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Short Communication

# The Might of Millets and the Heart

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The UNO and the Global Panel of Agriculture and Food Systems for Nutrition (GLOPAN), emphasize to prevent major losses of resources, including water, land and energy, that contribute to climate change [1-3]. The UNO helps countries to protect and restore freshwater and marine ecosystems to sustain their services for generations to come [1,2]. Because, water is fundamental to life on our planet, but this precious resource is increasingly in demand and under threat [1,2]. The UNO also emphasize on human development by proposing Sustainable development Goals that cannot be achieved without prevention of cardiovascular diseases (CVDs). The UNO helps to achieve Sustainable Food and Agriculture that is supported by World Bank for environment protection [4-8]. In view of the above objectives, all of the above agencies are looking for foods which can replace wheat, rice and corn that need plenty of water and manures for production. If these grains are milled and refined into flour, they also predispose CVDs [9]. Millets have been proposed to be a new gift from Asia to western world, because growing millets do not require much of water and manures and it can grow on barren land or forest with relatively lower quantity of water [9]. This viewpoint aims to highlight the role of millets in the prevention of cardiovascular diseases (CVDs) and diabetes.

There is evidence that millets are rich sources of dietary fiber and flavonoids and polyphenolics which have been demonstrated to provide benefits in diabetes and CVDs [9-19]. The food chemistry of millets showed that it has natural antioxidants in edible flours of small millets. Total carotenoids content varied from 78 - 366 μg/100 g in the millet varieties with an average of 199 ± 77, 78 ± 19, 173 ± 25 and 366 ± 104 μg/100 g in finger, little, foxtail and proso millets respectively [11]. HPLC analysis of vitamin E indicated a higher proportion of γ–and α-tocopherols; however, it showed lower levels of tocotrienols in the millets [11]. Total tocopherol content in finger and proso millet varieties were higher (3.60 - 4.0 mg/100g) than in foxtail and little millet varieties (~1.3 mg/100g). Total antioxidant capacity in finger, little, foxtail and proso millets were 15.3 ± 3.5, 4.7 ± 1.8, 5.0 ± 0.09 and 5.1 ± 1.0 mM TE/g, respectively. It is known that edible flours of small millets are good source of endogenous antioxidants [11]. In table 1 nutrient composition of millets and other grains are given for comparison.

### Effects of millets on coronary risk factors

Clinical studies are urgently needed to demonstrate the beneficial effects of millets on CVDs and diabetes in human beings. However, experimental studies indicate that millets can exert antioxidant effects and reduce oxidative stress and hyperglycemia [15-19]. These beneficial effects of millets may be due to their composition and enzyme inhibitory properties of seed coat phenolics which may cause inhibition of A-Glucosidase and pancreatic amylase indicating protection of beta cells of pancreas [17]. Further experiment, with feeding of finger millet, during the process of wound healing revealed beneficial effects in diabetic rats, by decreasing blood glucose and healing process [18]. In an experiment in hyperlipidemic rats, millet consumption was associated with significant reduction in serum concentration of triglyceride and C-reactive protein without any effects on oxidative status [19]. The decline in triglycerides and C-reactive protein is similar to a unpublished clinical study, whereas no effect on oxidative stress is surprising, because millets are rich in antioxidant polyphenolic, flavonoids and carotenoids [9-19].

| Food | Proteina (g) | Fat (g) | Ash (g) | fiber (g) | Carhohydrate (g) | (kcal) |
|---|---|---|---|---|---|---|
| Rice (brown) | 7.9 | 2.7 | 1.3 | 1.0 | 76.0 | 362 |
| Wheat | 11.6 | 2.0 | 1.6 | 2.0 | 71.0 | 348 |
| Maize | 9.2 | 4.6 | 1.2 | 2.8 | 73.0 | 358 |
| Sorghum | 10.4 | 3.1 | 1.6 | 2.0 | 70.7 | 329 |
| Pearl millet | 11.8 | 4.8 | 2.2 | 2.3 | 67.0 | 363 |
| Finger millet | 7.7 | 1.5 | 2.6 | 3.6 | 72.6 | 336 |
| Foxtail millet | 11.2 | 4.0 | 3.3 | 6.7 | 63.2 | 351 |
| Common millet | 12.5 | 3.5 | 3.1 | 5.2 | 63.8 | 364 |
| Little millet | 9.7 | 5.2 | 5.4 | 7.6 | 60.9 | 329 |
| Barnyard millet | 11.0 | 3.9 | 4.5 | 13.6 | 55.0 | 300 |
| Kodo millet | 9.8 | 3.6 | 3.3 | 5.2 | 66.6 | 353 |

***Table 1:*** *Nutrient composition of millets compared to other cereals (per 100g edible portion; 12% moisture) modified from FAO. All values except protein are expressed on a dry weight basis.(modified from, Sources: Hulse and others (1980); United States National Research Council/National Academy of Sciences (1982); USDA/HNIS (1995); FAO (2012).*

In India, a population survey by the National Nutrition Monitoring Beauro on diet and nutritional status of rural population and prevalence of hypertension among adults in rural areas revealed, that increased intake of millets was associated with decreased prevalence of hypertension [20]. No other study has examined the antihypertensive effects of millets in human beings. Millets can also protect genetic and epigenetic damage and enhance microbiome which may be the additional mechanism for beneficial effects of such diet, against CVDs and diabetes as well as cancers [21,22]. Finally, it has been reported that millet based intervention diet can cause significant increase in serum iron and haemoglobin indicating that it can be beneficial in combating undernutrition in females [23,24].

A clinical study conducted by us among 60 patients of diabetes mellitus who were administered millet based functional food rich intervention diet showed interesting results [25]. Supplementation with millets was associated with significant decline in fasting and 2-hour post prandial blood glucose and Hb 1c indicating that this diet can prevent diabetes. Total cholesterol, VLDL cholesterol and triglycerides showed significant decline compared to baseline levels. Pro-inflammatory cytokines; C-reactive proteins, TNF-alpha and interleukin-6 also showed significant reduction after treatment with intervention diet compared to baseline levels. In association with these changes, there was a significant decline in the parameters of oxidative stress; TBARS, MDA and diene conjugates with an increase in antioxidant vitamins; A, E and C and beta-carotene. Underlying these changes, all subjects received a 11 fold greater amount of millet based intervention diet which increased from mean 21.36 ± 3.8 g/day to 235.20 ± 23.6 g/day ($p < 0001$). Among females ($n = 33$), there was a significant increase in hemoglobin and serum calcium and magnesium indicating that millet based diet can also prevent undernutrition. Our study also showed significant decline in both systolic and diastolic blood pressure after 12-week administration of millet based functional food intervention. The decline in blood pressures may be due to decline in angiotensin converting enzyme and increase in nitrite which were also observed in this study. Angiotensin converting enzyme is known to cause conversion of angiotensin to angiotensinogen 1 and 2 which are potential oxidants and can predispose smooth muscle cell dysfunction, leading to increase in blood pressures. Increase in nitrite acts by increasing NO release from endothelial cells which is a vasodilator leading to decline in blood pressures.

In brief, it is clear that millets are rich sources of polyphenolics and flavonoids, fiber, calcium and magnesium as well as potassium. It is possible that millet-based intervention diet can cause significant decline in blood glucose, Hb1c, oxidative stress, blood pressures, blood lipoproteins and inflammatory cytokines with an increase in antioxidant vitamins, magnesium, calcium and hemoglobin. Large scale randomized, controlled intervention trials, would be necessary to confirm the role of millets in the prevention of CVDs and diabetes. Increased production and consumption of millets may be useful in the protection of environment and prevention of diseases.

## Conflict of Interest

It has not been declared by any of the authors.

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