Amaya-Llano, Sivaguru, and Mejia (2016). McCrory & Associates demonstrate that eating soluble fiber- and resistant-starch-containing *Phaseolus vulgaris* on a regular basis lowers blood levels of low-density lipoprotein (LDL), raises levels of high-density lipoprotein (HDL), and positively affects metabolic syndrome risk factors, all of which lower the risk of diabetes, obesity, and cardiovascular disease (CVD). (Hamaker, Mccrory, Lovejoy, & Eichelsdoerfer, 2010) Therefore, PVE have exceptional benefits in lowering the amount absorbed by the stomach, affecting the absorption of complex carbs, and delaying their breakdown. an opportunity in the treatment of glucose-insulin system, which in turn medical conditions like diabetes and obesity.(10-19)

Despite there was no appreciable effect on weight loss, the results of a systematic review and meta-analysis of randomized clinical trials that included WKBE demonstrated a substantial reduction in body fat.(20) However, a meta-analysis for research using a special confidential aqueous extract from entirely dried white kidney beans established through its alpha-amylase preventing activity (at least 3000 alpha-amylase hindering

units (AAIU), or Phase 2, revealed that Phase 2 supplementation had statistically significant effects on body weight and body fat.(21)

Glucosanol, Glycolite, PhaseLite, and Starchlite are some of the brand names for the second phase, which is composed of Phaseolus vulgaris extract and Arabic gum. The special manufacturing method used in Phase 2 improves the medication's durability in the acidic environments of the stomach and duodenum. When compared to generic extracts, Phase 2 retains its alpha-amylase inhibitory effect in vitro after being subjected to acidic conditions that resemble those of the gastrointestinal track The current investigation attempts to increase the clinical data of Phase 2 regarding safety and weight management in individuals who are overweight or moderately obese.(22,1)

Method

Subject

Screening was done on fifty adult obese participants. 35 females and 4 males made up the randomized subjects (n = 39), whose mean age was 36.5 years (range: 20- The average weight was 193.1 lbs (SD 12.19) and the range 148–256; standard deviation = 26.95. Between the two groups, there were no appreciable differences. Subjects over the age of eighteen (18) with a BMI (weight in kilograms divided by height in squares) of meters) of 30-43 kg/m²., sufficient prevention in females who are capable of producing children, and absence of using medication of any kind to manage obesity Participants were also disqualified if they had a history of seizures, active eating problems, or other serious metabolic, cardiac, renal, hepatic, mental, or endocrine diseases; or a history or current state of drug abuse Overindulgence in alcohol Prospective participants whose initial test results (serum creatinine > 1.6 mg/dL, BUN > 28 mg/dL, and AST > ALT more than 72; 57 IU/L in men and >39 IU/L in women.HbA1C greater than 6%, IU/L in men, and >52 IU/L in women.were likewise taken out of the research(23,24,25,26)

Sample generation

Many community recruitment efforts were used to identify the participants.

The research has the following inclusion criteria ;

1. Ages >18 and <40 at the time of screening
2. consenting to follow recommended lifestyle, nutrition, and exercise regimens during the study
3. between ≤ 23 kg/m² and ≤ 31 kg/m² for body mass index (BMI). while screening
4. consent to recurring follow-up
5. The consent of the female participants to use suitable birth control techniques throughout the active research

Among the exclusion criteria were the following:

- (1) abnormal physical examination, metabolic panel, complete blood count (CBC), or electrocardiogram (EKG); (2)an active eating disorder; (3) severe renal or hepatic illness;
- (4) a history of persistent malabsorption, alcoholism, and seizures diverticula, also known as diverticuliti. (27,28,29,30,41)

Study inventions

Participants were randomly allocated to one of two groups based on their measurements of body weight and body fat percentage: 60 were placed in the control group, which beginning the experiment with a placebo, and 60 were included in the intervention group, which got PVE(13,24). Every group had a minimum of 50 subjects at the conclusion of the experiment. To ensure there is no gender bias, the quantity of men women were balanced as well. The Yunnan Tianbaohua Biological Resources Development Co., Ltd. supplied the

PVE in the form of 400 mg capsules, which were kept in a cool, dry environment. The prescribed dosage of PVE capsules for humans was advised to be followed by the intervention group:

Before each of the three meals each day, take two capsules (400 mg per capsule) for a total of 2,400 mg per day for 35 days in a row. Protein constituted the majority of PVE, accounting for up to 75.4 ± 1.2 grams per 100 grams of extract (g/100g).

Additionally, 14.5 ± 0.6 g of carbohydrates per 100 g were found. Additionally, the fat content was found to be 2.8 ± 0.2 g/100g. Additionally, the product has fewer than 150 phytohemagglutinin, $1,360 \pm 30.2$ U/g of α -amylase inhibitor, and less than 150 hemagglutinating units/g. The control group was given the placebo, which contained maltodextrin (1632 kJ/100g). The intervention group's administration strategy was the same as ours. Placebo is identical to the extract in terms of look, texture, taste, smell, and packaging. In addition to anthropometric measurements and blood pressure and heart rate, blood samples were collected both before and after the intervention.(43,44,45,46)

Drug and binding

Throughout the course of the 12-week intervention, those who participated were instructed to take two capsules orally 30 minutes before each of each of the three primary meals (breakfast, lunch, and dinner) in conjunction with a sip of water (150 mL). It amounted to six capsules per day.(7) The each capsule consisted of 350 mg of microcrystalline cellulose (PLA) for Phase 2 (low administer the dose, WKBE LOW) or the equivalent of 500 mg for Phase 2 (high dose, WKBE HIGH). Researchers, study staff, and study participants were all blind to the assignment of therapy because every capsule had the same look, feel, taste, and smell in addition to the same packaging and labeling.(47,48)

A four-week trial that was double-blind, randomized, and placebo-controlled was carried out. The five-week period involved five visits from the subjects: one baseline visit (week 0) and four clinical appointments (weeks [1, 2, 3, and 4]. Written, informed consent was given by each participant. prior to the trial's start.(49,50)

Baseline

A medical history, physical exam, body weight assessment, and laboratory tests for hematology and clinical chemistry were all part of the initial screening visit. Following approval, participants received instructions on how to take their medications and diets from a licensed dietician in a randomized order. A week from baseline was the date of the next clinical appointment.(31,32,35,36)

Factor affecting alpha amylase

Numerous researches have demonstrated how pH, temperature, incubation duration, and the presence of certain ions affect the amylase inhibitor activity.

According to reports, the ideal pH for the inhibitory effect is 4.5 (49,50), 5.5 (32,51,52), and 5.0 (53), as opposed to 6.9, which is the ideal pH for mammalian amylase (PPA). The various pH optima that were identified were most likely caused by the various incubation temperatures that were employed in the research. Lajolo and Finardi Filho (49) observed that the optimal pH values for pancreatic and salivary α -amylase were 5.5 and 4.5, respectively.

There is a small range around the optimal range where high activity is seen, beyond which activity rapidly declines, as Le Berre-Anton et al. (50) showed. As demonstrated by Klueh et al. (53) the inhibitor must be pre-incubated at a low pH (pH 4) in comparison to the ideal for maximum efficacy.

There have been reports that the inhibitor's activity is impacted by temperature. However, at pH 6.9, the ideal pH for PPA, the impact of temperature is more pronounced than at pH 4.5, the ideal pH for inhibitor activity (56,57).

As stated by Le Berre-Anton and colleagues (55),

There is no action of the α -amylase inhibitor at 0°C, and activity peaks between 22 and 37°C with minimal variation within this range (51). Despite the fact that Marshall & Lauda (54) likewise found minimal activity at 0°C, they demonstrated a ten-fold increase in activity between 22 and 37°C. This disparity was ascribed by Le Berre-Anton et al. (50) to the use of different incubation pH values, with the rise taking place when the enzyme was incubated at pH 6.9, which is its ideal pH.

Boiling the inhibitor for 10 minutes at 100°C totally inactivates it (32,52). According to Collins et al. (53) the inhibitor transgenically expressed in peas was only rendered inactive after five minutes of heating at temperatures above 90°C.

The inhibitor's temperature-inactivation profile needs to be further characterized because heat treatment is necessary during processing for many possible products in which it can be used.

Other activities

Anti inflammation

A body's defense mechanism against different metabolic or pathogenic stimuli is inflammation. In addition to eliminating the resulting necrosed cells and tissues, it is a bodily defense response meant to stop or restrict the spread of a harmful chemical. Even though there are several NSAIDs available, scientists still struggle with the suppression of inflammation. This is due to the fact that NSAIDs not only have analgesic and anti-inflammatory properties, but they also lead to gastrointestinal problems such as dyspepsia, upper gastrointestinal tract hemorrhage, and perforation.

According to Schenone et al. (2006), efforts have been directed towards creating pro-drugs or altering commercially available formulations in an attempt to enhance the adverse effect profile of existing NSAIDs. The creation of selective cyclooxygenase inhibitors is a more recent strategy (COX-2). NSAIDs on the market now suppress COX-1 and COX-2. While inhibition of COX-2 prevents inflammation, inhibition of COX-1 minimizes the synthesis of the cytoprotective prostaglandins PGE₂ and PGI₂, which results in ulceration. Drugs that selectively inhibit COX-2 are consequently superior anti-inflammatory medicines, and total inhibition of COX-1 is not recommended. Making more potent analgesics is another area of increased focus.(58,59)

The synthesis of more potent analgesic agents is another area of greater concern(29). Analgesia is a serious issue that is linked to 90% of diseases, and NSAIDs, which are used to treat pain, have a number of negative side effects. Therefore, it is imperative to develop some natural agents (phytoconstituents) that can treat both acute and chronic pain.(60,62)

Anti diabetes

Regular consumption of dried common beans has been strongly indicated by Venn and Mann (65) to be helpful in the management and prevention of diabetes. Consuming three or more servings of beans each week reduces the risk of diabetes by about 35%, according to clinical studies, as opposed to eating fewer or no beans. Common beans' phenolic compounds, including flavonoids and their glucosides of delphinidin, petunidin, and malvidin(14), as well as their anthocyanins, catechin, myricetin 3-O-arabinoside, epicatechin, vanillic acid, syringic acid, and O-coumaric acid, have been shown to have anti-hyperglycemic properties through a

greater inhibition of α -amylase, α -glucosidase, and dipeptidyl peptidase-IV in vitro (62,71,73,74). Additionally, in vivo research has shown that phenolic chemicals in beans lower blood glucose, glycosylated hemoglobin, and insulin levels in animals (65,75,78).

The anti-hyperglycemic effect of kidney beans in healthy individuals has also been shown by Roman-Ramos et al. Rats showed a 21% decrease in the glucose tolerance curve graph plot when compared to 16% of the usual medication for diabetes (21). The risk of type-2 diabetes is inversely correlated with frequent consumption of common beans, according to epidemiological research conducted on the Chinese population (79). Additionally, Gupta et al. [80,81] and Tang et al. conducted studies on 56 individuals with diabetes based on according to conventional and Ayurvedic wisdom, which has shown that regular intake of black Glycosylated hemoglobin and plasma glucose are decreased after three months of bean consumption. According to the findings, black beans reduce type-2 diabetes because they include anthocyanins, tannins, and total phenolic. Studies of common beans' anti-diabetic effects in vitro and in vivo. (26)

CONCLUSIONS

Because of their low saturated fat percentage and high protein, carbohydrate, dietary fiber, vitamin, mineral, phytochemical, and other micronutrient content, dry common beans are a staple in diets all over the world and serve a purpose for human nutrition. Common beans also contain huge quantities of polyphenols and other metabolites, have antioxidant capabilities that have played an important part in boosting health, and offer protection against a number of diseases, ranging including as cancer, diabetes, cardiovascular disease, and microbial infections. Both of them their high nutrient content and their ability to replace animal-based foods in the diet are primary factors that contribute to these nutritional advantages of beans. Thus, it can be said that the benefits of eating more beans are directly correlated with their positive impacts on health. Furthermore, further clinical research is desperately needed to support the therapeutic value of common beans high in polyphenols. Moreover, Further investigation on the synergistic impact of common beans high in polyphenols with outside biologically active substances on biological functions is advised. The effectiveness of the bioactive substances found in common beans has been shown by this study, which also expands the range of readily available treatments for different illnesses.

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