

Millets: Processing and Utilization

Presented

by

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Millets?



Origin **Africa and Asia**
Group of annual grasses
arid and semiarid regions
Small seeded grains (cereals)

Genera/species

Penissetum, Eleusine, Setaria, Panicum and Paspalum

Africa, Asia, China and Russia
Federation

Origins and common names of minor millets

Table 1: Origins and common names of millets

Crop	Common names	Likely origin
<i>Sorghum bicolor</i>	Sorghum, great millet, guinea corn, kafir corn, aura, mtama, jowar, cholam, kaoliang, milo, milo-maize	Northeast quadrant of Africa (Ethiopia-Sudan border)
<i>Pennisetum glaucum</i>	Pearl millet, cumbu, spiked millet, bajra, bulrush millet, candle millet, dark millet	Tropical West Africa
<i>Setaria italica</i>	Foxtail millet, Italian millet, German millet, Hungarian millet, Siberian millet	Eastern Asia (China)
<i>Panicum sumatrense</i>	Little millet	Southeast Asia
<i>Paspalum scrobiculatum</i>	Kodo millet	India
<i>Panicum miliaceum</i>	Proso millet, common millet, hog millet, broom-corn millet, Russian millet, brown corn	Central and eastern Asia
<i>Echinochloa crus-galli</i>	Barnyard millet, sawa millet, Japanese barnyard millet	Japan
<i>Eleusine coracana</i>	Finger millet, African millet, koracan, ragi, wimbi, bulo, telebun	Uganda or neighboring region

Source: FAO (1995)

The millets include species in several genera. The most widely cultivated species in order of worldwide production are:

Major Millets

1. Pearl millet (*Pennisetum glaucum*)
2. Foxtail millet (*Setaria italica*)
3. Proso millet also known as common millet, broom corn millet, hog millet or white millet (*Panicum miliaceum*)
4. Finger millet (*Eleusine coracana*)

Minor millets

Barnyard millet (*Echinochloa* spp.)

Kodo millet (*Paspalum scrobiculatum*)

Little millet (*Panicum sumatrense*)

Guinea millet (*Brachiaria deflexa* = *Urochloa deflexa*)

Browntop millet (*Urochloa ramosa* = *Brachiaria ramosa* = *Panicum ramosum*)

Millet has a tiny, pale, yellow seed with a nutty flavour which lends itself well to being cooked and eaten whole.

DIFFERENT NAMES OF MINOR MILLETS IN INDIAN LANGUAGES

Common Name	Foxtail millet	Little millet	Kodo millet	Common millet	Barnyard millet	Finger millet
Scientific name	<i>Setaria italica</i>	<i>Panicum miliare</i>	<i>Paspalum scrobiculatum</i>	<i>Panicum miliaceum</i>	<i>Echinochloa frumentacea</i>	<i>Eleusine Coracana</i>
Bengali	Syama dhan	Kangni	Kodoadhan	..	Shamula	Madua
Gujarati	Ral kang	Gadro	Kodra	Vari	Sama	Bhav
Hindi	Kangni	Kutki	Kodra	..	Shama	Madua
Kannada	Priyangu thene	Samai	Haraka	Baragu	Samai	Ragi
Kashmiri	Shol	Ganuhaar	..	Pingu	..	..
Malayalam	Thina	Chama	Varagu	Panivaragu	..	Moothari
Marathi	Rala	Sava	Harik	Vari	Shamul	Nachni
Oriya	..	Suan	Kodus	China		Mandia
Punjabi	Kangni	..	..	..	..	..
Tamil	Thenai	Samai	Vargu	Panivaragu	Kudirai valu	Kezhvaragu
Telugu	Korralu		Arikalu	Varagalu	Bonta chamalu	Ragulu
Other names	Foxtail millet, Moha millet, Kakan kora, Chinka	Goudli, Gondola	Pakodi, Manakodra	French millet	Sawank, shyama	Finger millet, Korakan, rajika

Major Potential of Minor Millets

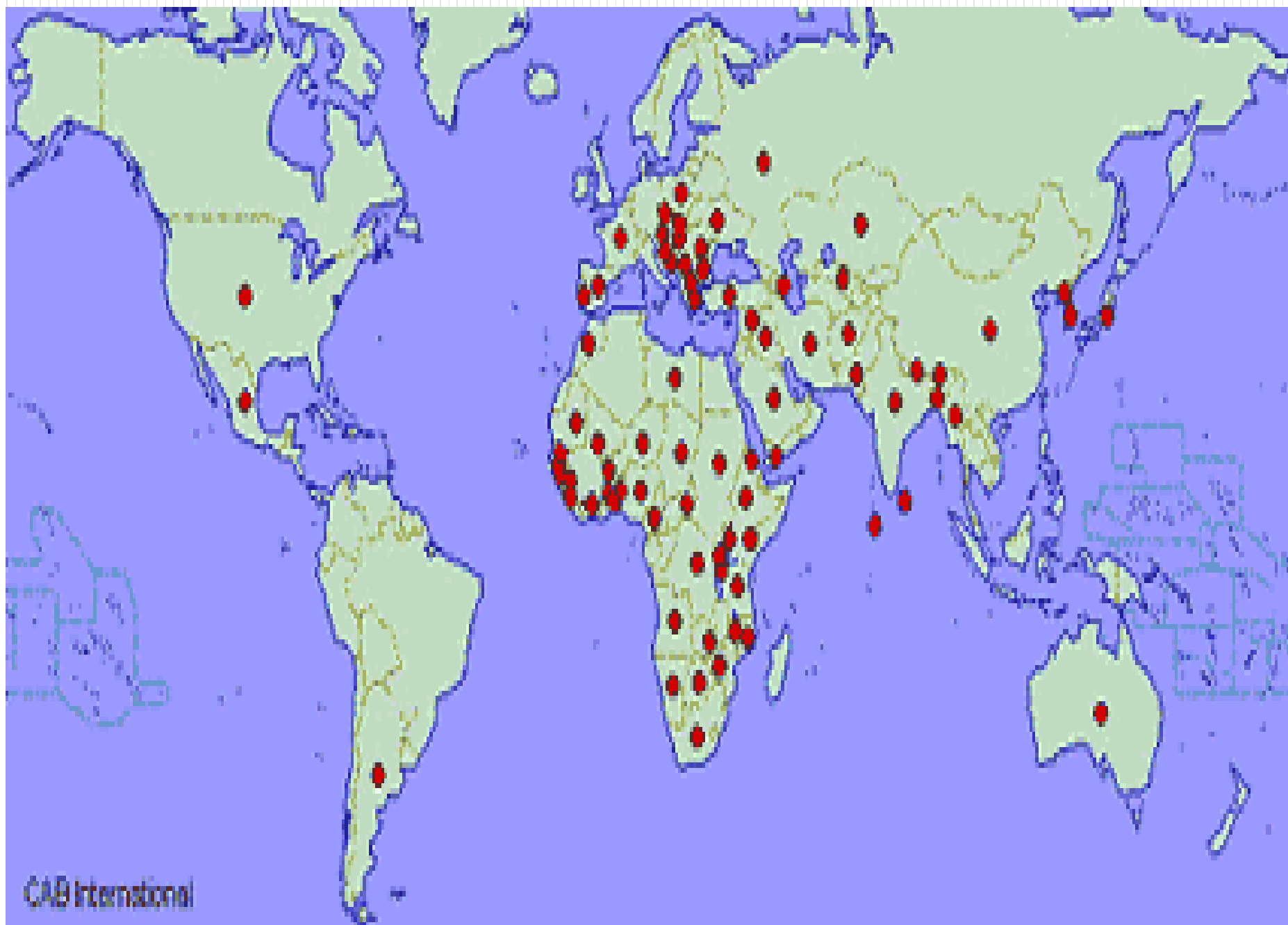
Country	Area (ha)	Yield (Hg/ha)	Production (MT)
India	11,000,000	8,812	9,000,000
Nigeria	N/A	N/A	7,964,000
Niger	N/A	N/A	2,500,000
China	1,070,420	18,225	1,950,800
Burkina Faso	1,500,000	7,158	1,214,419
Russian Federation	500,000	19,500	975,000
Mali	1,245,480	6,544	815,000
Sudan	2,440,000	2,541	620,000
Uganda	390,000	14,974	584,000
Senegal	820,000	5,488	450,000
Chad	706,935	6,083	430,000

Source: FAO (2003) Millet*- Yield for millet types have been lumped together; Conversion to kg/ha;

World Production of Millets*: Area Harvested (Ha) 1998-2003

<i>Millet</i>	<i>Year</i>					
<i>Area Harv (Ha)</i>	1998	1999	2000	2001	2002	2003
India	12,550,000	11,942,400	13,012,200	12,527,200	9,000,000	11,000,000
Sudan	2,762,000	2,393,580	2,087,000	2,586,000	2,437,000	2,440,000
Burkina Faso	1,243,853	1,283,701	1,138,581	1,322,953	1,389,618	1,500,000
Mali	910,816	932,307	1,078,624	1,442,388	1,245,480	1,245,480
China	1,411,406	1,329,353	1,250,296	1,148,609	1,140,398	1,070,420
Senegal	766,495	1,007,462	842,124	801,074	819,498	820,000
Chad	785,630	785,709	791,753	848,859	706,935	706,935
Russian Federation	530,500	987,600	1,370,400	697,700	341,900	500,000
Uganda	401,000	376,000	384,000	389,000	390,000	390,000

Millet growing area



Foxtail millet



Little millet



Kodo millet



Proso millet



Japanese barnyard millet



Finger millet



Millet is very easy to digest; it contains a high amount of lecithin and is excellent for strengthening the nervous system. Millets are rich in B vitamins, especially niacin, B6 and folic acid, as well as the minerals calcium, iron, potassium, magnesium and zinc. Relished for its nutritional value, being a rich source of carbohydrates and minerals, such as calcium, phosphorous and iron.

Millets contain no gluten, so they are not suitable for raised bread, but they are good for people who are gluten-intolerant.

Nutrient composition of sorghum, finger millet and other cereals (per 100 g edible portion; 12 % moisture)

Food	Protein (g)	Fat (g)	Ash (g)	Crude fibre (g)	Carbohydrate (g)	Energy (kcal)	Ca (mg)	Fe (mg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)
Rice (brown)	7.90	2.7	1.3	1.0	76.0	362	33	1.8	0.41	0.04	4.3
Wheat	11.6	2.0	1.6	2.0	71.0	348	30	3.5	0.41	0.10	5.1
Maize	9.20	4.6	1.2	2.8	73.0	358	26	2.7	0.38	0.20	3.6
Sorghum	10.4	3.1	1.6	2.0	70.7	329	25	5.4	0.38	0.15	4.3
Pearl millet	11.8	4.8	2.2	2.3	67.0	363	42	11.0	0.38	0.21	2.8
Finger millet	7.70	1.5	2.6	3.6	72.6	336	350	3.9	0.42	0.19	1.1
Foxtail millet	11.2	4.0	3.3	6.7	63.2	351	31	2.8	0.59	0.11	3.2
Common millet	12.5	3.5	3.1	5.2	63.8	364	8	2.9	0.41	0.28	4.5
Little millet	9.70	5.2	5.4	7.6	60.9	329	17	9.3	0.30	0.09	3.2
Barnyard millet	11.0	3.9	4.5	13.6	55.0	300	22	18.6	0.33	0.10	4.2

Source : Hulse et al. (1980); USNRC I NAS (1982). USDA/HNIS (1984).

Nutrient composition of Millets and Cereals: (per 100g.)

Food grain	Protein (g)	CHO (g)	Fat (g)	Crude fibre (g)	Ca (mg)	P (mg)	Fe (mg)
Kodo millet	8.3	62.0	1.3	9.0	27.0	188	12.5
Proso millet	12.5	70.0	3.1	7.2	14.0	206	12.0
Foxtail millet	5.0	60.9	12.3	4.3	15.0	209	31.0
Little millet	7.7	67.0	4.7	7.6	17.0	222	6.0
Barnyard millet	15.0	65.5	6.2	2.2	4.4	280	11.0
Wheat	11.8	71.2	1.5	1.2	41.0	306	5.3
Rice	6.8	78.2	0.5	0.2	45.0	160	-

Less popularity.....?

Lack of technical know-how @ processing methods

Associated cultural issues in adoption and diversification of food

Lack of awareness @ nutritive value with a opinion that the small millets are poor men crop

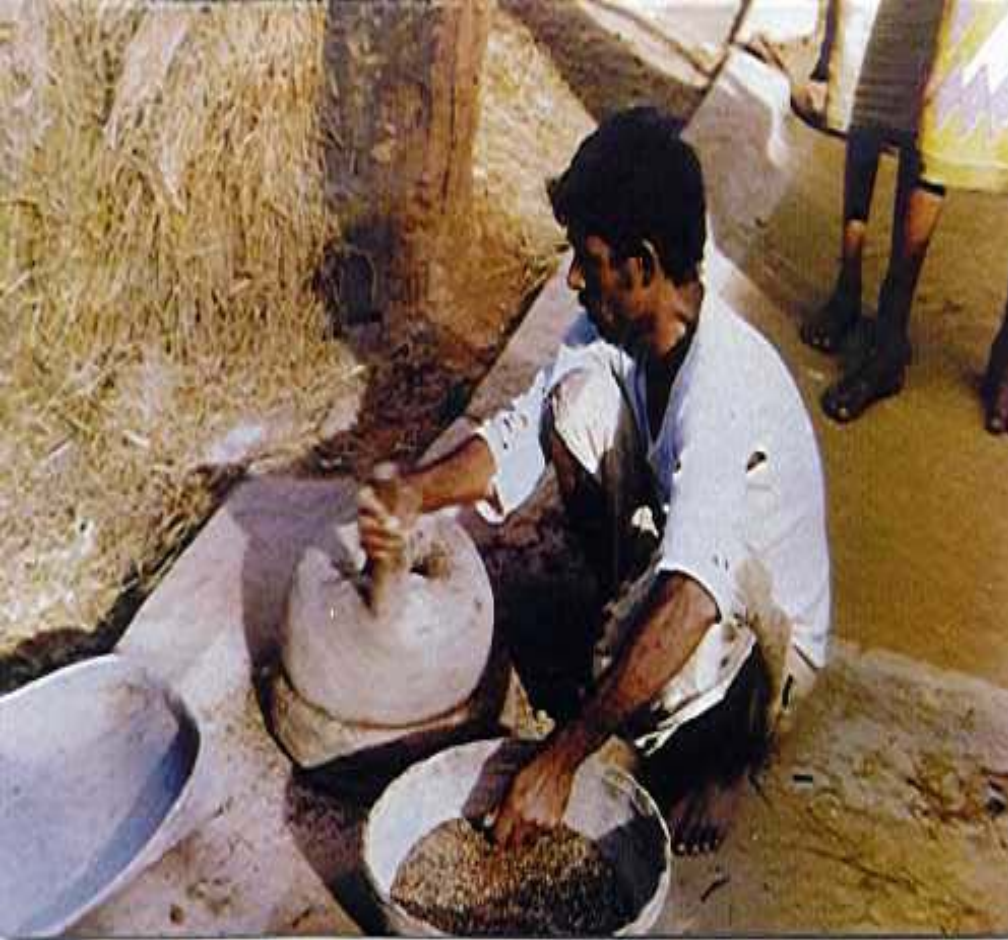
Reluctance among consumers to buy and utilize

Why Grains , Whole Grains and Pearling...?

Learned grains are good for us because of their calorie and energy contributions

Discovered grains are a good source of fiber

Focused on grains as a good source of phytochemicals



Traditional dehulling

In manual pounding

The grain is moistened +10% water to facilitates the removal of fibrous bran and separation of the germ and the endosperm, if desired produces a slightly moist flour, leads to reduce its shelf-life

(Perten, 1983)

Parboiling is reported to help in dehusking kodo millet and to eliminate the stickiness in cooked finger millet porridge. The resulting product is dried, dehusked and decorticated.

(Shrestha, 1972 and Desikachar, 1975)

Key raw material characters for any grain processing quality are size, form and structure of the seed, including its development on its outer (bran) layer and the endosperm hardness.

Due to the small grain size of minor millet, pearling and milling are often more complex.

Decortication reduced total protein and lysine by about 9 and 21 percent, respectively, but that it also improved the utilization of the remaining protein

Pushpamma (1990)

Phytate content of millet varieties ranged from 170 – 470 mg/100g of whole grain, and dehulling resulted in a 27-53 percent reduction in phytate content

Lorenz (1983)

On dehulling, phytin phosphorus decreased 12% in common millet, 39 % in little millet, 25% in kodo millet and 23% in barnyard millet

Sankara Rao et al., 1983

Classification of Gluten flours

HIGH

Hard wheat
Durum
Gluten

Kamut
Spelt
Triticale

LOW

Barley
Oats
Rye

NIL

Amaranth
Buckwheat
Chickpea

Cornmeal
Millet
Quinoa
Rice
Teff

Gluten **high-protein element in flour that allows bread to rise**

Gladins that make the dough stick together and causes digestive distress

Glutenins that make the dough elastic

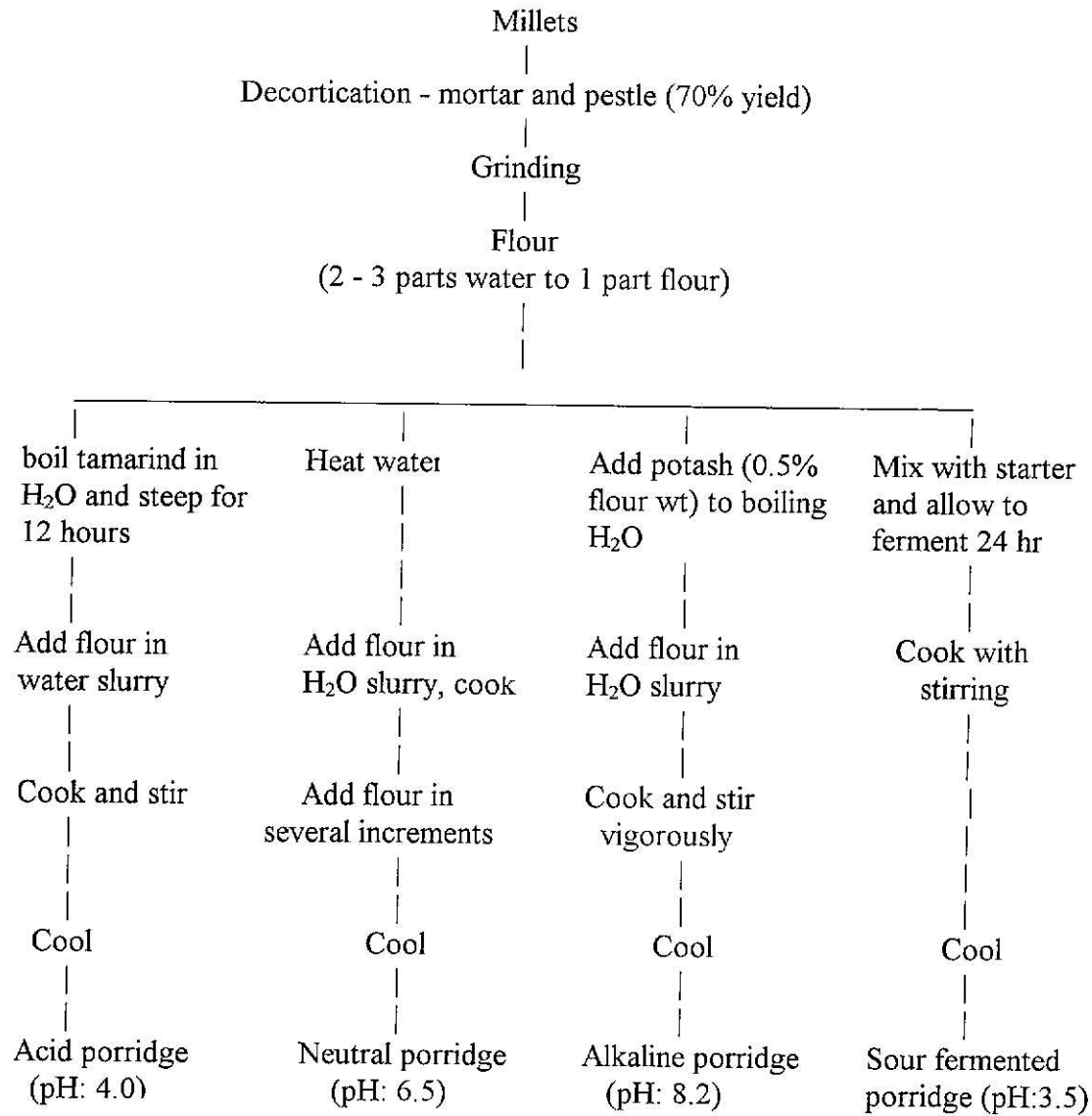
High gluten flours make high, light loaves of bread

Low or non-gluten flour is fortified to vary the taste or texture of bread

Utilization of Minor Millets in India

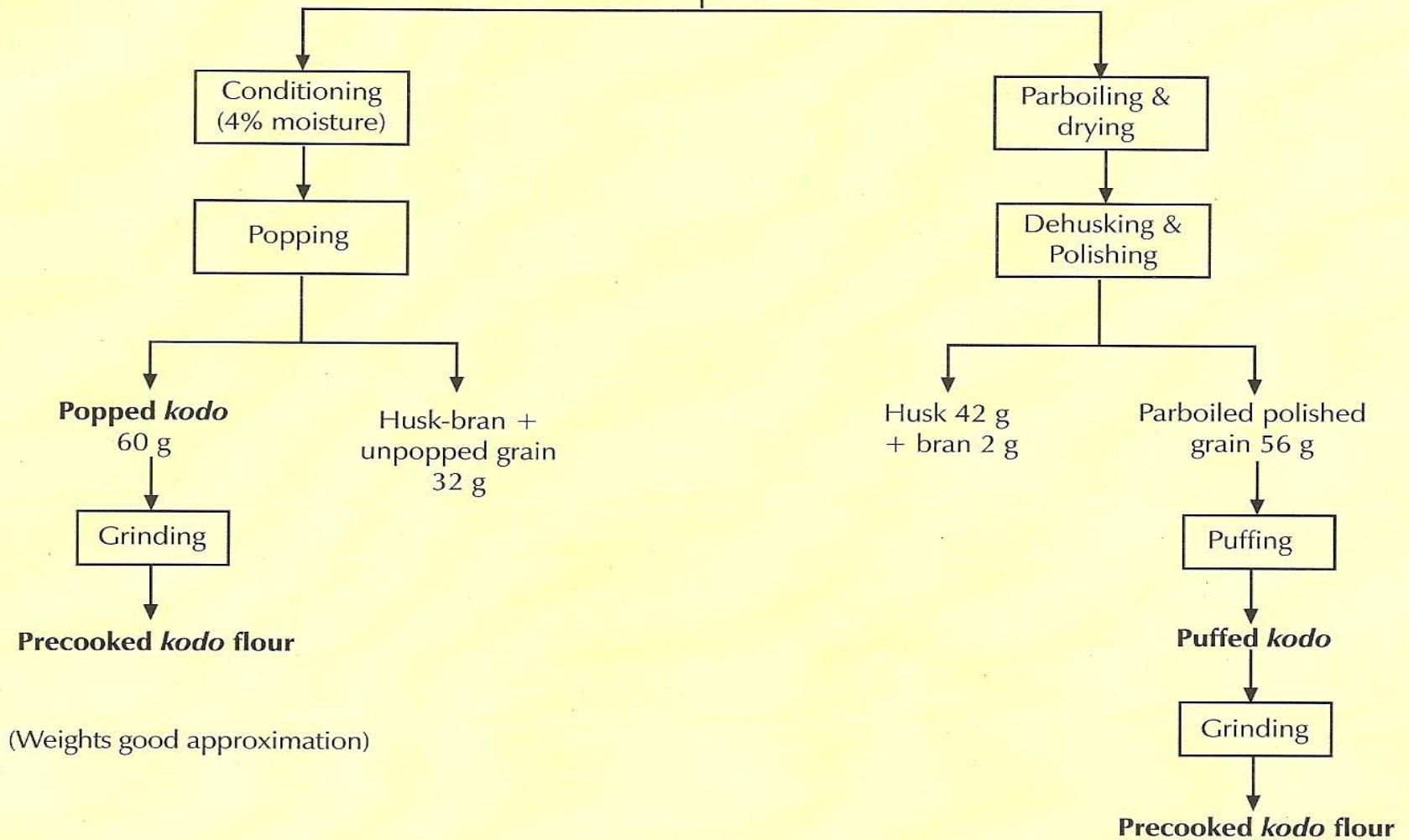
Millet / Products	Nature of Products	Raw material form
<i>FINGER MILLET</i>		
<i>Sangati</i>	Stiff porridge	Rice brokers and flour
<i>Roti</i>	Unleavened bread	Flour
<i>Ambali</i>	Thin porridge	Flour
<i>PROSO MILLET</i>		
<i>Annam</i>	Rice-like	Dehulled grain
<i>Muruku</i>	Deep fried	Flour
<i>Karappoosa</i>	Deep fried	Flour
<i>Ariselu</i>	Deep fried	Flour
<i>FOXTAIL MILLET</i>		
<i>Annam</i>	Rice-like	Dehulled grain
<i>Ariselu</i>	Deep fried	Flour
<i>Sangati</i>	Stiff porridge	Flour
<i>Roti</i>	Unleavened bread	Flour
<i>KODO MILLET</i>		
<i>Annam</i>	Rice-like	Dehulled grain

(Source: Pushpamma and Chittemma Rao, 1981)



Process for Stiff porridge from millets

Kodo Grain, 100 g
(Clean, dry, grade)



Process flow for value addition of kodo millets

Need for minor millet processing

Digestibility

process to produce dried grains edible and digestible.

Food safety

cooking inactivates natural toxins, such as trypsin inhibitors and also prevents bacterial growth and food spoilage

Organoleptic properties

process to optimise the appearance, taste and texture of foods to meet the needs of consumers

Convenience

ready-to-eat food products meet consumer demand for quick and easy meal solutions

Maximizing their nutritional value

process to make it easier for nutrients from grains to be digested. Nutrients lacking in the diet can be added to staple grain-based foods (e.g. thiamin added to flour)

Profitability

develop good profitable uses for millets

Need to Establish processing facilities

particularly important for vital to the future of local cereal farming (In dry regions)

Meeting demand for pre-processed and convenience foods

increasing urbanization and rising disposable incomes, through diversified products

Health Benefits Of Eating Millet

- **Lignans, an essential phytonutrient present in millet, are very beneficial to the human body. Under the action of interstitial friendly flora, they are converted to mammalian lignans, which act against different types of hormone-dependent cancers, like breast cancer and also help reduce the risk of heart disease.**
- **Regular consumption of millet is very beneficial for postmenopausal women suffering from signs of cardiovascular disease, like high blood pressure and high cholesterol levels.**
- **Children's intake of whole grains like millet and fish has been shown to reduce the occurrence of wheezing and asthma.**

- **A high source of fiber, millet is very beneficial against breast cancer in post-menopausal women.**
- **According to research and recent studies, consumption of millet can help women combat the occurrence of gallstones, as they are a very high source of insoluble fiber.**
- **This form of cereal grain is very high in phosphorus content, which plays a vital role in maintaining the cell structure of the human body. The key role of this mineral is that it helps in the formation of the mineral matrix of the bone and is also an essential component of ATP (adenosine tri-phosphate), which is the energy currency of the body.**
- **A single cup of millet provides around 24.0% of the body's daily phosphorus requirement. This mineral is a very important constituent of nucleic acids, which are the building blocks of genetic code.**

- **Recent research has indicated that the regular consumption of millet is associated with reduced risk of type 2 diabetes mellitus. This is mainly due to the fact that whole grains like millet are a rich source of magnesium, which acts as a co-factor in a number of enzymatic reactions in the body, regulating the secretion of glucose and insulin.**
- **Magnesium is also beneficial in reducing the frequency of migraine attacks. It is even very useful for people who are suffering from atherosclerosis and diabetic heart disease.**
- **To get the health benefits of millet, serve it warm with milk as an alternative to hot oatmeal in the morning. Its nutty taste can be enhanced by gently roasting the grains in a pan on the stovetop. It can also be popped like popcorn to create a healthy “puffed” cereal. It can be ground into gluten-free flour and added to baked goods. One can also use it in soups, casseroles, and as a side-dish in place of rice. Enjoy the many health benefits millet has to offer!**

THANK YOU