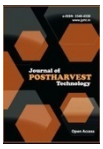

Journal of Postharvest Technology
2022, **10**(4): 179-190
www.jpht.in

REVIEW ARTICLE

Smart food for better health and nutrition – a promising concept

Aastha Garg, Kirti Joshi, Pramod K. Raghav*

Department of Food and Biotechnology, Jayoti Vidyapeeth Women's University, Jaipur-303122, Rajasthan, India

Received: 22.09.2022 Accepted: 11.10.2022

ABSTRACT

Smart food can be defined as foods that benefit us by providing sustainability in three ways by being good for our health, good for environment and favoring farmers' livelihood. An initiative started by ICRISAT (International Crops Research Institute for the Semi-Arid Tropics) with an aim of increasing the staples from just big three crops and including millets and legumes in place due to the immense health benefits offered by them. Following 16 crops are included under the criteria: Pearl millet, Sorghum, Finger millet, Proso millet, Barnyard millet, Browntop millet, Foxtail millet, Little millet, Kodo millet, Teff, Fonio, Job's Tear, Chickpea, Pigeon pea, Ground nuts and Green gram. Each of the mentioned crops is nutritionally rich and leads to improvement of overall health and nutritional status of people. Out of which pearl millet is one of most promising millet cultivated in Rajasthan, India that offers high nutritional and health benefits in addition of being staple growing crop of the region. These crops can be easily included in the daily meals due to their easy incorporation into daily recipes.

Keywords: ICRISAT, Pearl Millet, Smart Food and Sorghum

Citation: Garg, A., Joshi, K. and Raghav, P.K. 2022. Smart food for better health and nutrition – a promising concept. *Journal of Postharvest Technology,* **10**(4): 179-190.

INTRODUCTION

Food is an indispensable part of life. This is a basic and utmost important need of any living organism, making it essential for a quality life. Availability of proper and healthy food that too all the time round the year is vital for sustaining life and becomes an elementary outline of food security. Thus the definition agreed upon at the World Food Summit in 1996 is that food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food to meet their dietary needs and food preferences for a healthy and active life (Pinstrup-Andersen, 2009).Hence, having proper food to eat has always been important.

Historically, elevating starvation among the mass was the major focus, leading to over focus over few crops during green revaluation. Wheat, rice and maize became the dominant and most consumed crops. That has resultant in cyclic production of same crops which can have negative impact on farmers and natural resources and consumption of similar type food leading to emergence of a new threat of 'hidden hunger' (Kane-Potaka et al., 2021). Recently, UN and organizations talk about 'sustainable diets' that are explained as a diet that have less impact over the environment and even have a contribution in food and nutritional

* *For correspondence*: P. K. Raghav (Email: pramodraghav31@gmail.com)

ISSN: 2348-4330

security. Combining all these points of focus together, ICRISAT (International Crops Research Institute for the Semi-Arid Tropics) came with new foci called as 'SMART FOOD' (Kane-Potaka, 2018). 'Smart Food is food that fulfill all criteria of being good for you (nutritious and healthy); good for the planet (environmentally sustainable); and good for the farmer (climate smart, potential to increase yields, multiple uses)' (Smart Food, 2020).Millets and sorghum were the first one to be added into the list of smart foods (Diama et al., 2020) and then pulses were included under the criteria.

Millets are small-seeded, highly nutritious staple crops grown in many parts of the world. Many types of millets are known pearl millet being one of them. (Saini et al., 2021). Pearl millet is a hardy crop with a relatively short growth period compared to maize (*Zea mays* L.), wheat (*Triticum aestivum*) and rice (*Oryza sativa* L.) that are widely grown in Africa. They are highly nutritious and palatable when consumed (Dube et al., 2021). The aim of the paper is to understand what smart foods are and to study the crops which have been identified as smart food along-with their nutritional potential and health benefits.

SMART FOODS

With the development process a shift have been observed in the need of a food system from just being able to fulfill hunger i.e. food security to nutritional security and from it to sustainable diets, that cover more recent issue by being more sustainable to environment. To cover all this in an inclusion, ICRISAT came with a new term 'Smart Food', it is an initiative that tries find a solution in unison by being able to promote the health, being less harmful to the earth and being good to the farmers as well (OBE and Kane-Potaka, 2020). The main objective of 'smart food initiative' is to focus on diversifying staples and not just restricting the choice to the Big 3 commonly consumed crops. For this millets and sorghum were the first selected staples to be focused on. The high nutritional values, great health benefits and ability to grow with minimal resources made them the first choice (Kane-Potaka et al., 2021). Considering the benefits offered by the pulses, they were the next to be the part of smart food initiative. Analysis of the combination of millets and pulses in a ratio of 3:1 showed to have a complete protein content that to being highly digestible and full of various essential micronutrients (Anitha et al., 2019; ICRISAT, 2019).

These crops were used traditionally to form many dishes and were consumed locally, making them important staple food in the local culture. But recently, usage of these wonderful crops has been decreasing over years majorly due to policies that focus over production and consumption of few selected cereals (Kane-Potaka et al., 2021). Staples make the most of our diet; most of the calories consumed are obtained from the staples in our plates. Smart food initiative tends to focuses on diversifying these staples from just being the 'Big 3' crops to 'Big 5' and eventually 'Big 7'. Hence, a change in the peoples' habit, by including the traditional staple crops is required for bringing desired changes required for nutritional, environmental and farmer's sakes (Kane-Potaka, 2018). Following are the crops included under the criteria of smart food.

Pearl Millet

Pearl millet (*Pennisetum glaucum*) also known as Bajra, belongs to the section *Paniceae* of *Poaceae* family is a crop that can adapt in extreme conditions where other crops such as wheat and maize can't survive (Nambiar et al., 2011). It is rich in quality protein, minerals like phosphorous, iron as well as zinc and contains good amount of antioxidants making it beneficial for human health and wellbeing (Rani et al., 2018) and additional qualities such as low glycemic index, being gluten free, high fibre content makes it a great possible alternative for food diversification (Nambiar et al., 2011).

Sorghum

Sorghum (*Sorghum bicolor* L.) also known as Jowar is the fifth most cultivated cereal in the world after wheat, rice, maize and barley whose cultivation for human consumption began from 3700 to 4000 yr ago. It is a cereal crop of the *Poaceae* family and is native to Africa (de Morais Cardoso et al., 2017). It is an important crop not just because it is climate smart but also because of its high nutritional and health values. Dietary values and chemical composition of whole sorghum are mostly similar to rice, maize and wheat but it is gluten free, rich in resistant starch and posses nearly all classes of diverse phenolic compounds in abundance that make sorghum full of numerous health benefits such as reducing oxidative stress and benefiting people with diabetes (Xiong et al., 2019).

Finger Millet

Eleusine coracana (Finger Millet) is a cereal crop that is a part of subfamily *Chloridideae* within family *Poaceae*, commonly grown in Africa, Southern Asia, Nepal and many states of India such as Uttar Pradesh, Bihar, Tamil Nadu, Karnataka and Andhra Pradesh (Dida and Devos, 2006). Commonly known as *Ragi* and *Mundua* in India is the sixth most cultivated cereal after wheat, rice, maize, sorghum and bajra. Offering multiple health benefits, these minor cereals have calcium content that is highest of all other cereals, rich in dietary fibre and phenolic compounds. Regular consumption of them aids by providing protection against diabetes, cardiovascular diseases by being anti-diabetic, antitumerogenic, anti-diarrheal, antiulcer, anti-inflammatory, atherosclerogenic and possessing antioxidant and antimicrobial properties (Chandra et al., 2016; Devi et al., 2014).

Proso Millet

Proso millet (*Panicum miliaceum*) commonly known as *Chenna, Barri, Baragu, Vari, Panivaragu* and *Swahili* in India, is a warm season grass commonly used to feed birds, human consumption and production of ethanol (Habiyaremye et al., 2017; ICRISAT, 2020). Being one of the underutilized crop Proso millets fulfill the nutritional needs when consumed by being rich in minerals (such as phosphorus, calcium, zinc and iron), dietary fibre, vitamins (such as niacin, vitamin B-complex, and folic acid), polyphenolsand essential amino acids (methionine and cysteine) (Das et al., 2019).

Barnyard Millet

Barnyard millet (*Echinochloa frumentacaea*) generally known as *Sanwa, Shyama*, *oodalu, Kavadapullu , Kuthiravali, Udalu* and *Kira* in India is another nutritionally rich yet underutilized millet (ICRISAT, 2020). They have high nutritional values that offer great health benefits on consumption. They contain decent amount of protein that are easily digestible, low amount of carbohydrate that is slowly digested, contain linoleic acid and oleic acid making them a naturally prepared gift for diabetic and CVD patients (Kaur and Sharma, 2020).

Browntop Millet

Browntop millet (*Urochloa ramosa*) an annual warm-season grass is minor millet commonly known with names as *Korale*, *Karlakki* and *Andukorralu* in different regions of India (Sravan et al., 2020). It is one of the rarest crop able to survive in adverse climatic condition, which becomes an excellent choice for people dealing with lifestyle diseases as it is gluten-free, full of essential nutrients, good source of zinc, iron, fibre and a rich source of natural fibre (Mohapatra et al., 2021).

Foxtail Millet

Foxtail millet (*Setaria italica*) of *Poaceae* family is one of the oldest cultivated crop generally known as *Italian Millet, Kangni, Kankum, Rala, Navane, Thinai, Kang, Rala, Kangu, Kora* across India (ICRISAT, 2020). This millet is known to have a suitable nutritional constituents especially protein (contain essential amino acids such as methionine), high fibre content, needed minerals and photochemical (Verma et al., 2015). It have been seen that consuming foxtail millet regularly provides several health benefits such as lowering blood glucose levels, prevention against cancer, aid in weight loss and may lower blood pressure (Hou et al., 2018).

Little Millet

Little millet (*Panicum miliare*) is known by many names such as *Kutki, Saame, Saave, Chama, Saamai, Samalu, Sava, Halvi* and *Suan* (ICRISAT, 2020). These millets might be called little but that does not make them any less in the nutritive content. They are good source of B-vitamins, needed minerals like calcium, iron, zinc, potassium, essential fats which aids inn weight loss, high fibre content and nutraceutical components such as pheols, tannins and phytates (Ambati and Sucharitha, 2019; Mannuramath et al., 2015) which imparts numerous health benefits.

Kodo Millet

Kodo millet (*Paspalum scrobiculatum L*) is known by many common names such as *Koden, Kodra, Harka, Koovaragu, Varagu, Arikelu, Kodua* (ICRISAT, 2020). Rich in nutrition kodo millet offer higher protein, fibre and minerals then major cereals and can be used as a good substitute for wheat and rice (Deshpande et al., 2015). Rich in phytochemicals and antioxidants it is very easily digested which makes it helpful in combating various lifestyle disorders. It even aids in decreasing joints pain and normalizing the menstruation cycle in women (Ambati and Sucharitha, 2019).

Teff

Teff (*Eragrostis tef* (Zucc.) Trotter) is a small highly nutritional nutty flavored seed originated from horn of Africa. It is tolerant to stress, storage pests and grows in variety of environment making it a low risk crop. Its small size barely gives any idea about the nutritional benefits offered; Teff is a gluten free seed, rich in essential amino acids levels, have impressive contents of required minerals and crude fibre which makes it a beneficial cereal for celiac, diabetic and anemic patients (Gebru et al., 2020; Hackett, 2021).

Fonio

Fonio is a small sized underutilized traditional cereal that belongs to genus *Digitaria* grown in Western Africa. There are generally two types of Fonio grains, white Fonio and black Fonio commonly known as fundi/hungry rice and iburu respectively. It usually grows on marginal lands and requires minimal input as it is adaptable drought and less fertile soil. Nutritionally Fonio seeds provide all macronutrients such as starch, dietary fibre, proteins especially methionine and fats; micronutrients that include polyphenols, minerals like iron and B vitamin (Salahudeen and Orhevba, 2021; Zhu, 2020).

Job's Tears

Job's tear (*Coix lacryma-Jobi L.*) a pear shaped seed with shiny dark brown to gray black hull is a member of *Graminae* family. These seeds provide phenols, flavonoids, polysaccharides, proteins, fibres, vitamins and oil on consumption all this made them well known in Chinese medications. Chemical composition of the seeds inhibits enzyme COX, synthesis of fatty acids, synthesis of liver cholesterol and offers high antioxidant, anti-inflammatory, anti-obesity activity, maintain levels of reproductive hormones, uterine contractions and maintain gut microflora (Devaraj et al., 2020).

Chickpea

Chickpea (*Cicer arietinum L*) one of the oldest vegetarian protein sources is also known as Garbanzo beans, an important crop grown and consumed all over the world. Due to the presence of numerous health promoting components, that includes vegetable protein (all essential amino-acids except sulphur containing amino-acids), complex carbohydrate, dietary fibres, nutritionally important unsaturated fatty acids (linoleic and oleic acids), important vitamins and minerals, oligosaccharides, isoflavones, phospholipids and antioxidants, they have several potential health benefits and are considered an important part of healthy diet (Jukanti et al., 2012; Gupta et al., 2017).

Pigeonpea

Pigeon pea or red gram (*Cajanus cajan (L.) Millspaugh*) is known by different names such as Cajan pea, no-eyed pea, and tropical green pea around the world, whereas in India it is known as red gram, tur or arhar. They are full of carbohydrates, dietary fibre, proteins (essential amino acids), vitamins and minerals (both micr and macro), which impact health in numerous ways by aiding in management of blood pressure, weight, hearth health, gives energy boast and helps in growth and development (Abebe, 2022; Saxena et al., 2010; ICRISAT, 2020).

Table 1: Health Benefits Offered by the Crops Included Under the Criteria of Smart Food

Name	Nutrients/ Characteristics	Health Benefits
Peal Millet	Iron and Folic Acid	Reduces chances of neural tube defects in pregnant women and helps in preventing anemia
Sorghum	Resistant Starch, Low Glycemic Index	Slows down the absorption of carbohydrates that prevent from sudden fluctuations in glucose levels
Finger Millet	Calcium	Bone strengthening, relieves joint pains and reduces the risk of bone fractures
Proso Millet	Niacin Lecithin	Pellagra, Intensify metabolism of brain cells and helps in regeneration and repairing of myelin fibre
Barnyard Millet	Low carbohydrates, High Fibre and Resistant Starch	Nature gift for diabetic and cardiovascular disease patients
Browntop Millet	Dietary Fibre	Good for people with lifestyle disease
Foxtail Millet	Magnesium	Makes it a healthy heart food
Little Millet	Rich in fiber, slow digesting carbohydrates and antioxidants	Low glycemic index that's helps in maintaining blood glucose levels and helps in body detoxification
Kodo Millet	Photochemical and antioxidant	Reduce joint and knee pain and regularize menstrual cycle
Teff	Resistant starch and high dietary fibre	Aids in blood glucose management, beneficial in diarrhea and constipation
Job's Tear	Various Phytoconstituent,	Antioxidant, anti-inflammatory, weight reduction, simulative reproductive hormones, uterine contractions and gut health

	Polysaccharides, Phenols, Flavonoids	
Fonio	Iron and folic acid	Helps against anemia and detoxify liver and the body
	isoflavones and phytosterols,	Limits the absorption of cholesterol
Chickpea		Support functions of liver enzymes and detoxify cancer causing substances
	selenium and manganese	Prevent from cardiovascular diseases
Pigeopea	Potassium	Helps in lowering blood pressure
Green Gram	Protein	Vegetarian source of lean protein that aids in weight loss by keeping you filled
Ground Nuts	Biotin and Vitamin E	Helps in releasing energy from the carbohydrates and strengthens the immune system

Green Gram

Green gram (Vigna radiata (L.) Wilczek) is commonly called by names as mung bean, Chickasono pea, moong, chiroko, Oregon pea, Chickasaw pea, and golden gram. Green pearl is the name give to the pulse because of its high nutrient content (Nair et al., 2013). Being is rich in nutrients like proteins, carbohydrate, dietary fiber, vitamins, and minerals and low in fat content, makes them a lean protein source for vegetarians, helps in weight management and lowering blood pressure (Mekkara et al., 2021; ICRISAT, 2020).

Groundnut

Groundnut also known as peanut (*Arachis hypogaea*) is an edible seed from legume family. These nutri seeds are an important food crop by being easily available, affordable when compared to other nuts and nutritionally rich. They offer desirable profile of lipids that is high in unsaturated and not in saturated fatty acids, rich source of protein, good amount of fiber, vitamins (biotin, niacin, thiamine), minerals (manganese, phosphorous, magnesium), carbohydrates and consumed around the world (Bonku and Yu, 2020; Suchoszek-Łukaniuk et al., 2011; ICRISAT,2020).

MILLETS

Millets are tiny, round seeds of small seeded grass family (*Poaceae*) with different varieties, which are widely cultivated all around the world as cereal crops for fodder and human consumption (Dayakar Rao et al., 2017). Around 27.83 million tones of millets are produced around the world (Malathi et al., 2016) and Indian millets cultivation covers an area of 12.09 hectares which produces 13.71 million tones yielding 1134kg millets per hector. Rajasthan covers the highest area for millet cultivation (31.3%) after that Maharashtra (18.9%), Karnataka (13.3%), Uttar Pradesh (8.9%), Tamil Nadu (4.2%) and Madhya Pradesh (3.9%). Yet highest production was observed in Tamil Nadu (Rao et al., 2021).

Millets show remarkable abilities by being drought-resistant, able to grow in less fertile soil, resistant to attack of pests and diseases, harvested in less time and able to be cultivated round the year. They are among the most ancient cereals cultivated from the starting of human civilization under rainfed conditions (Sarita and Singh, 2016). Millets are nutri-cereals, as they are highly nutritious and are full of health promoting nutrients. They are full of protein, essential fatty acids, crude fibre, and excellent source of B-vitamin, minerals and polyphenols. They provide numerous health benefits by lowering blood sugar levels in diabetes, regulating blood pressure, thyroid, CVD and gluten allergies (Dayakar Rao et al., 2017).

Millets are classified into two groups, namely, major and minor / small millets. Pearl millet (Pennisetum typhoides L.) and Sorghum (Sorghum bicolor L.) are part of major millet group, whereas millets like finger millet/ragi (Eleusine coracana L. Gaertn),

barnyard millet (Echinochloa frumentacea L.), foxtail or Italian millet (Setariaitalica L.), kodo millet (Paspalum scrobiculatum L.), little millet (Panicum sumatrens L.), proso millet (Panicum miliaceum L.) and brown-top millet (Brachiaria ramosa L. Stapf; Panicum ramosum L.) comes under the category of minor or small millets (Maitra, 2020).

Pearl Millet

Pearl millet or Bajra is a fast growing vertical grass crop with a summer annual cycle of 75 to 120 days depending on the environment that can reach an average height of 1.5 to 3 m. It is a coarse grain crop with oval seeds that resembles a pearl hence got its name 'pearl millet' (Dias-Martins et al., 2018). The plant can easily adapt to cultivation system characterized by less rainfall (nearly 200-600 mm), soil with low fertility, extreme high temperatures and with stand drought much better than any other cereals and millets, which makes it a crop that can survive where other cereal crops can't (Nambiar et al., 2011). Pearl millet is primarily considered a fodder crop during summers in western regions of Rajasthan and Gujarat when there is a lack of green fodder. Rajasthan state covers highest producing area for pearl millet, followed by Uttar Pradesh, Maharashtra, Haryana, Gujarat and Madhya Pradesh. (Rao et al., 2021).

Pearl millet are even known as 'nutri-cereals' due to the excellent nutritional profile that they offer, which is comparable and even superior to most of the commonly consumed cereals (Florence et al., 2014). Pearl millet offers 360 kcal per 100 gm being consumed, making it a rich source of energy. Macronutrients content of the millet per 100 gm are 67 gm carbohydrates of which 1 gm is the dietary fibre, nearly 12 gm of protein with a good amino-acid balance and 5 gm of total fat majority of which are unsaturated fatty acids (Malik, 2015). Overall content of minerals offered is 2.3 gm/100 gm being rich source of potassium, phosphorous, magnesium, iron, zinc, copper and manganese. It is a very rich source of phytochemicals and micronutrients, which impart pearl millet with many health benefits (Nambiar et al., 2011).

Table 2: Nutritional Content of Pearl Millet per 100 gm.

Nutrients	Amount
Energy	350 Kcal
Protein	11.09 gm
Carbohydrates	62.2 gm
Total Fibre	11.8 gm
Total Free Sugar	0.81 gm
Total Fat	5.75 gm
Total Saturated Fatty Acids	892.25 mg
Total Monounsaturated Fatty Acids	1067 mg
Total Polyunsaturated Fatty Acids	2012 mg
Ash content	1.45 gm
Iron	6.94 mg
Magnesium	133.75 mg
Phosphorous	301.65 mg
Zinc	2.94 mg

Source (IFCT, 2017) / (Longvah et al., 2017)

The possible health benefits offered by pearl millets comprises of an aid that may help in rising Hb levels due to high iron (8 mg/100 gm) and zinc (3.1 mg/100 gm) content, may give relief in constipation, help in lowering blood glucose levels (low glycemic index), an alternative for people suffering from celiac disease (gluten free), diarrhea as contain lactic acid bacteria that provide

a probiotic treatment, helps in growth of bones and their development as it have a good amount of phosphorous and calcium, presence of flavonoids, phenolic omega 3 fatty acids may provide protection against non-communicable diseases, the ability of bajra to maintain its alkaline property helps it in providing protection against stomach ulcers (Patni and Agrawal, 2017).

Pearl millet has every quality that makes it an intelligent choice among available major cereals in the market. Offering high nutritional qualities and health benefits efforts should be made for changing the attitude of people towards the underutilized crop and increasing its consumption among all the groups of people. It can be easily included in the daily lifestyle and meal pattern of any individual. Pearl millet can be easily incorporated in the chapatti flour, porridge formation, baking of breads and cookies, making of malted drinks and many more. Hence diversifying our daily meals with it would enhance the nutritional profile of the meals and benefit our health.

CONCLUSION

Smart food is an initiative started by ICRISAT with an aim to diversify the staples to enhance the nutritional quality of the meal consumed. Diversifying the diet with underutilized neglected crops of the areas can bring a great impact by benefiting health, being good to planet and farmers as well. Millets are comparably same or more nutritional dense to majorly consumed cereals offering better macro and micro nutrient composition. Consuming millets with the combination of legumes complements with the deficient amino acids providing all the required essential amino acids by the body. Pearl millet is one of the many crops included under smart food criterion, which is full of nutrients and health benefits. Its consumption and incorporation is easy and palatable and can be incorporated in our daily diets. There is an urgent need to enhance the awareness and knowledge among the people regarding the utilization of these wonderful nutritional crops. Sufficient efforts should be made in order to bring these neglected crops among the staple and enhance the area of their utilization. In future such ways should be focused on that can enhance their consumption as well as their inclusion in the industrial manufacturing of ready to use food products.

REFERENCES

Ambati, K. and Sucharitha, K.V. 2019. Millets-review on nutritional profiles and health benefits. International Journal of Recent Scientific Research, 10(7): 33943-33948.

Anitha, S., Kane-Potaka, J., Tsusaka, T.W., Tripathi, D., Upadhyay, S., Kavishwar, A., Jalagam, A., Sharma, N. and Nedumaran, S. 2019. Acceptance and impact of millet-based mid-day meal on the nutritional status of adolescent school going children in a peri urban region of Karnataka State in India. Nutrients, 11(9): 1-16.

Bonku, R. and Yu, J. 2020. Health aspects of peanuts as an outcome of its chemical composition. Food Science and Human Wellness, 9(1): 21-30.

Chandra, D., Chandra, S. and Sharma, A. K. 2016. Review of Finger millet (Eleusine coracana (L.) Gaertn): a powerhouse of health benefiting nutrients. Food Science and Human Wellness, 5(3): 149-155.

Das, S., Khound, R., Santra, M. and Santra, D.K. 2019. Beyond bird feed: Proso millet for human health and environment. Agriculture, 9(3): 1-19.

Dayakar Rao, B., Bhaskarachary, K., Arlene Christina, G.D., Sudha Devi, G., Vilas, A.T. and Tonapi, A. 2017. Nutritional and health benefits of millets. ICAR_Indian Institute of Millets Research (IIMR), Rajendranagar, Hyderabad: 1-112.

de Morais Cardoso, L., Pinheiro, S.S., Martino, H.S.D. and Pinheiro-Sant'Ana, H.M. 2017. Sorghum (Sorghum bicolor L.): Nutrients, bioactive compounds, and potential impact on human health. Critical Reviews in Food Science and Nutrition, 57(2): 372-390.

Deshpande, S.S., Mohapatra, D., Tripathi, M.K. and Sadvatha, R.H. 2015. Kodo millet-nutritional value and utilization in Indian foods. Journal of Grain Processing and Storage, 2(2): 16-23.

Devaraj, R.D., Jeepipalli, S.P. and Xu, B. 2020. Phytochemistry and health promoting effects of Job's tears (Coix lacryma-jobi)-A critical review. Food Bioscience, 1(34): 100537: 1-10.

Devi, P.B., Vijayabharathi, R., Sathyabama, S., Malleshi, N.G. and Priyadarshini, V.B. 2014. Health benefits of finger millet (Eleusine coracana L.) polyphenols and dietary fiber: a review. Journal of Food Science and Technology, 51: 1021-1040.

Diama, A., Anitha, S., Kane-Potaka, J., Htut, T.T., Jalagam, A., Kumar, P., Worou, O.N. and Tabo, R. 2020. How the smart food concept can lead to the transformation of food systems and combat malnutrition: different approaches in Africa, globally, and a case study from Myanmar with lessons learnt for creating behavior change in diets. In Hidden Hunger and the Transformation of Food Systems, 121: 149-158. Karger Publishers.

Dias-Martins, A.M., Pessanha, K.L.F., Pacheco, S., Rodrigues, J.A.S. and Carvalho, C.W.P. 2018. Potential use of pearl millet (Pennisetum glaucum (L.) R. Br.) in Brazil: Food security, processing, health benefits and nutritional products. Food Research International, 109: 175-186.

Dida, M.M. and Devos, K.M. 2006. Finger millet. Cereals and Millets, 333-343.

Dube, M., Nyoni, N., Bhebhe, S., Maphosa, M. and Bombom, A. 2021. Pearl Millet as a Sustainable Alternative Cereal for Novel Valueadded Products in Sub-Saharan Africa: A Review.

Florence, S.P., Urooj, A., Asha, M.R. and Rajiv, J. 2014. Sensory, physical and nutritional qualities of cookies prepared from pearl millet (Pennisetum typhoideum). Journal of Food Processing and Technology, 5(10): 1.

Gebru, Y.A., Sbhatu, D.B. and Kim, K.P. 2020. Nutritional composition and health benefits of teff (Eragrostis tef (Zucc.) Trotter). Journal of Food Quality, 2020: 1-6.

Gupta, R.K., Gupta, K., Sharma, A., Das, M., Ansari, I.A. and Dwivedi, P.D. 2017. Health risks and benefits of chickpea (Cicer arietinum) consumption. Journal of Agricultural and Food Chemistry, 65(1): 6-22.

Habiyaremye, C., Matanguihan, J.B., D'Alpoim Guedes, J., Ganjyal, G.M., Whiteman, M.R., Kidwell, K.K. and Murphy, K.M. 2017. Proso millet (Panicum miliaceum L.) and its potential for cultivation in the Pacific Northwest, US: a review. Frontiers in Plant Science, 1961.

Hackett, J. 2021. What is Teff? Buying, cooking, and recipes. The Spruce Eats. https://www.thespruceeats.com/teff-gluten-free-whole-grain-3376844

ICRISAT. 2020. Millets and sorghum. www.smart.org. https://www.smartfood.org/smart-food-foxtail-millet/

ICRISAT. 2020. Millets and sorghum. www.smart.org. https://www.smartfood.org/smart-foods/pigeon-pea/

ICRISAT. 2020. Millets and sorghum. www.smart.org. https://www.smartfood.org/smart-foods/green-gram/

ICRISAT. 2020. Millets and sorghum. www.smart.org. https://www.smartfood.org/smart-food-proso-millet/

ICRISAT. 2020. Millets and sorghum. www.smart.org. https://www.smartfood.org/smart-food-barnyard-millet/

ICRISAT. 2020. Millets and sorghum. www.smart.org. https://www.smartfood.org/smart-food-kodo-millet/

ICRISAT. 2020. Millets and sorghum. www.smart.org. https://www.smartfood.org/smart-food-little-millet/

ICRISAT. 2020. Millets and sorghum. www.smart.org. https://www.smartfood.org/smart-foods/groundnut/

Jukanti, A.K., Gaur, P.M., Gowda, C.L.L. and Chibbar, R.N. 2012. Nutritional quality and health benefits of chickpea (Cicer arietinum L.): a review. British Journal of Nutrition, 108(S1): S11-S26.

Kane-Potaka, J. 2018. Breaking the food-system divide with Smart Food: good for you, the planet and the farmer. In: Proceedings of the Crawford Fund 2018 Annual Conference, 13–14 August 2018, Parliament House, Canberra ACT, Australia. pp. 57-61.

Kane-Potaka, J., Anitha, S., Tsusaka, T.W., Botha, R., Budumuru, M., Upadhyay, S., Kumar, P., Mallesh, K., Hunasgi, R., Jalagam, A.K. and Nedumaran, S. 2021. Assessing millets and sorghum consumption behavior in urban India: A large-scale survey. Frontiers in Sustainable Food Systems, 5: 1-12

Kane-Potaka, J and Poole, N and Diama, A and Kumar, P and Anitha, S and Akinbamijo, O. 2021. The smart food approach: the importance of the triple bottom line and diversifying staples. In: Orphan Crops for Sustainable Food and Nutrition Security. Earthscan from Routledge, London, pp. 327-334.

Kaur, H. and Sharma, S. 2020. An overview of Barnyard millet (Echinochloa frumentacea). Journal of Pharmacognosy and Phytochemistry, 9(4): 819-822.

Kuraz Abebe, B. 2022. The dietary use of pigeon pea for human and animal diets. The Scientific World Journal, 2022: 1-12

Longvah, T., Anantan, I., Bhaskarachary, K., Venkaiah, K. and Longvah, T. 2017. Indian food composition tables. Hyderabad: National Institute of Nutrition, Indian Council of Medical Research, pp. 2-58.

Maitra, S. 2020. Potential horizon of brown-top millet cultivation in drylands: A review. Crop Research, 55(1and2): 57-63.

Malathi, B., Appaji, C., Reddy, G.R., Dattatri, K. and Sudhakar, N. 2016. Growth pattern of millets in India. Indian Journal of Agricultural Research, 50(4): 382-386.

Malik, S. 2015. Pearl millet-nutritional value and medicinal uses. International Journal of Advance Research and Innovative Ideas in Education, 1(3): 414-418.

Mannuramath, M., Yenagi, N. and Orsat, V. 2015. Quality evaluation of little millet (Panicum miliare) incorporated functional bread. Journal of Food Science and Technology, 52: 8357-8363.

Mohapatra, S.R., Panwar, N.S., Kumar, R. and Kumar, A. 2021. Quality enhancement of nutri-cereal browntop millet through agronomic practices. Current Science, 120(3): 468.

Nair, R.M., Yang, R.Y., Easdown, W.J., Thavarajah, D., Thavarajah, P., Hughes, J.D.A. and Keatinge, J.D.H. 2013. Biofortification of mungbean (Vigna radiata) as a whole food to enhance human health. Journal of the Science of Food and Agriculture, 93(8): 1805-1813.

Nambiar, V.S., Dhaduk, J.J., Sareen, N., Shahu, T. and Desai, R. 2011. Potential functional implications of pearl millet (Pennisetum glaucum) in health and disease. Journal of Applied Pharmaceutical Science, 1(10): 62-67.

OBE, N.P. and Kane-Potaka, J., The smart food triple bottom line–starting with diversifying staples. TAA Executive Committee, 21.

Poole, N and Kane-Potaka, J. 2020. The smart food triple bottom line – starting with diversifying staples. Agriculture for Development, 41: 21-23.

Rani, S., Singh, R., Sehrawat, R., Kaur, B.P. and Upadhyay, A. 2018. Pearl millet processing: a review. Nutrition and Food Science, 48(1): 30-44.

Saini, S., Saxena, S., Samtiya, M., Puniya, M. and Dhewa, T. 2021. Potential of underutilized millets as Nutri-cereal: an overview. Journal of Food Science and Technology, 1-13.

Salahudeen, H.O. and Orhevba, B.A. 2021. Nutritional Composition, Health Benefits and Utilization of Fonio (Digitaria exilis) Grains: A Review. Pan African Society for Agricultural Engineering and The Nigerian Institution of Agricultural Engineers (A Division of the Nigerian Society of Engineers). 2021 Virtual International Conference.

Sarita, E.S. and Singh, E. 2016. Potential of millets: nutrients composition and health benefits. Journal of Scientific and Innovative Research, 5(2), 46-50.

Saxena, K.B., Kumar, R.V. and Sultana, R. 2010. Quality nutrition through pigeonpea-a review. Health, 2(11), 1335-1344.

Smart Food: The initiative. 2020. https://www.smartfood.org/the-initiative/

Sravani, M., Kuna, A., Devi, S.S., Rao, K.S. and Gayatri, B. 2020. Effect of processing on the Physico-chemical properties of Browntop millet (Brachiaria ramosa). Journal of Pharmacognosy and Phytochemistry, 9(5): 1480-1483.

Suchoszek-Łukaniuk, K., Jaromin, A., Korycińska, M. and Kozubek, A. 2011. Health benefits of peanut (Arachis hypogaea L.) seeds and peanut oil consumption. In Nuts and seeds in health and disease prevention, Academic Press, pp. 873-880.

Ugare, R., Chimmad, B., Naik, R., Bharati, P. and Itagi, S. 2014. Glycemic index and significance of barnyard millet (Echinochloa frumentacae) in type II diabetics. Journal of Food Science and Technology, 51: 392-395.

Verma, S., Srivastava, S. and Tiwari, N. 2015. Comparative study on nutritional and sensory quality of barnyard and foxtail millet food products with traditional rice products. Journal of Food Science and Technology, 52(8): 5147-5155.

Xiong, Y., Zhang, P., Warner, R.D. and Fang, Z. 2019. Sorghum grain: From genotype, nutrition, and phenolic profile to its health benefits and food applications. Comprehensive Reviews in Food Science and Food Safety, 18(6): 2025-2046.

Zhu, F. 2020. Fonio grains: Physicochemical properties, nutritional potential, and food applications. Comprehensive Reviews in Food Science and Food Safety, 19(6): 3365-3389.

© The Author(s)

This is an Open Access article licensed under a Creative Commons license: Attribution 4.0 International (CC-BY).