



Milling quality of raw and parboiled *Kodo* (*Paspalum scorbiculatum* L.) by various hand grinders

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ABSTRACT : *Kodo*, a neglected but useful grain, holds promise for future food security. *Kodo* is nutritionally comparable with other cereals and in some respect superior to rice and wheat. In India, it is mainly consumed by tribal people, who dehusk it by hand pounding. In the present investigation milling quality of raw as well as parboiled *Kodo* were determined. The *Kodo* grains were parboiled by soaking grain at 50°C for 3 h, then steamed for 15 min. followed by shed drying for 24 h. *Kodo* millet was dehusked using hand grinders to assess the maximum possible value of milling parameters. Three types of hand grinders namely dried mud, Plaster of Paris (POP) and cement were used. In the preliminary experiment POP hand grinders was found totally unsuitable for milling of *Kodo* because grains were severely damaged and mixing of POP powder. Raw and parboiled *Kodo* grains were dehusked on dried mud and cement hand grinders in two passes. With dried mud grinder head yield and milling efficiency of raw *Kodo* samples were found 84.8 per cent and 70.07 per cent while parboiled *Kodo* sample had shown 98.79 per cent and 96.03 per cent. Similarly with cement grinder head yield and milling efficiency of raw *Kodo* samples were found 13.72 per cent and 41.45 per cent while parboiled *Kodo* sample had shown 84.14 per cent and 84.0 per cent.

KEY WORDS : Grinding, Hand grinder, Millets, Raw *Kodo*, Parboiled *Kodo*

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INTRODUCTION

Minor millets are small seeded annual cereals cultivated for food, feed, forage and other industrial uses. The term minor millet embraces at least 10 to 14 species of the grass family. The world's population is expected to reach 8 billion by 2020 and food production will have to be doubled from current level of about 5 billion tones per year to meet the demand (Balkrishnan, 2000). There are many unique characteristics possessed by the minor millets that could make them important components of semi arid agricultural production systems. *Kodo* is the staple food in the tribal belt of Madhya Pradesh and Chhattisgarh

(Mandhyan and Sharma, 1992). Other than India it is grown in Africa, East Asia and China. *Kodo* grains are easily preserved and proved as a good famine reserve. *Kodo* grains contain 8.35 per cent protein, 1.45 per cent fat, 65.65 per cent carbohydrate and 2.95 per cent ash. It may be considered as nutriceal. Nutritionally it is comparable with other common cereals and in some respect it is superior to rice and wheat. The grain is recommended as a substitute for rice to the patients suffering from diabetes disease (Singh, 1989). *Kodo* grains provide cheap proteins, minerals and vitamins to poor.

Kodo millet is a highly drought resistant crop. It is the coarsest of all food grains. The grain is covered with a horny seed coat, which has to be broken before it is eaten (Raghavkurup, 1967). The milling of *Kodo* by various types of hand grinders made of different materials would affect the head yield and broken percentage etc. Therefore, the present study was planned to study the effect on milling characteristics of *Kodo* by different hand grinders made of different material. Raw *Kodo* grains are of small irregular size. *Kodo* is mainly consumed by poor tribal people, who dehusk *Kodo* by hand

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pounding, which is time consuming and labour intensive.

MATERIAL AND METHODS

Raw material :

In the present investigation, a lot of *Kodo* grains (10 kg) was procured from the local market of Raipur city. The moisture content of the grains at the time of procurement was found to be 5.56 per cent (wb). Prior to use the grains were sieved and cleaned properly in order to remove dirt, foreign matter and immature grains.

Parboiling experiment :

Cleaned *Kodo* grains (2 kg) were taken in stainless steel containers. Grain to water ratio was kept 1:3. To the container, 6 l of hot water at pre-determined temperature was added in order to attain the desired mixture temperature. The water bath was maintained 2°C higher than the desired temperature. To ensure uniform soaking, the grain- water mixture was stirred at regular intervals by using an iron ladle. The container was taken out from the water bath after desired soaking duration and then water was drained out. The soaked *Kodo* samples (800g each) of approximately even thickness were subjected to 15 min. steaming in autoclave at 1 kg/cm² steam pressure. After steaming, samples were cooled and shade dried for 24 hours.

Dehulling experiment :

Three types of hand grinders namely Mud (dried), Plaster of Paris (POP) and Cement were selected for present study. Hand grinders, as the name suggests were based on grinding of grains between two discs: lower one is stationary and upper one moving. A wooden (on mud and POP) or metallic (on cement) handle was fixed to the top disc and an opening was provided in the top disc for feeding the grains. Dimensions of the three grinders are kept nearly uniform.

Kodo samples (100 g) were dehusked on each grinder in two passes. After milling, fractions of hull, head, brokens and unhusked grains were separated manually. Each fraction was weighed separately on a high precision balance accurately. The milling parameters were calculated by using the following equations suggested by (Mandhyan and Sharma, 1992).

Milling efficiency :

$$E, \% = 100 \times \frac{M_{uh}}{M_t} - \frac{M_b}{M_t} \quad (i)$$

where,

E = milling efficiency, per cent

M_{uh} = weight of unhusked grain after dehusking, g

M_b = weight of brokens including mealy waste, g

M_t = total weight of grains before dehusking containing no brokens and mealy waste, g

Head and broken yield (%) :

$$\text{Head yield (\%)} = \frac{W_{hg}}{W_{mg}} \times 100 \quad (ii)$$

$$\text{Broken yield (\%)} = \frac{W_{bg}}{W_{mg}} \times 100 \quad (iii)$$

where,

W_{hg} = weight of head grains, g

W_{bg} = weight of brokens, g

W_{mg} = total weight of milled grains, g

RESULTS AND DISCUSSION

Raw *Kodo* was milled by three different hand grinders namely mud, cement and POP grinder. It was found that only mud and cement grinders are suited for *Kodo* milling. The POP hand grinder was rejected because it was very difficult or even impossible to separate different fractions of *Kodo* and lots of powdered POP was adhere them so strongly that it was impossible to identify husked and unhusked grains. Therefore, further experiments were conducted using only dried mud and cement hand grinders.

The Table 1 shows that the head yield and milling efficiency of *Kodo* by mud hand grinder was very high as compared to cement hand grinder. This may be due to grinding surfaces of mud hand grinder were smooth and were relatively soft, while those of cement hand grinder were very rough and hard. Weight of upper grinding disc of cement grinder was comparatively more than that of mud grinder. It seems that raw *Kodo* grains could withstand the milling stress of mud grinder

Table 1 : Milling analysis of raw *Kodo* by different hand grinder

Milling quality	Mud hand grinder		Cement hand grinder	
	Raw	Parboiled	Raw	Parboiled
Total weight of grain before milling, g	100	100	100	100
Weight of unhusked grain, g	22.96	5.16	4.56	5.84
Weight of milled grain, g	59.60	68.91	65.56	67.98
Weight of broken grain, g	9.03	0.83	56.56	10.78
Weight of head grain, g	50.57	68.08	9.00	57.20
Head yield, %	84.84	98.79	13.72	84.14
Broken, %	15.15	1.20	86.27	15.85
Milling efficiency, %	70.07	96.03	41.45	84.00

and resulted in higher head yield, milling efficiency and lower broken as compared to cement hand grinder. It is noticeable that hand grinder of mud gave better performance than hand grinder of cement. However, per cent of unhusked grains for cement grinder was found to be lower than that of mud hand grinder because of its comparatively heavy and rough upper grinding disc.

Conclusion :

It may be concluded that mud hand grinder gave better results for milling of raw *Kodo*. Milling efficiency and head yield were found higher and broken were lower with mud hand grinder.

LITERATURE CITED

- Balkrishnan, R. (2000). Gender defined Strategies for biodiversity management for household food security: In FAO Regional research consultation: Gender dimensions in biodiversity management and food security: Policy and programme strategies for Asia. M. S. Swaminathan Research Foundation, Chennai (India).
- Mandhyan, B.L. and Sharma, S.K. (1992). Engineering, milling and hydration properties of *Kodo*. *J. Agril. Engg.*, **2**(2) : 98-101.
- Raghavkurup, C.G. (1967). Hand Book of Agriculture. ICAR Publications, NEW DELHI (INDIA).
- Singh, C. (1989). Modern techniques of raising field crops. Oxford Publications, New Delhi, IBH Publications, Bombay, M.S. (INDIA).

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