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REVIEW ARTICLE

Kodo Millet-Nutritional Value and Utilization in Indian Foods

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Abstract

Kodo millet, one of the ancient grains of the world, originated from Africa and domesticated in India few thousand years ago is a draught resistant plant. This millet crop is grown in arid and semi-arid regions of African and Asian countries. In India, Kodo millet grown mostly in the Deccan region and the cultivation extends to the foothills of Himalayas. Kodo millet is rich in dietary fiber and minerals like iron, antioxidant. The phosphorus content in kodo millet is lower than any other millet and its antioxidant potential is much higher than any other millet and major cereals. Processing like parboiling and debranning affects the mineral content and fibre, however it reduced anti-nutritional factors like phytate. Several traditional Indian food items have been prepared solely from kodo or blended with other cereal and legume flours to enhance the nutritional value, palatability and functionality.

Keywords: Kodo millet, Minerals, Fibre, Nutrition, Processing, Food Product.

1. Introduction

Cereal grains have contributed to the growth of human races since ages and play a vital part in the daily diet of billions of people all over the world. However, production of the major cereal crops are dwindling in recent years because of the climate changes, crop failure due to erratic weather causing flood and draught conditions, lower productivity as a result of soil nutrient depletion, chemical residues spoiling soil health. This is putting an onus on the agricultural and food sector. Furthermore, increasing world population, rising food prices and essential commodities, and other socio-economic impacts are threatening the global agriculture and food security. The impact can be most felt by the people who live in arid and sub-arid regions, with limited resources (Saleh *et al.*, 2013). Food for all is a great challenge to the scientists working in the area of production, processing, storage and nutrition to combat hunger and poverty. Millets are considered as ancient grains, domesticated thousands of years ago at the beginning of human civilization. Some evidences point out about the cultivation of millets about 4000 years ago (Shahidi and Chandrasekara, 2013). There is growing realization regarding nutritional and health benefits of the under-utilized millet grains, which have paved the way for growth of millet production that has been declining since the focus has been mainly on cereal crops like rice and wheat. The millets, the most draught-resistant crops, widely grown in the Africa, Indian Peninsula, and other Asian countries, are the major source of nutrition to the people living in rural area. These millets are being used as nutraceuticals as they are rich in antioxidants much higher than the major cereal crops. They are reportedly beneficial in curbing asthma, migraine, blood pressure, diabetic heart disease, atherosclerosis and heart attack. The high fibre content in millets prevents gall stone formation. The whole grain consumption has health promoting effects like prevention of insulin resistance, heart disease, diabetes, ischemic stroke, obesity, breast cancer, childhood asthma and premature death (Balasubramanium, 2013). Because of these benefits, millets can be used in functional foods and as neutraceuticals. Hence, they are also called as *'nutricereals'*. In addition, because of their important contribution to national food security and potential health benefits, of combating various diseases (Shahidi and Chandrasekara, 2013), millet grains are now receiving increased interest from food processors, technologists, and nutritionists. Once a poor man's staple, now adorns the plates of affluent and health conscious people. One of such ancient millet grains is kodo millet, a native tropical Africa, believed to be domesticated in India about 3000 years back (De Wet *et al.*, 1983). The kodo millet *(Paspalum scrobiculatum)*, is also known as cow grass, rice grass, ditch millet, Native Paspalum, or Indian Crown Grass. It is grown in India, Pakistan, Philippines, Indonesia, Vietnam, Thailand and West Africa. It is major food source in the Deccan plateau of India (Gujarat,

Karnataka and parts of Tamil Nadu), some regions of Maharashtra, Odisha, West Bengal, Rajasthan, Uttar Pradesh and Himalayas and consumed traditionally as health and vitality foods in rural India (Hegde and Chandra, 2005). The local names of kodo varies from region to region and it is known as *Kodo* in Bengali, *Kodra* in Gujarati, Punjabi and Marathi, *Kodon* in Hindi, *Harka* in Kannada, *Kodua*in Odia, *Varagu* in Tamil and *Arikelu, Arika* in Telugu. An estimation says Kodo millet is grown in area of about 907,800 ha with annual production of about 310,710 tonnes (Yadav *et al.,* 2013). Madhya Pradesh and Tamil Nadu have the maximum share in the production and promotion of kodo millet. Government of MP also playing active role in promoting the cultivation and marketing of this crop.

The *Paspalum genus* has more than 400 species, usually an annual crop, however many cultivars root at the nodes and grow culms after the mature plant flowers and matured their inflorescence. Some of the species are perineal in nature (De Wet *et al.,* 1983). This crop is drought tolerant and usually grown in semi-arid regions without any intercultural operations. Kodo is monocot and the seeds are very small and ellipsoidal, being approximately 1.5mm in width and 2mm in length; they vary in colour from being light brown to a dark grey. Kodo millet has a shallow root system which may be ideal for intercropping. The grain is enclosed in hard, corneous, persistent husks (FAO, 1995).

2. Kodo-Poisoning

Kodo grain is often referred to be poisonous to cattle and human. The poisoning of the grain is associated with the fungus. The fungal disease *Paspalum ergot* causes nervousness, lack of muscular coordination, staggering gait, spasms depression and in extreme cases causes death in Animals. In human, the kodo-poisoning causes nausea, vomiting, delirium, depression, intoxication, and unconsciousness. The toxic substance, cyclopiazonic acid, whose presence of kodo millet causes 'kodua poisoning' and is believed to be produced by *Aspergillus flavus, A. tamarii* and *Phomopsis paspalli* (Patwardhan *et al.,* 1974; Rao and Husain, 1985; Antony *et al.,* 2003).

3. Nutritional Information

Kodo millet is a nutritious grain and a good substitute to rice or wheat. The nutritional composition of various cereal crops is shown in Table 1. The protein, fiber and mineral content are much higher than the major cereals like rice. The kodo millet grain is composed of 8 % protein. The major protein fraction in kodo millet is glutelin (Sudharshana *et al.,* 1988). Kodo millet is an excellent source of fiber (9%), as opposed to rice (0.2%), and wheat (1.2%). Kodo millet contains 66.6g of carbohydrates and 353 kcal per 100g of grain, comparable to other millets. It also contains 1.4% fat and 2.6% minerals. The iron content in kodo millet ranges from 25.86ppm to 39.60ppm (Chandel *et al.,* 2014). Among the millets, it has the least amount of phosphorous content. Hegde and Chandra (2005) reported that kodo millet had good DPPH quenching capability as it required only 18.5µl for 50% quenching as compared to 0.946µmol/ml of Vitamin C and 0.348 µmol/ml Vitamin E to achieve the same (50% DPPH quenching). Kodo millet flour has a gelatinization temperature range of 13°C (76.6-90°C), which has less resistant to gelatinization (Shinoj *et al.,* 2006) and can be incorporated baking of bread and cakes, extrusion of cereal-based products, gravy, soup, heat set gel, porridge, instant powders and modified flour and starches for specialty foods. As with other food grains, the nutritive value of kodo millet protein could be improved by supplementation with legume protein.

4. Effect of Processing on Nutritional Quality of Kodo Millet

Apart from being a rich source of nutrients, kodo millets also contain high amounts of polyphenols, antioxidants, tanins, phosphorous and phytic acids. These anti-nutrients form complexes with micronutrients such as iron, calcium and zinc, and reduce their solubility and bioavailability. Tannin also adversely affects utilization of proteins and carbohydrates by forming complexes, thus resulting in reduced growth, feeding efficiency, metabolizable energy and bioavailability of amino acids (Balasubramanian, 2013). Traditional technologies such as decortication, soaking, germination and fermentation of cereal-based foods reduce the levels of tannins and phytates, increase bioavailability of amino acids and mineral elements and improve protein and starch digestibility. Dehulling can remove 40 to 50 percent of both phytate and total phosphorus. Balasubramanian (2013) emphasized on the importance of dehulling the millet grains prior to consumption as the phytate content of common millet varieties ranged from 170 to 470mg per 100g whole grain, and dehulling results in a 27 to 53% reduction in phytate content. On dehulling, phytin phosphorus decreases by 25% in kodo millet. Chandrasekher *et al.* (1981) screened millet varieties for inhibitory activity against human salivary amylase and observed that kodo millet strains had no detectable activity.

On the other hand, the antioxidant activity of kodo millets decreases when the whole grain is dehulled and cooked. A report by Chandrasekara *et al.*

(2012) says that the antioxidant activity of whole kodo decreased from 32.4 to 6.86 in case of dehulled one, whereas the dehulled boiled kodo millet has only 6.06, further the bran contains about 112 (μmol ferulic acid equiv/g defatted meal). These finding were corroborated by Annor *et al.* (2013), who had justified the use of whole grains for food product development. Their study revealed that the expected glycemic index (eGI) of whole kodo starch is lower than the rice starch. Moreover, the whole kodo grain has lower starch digestibility and eGI than the decorticated grains. Therefore, they advocated use of whole kodo millets for development acceptable products to maintain its hypoglycemic property. A study conducted by Hegde and Chandra (2005) reveals that kodo millet (*Paspalum scrobiculatum*) has higher free radical quenching capacity (70%) compared to other millets like finger millet (*Eleusine coracana*), little millet (*Panicum miliare*), foxtail millet (*Setaria italica*), barnyard millet (*Echinochloa utilis*) and great millet (*Sorghum bicolor*) (15-53%). Moreover, thermal processing of kodo millet by roasting or boiling reduced the activity. It was also observed that fractionation of kodo millet in to husk and endosperm also decreased the activity and the phytochemicals appear to act synergistically in the whole grain. A study by Chandrasekara and Shahidi (2012) reveals that the phenolics content after digestion and colonic fermentation by gut microflora, of cooked kodo millet had the lowest insoluble residue, which mainly consisted of insoluble fibre (81mg/g of cooked grain) as compared to finger millet (179mg/g of cooked grain), pearl millet (132mg/g of cooked grain), foxtail (157mg/g of cooked grain) and proso millet (210mg/g of cooked grain). Vijaykumar *et al.* (2013) subjected the kodo millet to heat treatments such as boiling for 25 minutes at 95-100°C, steaming at 80-90°C and pressure cooking at 9.8×10^4 Pa for 20 minutes. Boiling reduced the starch yield, exhibited greater porosity and water absorption capacity. Pressure cooked samples had greater oil absorption capacity and swelling power; reduced the peak and final viscosity which indicates large starch damage due to greater α-amylase activity. The resistant starch content was higher in pressure cooked flour resulting in low starch digestibility index. They concluded that since, the pressure cooked flour was less viscous, high dense, rich in resistant starch, it is more suitable food in the diet for degenerative disorders. Amadou *et al.* (2013) in their report emphasized the importance of millets in providing sulphur containing essential amino acids like methionine and cysteine and the loss of germ, antioxidant containing bran and other minerals on debranning.

5. Uses

Kodo millets can be used for traditional as well as novel foods. Unprocessed or processed grain can be cooked whole or decorticated and if necessary ground to flour by traditional or industrial methods. In India, kodo millet is ground into flour and used to make pudding. In tribal sectors, it is cooked as rice also and out of flour tribal population prepares different recipes. In Africa, it is cooked like rice. It is also a good choice of animal fodder for cattle, goats, pigs, sheep, and poultry. In Hawaii, variety of *P. scrobiculatum* is found to grow well on hillside slopes where other grasses do not flourish. It has the potential to be grown as a food source on hillside farms. It may also have potential to be used as grass ties on hillside plots to prevent soil erosion, while also providing a famine food as a secondary purpose. It has been noted that it makes a good cover crop. Though it is not been a major carbohydrate source in European countries; however it is gaining importance as a gluten free food and is a component in multigrain gluten free food products.

6. Traditional Indian Foods from Kodo

Several literatures reported the use of kodo flour to the extent of 30-100% for development of traditional as well as novel food products like idli, dosa, chappathi, pongal, puttu, idiyappam, kozhukattai, boli, biscuit, soup, adai, payasam, cutlet, biscuits, bread, cookies and laddoo to name a few (Kalpana *et al.*, 2013; Senthamarai *et al.*, 2013; Padma and Rajendren, 2013; Chakraborty and Kotwaliwale, 2016).

Papad is prepared using kodo millet flour, blackgram flour by mixing both the flours in equal quantity and adding cumin seeds, salt and sodium bicarbonate for taste and getting good texture. The stiff dough is made to roll out in circular shape and dried. Kodo millet flour is mixed with chilli powder, salt and cumin seeds and thick batter is formed by adding water. This batter is then dropped on greased plates to sundried.

Dried *Vadagam* packed for further use *Idli* and *Dosa* can be prepared using kodo and blackgram dhal in a ratio of 3:1 ratio. Soaking is the first step to prepare the product followed by course grinding for idli and fine grinding for Dosa. Fenugreek seeds and salt to taste were added for taste and the mixture is fermented overnight. Using this batter, idli is steamed using idli pots (stand) and to make dosa, greased flatten pan is used to turn into dosa shape.

Thatuvadai is prepared using kodo millet flour and small quantity of roasted Bengal gram dhal. Thick dough is prepared, to which salt, chilli powder curry leaves and butter is added. Small portions of the dough is rolled out on polythene sheet and deep fried in hot oil.

Table 1: Nutritional composition of various millets and cereals per 100 g at 12% moisture content.

	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Minerals (g)	Iron (mg)	Phosphorus (mg)	Calcium (mg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)
Barnyard millet	6.2	2.2	65.5	9.8	4.4	15.2	280	11	0.30	0.1	4.2
Finger millet	7.5-11.7	1.3	72	3.6	2.7	3.6-6.8	283	376-515	0.42	0.19	1.1
Foxtail millet c	11.2	4.0	63.2	6.7	3.3	2.8	…	31	0.59	0.11	3.2
Kodo millet	8.3	1.4	65.9	9.0	2.6	0.5	188	27	0.33	0.09	0.2
Little millet	7.7	4.7	67	7.6	4.5	9.3	220	17	0.30	0.09	3.2
Pearl millet*	8.5-15.1	2.7-7.1	58-70	2.6-4.0	1.6-2.4	70-180	450-990	10-80	0.38	0.21	2.8
Proso millet	12.5	3.1	70.4	7.2	1.9	0.8	206	14	0.41	0.28	4.5
Sorghum	10.4	3.1	70.7	2.0	1.6	5.4	520	25	0.38	0.15	4.3
Corn	9.2	4.6	73.0	2.8	1.2	2.7	92-178	70-75	0.38	0.20	3.6
Rice	6.8	2.2	78.2	0.2	0.5	0.7	160	45	0.41	0.04	4.3
Wheat	11.8	1.5	71.2	1.2	1.5	5.3	306	41	0.41	0.10	5.1

Ref: Abdalla et al., 1998; [b]Barbeau and Hilu, 1993, [c]Saleh et al., 2013, Obilana, 2003, Léder, 2004, Sokrab et al., 2012.

Muruku is a popular snack food, which is known as chakli in other regions. Kodo millet flour is added with chilli powder, sesame seeds, cumin seeds, asafoetida, butter, salt to taste. Mixture of all is turned into thick dough using required quantity of water, then extruded through hand extruder and deep fried in hot oil till it turns golden brown.

Hot *kolukattai* is prepared from kodo millet flour by mixing it with water to make paste. Paste is seasoned using chopped onion, chopped green chillies, coriander leaves, asafoetida, mustard seeds and blackgram dhal and boiled with continuous stirring to make dough of thick consistency. Dough is turned into oval shape and steamed using *idli* cooker. Similarly for preparation of *Sweet kolukattai***,** the kodo millet dough is filled with filled with a mixture of jagerry, shredded coconut and cardamom powder, which is then steam cooked. *Rotior paratha*, is prepared from kodo millet flour and rice flour in 2:1 proportion. Chopped onion, green chillies, asafoetida, cumin seeds, salt is added to the flour and kneaded to thick dough. It is flattened the dough on flat pan and cooked using oil.

Pakoda and *Vadai* which are very common in all parts could be prepared using kodo millet flour with other ingredients such as chopped onion, green chillies, spices and deep fried in hot oil. Addition of Bengal gram dhal to the kodo millet rice gives the shape to the product. For preparation of *Puttu* a mixture is prepared using kodo millet flour, salt and water, which was then steamed and added with jaggery and shredded coconut. Coarse flour (rawa) of kodo millet is used to make *Upama*. Chopped onion, green chillies, curry leaves, black gram dhal, Bengal gram dhal, mustard seeds are used to season it. Water is added to seasoning material, boiled and added in to the roasted kodo rawa with continuous stirring. Similarly, sweet products like *kesari* and can also be prepared. Instead of salt and other seasonings, milk, sugar and dry fruits are used to prepare *Kesari* out of roasted kodo rawa. For preparing *halwa*, the coarse kodo flour and wheat flour (2:1) is roasted with ghee and added to boiling milk while stirring to avoid lumps. On solidification, sugar and ghee is added to obtain required consistency, which is then seasoned with dry fruits (Malathi *et al.,* 2012).

Adai is prepared by soaking kodo millet rice, black gram dhal, green gram dhal and parboiled rice in 4:1:1:1 proportion for 2 hours. Course batter is prepared through grinding, which is added with chilli powder, asafetida, cumin seeds, salt and curry leaves. The batter is cooked on a flat greased pan. *Sweet Adai* can be prepared using kodo millet flour with roasted Bengal gram and green gram flour. To sweeten the product, jaggery is used. To prepare *adai* batter, jaggery syrup is made using required quantity of water. All flours are mixed well to get thick consistency. On greased flat pan, dough is flattened to get cooked.

Chapati dough is made by mixing kodo flour and wheat flour 1:1 ratio and kneaded with water and salt to make soft dough which is then flattened and roasted on preheated pan and to prepare *Khakra* flattened dough is roasted till stiff pan bread is obtained.

Fig 1: Traditional foods from kodo millets (Ref: Malathi *et al.*, 2012; Chakraborty and Kotwaliwale, 2016; Google Images).

Adhirasam is prepared using kodo millet flour and rice flour in 1:1 proportion. Both flour are mixed using little water and kept for 4 hrs. Jaggery syrup is prepared separately in which mixture of flour is mixed thoroughly, which is then fermented overnight at room temperature. The fermented dough is flattened on a greased polyethylene sheet and it is deep fried in hot oil for 2-3 minutes till it turns golden brown. Like rice kheer, Kodo millet rice is also used to prepare *Kheer*. Preparation is same as rice *kheer* prepared. To sweeten the *kheer*, jaggery or sugar can be used (Malathi *et al.*, 2012). Pittu mix: Instant pittu mix can be prepared using kodo flour (Senthamarai *et al.,* 2013).

7. Bakery Products

Leavened bread can be prepared from gluten kodo flour with addition of hydrocolloids, which imitate the gluten characteristics (Chakraborty and Kotwaliwale, 2016). *Biscuit* prepared by addition of soy flour and 70% kodo flour increased the protein content of the biscuit (Kumar *et al.,* 2010). Vijayakumar and Mohankumar (2009) prepared biscuit using composite flour (kodo, barnyard millet, whole wheat flour and defatted soy flour). Ranganna and Ramya (2010) used kodo millet flour for preparing butter biscuit, sponge cake and *ajwain* biscuit using kodo and wheat flour. The mixture having ratio of 20:80, 30:70 and 40:60 was used for both *butter biscuit* and *sponge cake*, whereas for *ohmo biscuit*, the above flours were in the ratios of 15:85, 20:80 and 25:75 respectively. Ranganna *et al.* (2011) used parboiled kodo millet flour for preparation of biscuit and sponge cake using different ratio of kodo millet flour and wheat flour 20:80, 30:70 and 40:60, and 15:85, 20:80 and 25:75 respectively.

8. Extruded Products

Pasta was prepared using kodo flour and refine wheat flour of different proportions (Devi *et al.,* 2014). Ranganna *et al.* (2014) also prepared cold extruded *Vermicelli* and *pasta* using kodo flour, refined wheat flour and soy flour having a ratio of 50:40:10.(Geetha *et al.,* 2014) prepared kodo and chick pea flour (70:30) *extruded product* using twin screw extruder.

9. Conclusion

Though rich in nutrient and traditionally been taken as poor man's staple. Millets are again gaining their foothold in the Indian diet. Though the some references on nutritional composition on different millets are available, and several traditional recipes are prepared from this nutria-cereal, through research is needed regarding their bio-availability and reduction of anti-nutritional factors. Farmers should be educated against kodo-poisoning so that suitable precautionary measures can be taken up for production in large area, instead of small pockets. Moreover, mechanization in the area of cultivation, harvesting and processing needs to be taken up.

References

Abdalla AH (1998). Proximate composition, starch, Abdalla AA, El Tinay AH, Mohamed BE and phytate and mineral contents of 10 pearl millet genotypes. *Food Chemistry*, 63(2): 243-246.

Amadou I, Gounga ME and Le GW (2013). Millets: Nutritional composition, some health benefits and processing-A review. *Emirates Journal of Food and Agriculture*, 25(7): 501.

Annor GA, Marcone M, Bertoft E and Seetharaman K (2013). In-vitro starch digestibility and expected glycemic index of Kodo millet (*Paspalum scrobiculatum*) as affected by starch-protein-lipid Interactions. *Cereal Chemistry*, 90(3): 211-217.

Anonymous(2016).http://www.sharmispassions.com/p/millet-recipes-indian-millet-recipes.htmlaccessed on 22nd Feb 2016.

Antony M, Shukla Y and Janardhanan KK (2003). Potential risk of acute hepatotoxicity of kodo poisoning due to exposure to cyclopiazonic acid. *Journal of Ethnopharmacology*, 87(2): 211-214.

Balasubramanian S (2013). Processing of Millets. Paper presented National Seminar on Recent Advances in processing, utilization and nutritional impact of small millets. *Madurai Symposium, Thamukkam Grounds, Madurai, 13 September, 2013.*

Barbeau WE and Hilu KW (1993). Protein, calcium, iron, and amino acid content of selected wild and domesticated cultivars of finger millet. *Plant Foods for Human Nutrition*, 43(2): 97-104.

Chakraborty S and Kotwaliwale N (2016). Development of leavened bread from minor millet flours. *Paper presented at 50th ISAE convention at Bhubaneswar, January 19-21, 2016.*

Chandel G, Meena RK, Dubey M and Kumar M (2014). Nutritional properties of minor millets: neglected cereals with potentials to combat malnutrition. *Current Science*, 107(7): 1109-1111.

Chandrasekara A and Shahidi F (2012). Bioaccessibility and antioxidant potential of millet grain phenolics as affected by simulated in vitro digestion and microbial fermentation. *Journal of Functional Foods*, 4(1): 226-237.

Chandrasekara A, Naczk M and Shahidi F (2012). Effect of processing on the antioxidant activity of millet grains. *Food Chemistry*, 133(1): 1-9.

De Wet JMJ, Brink DE, Rao KP, and Mengesha MH (1983). Diversity in kodo millet, *Paspalum scrobiculatum*. *Economic Botany*, 37(2): 159-163.

Devi GS, Palanimuthu V and Arunkumar P (2014). Studies on development and storage of kodo millet based pasta. *International Journal of Processing and Post Harvest Technology*, 5(1): 33-40.

FAO (1995). Sorghum and millets in human nutrition. *Food and Nutrition Series*, No. 27; ISBN 92-5-103381-1.

Hegde PS and Chandra TS (2005). ESR spectroscopic study reveals higher free radical quenching potential in kodo millet (*Paspalum scrobiculatum*) compared to other millets. *Food Chemistry*, 92(1): 177-182.

Kalpana CA and Koushikha NM (2013). Development and evaluation of varagu incorporated Recipes. Paper presented National Seminar on Recent Advances in processing, utilization and nutritional impact of small millets. *Madurai Symposium, Thamukkam Grounds, Madurai, 13 September, 2013.*

Kobayashi H and Sakamoto S (1990).Weed-crop complex in cereal cultivation. *Biological Approaches and Evolutionary Trends in Plants*, 67-80.

Kothari-Chajer A, Sharma M, KachhwahaS and Kothari SL (2008). Micronutrient optimization results into highly improved in vitro plant regeneration in kodo (*Paspalum scrobiculatum* L.) and finger (*Eleusine coracana (L.) Gaertn.)* millets. *Plant Cell, Tissue and Organ Culture*, 94(2): 105-112.

Kumar S, Rekha SL and Sinha LK (2010). Evaluation of quality characteristics of soy based millet biscuits. *Advances in Applied Science Research*, 1(3): 187-196.

Léder I (2004). Sorghum and millets. *Cultivated Plants, Primarily as Food Sources*, 66-84.

Malathi D, Thilagavathi T and Sindhumathi G (2012). Traditional recipes from kodo millet.doi: http://www.dhan.org/smallmillets/docs/books/Receipe_booklet_kodo_millet.pdf, accessed on 22nd Feb 2016.

Geetha R, Mishra HN and Srivastav PP (2014). Twin screw extrusion of kodo millet-chickpea blend: process parameter optimization, physico-chemical and functional properties. *Journal of Food Science and Technology*, 51(11): 3144-3153.

Michaelraj PSJ and Shanmugam A (2013). A study on millets based cultivation and consumption in India. *International Journal of Marketing, Financial Services and Management Research*, 2(4): 49-58.

Obilana AB (2003). Overview: Importance of millets in Africa and World (all cultivated millet species), 38: 28. http://www.afripro.org.uk/papers/Paper02Obilana.pdf

Padma A and Rajendren R (2013). Standardization of spirulina and kodo millet incorporated cookies. Paper presented National Seminar on Recent Advances in processing, utilization and nutritional impact of small millets. *Madurai Symposium, Thamukkam Grounds, Madurai, 13 September, 2013.*

Patwardhan SA, Pandey RC, Dev S and Pendse GS (1974). Toxic cytochalasins of Phomopsispaspalli, a pathogen of kodo millet. *Phytochemistry*, 13(9): 1985-1988.

Ranganna B and Ramya KG (2010). Development of millets based nutri-rich value added bakery products. *Mysore Journal of Agricultural Sciences*, 44(4): 818-823.

Ranganna B, Ramya KG and Jamuna KV (2011). Blending of parboiled millets flours for nutri-rich bakery products. *Mysore Journal of Agricultural Sciences*, 45(1): 53-57.

Ranganna B, Ramya KG, Kalpana B and Veena R (2014): Development of cold extruded products (Vermicelli and Pasta). *International Journal of Agricultural Engineering*, 7(2): 360-364.

Rao BL and Husain A (1985). Presence of cyclopiazonic acid in kodo millet (*Paspalum scrobiculatum*) causing 'kodua poisoning' in man and its production by associated fungi. *Mycopathologia*, 89(3): 177-180.

Saleh AS, Zhang Q, Chen Jand Shen Q (2013). Millet grains: Nutritional quality, processing, and potential health benefits. *Comprehensive Reviews in Food Science and Food Safety*, 12(3): 281-295.

Senthamarai Selvi L, Malathi D and Banumathi P (2013). Standardization and evaluation of small millet based instant pittu mix. Paper presented National Seminar on Recent Advances in processing, utilization and nutritional impact of small millets. *Madurai Symposium, Thamukkam Grounds, Madurai, 13 September, 2013.*

Senthamarai SL, Malathi D and Banumathi P (2013). Standardization and evaluation of small millet based instant pittu mix. Paper presented National Seminar on Recent Advances in processing, utilization and nutritional impact of small millets. *Madurai Symposium, Thamukkam Grounds, Madurai, 13 September, 2013.*

Shahidi F and Chandrasekara A (2013). Millet grain phenolics and their role in disease risk reduction and health promotion: a review. *Journal of Functional Foods*, 5(2): 570-581.

Shinoj S, Viswanathan R, Sajeev MS and Moorthy SN (2006). Gelatinisation and rheological characteristics of minor millet flours. *Biosystems Engineering*, 95(1): 51-59.

Sokrab AM, Ahmed IAM and Babiker EE (2012). Effect of germination on antinutritional factors, total, and extractable minerals of high and low phytate corn (*Zea mays* L.) genotypes. *Journal of the Saudi Society of Agricultural Sciences*, 11(2): 123-128.

Sreeja R, Subramanian A, Nirmalakumari A and Bapu JR (2014). Selection criteria for culm strength in Kodo millet (*Paspalum scrobiculatum* L.) to suit mechanical harvesting. *Electronic Journal of Plant Breeding*, 5(3): 459-466.

Sudharshana L, Monteiro PV and Ramachandra G (1988). Studies on the proteins of kodo millet (*Paspalum scrobiculatum*). *Journal of the Science of Food and Agriculture*, 42(4): 315-323.

Verma PK and Banafar KNS (2013). Economics analysis of minor millets in Bastar district of Chhattisgarh. *African Journal of Agricultural Research*, 8(39): 4928-4931.

Vijayakumar PT and Mohankumar JB (2009). Formulation and characterization of Millet flour blend incorporated composite flour. *International Journal of Agriculture Sciences*, 1(2): 46.

Vijaykumar TP, Shetty HS and Urooj A (2013). Physico chemical and functional characteristics of processed kodo millet flour. Paper presented National Seminar on

Recent Advances in processing, utilization and nutritional impact of small millets. *Madurai Symposium, Thamukkam Grounds, Madurai, 13 September, 2013.*

Yadav N, Chaudhary K, Singh A and Gupta A (2013). Evaluation of hypoglycemic properties of kodo millet based food products in healthy subjects. IOSR *Journal of Pharmacy,* 3(2):14-20.

Yadava HS, Ahmad MS and Singh SB (1996). Phenotypic stability for grain yield and fodder yield in Kodo-millet. *Crop Research (Hisar),* 12(3): 343-348.