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Original Research Article

Utilization of Uncommon Grains for the Development of Nutrient Rich Food Products

Stuti Srivastava[1*], Sadhna Singh[1], Deepti Giri[1] and Rajni Singh[2]

[1]Department of Food Science and Nutrition, College of Home Science, NDUAT, Kumarganj, Ayodhya, India
[2]Rajat P.G College, Lucknow, India
**Corresponding author*

A B S T R A C T

The present study was conducted to collect information regarding physical, nutritional and product development of uncommon grains used in Barabanki and Sultanpur district of Eastern U.P. So as to ensure nutritional security. Total six grains were identified as being uncommon namely sanwa, kodo/kodai, kakun/cheena, Madua/Ragi, Ramdana/cholaidna, Tisi/alsi/ tikhur. All there uncommon grains were found throughout the year. The average length grains were ranged from 0.26 to 0.43 cm. and average weight of 100 grains ranged from 2.25 to 7.3 g. Among the grains maximum crude protein was found in Ramdana. (13.40%) followed by Rakun (11.20%), kodo (9.80%), Tisi (8.29%), Madua (7.7%) and Sanwa (4.60%). Fat content of grains ranged from (3.39 to 7.60) Product prepare from uncommon grains were laddoo, kheer, cheela, utpam cutlet, buri etc. 21.37 and minimum were observed in sanwa meetha cheela, highest fat content were observed in kukun burfi (47.28%). Maximum fiber found in Sanwa kheer (24.39) and minimum were observed in ragi halwa (0.98). The developed products were subjected for sensory evaluation. Most of the product was like very much by panel members. The cost per 100 gm of developed products was also determined.

Keywords

Uncommon grains, Limited scale, Urbanization and modernization

Introduction

India has a vast biodiversity but many of them are no longer in use in our daily diet due to the influence of urbanization and modernization. Now a day uncommon grains are not being used for food production at all or are being used on limited scale are termed as uncommon foods.

For the development of any nation it is essential that its population should be healthy. As our countries population is growing at a fast rate there is a great demand to provide nutritional security to all.

For enhancing nutrition in our food basket, it is important to document and propogate knowledge about the uncommon grains. To

meet the nutritional requirement of the growing population through common source is not possible. Therefore to over come the pressure exerted by the growing population, it has become important to look for economic and daily available substitutes for the common grain. Therefore it is necessary to identify the uncommon food items and their production belt in the country so that they could be propogated on a commercial basis.

Most of the foods consumed by people have been upgraded to an extreme through refined and modified processes using various food preparation techniques such an cooking, crushing, leaching and husking that cause in advertently reduction or removal of certain essential nutrients from the food (Legwaila *et al.,* 2009).

Many uncommon grains or food were earlier available and were used by people to some extent in olden times have now changed. These were comparatively cheaper and had good nutritive value. With the modernization these uncommon food items have been replaced by refined food. Therefore, the present study was undertaken to explore the uncommon grains for sources good nutrition and utilization of uncommon grains for the product development.

Materials and Methods

Locale of the study

The survey was done in Barabanki and Sultanpur district of eastern UP. Information regarding uncommon grains consumed in different blocks of Sultanpur and Barabanki district was collected through group discussion and appraisal.

Physical parameters

Colour and shape of the selected uncommon grains was observed by visual appearance. Length of 3 randomly selected grain was measured with the help of tape/scale and expressed in centimeters. Weight of 100 grains was recorded by using electronic balance.

Nutritional Composition

Moisture, crude protein, fat and crude fibre were done by using standard procedure of AOAC, 1990.

Dry Matter

Moisture value was subtracted from 100, the difference gave value of available dry matter.

Carbohydrate

Values of moisture crude protein, crude fat crude fiber and total ash were subtracted from 100. The difference gave values of available carbohydrate.

CHO(%)=100-(Moisture+ crude protein + crude fat crude fibre +total ash)

Energy value was calculated by factorial method

Energy (Kcal) = 4×CHO+4×crude protein+9×crudefat.

Product Development

The collected uncommon grains were utilized for the preparation of various products like laddoo, kheer, uttpam, cheela of sanwa, laddoo, panjiri of alsi Baati, cuttels, sweet cheela of kodo spicy cheela, Halwa of Ragi or Madua, khichdi, kheer, laddoo of ramdana and burfi from kakun.

Nutritional evaluation of developed products

The nutritional value of the developed products was calculated by taking in

consideration the chemical composition of the selected uncommon grains and values given the food composition table compiled by Gopalan *et al.,* (1976).

Sensory evaluation

Sensory evaluation of the prepared products was done by a semi- trained panel of judges using 9 point hedonic scale.

Economics of the developed products

The cost of the developed products was calculated by taking into consideration the cost of raw materials and over head charges for the preparation of different recipes.

Results and Discussion

General information about selected uncommon grains

General information on regarding selected uncomman grain is presented in table 1. Six uncommon grains namely sanwa koda / kodai, kakun / cheena madua / ragi, Ramdana / cholaidana and Tisi / alis / tikhur were used. Most of the grains are available throughout the year.

There uncommon grains are used for the preparation of kheer, khichadi, laddoo, chella, Halwa etc.

Physical parameters of uncommon grains

Physical parameters of uncommon grains are presented in table 2. The colour of grain varied from pale yellow, dark brown to radish brown.

The length of the grain varied from 0.26 to 0.43cm. While the 100 grain weight ranged from 2.25-7.3 gm. Shape varied from oval to round.

Nutritional composition of selected uncommon grains

On fresh and dry basis the nutrient composition of selected grain is depicted in table 3 and 4.

The moisture content of the foods on fresh basis ranged from 8.9 to 13.10 per cent. Protein content was highest in Ramdana (11.83%) and lower in Sanwa(4.07%). Fat values of grains ranged from 1.30 to 36.58.

Crude fibre content of Sanwa, kodo, kakum, Madua and this 6.72, 4.53, 5.90, 3.12, 2.99, and 6.65 per cent respectively.

Total ash content values ranged from 2.25 to 3.89, carbohydrate varied from 37.68 to 73.54 per cent, energy values between 333 to 510 kcal.

On dry matter basis moisture, crude protein, crude fat, crude fiber and carbohydrate content varied. The results showed that among signify collected grains the moisture content varied from 3.9 to 5.8g/100g,crude protein content ranged from 4.60 percent in sanwa (*Enchinachloa frumenteeca*) to 13.40 percent in Ramdana/ cholaidana (*Amrunthus cardotus*). Crude fat content was found to be the minimum in madua (*Eleusine coracana*) and the maximum (40.16%) in Tisi /alsi/tikhur (*Linum asistatissimum*), crude fiber content of sanwa, rodo, Rakum, madua, ramdana and tisi were 7.6,5.2,6.4,3.6,3.39 and 7.3 per cent respectively. The energy values showed no significant differences.

Srivastava and Batra (1998) reported that whole (hulled) Baruyard millet was olive or olive yellow colour.

According to Bhawana et.al (2008) reported that in koda (*Pospalum scrobiculatum*) 1000 grain mass varied from 5.55 to 1.32 g, Length breadth ratio varied from 1.30 to 1.18.

Standardization of products using uncommon grains

The collected uncommon grains were used for the preparation of variety of products. The standardized recipe indicating ingredients used method of preparation, cooked weight and numbers of serving etc. are given in Table 5.

Nutritional and sensory evaluation of products from uncommon grains (g/100gm)

The uncommon grains were used for the preparation of variety of products. The nutrient content of developed products is given in table 6. The protein content of grain based products ranged from 9.25 in ragi spicy cheela to 52.38 percent in Ragi Halwa. Fat content of various preparations ranged from 2.71 in sanwa uttpam to 34.30 per cent in sanwa laddoo.

Total 15 grain bared recipes were standardised

Fiber content of grain based preparation varied from 0.98 in ragi halwa to 24.39 percent sanwa kheer. Carbohydrate content of grain based preparation ranged from 22.88 in sanwa kheer to 127.92g/ 100g in kakun burfi. Energy value were found to be minimum in sanwa utpam (191Kcal/100g) and maximum in kakun burfi (974 Kcal/100g)

The maximum vitamin C in grain based recipes was found in Ramdana khichri (16.33 mg/%).

Protein content grain based recipe, ragi halwa (13.86%), Ramdana khichri (16.33), Ramdama kheer (16.37%). And kukun burfi (21.37%) may be designated as high protein recipe. These can be advocated to be served to school children through mid day meal programme for people suffering from protein energy malnutrition etc.

Low fat recipes (fat content between 0-5g/100g) included Ramdana Laddoo and Sanwa Uttpam. Medium fat recipes (10.1g/100 included Kodo baati (15.62%), Sanwa Kheer (21.09%), Kodo meetha cheela (22.37%), Ragi Spicy cheela (23.88%, Kodo cutlet (28.86%), Alsi panjiri (30.92%,), Ramdana Kheer (30.90%), Ragi (30.90%), Ragi halwa (34.56%) and kakun burfi (47.28%)

The prepared recipes were categorized on the basis of their fiber value as low fiber (0.5g/100g. medium fiber (5.1-10g/100g.) nad fiber grain high fiber (10.1g/100g) low fiber grain based recipes included Ragi Halwa, Kodo Baati, Ramdana Kheer, Ragi spicy cheela, Ramdana Laddoo, Sanwa Uttpam, Sanwa meetha cheela, Kodo cutlet, Kodo meetha cheela and Ramdana khichdi. Midium fiber recipes were kakun burfi and Sanwa Kheer was having amount of Fiber, low calories recipes (> 250Kcal/100g included Sanwa Uttapam.

Medium energy recipes (251-500Kcal/100g) included Kodo Baati, Alsi, Laddoo, Kodo meeta cheela, Ragi Spicy cheela, Ramdana Khichdi, Sanwa meetha cheela, Sanwa Kheer and Kodo cutlet. Remaining recipes namely Sanwa Laddoo, Ramdana Laddoo, Ragi Halwa, Alsi panjiri, Ramdana Kheer and Kakun burfi were having energy value above 500 kcal/100g.

Sensory evaluation and cost of products based on uncommon grains is given in table 7. Most of the products were liked very much by the semi trained panel members.

The cost of 100 g grain based recipe varied from Rs. 1.47 (Ramdana kheer) to Rs 35.48 (Kakun Burfi).

Table.1 General information about selected uncommon grains

S. No.	Common Name	Botanical Name	Area of collection	Place of availability	Seasonal availability	Part used as foods	Part used as food	Common use
1	Sanwa	Sanwa millet	*Enchinachloa frumentacae*	Kadipur block of Sultanpur	Cultivated crops	Throughout year	Grain	Kheer, Khichadi, Ladoo
2	Koda/Kodai	Koda millet	*Paspalum scrobiculatum*	Kadipur block of Sultanpur	Cultivated crops	Throughout year	Grain	Chella, Laddoo, Halwa
3	Kakun/Cheena	Italian millet/ Foxtail Millet	*Setaria italic*	Akhandnagar block of Sultanpur	Cultivated crops	Throughout year	Grain	Boiled Rice
4	Madua/ragi	Ragi/ finger millet	*Eleusine coracana*	Kadipur block of Sultanpur	Cultivated crops	Throughout year	Seed	Halwa, cheela
5	Ramdana/ cholaidana	Amarnath	*Amarnathus causatus*	Lambhua block of Sultanpur	Cultivated crops	Throughout year	Seed	Ladoo, chikki, kheer, khichadi
6	Tisi/alsi/ tikhur	Linseed	*Linum asitatissimum*	Bhadaya block of Sultanpur	Cultivated crops	Throughout year	Seed	Laddoo, Panjiri

Table.2 Physical parameter of selected uncommon grains

S. No.	Common name	English name	Botanical name	Colour	Shape	Average Size (cm)		100 grain weight (g)
						Length	Breadth	
1	Sanwa	Sanwa millet	*Enchinachloa frumentacae*	Pale yellow	Oval	0.31	-	3.52
2	Koda/Kodai	Koda millet	*Paspalum scrobiculatum*	Dark brown	Round	0.27	-	7.3
3	Kakun/Cheena	Italian millet/ Foxtail Millets	*Setaria italica*	Pale yellow	Oval	0.32	-	3.7
4	Madua/ragi	Ragi/ finger millet	*Eleusine coracana*	Dark Brown	Round	0.28	-	2.72
5	Ramdana/ cholaidana	Amarnathus	*Amarnathus causatus*	Radish Yellow	Round	0.26	-	2.25
6	Tisi/alsi/ tikhur	Linseed	*Linum asitatissimum*	Brown	Oval	0.43	-	3.21

Table.3 Nutritional composition of selected uncommon grains (% on dry matter basis)

S. No.	Common name	English name	Botanical name	Moisture (%)	Dry natter (%)	Crude Protein (%)	Crude fat (%)	Crude fiber (%)	Total ash (%)	Carbohydrate (%)	Energy (kcal)
1	Sanwa	Sanwa millet	*Enchinachloa frumentacae*	4.20	95.8	4.60	5.20	7.60	4.40	74.00	361
2	Koda/Kodai	Koda millet	*Paspalum scrobiculatum*	5.80	84.2	9.80	3.70	5.20	3.30	72.20	361
3	Kakun/ Cheena	Italian millet/ Foxtail Millet	*Setaria italic*	5.20	94.8	11.20	4.00	6.70	3.30	69.60	359
4	Madua/ragi	Ragi/ finger millet	*Eleusine coracana*	5.80	94.2	7.70	1.50	3.60	2.60	78.80	360
5	Ramdana/ cholaidana	Amarnath	*Amarnathus causatus*	4.60	94.5	13.40	2.40	3.39	3.50	72.71	366
6	Tisi/alsi/ tikhur	Linseed	*Linum asitatissimum*	3.90	96.10	8.29	40.16	7.30	2.90	37.45	544
CD (0.05)				**1.905**	**2.009**	**1.948**	**1.972**	**1.721**	**NS**	**4.421**	**NS**

Table.4 Nutritional composition of selected uncommon grains (% on Fresh basis)

S. No.	Common Name	English Name	Botanical Name	Moisture (%)	Crude Protein (%)	Crude fat (%)	Crude fiber (%)	Total ash (%)	Carbohydrate (%)	Energy (kcal)	Vitamin 'C' (mg)
1	Sanwa	Sanwa millet	*Enchinachloa frumentacae*	11.50	4.07	4.60	6.72	3.89	69.22	335	-
2	Koda/Kodai	Koda millet	*Paspalum scrobiculatum*	12.86	8.53	3.22	4.53	2.87	67.99	335	-
3	Kakun/ Cheena	Italian millet/ Foxtail Millet	*Setaria italic*	11.90	9.86	3.52	5.90	2.90	65.92	335	-
4	Madua/ragi	Ragi/ finger millet	*Eleusine coracana*	13.10	6.69	1.30	3.12	2.25	73.54	333	-
5	Ramdana/ cholaidana	Amarnath	*Amarnathus causatus*	11.70	11.83	2.11	2.99	3.09	68.28	339	-
6	Tisi/alsi/ tikhur	Linseed	*Linum asitatissimum*	8.90	7.55	36.58	6.65	2.64	37.68	510	-

Table.5 Product development using uncommon grains

S. No.	Name of Product	Ingredients	Method	Cooked weight (g)	Number of servings
1	Sanwa Laddoo	Wheat flour-50g, Sanwa flour-80g, Ghee-100g, Dry fruits-1 st.sp., Sugar-300g, Milk-100ml.	Sanwa flour and wheat flour were rosted separately in ghee till golden brown. Ground sugar, cardamom powder and all chopped dry fruits were mixed. Laddoo were made from other help of milk.	312	5
2	Sanwa Kheer	Sanwa rice-100g, Milk-50ml, Ghee, 30g, Sugar-50g, Dry fruit-1 st.sp.	Sanwa rice was washed. Milk was heated in a pan till it becomes slightly concentrated. Ghee was heated in a another pan and rice were fried for 3-5 min. Sanwa rice and saffron were added to the milk and cooked for about 10 min. Sugar, dry fruits and cardamom powder were added. It was cooled for 1hr and served.	618	4
3	Sanwa Uttpam	Sanwa rice-100g, Semolina-50g, Chopped coriander leaves-2st. sp., Chopped onions-30g, chopped green chilies-1 st. sp., Curd-50g, Salt-1 st.sp.	Sanwa rice and semolina was added in the curd. Batter was made using little water and kept for 10 min. was coriander leaves, onion, tomato and chilies and salt were mixed in the batter. This mixture was spread on a non stick pan with the help of ladle and covered with a pan. It was shallow fried on both sides.	280	3
4	Sanwa Meetha Cheela	Sanwa flour-100g, Samalina-50g, refined oil-50 ml, sugar-50, Dry fruit-1 st.sp.	Semolina and Sanwa rice were soaked is separately for 4-5 hours. Both were ground in a grinder to make a paste. Sugar and dry fruits were added to this paste. It was shallow fried from both side.	270	3
5	Alsi/Tisi Laddoo	Alsi powder-100g, Wheat flour-100g,. Sugar-100g, Cardamom powder-5g, Chopped dry fruits-1 st.sp., Ghee-50g	Wheat flour and alsi flour were roasted separately in ghee till golden brown. Ground sugar, wheat flour, cardamom powder and all chopped dry fruits were mixed. Laddoo were made from this mixture.	519	10
6	Alsi/Tisi/ Panjiri	Alsi powder-100g, Wheat flour-100g, Ground Sugar-100g, Ghee-50g, Cardamom Powder-10g, Dry Fruits-20g	Wheat flour and alsi flour were roasted separately in skillet ground. Ground sugar and cardamom powder were added to the mixture after it was cooled.	297	5
7	Koda/Kodai/Baati	Kodo flour-100g, Chopped coriander leaves-1 st.sp., green chillies-2-3, garlic-5g, ginger-3-4pc., Onion-30g, Wheat flour-100g, Mustard oil-200ml. turmeric powder-a pinch.	Kodo flour was roasted in oil. Coriander leaves, green chillies, garlic, onion, turmeric, ginger and salt were added to it for stuffing. A dough was prepared using require amount of water. And wheat flower Balls were made from the dough. Each ball was filled with stuffing and deep fried.	480	8
8	Koda/Kodai	Koda flour-100g, Boiled	Boiled and mashed added potato kodo flour coriander leaves, chilies, chat	256	8

	cutlets	potatoes-200g, coriander leaves 2 st.sp., Salt-1 st.sp., Oil-70 ml.	masala salt and mixed properly small oval shaped cutlets were made and then deep fried.		
9	Koda/Kodai Sweet cheela	Koda flour-100g, Sugar-30g, White till-5g, Dry fruits-1 st.sp., Cardamom powder-1/2 tea spoon, Refined oil-50ml.	Batter was made by mixing kodo flour, sugar, dry fruits and white till and then deep fried.	240	3
10	Ragi/Madua Ragi spicy cheela	Ragi flour-100g, Refined oil-50ml., Coriander leaves-2 st.sp., Green chillies-2-3, Copped onion-1small, Salt-1/2 st.sp., Curd-50g.	Ragi flour was mixed with curd and kept for 10-15 min. All the ingredients were added to it and mixed Cheela was made on non stick pan.	224	3
11.	Ragi/Madua Halwa	Ragi flour-50g, Sugar-30g, Milk-500ml, Dry fruits-1 st.sp., Ghee-30g.	Hated ghee in a pan. Added ragi flour and roasted on a slow fire till golden brown. Added sugar chopped, dry fruits and milk and cooked till dry.	183	2
12	Ramdana/ Cholaidana Laddoo	Ramdana seeds-100g. Onion-1 small, Tomatoes-1 small, Moo ng dal-50g, Ghee-10g, Salt-1/2 st.sp.	Ramdana seeds were popped. Ghee was heated in the cooker, onion, garlic and tomatoes were cooked till done popped ramdana seeds, moong dal and salt were added to it and were pressure cooked.	172	3
13	Ramdana/ cholaidana kheer	Ramdana seeds-100g, Milk-500ml, Sugar-30g, Ghee-30g, Dry fruits-1 st.sp.	Milk was cooked in a deep pan till it becomes slightly concentrated. Ghee was heated in another pan and popped ramdana seeds were fried for 3-5 min. Ramdana and sugar and dry fruits added into milk and cooked about 10-15 min.	210	5
14	Ramdana/ Cholaidana Laddoo	Popped ramdana-100g, Jaggery-200g	Jaggery was heated in a skillet and was cooked till it was liquefied. Ramdana seeds were added, mixed properly and laddoos were made from it.	212	4
15	Kakun/ Cheena Kakun burfi	Kakun grind rice-100g, Sugar-10g, Dry fruits-1 st.sp., Cardamom powder-1/2 tea spoon, ground nut-50g, Ghee-30g.	Roasted ground nut and ground in grinder. Heated ghee in another pan and fried kakun rice. Made sugar syrup fried kakun rice flour . Added sugar syrup, grind groundnut, dry fruits and cardamom powder mixed properly. Cooked for 15 to 20 min. put the prepared matter on a greased plate and cut into burfi pieces.	113	3

Table.6 Nutrient content of products developed from uncommon grains (g/100g)

S. No.	Name of Product	Protein (%)	Fat (%)	Fiber (%)	Carbohydrate (%)	Energy (kcal)	Vitamin 'C' (mg)
1	Sanwa Laddoo	3.95	34.30	14.24	102.87	511	3.21
2	Sanwa Kheer	4.23	21.09	24.39	22.88	432	1.55
3	Sanwa Uttpam	4.05	2.71	2.75	37.71	191	0.17
4	Sanwa Meetha Cheela	3.64	20.56	2.85	56.96	428	-
5	Alsi Laddoo	3.95	17.69	1.77	48.35	368	0.1
6	Alsi panjiri	6.91	30.92	3.12	84.49	647	0.20
7	Kodo baati	4.67	15.62	1.46	39.57	318	0.41
8	Kado cutlet	5.07	28.86	2.34	43.10	452	-
9.	Kodo meetha cheela	4.09	22.37	2.16	39.56	376	-
10.	Ragi spicy cheela	4.12	23.88	1.62	32.58	362	0.22
11.	Ragi halwa	13.86	34.56	0.98	49.49	622	2.73
12.	Ramdana Khichdi	16.33	7.76	3.97	64.04	391	16.86
13.	Ramdana kheer	16.37	30.90	1.61	57.34	624	2.38
14.	Ramdana laddoo	6.69	1.22	1.59	120.57	520	-
15.	Kakun burfi	31.37	47.28	7.23	127.92	978	-

Table.7 Economics and sensory evaluation of products based on uncommon grains

S. No.	Name of Product	Cost (Rs./100g.)	Sensory evaluation
1.	Sanwa laddoo	14.48	Like moderately
2.	Sanwa Kheer	7.79	Like moderately
3.	Sanwa Uttpam	6.78	Like moderately
4.	Sanwa Meetha Cheela	5.79	Like slightly
5.	Alsi/Tisi/Tikhur Laddoo	11.03	Like Very Much
6.	Alsi/Tisi/Tikhur panjiri	19.27	Like extremely
7.	Kodo/Kodai Baati	6.16	Like extremely
8.	Kodo/Kodai cutlet	11.17	Like Very much
9.	Kodo/Kodai sweet cheela	15.30	Like Very much
10.	Ragi/Madua ragi spicy cheela	9.33	Like Very Much
11.	Ragi/Madua halwa	27.38	Like moderately
12.	Ramdana/cholaidana khichdi	22.09	Like Slightly
13.	Ramdana/cholaidana Kheer	1.47	Like Very much
14.	Ramdana/cholaidana laddoo	12.26	Like Very much
15.	Kakun/cheena Kakun burfee	35.48	Like Very much

Depending on the cost of raw material used for recipe preparation namely tisi ladoo, kodo, cutlet kodo sweet cheela, ragi spicy cheela, ramandana kheer ramdana laddoo and kokum burfi were very much liked where as tisi paysam and kodo baati were extremely liked by the judges.

The high dietary selectivity is one of the important causes for difficulties in getting full complement of essential nutrients in daily diet. In our country two-third of total dietary energy in take is obtain from few selected grains.

Therefore, the result of the present study will be immensely useful in giving new ideas to promote utilization of untapped / underutilized crops in our daily life. The cultivation of crops like Ramdana, Kakun and Kodo may be promoted as these are good sources of protein and fiber. The recipe like Ragi halwa, Ramdana Khicdi, Ramdana Kheer and Kakun Burfi may be advocated to be served to school children through mid day meal programme.

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