

# Millets can reduce the risk of developing cardiovascular disease

Study shows consumption of millets reduce total cholesterol, triacylglycerol and BMI



Smart Food  
brief #7

NOTE: Millets are broadly defined to include sorghum

## MAJOR HEALTH CONCERNS

**Cardiovascular disease is the leading cause of deaths globally**

**Obesity is rising** : Nearly 40% of adults are overweight and 14% obese (2016)

## THE STUDY- in summary

19 efficacy studies on humans were analysed, with almost 900 people involved, using a meta-analysis and published in Frontiers in Nutrition journal. Five millets were studied, finger millet, foxtail millet, barnyard millet, sorghum and little millet combined with other millets in a meal. All results are based on consumption of 50 to 200 g of millets per day for a duration ranging from 21 days to four months.



## KEY RESULTS

### Consumption of millets:

- reduced total cholesterol by 8%, lowering blood cholesterol in the people studied, from high to normal levels.
- resulted in nearly a 10% decrease in low and very low-density lipoprotein cholesterol (commonly viewed as 'bad cholesterol') and triacylglycerol levels in blood.  
Through these reductions, the levels went from above normal to normal range.
- led to a slight increase (6%) in what is 'commonly' called the good cholesterol (high-density lipoprotein cholesterol).
- lowered blood pressure with the diastolic blood pressure decreasing by 5%.
- reduced BMI by 7% in people who were overweight and obese, showing the possibility of returning to a normal BMI.

## CONCLUSIONS

Based on this evidence, it is concluded that consuming millets can help reduce risk factors for atherosclerotic (hardening and narrowing of arteries) cardiovascular diseases and manage weight.

Overall, this provides further evidence of the benefits to popularize millets back into diets, especially as staples across Asia and Africa.

## GLOBAL HEALTH CONCERNS

**Cardiovascular diseases are rising:** “The number of people dying from cardiovascular disease is steadily rising, and it is one of the leading causes of deaths<sup>1</sup>, accounting for one-third of all deaths globally<sup>2</sup>.

“The cases of total CVD [cardiovascular diseases] nearly doubled from 271 million in 1990 to 523 million in 2019, while the number of CVD deaths steadily increased from 12.1 million in 1990 to 18.6 million in 2019.<sup>1”</sup>

**Obesity is rising :** Nearly 40% of adults (≥18 years), 1.9 billion people, were overweight in 2016. Of these, >650 million were obese. In 2019, an estimated 38.2 million children under the age of 5 years were overweight or obese<sup>3</sup>.

Obesity nearly tripled between 1975 and 2016. And is now on the rise in low- and middle-income countries, as well as wealthy countries<sup>3</sup>.

Hypertension, hyperlipidaemia, diabetes and smoking are the main risk factors for atherosclerotic cardiovascular disease. A systematic review conducted on millets (including sorghum) also showed that millets were useful for managing and preventing diabetes<sup>4</sup>.

## THE STUDY

⇒ **Type of analysis:** Scientific studies undertaken on millets in relation to hyperlipidaemia<sup>a</sup> were widely searched and collated.

A systematic review and meta-analysis was conducted to identify any evidence of positive or negative effects from the impact of consuming millets. This included impacts on: total cholesterol (TC), triacylglycerol (TG)<sup>b</sup>, high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C) and very-low-density lipoprotein cholesterol (VLDL- C).

A total of 19 efficacy studies on humans were found and analysed.

⇒ **Millets studied:** In total 5 types of millets were included in the studies: finger millet, foxtail millet, barnyard millet, sorghum and/or a mixture of millets (finger millet and little millet)

⇒ **How millets were consumed:** Millets were included in meals and in a variety of forms. Some included millet biscuits, burfi (sweet), porridge, buns, boiled in water (similar to rice), roti (flatbread), dumpling, upma or a drink. The amount of millets provided to the intervention groups varied from 50 g to 200 g (dry weight basis) either in one or divided into two meals per day.

1. Cardiovascular Disease Burden, Deaths are rising around the world, [American College of Cardiology](#), 2020

2. [WHO](#), 2021, Cardiovascular Diseases (CVDs) Key Facts

3. [WHO](#), 2021, Obesity and Overweight Key Facts

4. Anitha, S. et al., 2021, A systematic review and meta-analysis of the potential of millets and sorghum for managing and preventing diabetes mellitus. [Frontiers in Nutrition](#).

- a. Hyperlipidemia refers to acquired or genetic disorders that result in an above normal level of lipids (fats, cholesterol and triacylglycerol) in the blood.
- b. Triacylglycerol are the main component of animal and vegetable fats in the diet, and the main component of the body's fat stores.

A LDL-C and VLDL-C are needed by the body but are commonly above the required level hence viewed as ‘bad cholesterol’

B LDL-C normal level is <100 mg/dl, moderately elevated or borderline high level is 130 to 159 mg/dl, high is >160 mg/dl

C HDL-C is required in the body but can be too low or too high. Typically, the levels are normal or too low so is viewed as a ‘good cholesterol’

D HDL-C levels are low if <40 mg/dl, high if >60 mg/dl

E BMI is calculated taking into account a person's weight relative to their height

F BMI that is <25 is normal, 25-30 is overweight, >30 is obese

G *Diastolic blood pressure* is the bottom number on a reading. Normal is <80 mmHg

## RESULTS

**The consumption of millets for periods as short as 21 days to about four months, had the following beneficial effects:**

⇒ **reduced total cholesterol 7.8%**

Three of the studies demonstrated that millet consumption could bring above high levels of cholesterol to normal levels (From  $215.8 \pm 12.5$  to  $167.5 \pm 3.2$  mg/dl (normal being  $<200$ )).

⇒ **reduced 'bad cholesterol' 9-9.7%**

Low-density lipoprotein cholesterol (LDL-C) and very low-density lipoprotein cholesterol (VLDL-C), commonly viewed as 'bad cholesterol'<sup>A</sup>, were reduced by 9.7% and 9% respectively.

Five studies demonstrated the reduction of LDL-C from above normal level<sup>B</sup> of  $116.5 \pm 10.0$  to normal level of  $92.6 \pm 8.7$  mg/dl. One long-term cross-sectional study showed the reduction from high level of LDL-C ( $160.1 \pm 26$  mg/dl) to moderately high level ( $140.1 \pm 16.5$  mg/dl).

⇒ **increased 'good cholesterol' 6%**

High-density lipoprotein cholesterol (HDL-C)<sup>C</sup> commonly viewed as 'good cholesterol' because it helps remove other forms of cholesterol from your bloodstream, was slightly increased by 6% after consuming millet-based meals compared to regular rice or wheat meal ( $43.4 \pm 7.5$  to  $46.0 \pm 7.6$  mg/dl).

Five studies demonstrated the increase of HDL from low to normal<sup>D</sup> ( $38.7 \pm 1.3$  to  $41.5 \pm 0.8$  mg/dl).

⇒ **reduced triacylglycerol level in blood 9.4%**

Two of the studies showed the plasma triacylglycerol levels reduced from a hypertriglyceridaemic ( $>150$  mg/dl) condition to normal ( $<150$  mg/dl) if a millet-based meal is consumed once a day for three months instead of the regular rice- and/or wheat-based diet.

Cross-sectional studies conducted by recording more than two years of millet consumption information showed a similar reduction.

Four of the studies demonstrated that millet consumption could bring above normal levels of triacylglycerol to normal levels: from  $170.4 \pm 17.2$  to  $128.6 \pm 14.9$  mg/dl (normal being  $<150$ ).

⇒ **reduced Body Mass Index (BMI)<sup>E</sup> for people overweight and obese<sup>F</sup> to almost normal levels**

Consuming millets reduced BMI by 7% in people who were overweight and obese, (from a BMI of  $28.5 \pm 2.4$  to  $26.7 \pm 1.8$  kg/m<sup>2</sup>) showing the possibility of returning to a normal BMI ( $<25$  kg/m<sup>2</sup>).

⇒ **decreased blood pressure**

Consuming millets decreased blood pressure with the **diastolic blood pressure<sup>G</sup>** decreasing by 5%. This was based on five studies.

## POLICY RECOMMENDATIONS

### 1. **Design policies and incentives to diversify staples across Asia and Africa with millets:**

The positive benefits of millets in this systematic review support millets being in the diet. Given their benefits compared to major staples, it also supports the need to diversify major staples with millets. This is further supported by the fact that millets have nutritional and health benefits such as low glycaemic index and high levels of several necessary micro- and macronutrients (e.g. iron, zinc, calcium and protein).

Additionally, millets are a 'smart food': not only 'good for you' but also 'good for the planet' and 'good for the farmer', i.e. environmentally sustainable, climate-smart, with a lower carbon footprint. Therefore, they should also be part of solutions for reforming the food system.

This will help contribute to a range of UN Sustainable Development Goals such as Zero Hunger, Good Health and Well-being, Responsible Consumption and Production, and Climate Action.

### 2. **Design millet-based meals** especially where atherosclerotic cardiovascular diseases and weight management are potential high risks.

## RESEARCH PRIORITIES

1. **Study all the types of millets and different varieties:** Only five millets were assessed and no studies distinguished by variety.
2. **Identify variations by types of processing:** None of the studies compared results on the blood lipid profile by different types of processing.
3. **Conduct longer term studies:** The study duration was varied from 21 days to four months. However, having evidence for a much longer duration of a year or more will be useful evidence.
4. **More detailed research is needed that is focused on weight management and including different ages, gender and cultures.**
5. **More studies that include all the relevant parameters for cardiovascular disease:** Only two out of 6 studies determined total cholesterol to HDL cholesterol ratio, which is an important risk marker for cardiovascular disease. Therefore, it is also important to include all relevant parameters while conducting the dietary interventions including the impact on hyperlipidaemia and other risk markers for cardiovascular disease.
6. **Studies on non-alcoholic fatty liver disease (NAFLD):** Because millets were identified to reduce hyperlipidaemia, it is expected that millets may have a positive effect also on reducing or preventing NAFLD. This has never been studied in regard to millets and NAFLD is predicted to become a major cause of liver-related morbidity and mortality by 2030. (Dorosti et al., 2020)
7. **Undertake studies in more geographic locations:** Out of 17 studies, one study was conducted in Sri Lanka, two in China and the remaining 14 in India, indicating a geographical limitation.

Anitha, S. <sup>1</sup>, Botha, R. <sup>2</sup>, Kane-Potaka J. <sup>1</sup>, Givens, I. <sup>3</sup>, Rajendran, A. <sup>4</sup>, Tsusaka, T.W. <sup>5</sup>, Bhandari, R. <sup>6</sup>, 2021, **Can millet consumption help to manage hyperlipidaemia and obesity – A systematic review and meta-analysis**, *Frontiers in Nutrition*. Reviewregistry1123.

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“We were very surprised how many studies on humans had already been undertaken on the impact of millets on elements that impact cardiovascular diseases, and this is the very first time anyone has collated all these studies and analysed their data to test the significance of the impact. We used a meta-analysis, and results came out very strongly to show significant positive impact on risk factors of cardiovascular disease.”

**Dr S Anitha**

*Lead author and a Senior Nutrition Scientist, ICRISAT*



“As the world experiences a rise in cases of obesity and cardiovascular diseases, millets provide a cheaper option for reducing the disease burden especially in Southern Africa. We hope that the study findings motivate policy makers to encourage millet production in the region as the crop can be grown at relatively lower costs compared to most other cereals such as maize and rice.”

**Ms Rosemary Botha**

*Co-author, International Food Policy Research Institute (IFPRI)*



This latest review further emphasizes the potential of millets as a staple crop that has many health benefits. It strengthens the evidence that eating millet can contribute to better cardiovascular health by reducing unhealthy cholesterol levels and increasing the levels of whole grains and unsaturated fats in the diet.”

**Professor Ian Givens**

*Co-author of the study and Director, Institute of Food, Nutrition and Health, University of Reading*



Obesity and being overweight are increasing globally in both wealthy and poorer countries, so the need for solutions based on healthier diets is critical. This new information on the health benefits of millets further supports the need to invest more in the grain including the whole value chain from better varieties for farmers through to agribusiness developments. ”

**Dr Jacqueline d'Arros Hughes**  
Director General at ICRISAT



Unhealthy diet is a major contributor to the rising incidence of diseases, like cardiovascular disease and diabetes. The results of this study along with our recent study that showed that the consumption of millets reduced the risk of developing type 2 diabetes and helped manage type 2 diabetes, highlights a critical need to look carefully at how to most appropriately bring millets back into the diets in India and ensure this reaches the majority. ”

**Dr Hemalatha**  
Director, National Institute of Nutrition (NIN)



As a doctor I have seen first-hand a significant rise over the years in patients with serious coronary problems from high cholesterol and being overweight. Based on the evidence in this study we can help reduce hypertension and hardening and narrowing of arteries and manage weight with appropriate diet changes including millets. However, it is important to consume a millet-based and healthy diet regularly and make it a habit. ”

**Dr Raj Bhandari**  
Co-author, Medical doctor, Rep. on the Indian National Technical Board of Nutrition



In rapidly aging economies including Japan, prevention of cardiovascular and cerebrovascular diseases through dietary moderation of hyperlipidemia, as opposed to medical treatment, is becoming critically important towards sustaining quality of life and saving public expenditure. Evidence articulated in our study will justify and support initiatives aiming at incorporating millets into your food plate. ”

**Dr Takuji W Tsusaka,**  
Co-author, Kobe University, Japan



It is also recommended to have nutrition scientists to design millet-based meals especially where weight management and atherosclerotic cardiovascular diseases are potential high risks. Doing this in culturally acceptable ways and ensuring tasty meals is important. ”

**Dr Ananthan Rajendran,**  
Co-author, Scientist, National Institute of Nutrition (NIN)



A key recommendation from the study is for government and industry to support efforts to diversify staples with millets especially across Asia and Africa. Given that millets are hardy and climate smart, returning to this traditional staple makes a lot of sense and is a critical solution that could be the turning point of some major health issues. ”

**Ms Joanna Kane-Potaka**  
Co-author, Assistant Director General, ICRISAT, & Executive Director, Smart Food

## ABOUT MILLETS

'Millet' is a common term to categorize small-seeded grasses that are often called dryland cereals. There are 12 grasses most commonly referred to as millets. Sorghum is also considered a millet in some countries.

Millets are termed a **smart food** because they fit the criteria of being good for you, planet and farmer.

Millets are highly nutritious and fulfil some of the biggest health needs; have a low carbon footprint, survive in high temperatures and with very little water. They are often the last crop standing in times of drought, are climate-smart and a good risk management strategy for farmers. They have multiple uses, from food, feed and fodder, to brewing and biofuels.



### Nutrition study series

This study is part of a series that has been worked on for the last four years under the Smart Food initiative and will be progressively released in 2021, including systematic reviews on the impacts of millets on:

- Diabetes
- Iron deficiency anemia
- Managing lipid profile (cholesterol and cardiovascular disease) and cardiovascular disease)
- Calcium deficiencies and requirements

As part of this, ICRISAT and the Institute for Food Nutrition and Health at the University of Reading have formed a strategic partnership to research and promote the Smart Food vision that our diets become healthier, more sustainable on the environment and good for those who produce it.

Smart Food executive council:

