

Meliorative potential of Phyllanthus Emblica Dried fruit powder and Trigonella foenum-graecum Dried seed powder Attrition of Hyperlipidemia

Shanza Mukhtar¹, Aiza Qamar², Najaf Iqbal³, Nighat Naz⁴, Rubab Tufail⁵, Syeda Safoora Tauheed⁶, Sana Shahzad⁷, Anmol Tahir⁸, Rimsha Itifaq⁹ and Ambreen Sana¹⁰

Abstract

Background and objective: Hyperlipidemia is the innovative form of heart disease that is slow in progression but high in destructive levels. Fat accumulation in the wall of arteries and disturbed the blood flow towards the heart that increases the risk of certain coronary heart diseases such as atherosclerosis. The aimed of this study was carried out to explore the anti-hyperlipidemic effects of Indian gooseberry and fenugreek with the comparison of non-statin lipid lowering medications group (Gemfibrozil) and also execute its proximate and mineral analysis. **Materials and method:** Firstly, Amla fruit powder and fenugreek seeds powder was evaluated to proximate and minerals analysis. Randomized-controlled trails were investigated in hyperlipidemic males was divided into 3 groups (Go, G₁ and G₂). Experimental group given the considered amount of mixed raw material (500mg and 1g) respectively for 60 days. Go was control group given non-statin (gemfibrozil) medication. Lipid profile was checked before and after the treatment plan. The data obtained for each parameter will be observed statistically. Results: The most required triglycerides reduction in G₁ and G₂ (182.4±17.8 – 146.9±15.8 and 200.1±25.5 – 141.2±20.4) respectively. LDL reduction was clearly seen in G₂ (171.0±12.2 – 139.0±7.5). Level of cholesterol significant decreases in Go (non-statin) (240.8±32.1 – 193.1±14.6). HDL increases in G₁ and G₂ (31.0±6.2 – 39.8±4.3 and 32.9±8.4 – 44.1±4.4) respectively. **Conclusion:** This was concluded that Phyllanthus Emblica with the combination of Trigonella foenum-graecum managing the elevated levels of serum lipid profile and during the trails, no side effects were reported in the treatment groups G₁ and G₂. On the other hand, control group Go (non-statins) reported side effects such as nausea, loss

¹ Institute of Food Science and Technology, Nanjing Agriculture University, Nanjing – China

² Department of Nutrition and Health Promotion, University of Home economics, Lahore – Pakistan

³⁻⁹ Department of Nutrition and Dietetics, The University of Faisalabad, Faisalabad – Pakistan

⁴ Department of Nutritional Sciences, Government College University Faisalabad, Faisalabad – Pakistan

⁵ Department of Pharmacy, The University of Faisalabad, Faisalabad – Pakistan

⁶⁻⁸ College of Rehabilitation Science, Faisal Institute of Health Sciences, Faisalabad – Pakistan

⁷⁻¹⁰ Institute of food science and nutrition, University of Sargodha, Sargodha – Pakistan

of appetite, vomiting and gastrointestinal disturbance. It can be replacing able with the non-statin medication (gemfibrozil).

Keywords: Hyperlipidemia, heart disease, Fat accumulation, gooseberry, coronary heart diseases, medication, Lipid profile

Introduction

In the United States, hyperlipidemia is the foremost cause of death in older adults, and these peoples increase the twice risk of cardiovascular diseases as compared to the normal peoples suffering from high levels of cholesterol (Karr, 2021). In the survey of Punjab, the prevalence of CVD in the 56 cities was reported 49.2% in males and 50.8% in females (Zubair et al., 2020). In the year of 2020, behind one third of total deaths around the world is increasing the high levels of lipid profile which can be in relate to cardio vascular diseases such as coronary heart disease (CHD) (Shattat, 2019). In Norwegian population, hypocholesteremia patients were reported under the age of 70 years, which can increase the mortality rate of cardiovascular diseases. In the age of 20-39 years it can 12-fold increases the risk of CHD (Mundal et al., 2019). Hyperlipidemia is the abnormality in the lipid profile such as high levels of serum cholesterol, plasma levels of triglycerides and also increases the levels of low-density lipoprotein, or it can also decrease the high-density lipoproteins (El-Tantawy & Temraz, 2022). Hyperlipidemia is associated with lipid disorders which can increased the risk of certain heart diseases such as atherosclerosis (Feng et al., 2021). High-density lipoprotein which can be used for treated the atherogenic conditions and considering the good cholesterol for managing the internal organs such as brain (Millar et al., 2020).

In the treatment of hyperlipidemia, statins medications are far better than non-statin medications such as atorvastatin and simvastatin, but the peoples cannot tolerate statins groups and suffering hyperlipidemic disease then it can introduce the non-statin group such as fibrates (Adhyaru & Jacobson, 2022). Fibrates (gemfibrozil) can be used to treat hyperlipidemic patients which cannot tolerate the statins groups or it can decrease the elevated values of the low-density lipoproteins, fibrates separate or with the combinations of the statins play an important role for the treatment of the elevated levels of the lipid (Okopień, Buldak, & Böldys, 2023). Around the eras in many countries, medicinal plants contain several therapeutic

benefits which can treat many chronic ailments such as diabetes, atherosclerosis, hyperlipidemia and obesity. With the nutritional counselling and physical activities, because of its bioactive compounds *Phyllanthus Emblica* (Amla) powder can treat the hyperlipidemia and hypocholesteremia, with considering no side effects are mentioned (Jeevangi, Manjunath, & Sakhare, 2020). On the other hands, expect herbs and fruits there is many medicinal seeds which can used to treat many chronic and metabolic diseases such as diabetes, obesity and hypocholesteremia. Because of its bioactive anti-oxidants. *Trigonella foenum-graecum* (Fenugreek seeds) powder can treat hyperlipidemia and obesity (Yousefi et al., 2019).

All parts of (Amla) plant can be used for various purposes, but, the fruit of Amla are yellowish-green in color and globular shape, thicken and smooth. The fruit can also use for making delicious pickles, sweet debility, chutneys and vegetables (Baliga & Dsouza, 2020).

Amongst of all spices, fenugreek seeds can be used in the daily cooking meal services for the better taste, smell and texture of the food. This seed can be categorized by modified texture of food and also for the anti-bacterial, anti-inflammatory and against anorexia condition (Srinivasan, 2021).

Combination of both of these, Amla and Fenugreek seeds can be used for the treatment of the hypolipidemic, hyperlipidemic ad hypocholesteremia. Both of these are rich in anti-oxidant, anti-inflammatory and anti-obesity effect can treat the chronic and metabolic diseases up to 67-78%. Anti-oxidant activity has potential effect in the treatment trails (Joseph et al., 2021).

The aim of this study was to explore the anti-hyperlipidemic effects of Indian gooseberry (*Phyllanthus Emblica*) and fenugreek (*Trigonella foenum-graecum*), comparing their efficacy with the non-statin lipid-lowering medication gemfibrozil, while also conducting proximate and mineral analyses of the herbal treatments.

Materials and Method

❖ Collection of raw material

Amla (*Phyllanthus Emblica*) and Fenugreek (*Trigonella foenum*) was collected from local market, Faisalabad.

❖ Preparation of raw material

Amla (Phyllanthus Emblica) fruit and Fenugreek (Trigonella foenum) seed were washed to remove the dirt, dust and foreign material adhered to the surface. After washing, fruit of Amla and fenugreek seed were air-dried under shed at room temperature and finely powdered with the help of grinder and stored in plastic jar at room temperature (Pareek & Kaushik, 2022).

❖ Proximate analysis

Dried Phyllanthus Emblica fruit powder and Trigonella foenum-graecum seed powder were analyzed according to their standard procedures of American Associations of official Analytical Chemists (AOAC, 2000). Performed chemical analysis in Agri-Cultural University of Faisalabad, under Post Graduate Lab in the Department of Animal and Poultry Sciences.

❖ Moisture content

The moisture content was estimated according to the AOAC Method No. (AOAC, 2000). The samples were weighed and placed in Air Forced Draft Oven at a set temperature of $105 \pm 5^{\circ}\text{C}$ till the weight of the sample became constant.

$$\text{Moisture Content (\%)} = \frac{\text{Weight of sample(g)} - \text{Weight of dried sample(g)}}{\text{weight of sample}} \times 100$$

❖ Total Ash

The total Ash content were estimated by the method of direct incineration of sample taken in crucible according to AOAC, (2000). The sample and crucible were weighed and were heated on the oxidizing flame till it gave no fumes and then ignited in muffle furnace at temperature $500-550^{\circ}\text{C}$ till the sample changes in grayish white residue.

$$\text{Ash Content (\%)} = \frac{\text{Weight of Ash}}{\text{WEIGHT OF sample}} \times 100$$

❖ Crude fiber

Crude fiber of fat-free sample analyzed by taking weighed sample in 500ml beaker and the volume was increased by using distilled water to 200ml. The sample mixture was then heated after addition of 25ml H_2SO_4 for 30 minutes. Then the solution was filtered and the residue was collected and washed with distilled water. The washed residue was transferred to another beaker and the volume was again raised

to 200ml solution and heated for 30 minutes. The resulting solution was filtered and then washed with distilled water. The collected washed residue was transferred to previous weighed crucible and kept for drying in hot air oven till the weight become constant. Then dried residue was weighed and noted (W_1). The dries content was later ignited in fume hood. After ignition the crucible was safely placed in the muffle furnace till the residue turns to whist grey color at 550-600°C. The crucible was shifted to desiccator to cool down. Lastly, the Ash was considered as the loss in weight during the process of ignition as mentioned in the guidelines of (AOAC, 2000).

$$\text{Crude fiber (\%)} = \frac{\text{weight loss on ignition(g)}}{\text{weight of sample(g)}} \times 100$$

❖ Crude Protein

The crude Protein percentage value was calculated by application of Kjeltech Apparatus following the guidelines of AOAC (2000). Firstly, the sample under goes wet digestion by using 25ml conc. H_2SO_4 Digestion mixture (K_2SO_4 : $FeSO_4$: $CuSO_4$ 90:3:7) for about 4 to 6 hours till the color of the solution turned light greenish and transparent. Further, the digestion mixture was diluted by distilled water to make the total volume 250ml. The procedure was followed to distillation process by extracting 10ml from dilution and 10ml of NaOH (10%) solution in the conical flask and add it to distillation assembly. The ammonia produced was collected in flask containing boric acid (2%) solution containing the methyl red indicator. Lastly, the collected distillate was titrated till the end point golden brown with 0.1 N H_2SO_4 . Then the calculated percentage of crude protein was multiplied with the nitrogen factor.

$$\text{Crude protein (\%)} = \frac{\text{Volume of 0.1 Normal } H_2SO_4(\text{ml}) \times \text{Volume of Sample(ml)} \times 0.0014}{\text{Weight Of Sample(ml)} \times \text{Volume of Sample(ml)}}$$

❖ Crude fat

The crude fat determined by taking 5g of each sample in the Soxhlet Apparatus by using n-hexane as solvent was analyzed through (AOAC, 2000).

$$\text{Crude fat (\%)} = \frac{\text{weight of sample(g)} - \text{weight of fat free sample(g)}}{\text{weight of sample(g)}} \times 100$$

❖ Nitrogen free extract (NFE)

The NFE of the samples was calculated according to the following expression:

NFE = 100 - (% moisture + % crude protein + % crude fat + % crude fiber + % ash)

❖ Mineral determination

Mineral profile of Amla fruit and fenugreek seed powder was determined by using flame photometer according to the AOAC method (AOAC, 2000). Wet digestion of sample of each variety was done in di-acid mixture of HNO₃:HClO₄ at hot plate for 2 hours. Na and K were determined by Flame photometer.

$$\text{Standard} = \frac{10}{\text{standard}} \times \text{sample reading} = A$$

$$0.5 = \frac{A}{0.5} \times 100 = B$$

$$\frac{B}{100} = \text{Ans (G)}$$

❖ Experimental Setting

The bio evaluation was conducted to investigate the positive effect of gooseberry fruit powder and fenugreek seed powder on the hyperlipidemic patients. This selection of the patients was carried out their family history, biochemical history, medications and eating habits. The human trials were conducted in 3 groups; each group contain 10 members. One group was given regular non-statin cholesterol control medication (lipid 600mg), second group was given 500mg of raw material in mid-morning as similar third group was given 1g of raw material for a period of 6 weeks and their lipid profile was checked after 6 weeks. Before initiation and after the termination of trails, fasting blood samples was collected to note down the readings.

❖ Preparation of capsule

T ₁	250mg of each amla and fenugreek (mixed) in 500mg of capsule.
T ₂	500mg of each amla and fenugreek (mixed) in 1gram of capsule.

❖ Statistical analysis

Data acquired for each parameter was analyzed using statistical models by Steel et al. (2022) to determine the level of significance.

Information: Statistical analysis: IBW SPSS VERSION 26

❖ Type of statistical model

- General linear model (univariate analysis) 2-way ANOVA

- Descriptive analysis

Results and Discussion

Interpretations according to their results are divided into two major categories i.e., constitutional analysis of *Phyllanthus Emblica* and *Trigonella foenum-graecum* and their efficacy studies.

▪ Constitutional analysis

Indian gooseberry fruit powder was analyzed for varied quality attributes, such as moisture, ash, fiber, proteins, fat, nitrogen free extract, sodium and potassium. These six quality attributes make up complete components of proximate analysis (Figure 1). According to analysis, Amla dried fruit powder contain 0.02 % of fat. The fiber content of Amla contain 15.9 ± 0.12 , whereas, moisture content, ash content, crude protein and nitrogen free extract are considered to be 6.6 ± 0.001 , 4.5 ± 0.02 , 2.1 ± 0.01 and 70.7 ± 0.1 as shown in figure 1, correspondingly (Goraya & Bajwa, 2020). Amla also contain sodium and potassium was calculated to be 1.5 ± 0.01 and 1.2 ± 0.01 , respectively (Pareek, Paliwal, & Mukherjee, 2021).

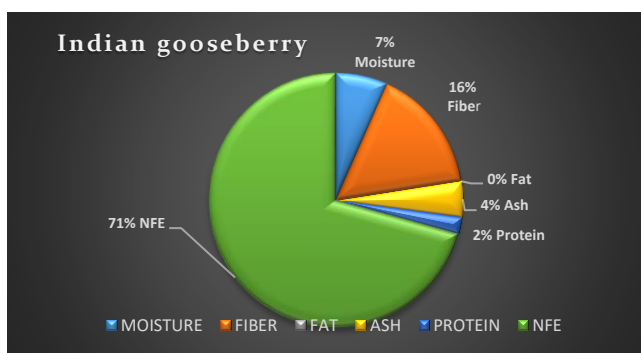


Figure 1 proximate analysis of Indian gooseberry fruit powder

On the other hand, Fenugreek seeds powder was analyzed for varied quality attributes, such as moisture, ash, fiber, proteins, fat and nitrogen free extract. These six quality attributes make up complete components of proximate analysis (Figure 2). According to analysis, Fenugreek seeds powder contain $6.8 \pm 0.2\%$ of fat. The fiber content of fenugreek seeds contains 8.8 ± 0.2 , whereas, moisture content, ash content, crude protein and nitrogen free extract are considered to be 7.2 ± 0.01 , 5.5 ± 0.01 , 26.8 ± 0.01 and 44.7 ± 0.2 , correspondingly (Al-Jasass & Al-Jasser, 2019). Fenugreek seeds also contain sodium and potassium was calculated to be 0.04 ± 0.01 and 1.3 ± 0.01 , respectively (Zuk-Golaszewska & Wierzbowska, 2019).

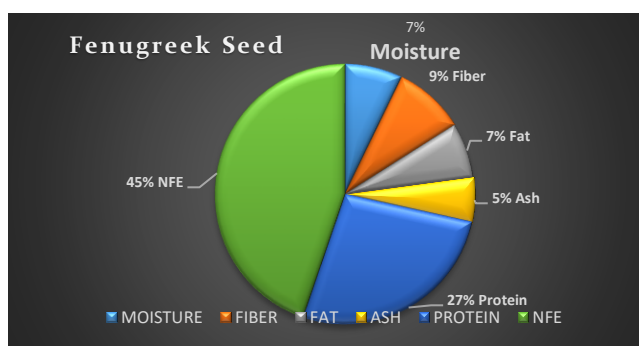


Figure 2 proximate analysis of fenugreek seed powder

Table 1: Effect of *Phyllanthus Emblica* and *Trigonella foenum-graecum* treatment and days on serum lipid profile

Serum lipid profile (mg DL ⁻¹)				
Groups	CHOL	HDL	LDL	TG
Baseline phase				
G ₀ = non-statin (600mg)	240.8±32.1	28.3±5.1	185.1±14.7	193.3±12.6
G ₁ = mixed herbs (500mg)	229.6±22.5	31.0±6.2	173.8±17.9	182.4±17.8
G ₂ = mixed herbs (1g)	239.0±20.6	32.9±8.4	171.0±12.2	200.1±25.5
Chronic phase				
G ₀ = non-statin (600mg)	193.1±14.6	35.9±5.1	152.3±23.9	153.3±16.5
G ₁ = mixed herbs (500mg)	184.4±19.6	39.8±39.8	141.5±20.8	146.9±15.8
G ₂ = mixed herbs (1g)	181.4±16.2	44.1±4.4	139.6±7.9	141.2±20.4

▪ Efficacy study

This study aimed to evaluate the nutraceutical value of Indian gooseberry fruit powder and fenugreek seeds powder against hyperlipidemia in human subjects. Participants were divided into three groups: Control group (G₀, 600mg/day), Experimental group (G₁, 500mg/day), and Hyperlipidemic treatment group (G₂, 1g/day).

The subjects were given the Indian gooseberry fruit powder and fenugreek seeds powder along with dietary instructions for 60 days. Complications and symptoms were noted with a one-day gap. Blood samples were collected before and after the trial to analyze lipid profiles (HDL, LDL, cholesterol, and triglycerides). The study aimed to provide a comprehensive understanding of the potential benefits of these natural remedies.

Means for LDL contents indicate significant changes in the Go as compared to the G₁ and G₂ as shown in Figure 3. In the Go group the LDL decrease from 185.1 ± 14.5 to 152.3 ± 23.9 whereas in the G₁ and G₂ group the value of LDL decreases from 173.8 ± 17.9 to 141.5 ± 20.8 and 171.0 ± 12.2 to 139.6 ± 7.5 respectively as shown in (Table 1).

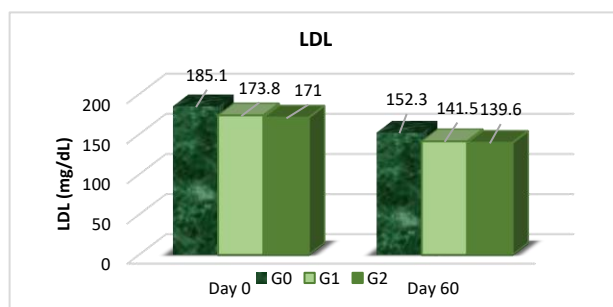


Figure 3 treated trail of Low-density Lipoprotein

The two-way analysis of variance conducted to check the impact of Indian gooseberry fruit powder and Fenugreek seed powder on hyperlipidemia compared to lipid lowering drug (gemfibrozil). During the study period of 60 days the effect of drug (Go) was statistically significant within group Go. LDL was observed to decrease from 185.1 ± 14.7 to 152.3 ± 23.9 in the duration of day 0 and day 60 respectively. The effect of raw material dose with 500mg was statistically significant within group G₁ from 173.8 ± 17.9 to 141.5 ± 20.8 in the duration of day 0 and day 60 correspondingly. The effect of raw material dose with 1gram was statistically significant within group G₂ from 171.0 ± 12.2 to 139.6 ± 7.5 in the duration of day 0 and day 60 respectively.

A significant decrease is also seen in the triglycerides of the experimental group G₁ and G₂ shows the reduction in the triglycerides level from 182.4 ± 17.8 to 146.9 ± 15.8 and 200.1 ± 25.5 to 141.2 ± 20.4 respectively, with the comparison of Go (non-statins) also decreases the level of triglycerides from 193.3 ± 12.6 to 153.3 ± 16.5 .

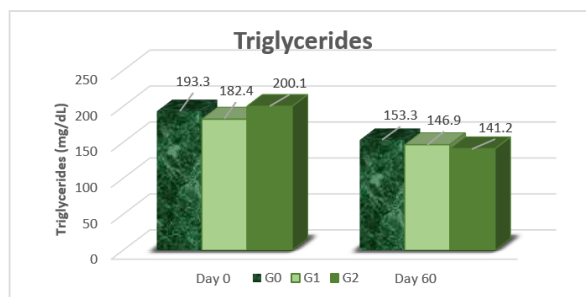


Figure 4: treated trails of Triglycerides

A significant decrease is also seen in the cholesterol of the experimental group G1 and G2 shows the reduction in the cholesterol level from 229.6 ± 22.5 to 184.4 ± 19.6 and 239.0 ± 20.6 to 181.4 ± 16.2 respectively. On the other hand, G0 (non-statins) also shows a decrease in the cholesterol level from 240.8 ± 32.1 to 193.1 ± 14.6 .

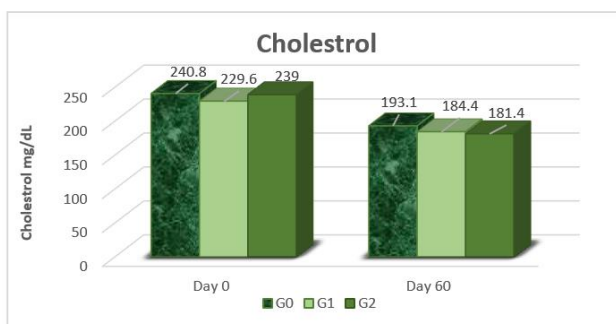


Figure 5: Treated trails for cholesterol

The two-way analysis of variance was assessed on the impact of Indian gooseberry fruit powder and Fenugreek seed powder on hyperlipidemia against the comparison of lipid lowering drug (gemfibrozil). During the study period of 60 days the effect of drug (Go) was statistically significant within group Go. Cholesterol was observed to decrease from 240.8 ± 32.1 to 193.1 ± 14.6 in the duration of day 0 and day 60 respectively. The effect of raw material dose with 500mg was statistically significant within group G1 from 229.6 ± 22.5 to 184.8 ± 19.6 in the duration of day 0 and day 60 correspondingly. The effect of raw material dose with 1gram was statistically significant within group G2 from 239.0 ± 20.6 to 181.4 ± 16.2 in the duration of day 0 and day 60 respectively.

As compared to the Go (non-statins) group, HDL is also increased in the experimental group G1 and G2. The value of HDL increases from 31.0 ± 6.2 to

39.8±4.3 and 32.9±8.4 to 44.1±4.4 respectively. Hence it is clear from the results that Indian gooseberry fruit powder and Fenugreek seed powder shows a significant impact on the Lipid profile such as LDL, HDL, cholesterol and triglycerides (Table 1).

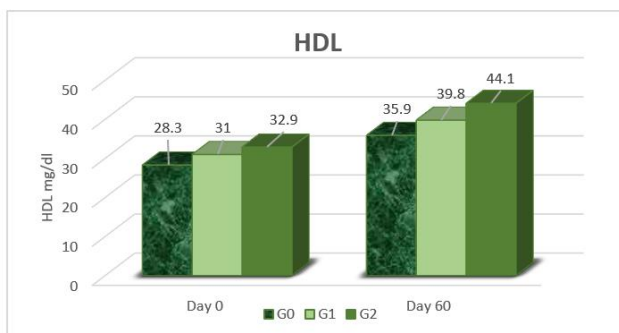


Figure 6: treated trails of high density lipoprotein

A clear difference before and after Indian gooseberry and Fenugreek seed dose observed. Patients, which were given 500mg and 1g Indian gooseberry and Fenugreek seed reduced lipid profile such as LDL, Cholesterol and triglycerides, it can also increase the level of HDL. The Indian gooseberry and Fenugreek seeds could be a possible natural health product for the prevention and treatment of Lipid profile. It is important to increase awareness of the public, dieticians, and other health professionals as to the unique properties of Indian gooseberry fruit powder and Fenugreek seed powder and to recommend it for the prevention of hyperlipidemia. It is, however, important that the biological effects of Indian gooseberry fruit powder and Fenugreek seed powder are firmly established through well-controlled clinical trials.

Discussion

In Pakistan, this study aimed to investigate the potential therapeutic effects of Indian gooseberry fruit powder and fenugreek seed powder in reducing hyperlipidemia among human participants. The current research confirmed the characterization of proximate findings for both Indian gooseberry fruit powder and fenugreek seed powder as documented in the literature, with considering minor differences in the values. Several factors that may account for these variations

examined, including environmental conditions and the specific locations from which the Indian gooseberry fruit and fenugreek seeds were sourced. Furthermore, alterations in genetic compositions were also considered as a potential environmental factor contributing to the slight differences in the results.

In present research, the characterization of proximate findings of Indian gooseberry fruit powder and fenugreek seeds powder were confirmed in the literature with considering minor differences in the values. Some possible motives beyond the variations in findings was examine such as environmental factor and locations where collected the Indian gooseberry fruit and fenugreek seeds. Additionally, the modifications in genetic compositions could also considered as an environmental factor for minor changes in the readings.

Around the world, many researchers pinned down some suggestions about the nutritional composition of Indian gooseberry fruit powder and fenugreek seeds powder. However, our findings of Indian gooseberry fruit powder moisture, fat determination, crude protein, ash, crude fiber and nitrogen free extract 6.6 ± 0.01 , 0.02 ± 0.00 , 2.1 ± 0.01 , 4.5 ± 0.02 , 15.9 ± 0.12 and 70.7 ± 0.1 respectively (Goraya & Bajwa, 2022).

Moreover, our findings of fenugreek seeds powder moisture, crude protein, fat determinations, crude fiber, ash and nitrogen free extract are 7.2 ± 0.01 , 26.8 ± 0.01 , 6.8 ± 0.2 , 8.8 ± 0.2 , 5.5 ± 0.01 and 44.7 ± 0.2 respectively (Al-Jasass & Al-Jasser, 2020). Many researchers around the world also mentions some minerals content in the fenugreek seeds powder such as sodium and potassium are 0.04 ± 0.01 and 1.3 ± 0.01 respectively (Zuk-Golaszewska & Wierzbowska, 2017). On the other hand, Indian gooseberry fruit powder also findings the minerals compositions such as sodium and potassium are 1.5 ± 0.01 and 1.2 ± 0.01 respectively (Pareek et al., 2021).

Indian gooseberry is recognized for its applications in herbal and Ayurvedic medicine, renowned for its numerous therapeutic properties, including anti-inflammatory, anti-diabetic, anti-cancer, anti-oxidant, anti-bacterial, anti-microbial, anti-carcinogenic, and anti-aging effects. This fruit is significant in managing various chronic conditions such as hyperlipidemia, diabetes, obesity, cancer, and both fungal and bacterial infections, as well as addressing a wide range of age-related issues. Numerous researchers have identified Indian gooseberry as a viable treatment option for hyperlipidemia. Several studies conducted on both animal and human subjects have highlighted its potential in treating

hyperlipidemia, with reports indicating the absence of adverse side effects. (Gopa, Bhatt, & Hemavathi, 2022).

Fenugreek seeds are utilized in herbal and Ayurvedic medicine due to their therapeutic and pharmacological properties, which include anti-diabetic, anti-obesity, anti-inflammatory, anti-oxidant, anti-carcinogenic, and anti-aging effects. These seeds play a crucial role in managing chronic and metabolic conditions such as obesity, diabetes, high cholesterol, cancer, and cardiovascular diseases. Numerous researchers have examined the efficacy of fenugreek seeds in treating hyperlipidemia. Studies conducted on both animal and human subjects have highlighted the potential of fenugreek seeds in addressing hyperlipidemia, with reports indicating minimal to no side effects. (Hasani-Ranjbar et al., 2020).

Indian gooseberry fruit is recognized for its medicinal properties and can serve as a valuable therapeutic agent in addressing conditions such as hyperlipidemia, obesity, cancer, and lower gastrointestinal disorders. Its beneficial effects include anti-hyperlipidemic, anti-obesity, anti-cancer, and laxative properties. In a study involving 56 participants diagnosed with hyperlipidemia, an experimental dosage of 1 gram of Indian gooseberry fruit powder was administered in conjunction with fenugreek seeds. After an 18-week period, the results demonstrated significant improvements, with no reported side effects. The use of Indian gooseberry was effective in lowering elevated levels of cholesterol, serum triglycerides, and LDL, with no indications of toxicity or adverse effects observed during the trial. (Kapoor, Suzuki, Derek, Ozeki, & Okubo, 2020).

This research aimed to explore the potential impact of fenugreek seed powder on hyperlipidemic conditions. Hyperlipidemia is characterized by an elevated lipid profile, which can lead to increased levels of low-density lipoproteins, heightened serum cholesterol, and elevated plasma triglyceride levels. The study involved ten albino rats that were administered a high-fat diet supplement at a dosage of 0.5 mg/kg of body weight, along with 500 mg of fenugreek seed powder and specific dietary guidelines, including a low-fat diet. A second group of rats also received the high-fat diet prior to the treatment regimen, with the same dosage of 0.5 mg/kg of the fat diet supplement, but were given 1 g of fenugreek seed powder, accompanied by similar dietary modifications as the first group. Following a treatment period of 5 to 7 weeks, blood samples were collected after fasting and analyzed for significant outcomes in managing elevated lipid levels, including reductions in serum

cholesterol, triglycerides, and low-density lipoprotein values, with no reported side effects. (Sharma & Choudhary, 2020).

Fenugreek seeds powder can be used for the treatment of the hyperlipidemic disease such as high levels of the triglycerides, cholesterol and LDL. In this study, 10 female Wister rats given the high fat diet 0.5mg/kg/ body weight. On the other hand, other 10 female Wister rats also given the high fat diet 0.5mg/kg/body weight, both of these placed in the same conditions along with the same and equal diet and environment. In the treatment trails, first group were given the 500mg-1g fenugreek seeds powder along with some dietary restrictions and modifications, on the other hand, second group were given the statin group medicine such as atorvastatin 20mg and also mentioned restricted and modified dietary history. After 12 weeks, the significant result was shown in the first group with also considering no side effects were reported in the treatment trails. On the other hand, second group was also shown significant results but it can have reported some side effects such as vomiting, nausea, abdominal pain and diarrhea. This study was considering the side effects were reported against the experimental dosage of the atorvastatin and no side effects was mention in the treatment trails of the fenugreek seeds powder (Kumar, Bhandari, & Jamadagni, 2021).

Coronary heart disease significantly heightens the risk of sudden cardiac arrest and is increasingly prevalent in Western nations. This study aimed to explore the efficacy of both statin and non-statin medications, specifically simvastatin and gemfibrozil. The treatment trial involved four groups, each comprising 40 participants diagnosed with hyperlipidemia. The first group received simvastatin at a dosage of 10 mg, the second group at 20 mg, the third group at 40 mg, and the fourth group was administered gemfibrozil at 600 mg for a duration of 4 to 5 weeks. Throughout the treatment period, daily assessments were conducted to monitor specific side effects, alongside dietary modifications. At the conclusion of the 5-week treatment, simvastatin demonstrated a more effective reduction in elevated triglycerides, LDL, and cholesterol levels compared to gemfibrozil, which was effective in lowering cholesterol levels by approximately 15% and increasing HDL levels by 12-20%. In contrast, simvastatin was able to reduce LDL cholesterol levels by 30-40%. While both medications contributed to the improvement of lipid profiles, participants reported several major side effects, including nausea, vomiting, constipation, dizziness, heartburn, loss of appetite, fatigue, and lethargy. (Tikkanen et al., 2019).

The study was conducted to investigate the potential effect of Amla by decreases the low-density lipoproteins, it can increase the risk of the further heart diseases such as IHD. This study was nearly similar to 179.50 ± 50.61 by using the lemon grass powder with the comparison of statins (Atorvastatin). This study was declaring that lemon grass can decreasing the values of low-density lipoprotein as similar with statins. It can also decrease the other parameters of the lipid profile such as serum levels of cholesterol and plasma levels of triglycerides. (Waheed, Itrat, Anwaar, & Javed, 2020).

The comparison study was conducted to evaluated the therapeutic benefits of medicinal herb amla with the comparison of statins (simvastatin). This study was declaring that amla decreases the similar values of low-density lipoproteins (189.10 ± 41.08) with the compared of statins (192.90 ± 36.55). On the other hand, the comparative study amla and non-statins (gemfibrozil) was shown the similar results by using the amla (Kapoor et al., 2020).

No adverse effects were reports in the treatment group G₁ and G₂. On the other hand, the control group G₀ given the lipid lowering drug were give the gastrointestinal disturbance were reported. No hepatic and renal side effects reported in treatment groups G₁ and G₂. All treatments groups have positive effects on lowering the elevated levels of the lipid profile with no side effects except G₀ that were given lipid lowering drug with experimental dosage.

Conclusion

The prevalence of hyperlipidemia has been raising possibly due to lifestyle alterations that encourage inactive lifestyle, lack of physical activities and increasing rate of aging spectrum. Herbal and nutraceutical medicine has increased much applicable in the modern past as an alternative therapy.

Our study investigated the effects of a combination of Indian gooseberry fruit powder and fenugreek seeds powder on patients with elevated lipid profiles. Over 60 days, doses of 500 mg/day and 1 g/day of Indian gooseberry, combined with fenugreek, significantly reduced LDL cholesterol, total cholesterol, and plasma triglycerides, while increasing HDL levels. No significant adverse effects were observed compared to the control group, which experienced side effects from lipid-lowering medication.

Thus, the combination of Indian gooseberry and fenugreek shows promise in managing hyperlipidemia. Further validation through controlled clinical trials is necessary to confirm these findings.

Significance Statement: This study was conducted to investigate the therapeutic effects of Phyllanthus Emblica fruit powder mixed in Trigonella foenum-graecum seeds powder against the serum lipid profile in human trials. During the trials, this study was not reported any side effects in the treatment groups except control group. This study provides the data for further researchers on better treatment and healthy lifestyles.

References

- Adhyaru, B. B., & Jacobson, T. A. (2021). Role of Non-Statins, LDL-C Thresholds, and Special Population Considerations: A Look at the Updated 2016 ACC Consensus Committee Recommendations. *Current Atherosclerosis Reports*, 19(6), 29. doi: 10.1007/s11883-017-0666-x
- Al-Jasass, F. M., & Al-Jasser, M. S. (2020). Chemical composition and fatty acid content of some spices and herbs under Saudi Arabia conditions. *Scientific World Journal*, 2012, 859892. doi: 10.1100/2012/859892
- Baliga, M. S., & Dsouza, J. J. (2019). Amla (*Embolica officinalis* Gaertn), a wonder berry in the treatment and prevention of cancer. *European Journal of Cancer Prevention*, 20(3), 225-239. doi: 10.1097/CEJ.0bo13e32834473f4
- El-Tantawy, W. H., & Temraz, A. (2019). Natural products for controlling hyperlipidemia. *Archives of physiology and biochemistry*, 125(2), 128-135.
- Feng, K., Zhu, X., Chen, T., Peng, B., Lu, M., Zheng, H., . . . Cao, Y. (2019). Prevention of obesity and hyperlipidemia by heptamethoxyflavone in high-fat diet-induced rats. *Journal of agricultural and food chemistry*, 67(9), 2476-2489.
- Gopa, B., Bhatt, J., & Hemavathi, K. G. (2022). A comparative clinical study of hypolipidemic efficacy of Amla (*Embolica officinalis*) with 3-hydroxy-3-methylglutaryl-coenzyme-A reductase inhibitor simvastatin. *Indian journal of pharmacology*, 44(2), 238-242. doi: 10.4103/0253-7613.93857
- Goraya, R. K., & Bajwa, U. (2021). Enhancing the functional properties and nutritional quality of ice cream with processed amla (Indian gooseberry). *Journal of food science and technology*, 52(12), 7861-7871. doi: 10.1007/s13197-015-1877-1
- Hasani-Ranjbar, S., Nayebi, N., Moradi, L., Mehri, A., Larijani, B., & Abdollahi, M. (2020). The efficacy and safety of herbal medicines used in the treatment of hyperlipidemia; a systematic review. *Current pharmaceutical design*, 16(26), 2935-2947.
- Jeevangi, S., Manjunath, S., & Sakhare, P. M. (2022). A study of anti-hyperlipidemia, hypolipidemic and anti-atherogenic activity of fruit of *Embolica officinalis* (amla) in high fat fed albino rats. *International Journal of Medical Research & Health Sciences*, 2(1), 70-77.
- Joseph, S., Santhosh, D., Udupa, A., Gupta, S., Ojeh, N., Rathnakar, U., . . . Rao, S. P. (2023). Hypolipidemic Activity of *Phyllanthus Emblica* Linn (Amla) & *Trigonella Foenum Graecum* (Fenugreek) Combination in Hypercholesterolemic Subjects—A Prospective, Randomized, Parallel, Open-Label, Positive Controlled Study. *Asian Journal of Biochemical and Pharmaceutical Research*, 2(1), 225-230.
- Kapoor, M. P., Suzuki, K., Derek, T., Ozeki, M., & Okubo, T. (2020). Clinical evaluation of *Embolica Officinalis* Gaertn (Amla) in healthy human subjects: Health benefits and safety results from a randomized, double-blind, crossover placebo-controlled study. *Contemporary Clinical Trials Communications*, 17, 100499. doi: https://doi.org/10.1016/j.conctc.2019.100499
- Karr, S. (2019). Epidemiology and management of hyperlipidemia. *The American journal of managed care*, 23(9 Suppl), S139-S148.
- Kumar, P., Bhandari, U., & Jamadagni, S. (2020). Fenugreek Seed Extract Inhibit Fat Accumulation and Ameliorates Dyslipidemia in High Fat Diet-Induced Obese Rats. *BioMed Research International*, 2014, 606021. doi: 10.1155/2014/606021
- Millar, C. L., Norris, G. H., Jiang, C., Kry, J., Vitols, A., Garcia, C., . . . Blesso, C. N. (2021). Long-Term Supplementation of Black Elderberries Promotes Hyperlipidemia, but Reduces Liver Inflammation and Improves HDL Function and Atherosclerotic Plaque Stability in Apolipoprotein E-Knockout Mice. *Molecular nutrition & food research*, 62(23), 1800404.
- Mundal, L., Igland, J., Ose, L., Holven, K. B., Veierød, M. B., Leren, T. P., & Retterstøl, K. (2021). Cardiovascular disease mortality in patients with genetically verified familial hypercholesterolemia in Norway during 1992–2013. *European journal of preventive cardiology*, 24(2), 137-144.

AOAC. (2000). Official Methods of Analysis.15_Edition. Association of Official Analytical Chemists, Arlington, VA, USA.

Okopień, B., Buldak, L., & Boldys, A. (2022). Fibrates in the management of atherogenic dyslipidemia. Expert Review of Cardiovascular Therapy, 15(12), 913-921. doi: 10.1080/14779072.2017.1408410

Pareek, S., & Kaushik, R. A. (2022). Effect of drying methods on quality of Indian gooseberry (Embolica officinalis Gaertn.) powder during storage. Journal of scientific and industrial research, 71, 727-732.

Pareek, S., Paliwal, R., & Mukherjee, S. (2020). Effect of juice extraction methods, potassium metabisulphite concentration and storage temperature on the extent of degradation and reactivity of chemical constituents in mandarin (Citrus reticulata Blanco) juice. Journal of Food Agriculture and Environment, 13(2), 39-44.

Sharma, M., & Choudhary, p. r. (2021). Hypolipidemic Effect of Fenugreek Seeds and its Comparison with Atorvastatin on Experimentally Induced Hyperlipidemia. J Coll Physicians Surg Pak, 24, 539-542.

Srinivasan, K. (2019). Fenugreek (Trigonella foenum-graecum): A review of health beneficial physiological effects. Food reviews international, 22(2), 203-224.

Steel, R. G. D., & Torrie, J. H. (1960). Principles and procedures of statistics.

Tikkanen, M. J., Laakso, M., Ilmonen, M., Helve, E., Kaarsalo, E., Kilkki, E., & Saltevo, J. (2019). Treatment of hypercholesterolemia and combined hyperlipidemia with simvastatin and gemfibrozil in patients with NIDDM. A multicenter comparison studies. Diabetes Care, 21(4), 477-481. doi: 10.2337/diacare.21.4.477

Waheed, S., Itrat, N., Anwaar, L., & Javed, T. (2022). Ameliorative potential of Cymbopogon citratus dried leaf powder in attenuation of hyperlipidemia. Asian Journal of Emerging Research, 1(1), 12-18.

Yousefi, E., Zareiy, S., Zavoshy, R., Noroozi, M., Jahanihashemi, H., & Ardalani, H. (2020). Fenugreek: A therapeutic complement for patients with borderline hyperlipidemia: A randomised, double-blind, placebo-controlled, clinical trial. Advances in Integrative Medicine, 4(1), 31-35. doi: https://doi.org/10.1016/j.aimed.2016.12.002

Zubair, F., Nawaz, S., Nawaz, A., Nangyal, H., Amjad, N., & Khan, M. (2021). Prevalence of cardiovascular diseases in Punjab, Pakistan: a cross-sectional study. Journal of Public Health, 26. doi: 10.1007/s10389-018-0898-4

Zuk-Golaszewska, K., & Wierzbowska, J. (2022). Fenugreek: Productivity, nutritional value and uses. Journal of Elementology, 22. doi: 10.5601/jelem.2017.22.1.1396

Article Information:

Received	1-Sept-2024
Revised	28-Nov-2024
Accepted	5-Dec-2024
Published	15-Dec-2024

Declarations:

Authors' Contribution:

- ¹⁻²⁻³⁻⁴Conceptualization, and intellectual revisions.
- ⁵⁻⁶⁻⁷⁻⁸⁻⁹⁻¹⁰Data collection, interpretation, and drafting of manuscript
- The authors agree to take responsibility for every facet of the work, making sure that any concerns about its integrity or veracity are thoroughly examined and addressed

▪ **Conflict of Interest:** NIL

▪ **Funding Sources:** NIL

Correspondence:

Shanza Mukhtar

shanzakhanu@yahoo.com
