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THE ROLE OF MILLETS IN PREVENTION AND CURE OF NON-TRANSMISSIBLE DISEASES AND FUTURE RESEARCH OPPORTUNITIES

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Introduction

Non-transmissible diseases, also referred to as chronic diseases, are a major global health concern. As claimed by the World Health Organization (WHO), nontransmissible disorders are accountable for 74% of all loss of life globally. The main causes of nontransmissible include diabetes, respiratory disorders, cancer, and cardiovascular disease. [1] An important risk factor for non-transmissible diseases is inadequate nutrition, which includes foods abundant in carbohydrates, salt, trans-fats, and saturated fats, and low in vegetables, fruits, proteins, and that are lean. A diet abundant in fruits, vegetables, coarse-grains, and seeds and inadequate in processed foods, sugar, and trans and saturated fats is recommended by the World Health Organization. [2]

Certain dietary practices, such the DASH (Dietary Approaches to Stop Hypertension) and Mediterranean diet, have been found to improve the treatment of people with non-transmissible diseases and decrease the possibility of onset of new ones. [3] The eating of minimally processed or unprocessed foods is encouraged while processed and high-fat meals are restricted in these diets. Non-communicable diseases can be prevented and managed with the help of food and other lifestyle variables including exercise, abstaining from tobacco and excessive alcohol, and managing stress. [3-9]

The role of nutrition in non-transmissible diseases

Foods with a millet base are those in which millet is a primary ingredient. Small-seeded grains like millet are widely consumed worldwide, but especially in Asia and Africa. [10] There are several varieties of millet, including foxtail, proso, and pearl varieties. The main subject of this essay is the common Indian pearl millet, Cenchrus americanus. The health benefits of millet stem from its natural ingredients, which include oil, polyphenols, polysaccharides, isoflavones, and more. There is a dearth of research on the positive consequences of human intervention trials, even though numerous health benefits have been shown employing biological models in vitro investigations. [10]

A wide variety of millet-based foods are commercially accessible, one of which is millet porridge, a widely consumed morning dish in several countries, especially in Africa and Asia. To achieve the desired sweetness, millet grains may be heated in milk or honey before being sweetened with fruit, sugar, or honey. A variety of flatbreads, including roti, chapati, and naan, can be prepared with millet flour. They are utilized frequently in Indian cuisine. Millet can be used with meat, beans, vegetables, or other ingredients to provide a wholesome and complete meal or utilized as a foundation for casseroles. Spiked millet can be seasoned with butter, salt, or other spices to produce a scrumptious and healthful snack. Numerous studies have investigated the health benefits of millet-based meals; the most noteworthy findings are as follows:Foods made with millet that have a low

glycaemic index (G.I.) can aid with blood sugar regulation. A low-GI diet is more effective than a high-GI or control diet in lowering glycated haemoglobin and the level of fasting blood glucose in people with type 2 diabetes (< 200 and <150 mg/dl, respectively). Additionally, millet-based snacks reduced blood pressure by 4.0 and 5.0 percent, raised HDL-C by 6.0 percent, and decreased BMI by 7.0 percent. [11] A study found that participants who were overweight or obese lost a considerable amount of weight after following an eight-week millet-based diet. Millet has low salt content, which means that foods containing it may lower blood pressure. A study found that giving hypertensive rats millet-based diets lowered their blood pressure. [11] Diets based mostly on millet are high in antioxidants and can be help to lower puffiness and protect from long term illnesses which include cancer and heart disease. A holistic review indicates that there is a considerable depletion in whole cholesterol level by eating millets for duration of 21 days to 4 months. Foods obtained from millets also contain hypoglycemic, antihypertensive, hypocholesterolemia, anti-inflammatory, antibacterial and anti-oncogenic qualities (T.C.), triacylglycerol, lipoproteins with low density (LDL-C), lipoproteins with high density (HDL-C), and lipoproteins with very low density (VLDL-C) (VLDL-C). Additionally, four investigations found that consuming millet normalizes levels of triacylglycerol (<150 mg/dl) and TC (<200 mg/dl). Meals made of millet also reduced blood pressure by 4.0 and 5.0 percent, raised HDL-C by 6.0 percent, and decreased BMI by 7.0 percent. [11]

Action Mechanism

Meals based on millet have been shown through numerous processes to be beneficial in controlling metabolic diseases like diabetes, hypertension, and obesity. The following are few of the mechanisms through which millet-based diet can help with the treatment of metabolic disturbances: Compared to foods with a high glycemic index, including white bread and potatoes, millet encourages a slower and more gradual rise in blood sugar levels. Diabetics may be able to control their level of blood sugar due to this. The high fibre content of millet might help to postpone digestion and increase feelings of fullness. It is helpful in prevention of obesity and help with weight management. [13,14] Magnesium, potassium, vitamin B6, and many other essential minerals are all abundant in millet. [15] These nutrients support improved insulin sensitivity and lowered blood pressure, two factors critical to general health. Antioxidants, which can lower puffiness and protect from long term illnesses like cancer and heart disease, are also rich in millet. [10]

Since millets are gluten-free naturally , it can be a good substitute for those who stay away from grains carrying gluten like wheat, rye, and barley due to celiac disease or gluten sensitivity. It can be helpful to incorporate foods based on millet into the diet to treat metabolic illnesses. These studies collectively imply that including foods based on millet in the diet can help manage metabolic disturbances. It is imperative to stress, nonetheless, that people having metabolic disturbances must speak with a wellness program professional prior to implementing any dietary modifications and millet should be included in a well-balanced diet and taken in moderation.

The initiatives of Indian government to adopt a diet based on millets

The Reports of the Ministry of Agriculture and Farmers' Welfare stated that between 2016 and 2017, the area used for millet crops decreased by 60%. Several reasons have combined to cause this, such as changing eating patterns, a drop in requirement of millets, and the use of irrigated land to produce rice and wheat. As a result, the stocks of protein, vitamin A, iron, and iodine in women and children were depleted. Out of 81 countries, India is ranked 64 on the Global Hunger Index (GHI). Being the second-worst country in the world for child malnutrition is a some more reflection of the situation in our nation. If the Targeted PDS and Public Distribution System are still in use, the situation will not get better. This is because the spread of cereals like wheat and rice has traditionally taken precedence over millet. Millet is not a high priority crop in Indian agriculture, despite its significance for food security on both the regional and national levels. The above reasons have demonstrated the significance of millet. Reviving the consumption of millet has received more attention since the General Assembly of designated 2023 as the "International Year of Millets." To encourage and boost the consumption of meals based on millet, the Indian government has implemented several initiatives.

To increase awareness of the role of millet to food security and nutrition" was one of the main goals of MILLET MISSION. To motivate stakeholders to raise millets' quality and sustainably produced. Must concentrate on

increasing funding for extension services and research and development to accomplish the other two goals. Here are some instances of the initiatives taken by the government:

- The government of India declared 2023 to be the "International Year of Millets" to encourage the production and eating of millets across the country. [16,17]
- To promote production of millet and raise utilization of millet nationwide, the government launched the Millet Mission. [16,17]
- The goal is to expand the area used for millet production, support millet-based farming practices, and enhance awareness of the nutritional advantages of millets.
- Lunches made of millet have been introduced by the government to schools around the nation. The goal is to increase millet consumption while providing schoolchildren with wholesome lunches.
- The government is promoting products made from millet, such as ready-to-eat meals, snacks, and biscuits. These goods are being produced in response to the growing need for wholesome and nutrient-dense food options.
- The Indian government funds research and development projects relating to millet production and processing, product creation, and marketing, such as "Integrated Cereals Development Programs in Coarse Cereals."
- The Rainfed Area Development Program (RADP) is a component of the Rashtriya Krishi Vikas Yojana (RKVY), and the ICDP-CC based Cropping Systems Areas under Macro Management of Agriculture (MMA) are the only comprehensive initiatives to support millet production. Additionally, the Initiative for Nutritional Security through Intensive Millet Promotion (INSIMP) is a part of the RKVY.
- The government is working to encourage wholesome and sustainable food systems across the country, and these projects are a part of that effort. Their goal is to encourage the use of millets, which are wholesome, nutrient-dense, and eco-friendly food choices. [14]
- Numerous additional projects have also lately been introduced, including the "India's Wealth, Millets for Health" campaign, the "Millet Startup Innovation Challenge," the "Mighty Millets Quiz," and a "Logo and Slogan Contest."

Prospects for research on food based on millets

Meals made with millet have become more and more popular in recent years because of their sustainability and possible health advantages. The processes behind the health benefits of millets and their potential use in the prevention and treatment of metabolic diseases may be better understood with more research in this field. Potential directions for research on foods based upon millets in the future include the following:

Bioavailability

More advanced research is necessary to understand the nutritive constituents and bioavailability of elements found in millets, such as phytochemicals ,vitamins and minerals. This can help us learn more about the possible health benefits of millet and how it can be used to alleviate deficiencies in certain micronutrients. Development of Products and Processing Research can focus on developing new products based on millets and streamlining the processing steps to improve the nutritional value, shelf life, and sensory appeal of foods based on millets.

Impact on gut microbiota

Studies can look at how diets based on millets affect the gut microbiota and how that can be related to their potential health benefits, such as the treatment of chronic inflammatory gastrointestinal disorders. Future studies can examine the effectiveness of diets based on millets in managing, avoiding, and preventing metabolic diseases as obesity, diabetes, and hypertension. More animal-to-human translational studies may fall under this category.

Sustainability

Research can look at the effects of socio-economic status on promoting millet-based agricultural and food systems as well as the environmental effects of millet processing and cultivation. Although there is research indicating that millets may have advantages, several of the studies had methodological flaws like small sample sizes, observational designs, and difficulties in generalizability. Many of the published sources appear to be animal studies, which would severely restrict their generalizability. Overall, by illuminating the potential health

benefits and sustainability of millet-based meals, more interventional studies on humans can aid in the development of a wholesome and sustainable food ecology.

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