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Review Article

FRUITS, VEGETABLES & FOOD SUPPLEMENTS WITH ANTIHYPERLIPIDAEMIC EFFECT - A NARRATIVE REVIEW

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ABSTRACT

Because of the rapidly changing food habits and life style, the number of people living with hyperlipidaemia is continuously increasing worldwide. Hyperlipidaemia is strongly associated with increased risk of Coronary Artery Disease (CAD). The role of diet can never be undermined while planning management of disorders related to life style. Dietary interventions have been found effective in treating hyperlipidaemia either alone or along with standard medical therapy. Fruits, vegetables and selected food supplements rich in fibres remain an integral part of healthy diet plan. Since they contain dietary fibres, they are beneficial in improving lipid profile, lowering blood pressure in hypertensive patients, weight control and augmenting insulin sensitivity. The present narrative review aims at identifying common items from each category which are easily available, economical and effective to manage hyperlipidaemia.

INTRODUCTION

Hyperlipidaemia and cardio vascular disease (CVD) risk is strongly associated. Low HDL and high non-HDL cholesterol increase the risk of coronary artery disease (CAD). Diet and exercise play a key role in the management of hyperlipidaemia apart from medical intervention. [1] A good diet plan for treating hyperlipidaemia would definitely include fruits, vegetables and food supplements rich in fibres. Consumption of fruits and vegetables is inversely related to LDL level both in men and women. [2] Dietary fibre has multiple health benefits including improvement in lipid profile. [3] Apart from herbal drugs, there are a good number of vegetables, fruits and dietary supplements which help in managing hypercholesterolemia. *Pathya* (dietary advice) is an integral part of comprehensive *Ayurvedic* management. Hence these fruits, vegetables and other dietary supplement when included in the diet plan of a patient of hyperlipidaemia are definitely helpful in treating hyperlipidaemia. This review article will focus on critical and scientific appraisal of few fruits, vegetables and food items which are consumed in day-to-day life with special reference to their anti-hyperlipidaemic effect.

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MATERIAL & METHODS

A narrative review methodology was adopted for this paper. Relevant literature was identified through a comprehensive search of database like PubMed, Scopus, Cochrane Library, and the AYUSH Research Portal. The search covered publications in the last 50 years (from 1975 to 2025). Search terms included combinations of the following keywords and Medical Subject Headings (MeSH): hyperlipidaemia, antihyperlipidaemic, lipid-lowering, fruits, vegetables, nutraceuticals, dietary supplements, LDL, triglycerides, and cholesterol. Additional records were identified by manually screening reference lists of key articles.

Inclusion criteria

1. Clinical trials
2. Animal experimental studies
3. Systematic reviews and meta-analyses
4. Pharmacognostic or nutritional studies with direct relevance to dietary intake or food-based interventions.

Exclusion criteria

Studies evaluating isolated pharmacological agents lacking relevance to dietary consumption, non-peer-reviewed sources, conference abstracts without full texts, and items not quite relevant to Indian population.

Given the narrative nature of this review, no quantitative synthesis was performed. Instead, evidence was examined using a thematic synthesis approach, wherein findings were grouped according to major food categories-fruits, vegetables, and food supplements-and further analysed for their mechanisms of action, lipid-modifying potential, and clinical applicability.

Papaya (*Carica papaya* L.)

Papaya (commonly known as *Papita*) is a very common yet popular fruit which is consumed throughout Asia. Apart from fibres and modest carbohydrate, it contains Vitamin A, Vitamin C, saponins, alkaloids and flavonoids which are having anti-hyperlipidaemic activity.

In a systematic review done by Herviana et al found that Papaya whole fruit/fruit juice has the ability to improve lipid profile both in experimental and clinical model.

The review included all the research work conducted on Papaya from 2016 to 2021. The meta analysis of the results concluded that papaya fruit/juice can lower total cholesterol, LDL, VLDL and triglycerides. It can also significantly increase HDL. Since the glycaemic index score is 60 (moderate) and it contains a lot of fibre, it can be a good choice in diabetics with dyslipidaemia too. [4]

Bottle Gourd (*Lagenaria siceraria*)

It is commonly known as *Lauki* and much discussed for its health benefits. It belongs to the family cucurbitaceae. It is also found mentioned in Ayurvedic literatures.

The anti-hyperlipidemic activity of bottle gourd was proved in an animal study by Mohale et al. Male albino rats bred in animal house under standard conditions were used for the study. Hyperlipidaemia was induced by intraperitoneal injection of Triton-X-100 (100 mg/kg body weight). Then the animals were treated with bottle gourd extract. It resulted in significant reduction in total cholesterol, LDL, VLDL and Triglycerides. HDL was increased significantly. Hence bottle gourd can be a good choice in vegetables for patients with hyperlipidaemia. [5]

Bitter Melon (*Momordica charantia* L.)

It is also known as bitter gourd or Karela in India. Bitter melon belongs to the family Cucurbitaceae. It is grown and used as vegetable throughout Asia and Africa. Traditionally it is believed to lower blood sugar and hence frequently advised to patients of Diabetes. Apart from its anti-hyperglycaemic activity it has shown anti-hyperlipidemic activity in several experimental and clinical studies.

In a rat model experimental study Senanayake et al demonstrated the anti-hyperlipidemic effect of several varieties of bitter melon. Particularly the effect on lowering liver triglyceride level was found to be significant. However, the effect on serum lipids was marginal. [6]

In a randomized, double-blind, placebo-controlled clinical trial in 43 Japanese adult volunteers, bitter melon was tested for its anti-hyperlipidaemic activity. The intervention (trial) group had 23 and control group had 20 participants respectively. The intervention group received 100 mg of hot water extract of bitter melon and the control group received a placebo both given three times daily for 30 days. Significant reduction in LDL cholesterol was observed in the intervention group in comparison to trial group. But no statistical difference was observed in either group in blood pressure, total cholesterol, body weight and hence BMI and HDL cholesterol. [7]

Soybean (*Glycine max*)

It is commonly known as soy and belongs to the family Fabaceae. It is native to eastern Asia and widely used for its nutritional values. It is a significant yet cheaper source of plant-based protein. Several clinical and experimental studies have been conducted to evaluate its various nutritional benefits.

A meta-analysis done by Siyan Zhan et al to explore its anti-hyperlipidaemic effect. From the results of the meta-analysis, it is evident that soy protein supplements containing isoflavones is effective in improving lipid profile. It can significantly decrease serum total cholesterol, LDL and VLDL on short term and can increase HDL on long term consumption. Reduction in LDL is better in men in comparison to women. [8]

Paddy Straw Mushroom (*Volvariella volvacea*)

It is a variety of edible mushrooms and cultivated for food throughout Asia and other parts of the world. It is third highest variety of cultivated fungus in the world. It is truly a perfect combination of flavour, taste, aroma and nutritional values. It contains proteins, vitamins and minerals which act as anti-oxidant.

In an animal study to evaluate anti-hypercholesterolemic effect of paddy straw mushroom, it was observed that it can reduce total cholesterol and LDL in white albino wistar rats. However, it did not show any effect on the HDL level.[9]

Guar (*Cyamopsis tetragonoloba*)

Guar beans are used as vegetables across India. It belongs to the family Fabaceae. Guar gum is extracted from Guar beans. It is used as a food additive. It contains dietary fibres. [10]

Administration of guar gum reduces cholesterol level & blood sugar level. It increases the ability of fat digestion, reduces fat absorption from food and increases bile secretion. It reduces appetite. This may result in reduction of body weight of laboratory animals. [11]

Samai (*Panicum miliare*)

Popularly known as little millet, is a member of the millets group. It belongs to the family Poaceae. It is widely cultivated in Asia.

Millets are known for their nutritional and health benefits. This is the reason why Food and Agriculture Organization (FAO) and United Nations has recognised 2023 as International Year of Millets to create awareness about millets worldwide.

Radha et al selected 50 patients with cardiovascular problems (25 control and 25 under trial group). Trial group patients were supplemented with little millets for sixty days. Lipid profile was done before starting and after completion of the trial. The intervention reduced total cholesterol, LDL, VLDL and triglycerides. It also increased HDL level which is beneficial for the cardiac patients. [12]

Red Yeast Rice (RYR) (*Monascus purpureus*)

Red yeast rice is a food product prepared from rice with the help of fermentation by a yeast *Monascus purpureus*. It is used in traditional Chinese medicine for lowering cholesterol. Red yeast rice is also consumed in some parts of India, both as a traditional food ingredient (though less common than other forms of red rice) and as a dietary supplement for its health benefits. The name red yeast rice has been given to it for its typical red colour. It works like statins to lower cholesterol. However, US-FDA has not approved RYR to be sold legally in USA for safety concerns. Many experimental and clinical study have been done to prove its efficacy as a lipid lowering food supplement.

In an experimental model using rabbit and quail, Changling Li et al found that red yeast rice is effective in reducing total cholesterol, triglycerides and improved TC: HDL ratio. [13]

In another meta-analysis done on 93 randomised trials, it was concluded that RYR is effective in lowering total cholesterol, LDL and triglycerides. It also increases HDL level which is desirable. Since most of the studies were of short duration, there can be safety concerns on long term use of RYR. However, no major adverse effect was observed during short term consumption of RYR. [14]

Oat (*Avena sativa*)

It is mostly referred as common oat. It is a variety of cereal grain. Russia is the largest producer of oats. It belongs to the family “Poaceae”. It is well known for its nutritional and health benefits.

In a randomized controlled clinical trial conducted on 152 Hispanic Americans it was found that Oat consumption for 6 weeks can reduce both total cholesterol and LDL. [15]

In another meta-analysis of 28 randomised controlled trials concluded that adding ≥ 3g of oat ß – glucan to the diet for a reasonable period can reduce total cholesterol and VLDL. But it has no role on triglycerides and HDL. [16]

Apart from lipid lowering property, Oats can reduce the risk of CVD when consumed regularly for a reasonable period.

Psyllium (*Plantago ovata*)

The Psyllium husk is mainly used as a dietary fibre. It belongs to the family “Plantaginaceae”. It can remove constipation and widely used for this property.

In a randomized, double-blind, placebo-controlled parallel study including seventy-five patients of mild to moderate hypercholesterolemia, psyllium was supplemented at a dose of 1 tsf TDS for eight weeks. It was observed that Psyllium treatment can reduce total cholesterol and VLDL with no significant change in HDL level or blood pressure. [17]

In another double-blind placebo-controlled study on 125 patients of type -2 diabetes, it was found that apart from improving lipid profile, it can also significantly reduce fasting blood sugar (FBS) level. The total cholesterol, VLDL and triglycerides level were significantly lowered whereas HDL was found to be significantly increased which is beneficial. [18]

In both the studies Psyllium was well tolerated by the subjects. Treatment adherence and compliance were excellent. There was no adverse effect during the study period.

DISCUSSION

The present narrative review synthesizes existing evidence on the antihyperlipidaemic effects of selected fruits, vegetables, millets and dietary supplements commonly used in daily diets across India. Collectively, these findings reaffirm the crucial role of diet in the prevention and management of hyperlipidaemia.

Dietary fibre, plant-based proteins, polyphenols, flavonoids and bioactive phytochemicals present in the reviewed food items appear to act via multiple mechanisms, including reduction of intestinal cholesterol absorption, enhanced bile acid excretion, improved hepatic lipid metabolism and attenuation of oxidative stress.

Papaya emerged as a fruit having broad-spectrum lipid-modifying potential, with evidence demonstrating reductions in total cholesterol, LDL, VLDL and triglycerides, accompanied by an increase in HDL levels. The favourable glycaemic index and high fibre content further support its suitability for patients with combined dyslipidaemia and diabetes.

Similar benefits were observed with bottle gourd, which significantly improved lipid fractions in experimental models, thereby supporting its traditional use as a cardioprotective vegetable.

Bitter melon, although widely recognized for its anti-diabetic activity, displayed mixed but encouraging effects on lipid metabolism. While animal studies revealed substantial reductions in liver triglycerides, clinical outcomes reported modest but significant LDL reduction, suggesting selective lipid-lowering potential.

In contrast, soybean-rich in isoflavones-showed consistent improvements in total cholesterol and LDL across multiple studies. The beneficial effects, reported to be more pronounced in men, reinforce its value as an affordable plant-based protein with added therapeutic potential.

Foods such as paddy straw mushroom and guar which are very popular in rural India not only for their mouth watering taste, but also offer additional evidence-based lipid-lowering benefits. Mushrooms demonstrated significant reductions in total cholesterol and LDL in animal experiments, whereas guar gum improved lipid digestion, reduced fat absorption and positively influenced weight control in animal studies.

Traditionally millets are considered as healthy food in India and widely consumed in different parts. Millets, particularly little millet, have recently gained international recognition for their cardiometabolic benefits. Clinical evidence found in this review demonstrated significant reductions in total cholesterol, LDL, VLDL, triglycerides and improved HDL levels among subjects consuming little millet. These findings align with the global nutritional shift advocating for millet consumption, as endorsed by FAO's recognition of 2023 as the "International Year of Millets".

Among food supplements, red yeast rice (RYR) and psyllium stand out of the crowd for their unique health benefits. RYR displayed potent lipid-lowering effects comparable to statins, in both animal models and human trials, reducing total cholesterol, LDL and triglycerides. Despite its efficacy, concerns regarding long-term safety and regulatory restrictions necessitate cautious use of red yeast rice.

Psyllium husk, conventionally used as a bulk forming laxative, is also very popular for its effect on metabolism. It shows well-documented tolerance and compliance, consistently reduced total cholesterol, VLDL and triglycerides, while improving HDL and glycaemic control in diabetic subjects. Its favourable safety profile further justifies its use as a long-term adjunct in dyslipidaemia management.

Oats, one of the trending foods among weight conscious people, remain an established dietary recommendation worldwide due to their β-glucan content. The reviewed evidence confirms significant reductions in LDL and total cholesterol, highlighting oats as a simple yet effective component of dietary regimens in the management of hyperlipidaemia. However, minimal effects on triglycerides and HDL suggest their role as supportive rather than primary lipid-lowering food items.

Overall, the reviewed studies, ranging from experimental models to randomized controlled trials and meta-analyses, support the integration of these foods into dietary strategies for the prevention and management of hyperlipidaemia. While heterogeneity exists regarding dosage, duration and study design, the cumulative evidence aligns with the Ayurvedic concept of *Pathya* and modern nutritional science, underlining the importance of diet as a cornerstone of hyperlipidaemia management and cardiovascular risk reduction.

CONCLUSION

This review demonstrates that several fruits, vegetables, millets and dietary supplements possess potent anti-hyperlipidaemic properties and can serve as valuable components of lifestyle-based

interventions for individuals with hyperlipidaemia. Foods such as papaya, bottle gourd, soybean, little millet, oats, psyllium and red yeast rice consistently improved lipid parameters across studies, while bitter melon, paddy straw mushroom and guar gum provided additional dietary strategies with measurable metabolic benefits.

The findings highlight the importance of incorporating these evidence-based dietary components into routine clinical counselling, particularly in resource-limited settings where pharmacotherapy may be unaffordable, inappropriate or associated with adverse effects.

In conclusion, dietary recommendations based on the reviewed food items offer a safe, accessible and cost-effective approach in the management of hyperlipidaemia by integrating both modern medicine and traditional wisdom.

Limitations & Future Recommendations

The study is limited to review of items which fit well into Indian dietary pattern. However, there are many fruits, vegetables and nutraceutical agents consumed in different parts of the world with proven lipid lowering properties. But they are not a part of the current review.

While short-term efficacy of the reviewed items is well supported, future research should focus on long-term safety, comparative effectiveness, and potential interactions with standard lipid-lowering agents.

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