Research Paper :

Effect of grinding mills on quality of bajra flour and its products

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ABSTRACT

Investigations were carried out to study the effect of different grinding mills on quality of bajra flour *and suji*. Ready to eat products *viz.*, *chakali* from bajra flour and *kheer* from *suji* were prepared. The better quality bajra flour and *suji* were obtained using plate mill. The particle size of the flour and *suji* was obtained between 0.33 to 0.58 mm. and 0.69 mm. to 0.74 mm, respectively. *Chakali* prepared by using *chakali* mix (maida + moong dal + bajra flour) with proportion 2:1:2 was found most acceptable (score = 8.5). *Kheer* prepared by using bajra *suji* (0.58 mm. particle size) was found most acceptable (score = 8.3)

Bajra on pearl millet is an important staple food grain next to sorghum. It constitutes major source of energy and protein. In general, bajra has more fat and protein content than sorghum. The energy level (784 cal / kg.) is among the highest for whole grain cereals. Bajra flour is significantly different from wheat flour. Bajra flour is produced by grinding bajra grains on various types of grinders. It is mainly used in preparation of cookies and biscuits (snack food).

The chemical composition of bajra grain is 67.1% carbohydrates, 11.6% protein, 1.2% fibre, 2.7% mineral matter, 5.0% fat and 12.4% moisture, (Naikare,1983). Bajra flour has different characteristics, when it is ground by using different grinding mills. However, it is clear that one of the reasons that effect of bajra flour properties and their products is a method of grinding or type of grindings mills (Nishitha and Bean, 1982). Particle size distribution and average particle size are other important factors that also affect the quality and properties of flour. Therefore, the investigations were carried out to study the effect of different grinding mills (size reduction) on quality of bajra flour*,* suji and RTE products.

METHODOLOGY

The laboratory experiment was conducted during the year 2006 at the Dr. A. S. College of Agril. Engg. M.P.K.V., Rahuri. The experimental work plan for preparation of bajra products from its flour and *suji* is given in Fig.1. The bajra grain (var. local) was cleaned and graded by using laboratory cleaner cum grader machine (make – Agrosaw, Ambala cantt capacity -100 kg / hr) The cleaned and graded bajra grains were ground
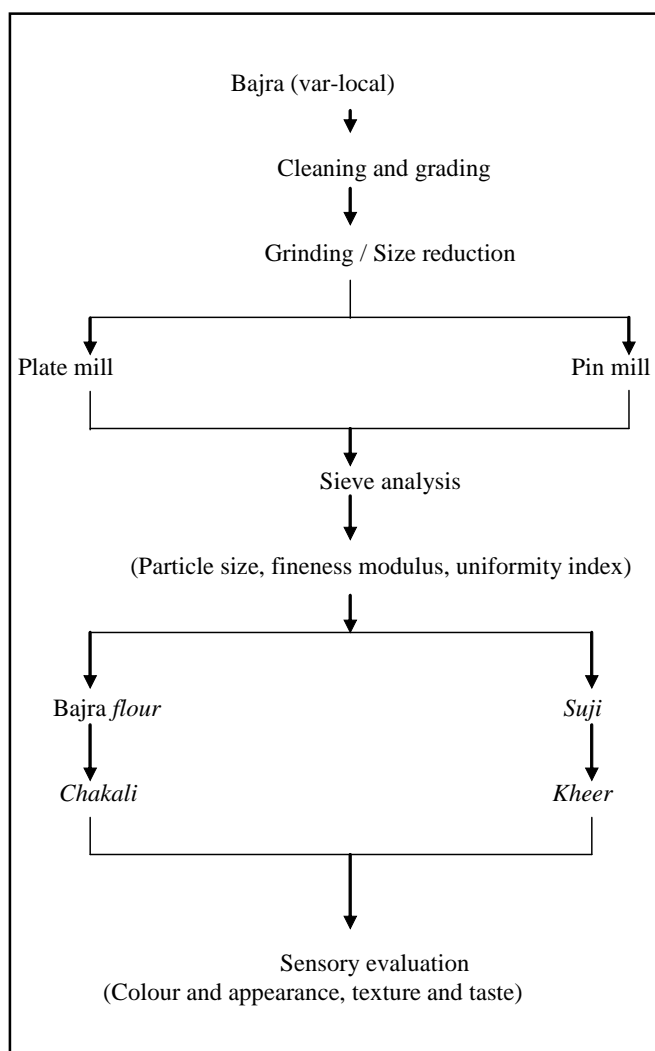

Fig. 1 : **Flow chart for preparation of bajra products (chakali and *kheer*)**

by using different grinding (size reduction) mills *viz*., plate mill (make Goodwyn industry, Pune , capacity - 60 kg / hr) and pin mill (make –Vagheshwary machine, Mumbai, capacity - 60 kg/hr). The bajra flour and *suji* obtained were further analyzed for its properties namely, particle size, fineness modulus and uniformity index. These properties were determined using standard procedure given by Sahay and Singh (2001). Ready to eat (RTE) products were prepared by using different combinations as given in Table 1 (*chakali*) and Table 2 *(kheer)*. The given proportion of maida, moong dal and bajra flour was steamed in the household cooker for 10 min. Then the mixture was kneaded by adding 5 g of oil / kg of mixture to achieve the consistency of the dough. The dough was used to prepare the *chakali* product by using hand operated *chakali*-making machine. It was further deep fried and evaluated for sensory acceptance. The bajra *suji kheer* was prepared by taking 30 g of ghee in the pan, then *suji* was roasted in it until reddish colour was observed. Milk and sugar were added during cooking. Dry fruits were added to get the final products. The sensory evaluation of these products was done as per the method given by Amerine *et al.* (1965).

RESULTS AND DISCUSSION

The results obtained from the present investigation are presented in Table 1, 2, 3, 4, 5 and 6.

Engineering properties of bajra grain:

Some engineering properties of bajra grains (m.c= 11.2%) were determined and given in Table 3. The size and sphericity found were 2.51 mm and 0.75, respectively. Thousand grain weight , bulk density, true density and specific gravity obtained were 12.08 g, 0.80 g /cc, 1.25 g /cc and 1.25, respectively .The angle of repose was found to be 52^0 (Table 3).

Effect of grinding mill on quality of bajra flour and suji:

The data on quality of bajra flour and *suji* by using different grinding mill is tabulated in Table 4. The particle size, fineness modulus and uniformity index of bajra flour varied between 0.33 to 0.42 mm, 3.11 to 3.92 and 0 : 1 : 9 to 0 : 2 : 8, respectively. Whereas particle size, fineness modulus and uniformity index of bajra *suji* varied between 0.58 to 0.74 mm , 5.09 to 5.80 and 6 : 3 : 1 to 8 : 0 : 2 , respectively . The values of particle size, fineness modulus and uniformity index were found minimum in case of pin mill as compared to plate mill.

RTE product from bajra flour (chakali):

The ready to eat (RTE) chakali products were prepared by using different *chakali* mix (Table 1). The results of sensory score are given in Table 5. The sensory score for all sensory attributes *viz*., colour and appearance, texture, taste and crispiness varied between 5.5 to 8.5. The maximum overall acceptability was found in case of *chakali* product PC_4 (8.5). The minimum overall acceptability was seen in case of *chakali* product, PC_1 (5.6). The *chakali* products prepared by using *chakali* mix with bajra flour were found more acceptable compared to the *chakali* mix without bajra flour. *Chakali* prepared by using *chakali* mix (maida + moong dal + bajra flour) with proportion 2: 1: 2 gave highest sensory score compared to all other products (Table 5).

RTE Product from bajra suji (kheer):

The ready to eat product namely *kheer* was prepared by using bajra *suji* of different particle size (Table 2). The data on sensory score of *kheer* is given in Table 6. The score for different sensory attributes *viz*; colour and

Table 1: Different *chakali* products from bajra *flour*	
Product No.	Particulars of *chakali* mix
PC_1	Prepared by using *chakali* flour of pravin company
PC_2	Prepared by using maida + moong dal (2:1)
PC_3	Prepared by using maida + moong dal + bajra *flour* (1:1:1)
PC_4	Prepared by using maida + moong dal + bajra *flour* (2:1:2)
PC_5	Prepared by using maida + moong dal + bajra *flour* (2:1:4)

Table 2 : Different *kheer* products from bajra *suji*	
Product No.	Particulars of *suji*
PK_1	Prepared by using bajra *suji*, particle size = 0.69
PK_2	Prepared by using bajra *suji*, particle size = 0.74
PK_3	Prepared by using bajra *suji*, particle size = 0.58

Table 3: Engineering properties of bajra grain (var. - local)	
Properties	Value
Size (mm)	2.51
Sphericity	0.75
Thousand grain weight (g)	12.08
Bulk density (g/cc)	0.80
True density (g/cc)	1.25
Specific gravity	1.25
Angle of repose (degree)	52

Table 4: Effect of type of grinding mill on quality of bajra *flour* and *suji*

Grinding mill	Product	Particle size (mm)	Fineness modulus	Uniformity index
Plate mill	*Flour*	0.33	3.11	0 : 1 : 9
	Flour	0.42	3.92	0 : 1 : 9
	Suji	0.69	5.63	6: 3 : 1
	Suji	0.74	5.80	6: 3 : 1
Pin mill	*Flour*	0.30	3.69	0 : 2 : 8
	Flour	0.34	3.88	0 : 1 : 9
	Suji	0.58	5.09	8 : 0 : 2

Table 5: Sensory evaluation of RTE products - *Chakali*

RTE product no.	Sensory score				
	Colour and appearance	Texture	Taste	Crispiness	Overall acceptability
PC_1	5.5	5.6	5.6	5.6	5.6
PC_2	6.9	6.6	6.2	6.2	6.5
PC_3	7.5	7.6	7.6	7.5	7.5
PC_4	8.5	8.4	8.5	8.5	8.5
PC_5	7.1	7.2	7.9	7.2	7.2

Table 6 : Sensory evaluation of RTE products -*Kheer*

RTE product no.	Sensory score			
	Colour and appearance	Texture	Taste	Overall acceptability
Pk_1	8.4	8.2	7.8	8.1
Pk_2	8.2	8.4	8.2	7.9
Pk_3	8.4	7.8	7.5	8.3

appearance, texture and taste was varied between 7.5 to 8.4. Whereas the overall acceptability was varied between 7.9 to 8.3 for all the products of *kheer*. The maximum score was found in case of bajra *kheer* PK_3 followed by product PK_2. The bajra *kheer* prepared by using suji having particle size 0.58 mm. was found most acceptable among all other products.

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