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QUALITY OF SOME INDIAN SUNFLOWER GENOTYPES AND UTILIZATION OF CAKES IN SNACK FOODS

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SUMMARY

Studies have been carried out on the quality and utilization of sunflower seed and cake. Sunflower hybrids have been examined for their proximate composition, micronutrients, fatty acid profile and tocopherol content. The major fatty acids namely oleic and linoleic acids, were 36-50% and 42-54%, respectively. Micronutrients like zinc, copper, manganese and iron were analyzed in various genotypes; zinc content ranged from 50 to 107.2 µg/g, copper 24.4-39.6 µg/g, manganese 28.2-89.6 µg/g and iron between 305 and 392 µg/g. Alpha, beta and gamma tocopherols ranged between 406 and 485, 35 and 56 and 4 and 10 mg/kg, respectively. MSFH 8 had high levels of tocopherols and micronutrients.

Sunflower cake flour and protein isolates were utilized in the preparation of biscuits and some snack food items like pakodi and chapati. Protein isolates added at 5% levels increased protein content of biscuits from 12 g/100g to 16 g/100g. At 10% level the protein content was 20 g/100g. Taste panel acceptability was 75-80% for the biscuits and snack foods against 100% for the control. There is thus a good opportunity for utilization of sunflower seed and cake flours and their protein isolates as food ingredients in India.

Key words: oil, protein, fatty acids, minerals, genotypes, hulled and dehulled cakes, protein isolates, snacks

INTRODUCTION

Sunflower which is an introduced crop in India has gained importance because of its richness in linoleic acid, a health-promoting polyunsaturated fatty acid. The crop can be grown over all seasons because of its photo- and thermo-insensitive nature and adaptability to all types of soil. As a rainfed crop it yields 800-1000 kg/ha, while under irrigation the yields are above 2000 kg/ha. It is presently grown all over India at about 2.2 million ha rendering 1.4 million tons (Oil World, 1998). It is a short-duration crop maturing in less than 100 to 120 days. Because of this it fits

into many cropping sequences like groundnut-sunflower and sunflower-sorghum, *etc*.

Sunflower seeds have an oil content of 30-40% and a protein content of 20-25%. Sunflower oil contains an essential fatty acid, linoleic acid, ranging from 40 to 70% (Bernardini, 1985). The seed contains other nutritional components like micronutrients and vitamins. There are some hybrids grown in India which are variable with respect to the proximate composition and other nutritional constiuents. In the present study the popular hybrids, namely KBSH 1, APSH 11 and MSFH 8, along with the variety Morden have been analyzed for proximate composition, fatty acids, tocopherols and micronutrients like zinc, copper and manganese.

Sunflower meal contains protein in the range of 30-40% (Narula, 1997). Recently much attention has been focused on utilizing oil meals for human consumption, as a source of protein and calories (Parpia, 1988). Sunflower cake availability in India is around 0.7 million tons. The protein content of sunflower cake ranges from 20-40% and in view of the high cost as well as the non-availability of animal proteins, there is a great potential for the utilization of oilcake proteins for human consumption (Deosthale and Longavh, 1988). In the present study varied grades of sunflower seed cakes and their protein isolates have been utilized in the preparation of biscuits and indigenous food items like pakodi and chapati and their utility and acceptability have been examined.

MATERIALS AND METHODS

Proximate composition

Seeds of sunflower genotypes grown during rainy season (July to November) of 1996-97 were collected from the DOR research farm, Rajendranagar, Hyderabad, India. The seeds, when necessary, were ground in a Knifetec grinder. The oil was extracted with a Komet oil expeller, the percentage of oil was estimated using a NMR spectrometer (Joanne Warnsely, 1988). Nitrogen content was analyzed with a Kjeltech system. The protein was calculated by multiplying nitrogen with the factor 5.3 (Mosse and Pernollet, 1983). The fatty acids in oil were analyzed by a gas chromatograph (AIMIL-NUCON) after interesterification with methanolic KOH (Paquot, 1988). Micronutrients, namely zinc, copper, manganese and iron, were analyzed with an atomic absortion spectrometer (Raguramulu *et al.*, 1988). Tocopherols were estimated using HPLC equipment (Shimadzu LC 10AT) with a UV detecor, silica column ODSC- 18, 2.5 cm and 4.6 mm injection value (Indyke, 1990).

Utilization of cakes

Protein isolates were prepared from sunflower whole cake and dehulled seed cake. Seed cake was extracted with 0.5 M NaCl (1:5 w/v) thrice, after through shaking, the proteins were precipitated using 1 N HCl at pH 4.5, filtered, washed with

H_2O and frezee dried at –30°C (Landey, 1970). The food items, namely biscuits, pakodi and chapati, were prepared according to the procedure of Taradalal *et al.* (1980). In place of maida for biscuits, bengal gram flour for pakodi and wheat flour for chapati, whole seed cake, partially dehulled cake and fully dehulled cake were incorporated at 10% and 20% levels, while the protein isolates were included at 5% and 10% levels. The products were evaluated for color, apperance, flavor, texture and overall acceptability (Mayor Doyal, 1982). Percent acceptability was calculated for each snack item and the results along with the protein content are presented in Tables 4 and 5.

RESULTS AND DISCUSSION

The oil and oil quality of four genotypes of sunflower are presented in Table 1. The oil content ranged between 28.7 and 32%, while for protein it was 19.37-25.75%. KBSH 1 showed the highest percentage of oil and protein. Morden had the lowest level of protein. Oleic and linoleic acids of the sunflower genotypes ranged from 36 to 51% and 42 to 54%, respectively. Stearic acid was present between 0.7 and 4.1% while palmitic acid ranged from 4.6 to 5.3%. MSFH 8 had the highest levels of 54% linoleic acid while APSH 11 and Morden had the highest level of oleic acid (49-51%). APSH 11 had the lowest level of linoleic acid (42%). It is evident that the linoleic acid levels of the sunflower genotypes grown in India are low. This may be due to high temperatures of around 35-40°C that prevail during the seed formation and maturation stages in India.

Table 1: Seed and oil quality of some sunflower genotypes

No	Variety	% of oil	Protein	Fatty acid			
				16:0	18:0	18:1	18:2
1	KBSH1	32	25.75	4.6	2.8	43.0	46.8
2	APSH11	30	20.12	4.9	0.7	50.9	42.0
3	MSFH8	31	23.45	5.3	4.1	36.0	54.2
4	Morden	29.7	19.37	4.8	1.0	48.9	43.8

Micronutrients like copper, zinc, manganese and iron are essential for human beings. Zinc is essential for the function of a large number of metallo enzymes including carbonic anhydrase, carboxy peptidase, phosphatases, hydrogenases and transaminases. It is also involved in the biochemical process which regulates protein and nucleic acid synthesis and turnover. In the sunflower genotypes, the zinc content was in the range of 64-107.2 µg/g. Copper is essential for normal development of bones and the central nervous system and connective tissue. Copper levels ranged from 30.0 to 39.6 µg/g. Manganese is involved in liver arginase activity and alkaline phosphatase activity of blood and bones. Manganese levels were between 32.0 to 89.6 µg/g. Iron is a major nutrient required for a number of biochemical functions and is also the constituent of hemoglobin, myoglobin, cytochrome and

main oxidative enzymes (Swaminathan, 1990). Iron ranged from 305 to 368 µg/g. The genotypes meet the daily nutrient requirements (recommended by FAO) in view of their copious contents of the micronutrients. MSFH 8 had somewhat higher levels of all four micronutrients.

Table 2: Micronutrients in some sunflower genotypes

No	Variety	Micronutrient (µg/g)			
		Zn	Cu	Mn	Fe
1.	KBSH1	64.60	29.6	32.0	367.6
2.	APSH11	72.0	29.6	42.0	363.8
3.	MSFH8	107.2	39.6	89.6	351.5
4.	Morden	98.6	31.6	57.8	305.0

Tocopherols are of biological and nutritional siginificance primarily because of the physiological role as antioxidants. Vitamin E congeners (alpha, beta and gamma) have been claimed to be the most frequent radical scavengers (Buton *et al.*, 1988). The alpha tocopherol content was higher than beta and gamma, ranging between 406 and 485, 35 and 56 and 4 and 10 mg/kg, respectively. MSFH 8 had increased values of alpha, beta and gamma tocopherols (Table 3).

Table 3: Tocopherols in sunflower genotypes

No	Variety	Tocopherol (mg/kg)		
		alpha	beta	gamma
1.	KBSH 1	423	35	5
2.	APSH 11	406	56	9
3.	MSFH 8	439	48	4
4.	Morden	485	44	10

Utilization of sunflower cakes and protein isolates

When incorporated at 10% and 20% levels in the preparation of biscuits, pakodi and chapati, dehulled seed cake was accepted to a level ranging from 72 to 92% with 10% level being more acceptable (86-92%). The partially dehulled cake acceptability ranged from 60 to 72% with the whole seed cake being least acceptable (50-70%) which might be due to the high crude fibre content which was higher in all preparations (13-27 g/100g) than in the control (11-21 g/100g). Keeping in view the high protein content of the snacks, incorporation of the seed cake flour, particularly dehulled cake, should be encouraged from the nutritional point as well as from the point of their availability and low price.

In similar fashion, the use of protein isolates from whole seed cake and dehulled seed cake showed 54-85% acceptance levels. Incorporation into biscuits and pakodi at 5 and 10% levels was found to be accepted at 76-85%. The acceptance was low (54-72%) with chapati, which might be due to the dark color of the product. Protein content of the items made with the isolate was higher (14.5-29 g/100g) than in the control (11-21 g/100g). It is thus again evident that the use of pro-

tein isolate in the snacks increases their protein content which should facilitate their utilization as protein rich food items.

Table 4: Acceptability and protein content of snack items made with sunflower seed cakes

No	Product		Control	Whole seed cake (%)		Partially dehulled cake (%)		Dehulled cake (%)	
				10	20	10	20	10	20
1. Biscuit									
	A	Protein (g/100g)	12.0	14.3	16.8	14.8	17.5	15.0	18
	B	O. Accept. (%)	100	55	50	66	60	92	82
2. Pakodi									
	A	Protein (g/100g)	21.0	23.2	25.5	23.6	26.4	24	27
	B	O. Accept. (%)	100	70	56	70	64	90	72
3. Chapati									
	A	Protein (g/100g)	1.0	13.4	15.7	13.8	16.5	13.9	17
	B	O. Accept. (%)	100	62	58	72	60	86	72

Note: O. Accept. = overall acceptability

Table 5: Acceptability and protein content of snack items made with sunflower protein isolates

No	Product		Control	Whole seed protein isolate		Dehulled protein isolate	
				5	10	5	10
1. Biscuit							
	A	Protein (g/100g)	12.0	15.3	18.6	16.2	19.8
	B	O. Accept. (%)	100	75	76	85	80
2. Pakodi							
	A	Protein (g/100g)	21	24.3	27.8	25	28.9
	B	O. Accept. (%)	100	80	76	84	82
3. Chapati							
	A	Protein (g/100g)	11.0	14.5	17.8	15.0	78.9
	B	O. Accept. (%)	100	60	54	72	68

Note: O. Accept. = overall acceptability

CONCLUSION

Among the genotypes tested, MSFH 8 was superior in terms of oil, protein, fatty acid profile, micronutrients and tocopherols. Dehulled seed cake and protein isolates should be encouraged for the incorporation in snack foods on account of high protein content and acceptability as well as the low cost of the oilcakes in general.

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CALIDAD DE CIERTOS GENOTIPOS INDIOS DEL GIRASOL Y LA UTILIZACION DE TORTADAS DE GIRASOL EN LOS PRODUCTOS A MORDISCAR

RESUMEN

La calidad y la utilizacion de semilla y tortada de girasol han sido estudiadas. Los hibridos del girasol han sido investigados en cuanto al contenido quimico total y a los contenidos en microelementos, acidos grasos y tocoferol. El contenido en los acidos grasos mas importantes, oleico y linoleico, variaba de 36 a 50% y de 42 a 54%. El contenido en microelementos, zinc, cobre, manganeso e hierro fue investigado en varios genotipos. El contenido en zinc variaba de 50 a 107.2 µg/g, en cobre de 24.4 a 39.6 µg/g, en manganeso de 28.2 a 89.6 µg/g y en hierro de 305 a 392 µg/g. El contenido en tocoferol alfa, beta y gama variaba de 406 a 485, de 35 a 56 y de 4 a 10 mg/kg. El hibrido MSFH tenia el mas grande contenido en tocoferol y microelementos.

La harina de tortadas de girasol y los aislados proteinicos han sido utilizados para la preparacion de galletas y ciertos productos a mordiscar como “pacadi” y “chapati”. Los aislados proteinicos adidos en la cantidad de 5% aumentaron el contenido proteinico de galletas de 12 g/100g a 16 g/100g. La adicion de aislados en cantidad de 10% aumento el contenido en proteina a 20 g/100g. La aceptabilidad de galletas y productos a mordiscar hechos con la adicion de tortadas de girasol era al nivel de 75 hasta 80% frente a 100% en caso de control. Eso significa que en India hay una grande posibilidad de utilizar semillas del girasol, harina de tortadas y aislados proteinicos como componentes de alimentos humanos en India.

QUALITÉ DE QUELQUES GÉNOTYPES DE TOURNESOL INDIEN ET UTILISATION DE GALETTES DE TOURNESOL DANS LES PETITS HORS-D'ŒUVRE

RÉSUMÉ

Des études ont été faites sur la qualité et l'utilisation des graines et des galettes de tournesol. On a procédé à l'examen des hybrides de tournesol pour déterminer leur composition chimique, leur contenu en micro-éléments, en acides gras et en tocophérol. Le contenu des acides gras les plus importants, les acides oléique et linoléique était de 36 à 50% et de 42 à 54%. Le contenu en micro-éléments comme le zinc, le cuivre, le manganèse et le fer a été examiné dans différents génotypes. Le contenu en zinc s'étendait sur une échelle de 50 à 107.2 µg/g, en cuivre de 24.4 à 39.6 µg/g, en manganèse de 28.2 á 89.6 µg/g et en fer de 305 á 392 µg/g. Le contenu en tocophérols alfa, bêta et gamma, sur une échelle de 406 à 485.35, de 35 à 56 et de 4 à 10 mg/kg. L'hybride MSFH 8 était celule plus de tocophérols et de micro-éléments.

De la farine de galette de tournesol et des isolats protéiques ont été utilisés dans la préparation de biscuits et de petits hors-d'œuvre comme les "pakodi" et les "chapadi". Les isolats protéiques ajoutés à des niveaux de 5% ont augmenté le contenu protéique des biscuits de 12 g/100g à 16 g/100g. À un niveau de 10%, le contenu protéique était de 20 g/100g. Le taux d'acceptabilité des biscuits et des petits hors-d'œuvre par le panel de goût était de 75-80% par rapport au groupe contrôle. Les conditions sont donc bonnes en Inde pour que soient utilisés la graine, la farine de galette de tournesol et les isolats protéiques dans l'alimentation.