



**NUTRITIONAL, PHARMACOLOGICAL AND CULINARY ASPECTS OF NAVY BEANS  
(*PHASEOLUS VULGARIS* L.): AN OVERVIEW**

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**ABSTRACT**

Recently, the demand of consumers for vegan protein options in food industry is at hype. Although, people are drifting towards plant-based diet, but at the same time they want to derive the maximum possible nutrients from these sources so that they remain healthy. This review aims to elaborate the botanical, nutritional and therapeutic benefits of *Phaseolus vulgaris* (Navy beans) and compilation of its culinary usage. Navy bean is an annual herbaceous, slow-digesting legume that provides feeling of satiety for a longer time. The high nutritive quotient of these beans enhances its consumption amongst people across the globe. This low-cost, low-calorie, gluten-free bean possess anti-diabetic, anti-obesity, anti-oxidant, anti-cancerous and cardio protective effects. The hindrance in the usage of navy beans in food products is their content of anti-nutrients, which can be reduced by processing methods like drying, soaking and germination. As per our analysis, navy bean has the potential to get incorporated into various foods and enhance its nutritional profile to overcome lifestyle diseases.

**KEYWORDS:** Plant-based diet, Gluten-free, Anti-diabetic, Anti-cancerous, Cardio protective, Lifestyle diseases.

**INTRODUCTION**

Legumes are plants belonging to Leguminosae family having a large group of 20,000 species that have the ability to fight malnutrition.<sup>[1]</sup> Legumes, often connoted as 'poor man's meat' is an important source of plant protein in diets worldwide. They have the potential to conquer food security issues and fulfil Sustainable Development Goals by 2030 to create a complete agri-system.<sup>[2]</sup> India occupies the first place in legume cultivation throughout the world. It is mainly grown in Maharashtra, Gujarat, Andhra Pradesh, Karnataka, Haryana, Madhya Pradesh, Rajasthan and Punjab. The commonly consumed legumes are soyabean, lentils, kidney beans, chickpeas, navy beans, mung beans, etc.<sup>[3]</sup>

Navy bean is a self-pollinated, diploid legume crop having creamy-white, elliptical shaped beans commonly known as Haricot, White, Pearl, Manglore, Michigan, Common beans or Sundal belonging to Fabaceae family. They are native to South America and are primarily grown in Central America (Gautamela and Mexico), African highlands, Europe, Australia. In India, it covers Punjab, Himachal, Jammu and Kashmir, Southern parts and Uttarakhand.<sup>[4]</sup> *Phaseolus vulgaris* plant comprises of leaves, flowers, pods, seeds and root. The leaves of the plant are trifoliate, flowers are axillary in position having white, pink or violet colour and taproot-based

lateral root system in predominant. 4-12 seeds are covered inside the narrow long pods that are 1-2 cm in width.<sup>[5]</sup> Navy beans primarily prefer dry winter season and scarce irrigation methods to flourish well in Lowveld region of Zimbabwe. They are considered as an important cash crop here as 90% of the farmers are involved in its cultivation, processing and canning. Although, the obstacles in the growth were poor soil fertility, less rainfall and pesticide infestations (bean stem maggot) that has lowered its production.<sup>[6]</sup> Navy bean grows best when receives moderate rainfall, sub-tropical to temperate climate below 3000 meters elevation in well drained, sandy or loamy soils having an optimum temperature of 22-30° C and a pH of 5.8-6.5.<sup>[7, 8]</sup>

**Kingdom:** Plantae

**Division:** Tracheophytes

**Class:** Rosids

**Order:** Fabales

**Family:** Fabaceae

**Genus:** *Phaseolus*

**Species:** *P. vulgaris*

**Fig No. 1: Taxonomic classification of Navy beans.**



Fig No. 2: Plant having navy bean pod.



Fig No. 3: Navy bean seeds.

### NUTRITIONAL AND ANTI-NUTRITIONAL PROFILE OF NAVY BEANS

Navy beans are economical, low calorie, low glycaemic index foods power packed with nutrients like protein, fibre, carbohydrates and micronutrients. Its lysine content is a characteristic constituent as plants generally lack this amino acid. Navy bean flour majorly contains 65–75% carbohydrates (6–8% sugar, 21–40% starch, and 14–25% fiber), 19–27% protein (37% albumins and 35% globulins), 1–2% oil, 4–5% ash and traces of minor compounds such as phenols and saponins.<sup>[9]</sup> They are majorly composed of starch (amylose and amylopectin)

and also contain considerable amounts of micronutrients, phytochemicals, anti-oxidants and flavonoids.<sup>[10]</sup>

Navy beans contain various phenolic compounds like tannins, saponins, phytates and flavonoids that have ill-effects on health when consumed. Its efficacy can be reduced by applying external procedures like soaking, germinating or temperature treatment to drain-off the toxic compounds to an acceptable value.<sup>[11]</sup> Navy beans, when not treated properly, impart bitter taste to the food product and decrease the nutrient bioavailability as they contain tannins in the seed coat.<sup>[12]</sup>

**Table No. 1: Nutritional composition of navy bean grain.**

Nutrient	Amount (per 100 g)
Energy	337 kcal
Protein	22.33 g
Fat	1.50 g
Carbohydrate	60.75 g
Calcium	147 mg
Iron	5.49 mg
Phosphorus	407 mg
Potassium	1185 mg
Folate	364 µg

Source: USDA.gov (2012)

### PHARMACOLOGICAL BENEFITS OF NAVY BEANS

#### 1. Anti-obesity

Studies conducted on navy beans have reported instances where its inclusion in the diet reduced obesity related abnormalities.<sup>[13]</sup> Overweight individuals who have a high risk of obesity can prevent it by regular consumption of navy beans.<sup>[14]</sup> Introduction of navy beans to obese mice reduced obesity and obesity related adipose inflammation in them, whilst being on an obesogenic diet.<sup>[15]</sup>

#### 2. Anti-cancerous

The stool sample analysis of colorectal cancer survivors proved that consumption of 35 g/day cooked navy beans powder indicated large amount of phytochemicals and fibre which influenced the intestinal health.<sup>[16]</sup> A study conducted showed, 12 week dietary intervention program of 30 g each, navy bean and rice bran powder improved

protein and lipid profile of colorectal cancer patients.<sup>[17]</sup> Similarly, other studies also reported alterations in lipid profile of cancer patients that were evident from metabolite changes in plasma, urine and stool.<sup>[18]</sup> A consistent consumption of navy beans for 4 weeks prevents the risk of developing colon cancer in humans due to the presence of bio-actives in the former.<sup>[19]</sup> An easier way to increase satiety value and intake of proteins as well as fibre for patients suffering from colorectal cancer is to increase the usage of navy beans in the daily diet.<sup>[20]</sup> Navy beans when taken in a specific amount for 4 weeks on a regular basis were known to reduce the chances of colon cancer and multiplicity in azoxymethane administered rats due to the presence of starch and bio-actives in the beans.<sup>[21]</sup> The starch, fibre, phenols and phytochemicals present in the navy beans acts on the bodily enzymes and scavenge the formation of free radicals to eventually prevent or reduce the

tumour formation process in individuals suffering from prostate, breast and colon cancer.<sup>[13]</sup>

### 3. Cardiovascular diseases

The regular consumption of navy beans by children aged between 8-13 years has visible effects in reducing complications related to cardiovascular diseases.<sup>[22]</sup> The instances of cardiovascular problems could be reduced by consumption of navy beans as they contain starch and fibre which is responsible for managing metabolic syndrome like elevated triglycerides and cholesterol levels. It is also prevented due to the resistant starch constituent of the beans as its fermentation causes increased production of short chain fatty acids which prevent the absorption of intestinal bile acids.<sup>[23]</sup> Navy beans have considerable amounts of nutrients that can positively reduce the risk of coronary heart diseases.<sup>[24]</sup>

### 4. Anti-diabetic

A researcher in his study explained the phenomenon of lowering of blood glucose level by consuming low-glycaemic foods (beans) due to its high fibre and amylose content, which ultimately results in production of short chain fatty acids and increment in insulin sensitivity.<sup>[25]</sup> Beans have the potential to replace carbohydrate-rich diet of diabetics and non-diabetics and also lower down their blood glucose level effectively at the same time.<sup>[26]</sup>

### CULINARY IMPORTANCE OF NAVY BEANS

Beans, in general, are an ingredient that has a potential to act as emulsifier, binder, texture and flavour enhancer. The additional processing conditions of beans like soaking, fermenting, blanching and germinating add to the functional properties of foods in which they are incorporated.<sup>[27]</sup> Navy beans flour possesses great binding and enrichment properties that have a characteristic attribute that adds to the process of food formulations.<sup>[28]</sup> Another commercial application of navy beans is the preparation of edible coatings made out of its starch (amylose) constituent along with the addition of sunflower oil for better quality films.<sup>[29]</sup> Singh *et al.*, (2015) in their study propagated the use of whole navy bean flour in baking a gluten-free cake to enhance the protein and fibre content. The findings of a study revealed low protein navy bean has the potential to replace wheat flour.<sup>[30]</sup> The application of navy beans flour in making cake, crackers,<sup>[31]</sup> muffins<sup>[32]</sup> and pita bread<sup>[33]</sup> is in trend nowadays. It has an excellent potential to be used in gluten-free food formulations to provide complete nutrition to health-conscious people.<sup>[34]</sup> Navy bean extruded puffs had the highest overall sensory acceptability among pinto and black bean puffs which also lowered lipid and raffinose content.<sup>[35]</sup> Canned navy beans are very much accepted by the consumers due to their increased palatability and shelf life.<sup>[36]</sup> Cookies made out of navy bean flour with different flavours (vanilla, cinnamon, almond) were greatly accepted for its overall sensory attributes.<sup>[37]</sup>

On the contrary, a study reported that the addition of navy beans to food products like bread, sponges, biscuits, pasta, etc increased the firmness, stickiness and chewiness which ultimately led to a decrease in its organoleptic attributes.<sup>[38]</sup> Navy bean starch requires physico-chemical modification to be incorporated into food products for better overall acceptability.<sup>[39]</sup>

### CONCLUSION

Navy bean, a wholesome protein-rich (predominantly lysine) ingredient, has an important place in Indian as well as Western diets. Legume is a broader term that encompasses a large number of pulses and beans which provides good quality protein to the humans for their better physiological functioning. Many researchers have discovered its functionality to be utilised in food product development. The pharmacological properties it possesses can be availed by children and adults to reduce or inhibit the disease symptoms. The limitation of navy beans which need to be rectified is possibilities of gas formation, flatulence and bloating in some people due to the presence of anti-nutritional components in the seed coat of the bean. More studies should be planned regarding its incorporation in recipes and whole consumption in salads, sandwiches, tacos, etc. Therefore, future researches should be based on its better quantitative and qualitative value addition to enjoy its maximum benefits.

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