Indian Res. J. Genet. & Biotech 7(4) : 415 – 421 (2015)

Quality Assessment of Multigrain Dalia Formulated From Cereals and Legume Mix

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Received : September 2015; Revised: October 2015; Accepted: October 2015)

Abstract

Dalia is the grit milled by wheat and other grains to provide balanced diet to consumers or patient to supply good nutrition with low cost. The present study were carried out in the Department of Food Technology, College of Agriculture, J.N.K.V.V., Jabalpur with the objective of quality assessment of multigrain Dalia formulated from cereals and legume mix blended multigrain Dalia could be consider the best from both nutritional and sensory point of view. The multigrain Dalia at the ratio of 60:30:10 (T_5) with wheat+ green gram+ oat was good in terms of protein and minerals. Supplementation of oat grits increased the amount of calcium, phosphorus, iron, fibers and calorific value in multigrain Dalia. It was concluded that low cost high protein energy multigrain Dalia could be developed.

Keywords : Quality assessment, Multigrain Dalia, Organoleptic and Storage study.

Introduction

Dalia is a product which is obtained by cooking wheat grits in boiling water or milk along with sugar to sweeten the product. A vast majority of the population in developing and under-developed countries do not have adequate nutrition to sustain a healthy life. Cereals are limited in essential amino acids such as lysine even though rich in Threonine and Tryptophan, while most oil seeds and legumes are rich in lysine and deficient in sulphur containing amino acids, **(**Many and Shadaksharaswamy, 2008). Therefore, the combination of cereals and pulses in formulation of Dalia gives a nutritious food containing all the amino acids. W heat is consumed in India mainly in the form of traditional products. Wheat porridge, popular in many parts of northern India, is made by cooking wheat grits, known as Dalia with water or milk and adding sugar to taste. It is also consumed as a savory dish after cooking with water, vegetables and spices. The wheat grits are prepared by coarse grinding of either polished or unpolished, cleaned wheat in a plate mill to a particle size of 300-850ìm (Sai Manohar et al. 1998). A meal consisting of a combination of cereal-pulse mixes is found to be more effective than the only cereal diet (Bijlani, 1993). Food legumes like beans, peas, lentils, and groundnuts belong to the family “Leguminosae”, also called “Fabaceae”. They are mainly grown for their edible seeds, and thus also named as grain legumes. They play an important role in human nutrition because they are rich source of protein, calories, certain minerals and vitamins (Deshpande, 1992).Several product development works have been reported for processing, packaging and value addition to Dalia grains. The grits, upon heating, gelatinizes to increase the consistency of the product (Sai Manohar et al. 1998; Gujral and Sodhi 2002). It is consumed as a breakfast food and is a preferred food for old age people as it is considered good for digestion. It is also given to convalescing patients to meet their nutritional requirements.

Materials and method

The present investigations on “Quality assessment of multi grain Dalia formulated from cereals and legumes

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Published by the Indian Society of Genetics, Biotechnology Research and Development, Biotech Bhawan 5 E Nikhil state, DPS Road, Shastripuram, Agra 282007, Online management by www.isgbrd.co.in

mix" were carried out in the department of Food Science and Technology, College of Agriculture, J.N.K.V.V., Jabalpur (M.P.)

Processing of selected grains:

First of all we took raw grains (after winnowing) then sorting, cleaning and washing were done. Dry milled after that sieved, then standardized size of grits. After this weighted and blending was done. Finally cooking was done. .

Development and standardization of multigrain Dalia *:* Preliminary studies were conducted to standardize the formulation for the development of the different cereal-pulses based Dalia. Multi grain Dalia was prepared from different grits of wheat, green gram and oat, using above different combination. After mixing properly they were subjected to sensory as well as nutritional evaluations.

Physical and functional properties : The bulk density is calculated by the method as suggested by **Wang and Kinsella (1976).** The water absorption capacity was determined by the method given by **Sosulski et al. (1976).** The cooking time was determined by the method given by **Mundra (2009).** The moisture was analyzed using the MBS4 moisture analyzer at 100°C for 10 minutes.

Proximate Composition Analysis : The crude protein, crude fat, total ash was estimated by **AOAC (1995).** The total carbohydrate in the samples was also estimated by hydrolysis method as described by AOAC (1995). The fibre content was determined by fibra plus–operational procedure for crude fiber. *Total Energy Value calculation:* Gross energy was calculated using At water factors (4x protein, 9x fat and 4 x carbohydrate) by method of **Oyenuga (1968).**

Minerals Composition Analysis : Minerals (Calcium, Phosphorus, Iron) content of Dalia were obtained by calculation using table values **(Gopalan et al. 1996).** In this case, percentage mineral content was calculated based on the mineral content of different ingredients used in the formulation of the Dalia.

Statistical Analysis *:* The results of the analysis for different parameters were analyzed statistically to assess the degree of variation within the treatments as compared to the control. The trial was laid out in randomized block design with five replications. The data were statistically analyzed following the ANOVA technique **(Panse and Sukhatme, 1985).**

Sensory evaluation *: All* the combinations of Dalia were cooked respectively in boiling water at a ratio of grits to water 1:8 (w/v). The organoleptic properties of nutritious Dalia were evaluated by the panel of 10 judges based on the sensory attributes of colour and appearance, taste, flavour, mouth feel and overall acceptability. The evaluation was done on a nine point hedonic scale as described by **Amerine et al. (1965).**

Storage studies *:* The shelf-life studies of Multigrain Dalia were carried out in polyethylene and laminated pouches for a period of 3 months at ambient temperature. 250 g of best one combination of multigrain Dalia and control samples were packed and kept at room temperature for 90 days. Both samples were drawn periodically after 0, 30, 60, 90, days and analyzed moisture and overall acceptability according to the standard procedures.

Results and discussion

Physical and functional quality of multigrain Dalia-Bulk Density *:* The data presented in table revealed that maximum bulk density was recorded in T2 formulated multigrain Dalia whereas minimum bulk density was found in T6 supplemented multigrain Dalia (Table 1). It was found that supplementation decreased the rate of bulk density of multigrain Dalia T2 (Wheat + Green gram, 80:20) Dalia obtained the highest value for bulk density. This might be due to the variation in the grain type, proportion of grits of studied grains and also the size of grits which varied sample to sample. Similar trend has also been found by **Akubor and Badifu (2004)** in wheat flour and **Mridula et al (2014).**

Water binding capacity *:* W ater binding capacity plays an important role during reconstitution into the blend before consumption (Table 1). Water binding capacity depends on the availability of hydrophilic groups that bind water molecules and on the gel forming capacity of macromolecules. It is evident from the tables and figures that maximum W BC was found in T_6 formulated multigrain Dalia, whereas minimum was found in T_1 multigrain Dalia. Supplementation of pulses in the cereals, this might be due to higher amylose or amylopectin ratio presented in multigrain Dalia. These findings have been supported by **FAO (1968) and Kushwah (2002).**

Cooking time *:* From the table we found that the maximum cooking time was in T_2 whereas minimum-cooking time was observed in T_3 (Table 1). T_2 sample had higher cooking time may be due to hardness and high fibre content of formulated Dalia. A similar finding was reported by Mundra (2009) in cooking quality of noodles and Dalia.

Moisture content *:* The maximum moisture content was found in control Dalia (T_1), whereas minimum was found in T_4 formulated multigrain Dalia moisture content decreased with formulation of various pulses grits (Table 1). The moisture content may be low due to high fibre content. Similar findings have been supported by **Sharma and Chawala (2011)** in oat-supplemented products.

Proximate Composition of Multigrain Dalia-Crude protein *:* Protein content increased with incorporation of legumes grits. Results showed that maximum protein content was found in T_5 formulated multigrain Dalia, whereas minimum was found in T3 multigrain Dalia. Different combination of multigrain Dalia supplemented with 30% Green gram grits was significantly superior than other formulated multigrain Dalia. This could be due to the supplementation with the pulses grits. Similar findings have been observed by **Vardis and Trichopoulou et al. (2009).**

Crude Fat *:* The fat content of control wheat Dalia increased gradually among pulses supplemented multigrain Dalia. However, a significant increase was observed in oat supplemented multigrain Dalia at the 30% level in T_6. This might be due to supplementation or fat rich grit of oat. These results are close agreement with **Curley (2008)** in oat porridge.

Ash *:* The ash content of control Dalia was minimum and it is not remained almost the same in various multigrain Dalia at all levels while control wheat dalai and T5 multigrain Dalia were significantly different from other multigrain Dalia. This might be due to supplementation of green gram grits in multigrain Dalia. Similar findings have been supported by **Sharma and Chawala (2011)** in oat porridge.

Carbohydrate *:* The data showed that carbohydrate content was increased with formulation of high carbohydrate content grain grits in various multigrain Dalia. Maximum carbohydrate content was found in various controls Dalia whereas minimum was found in T6 multigrain Dalia. Results showed that carbohydrate content was significantly differing in all multigrain Dalia. Content was decreased with supplementation of pulses in all multigrain Dalia. This might be due to the high carbohydrate content of the formulations is attributed the high carbohydrate content. Similar findings have been supported by **Mahgoub (1999)** in weaning food formulation.

Crude fiber *:* The table showed that the fibre content was increased with increasing the ratio of supplementation of oat and grits in multigrain Dalia. Maximum fibre content was found in T4 whereas minimum was found in T2. These findings might be due to incorporation of oat and green gram, which are rich source of fibre. Similar findings have been supported **Edema et al. (2005)** in porridge supplemented with soy.

Energy Value *:* Energy value was observed to be high for all formulated multigrain Dalia. Maximum percentage was found in T_6 formulated multigrain Dalia, whereas minimum was found in T_3. Data showed that incorporation of green gram, oat and wheat grits enhance the energy value of formulated multigrain Dalia. This might be due to supplementation of protein, fat and carbohydrate rich grits. Similar findings have been supported by **Mahgoub (1999) and Kulkarni et al. (1991)** in weaning food formulation.

Minerals Composition of Multigrain Dalia -Minerals *:* the minerals content of oat supplemented multigrain Dalia was high as compared to control Dalia. *Calcium:* Calcium content of multigrain Dalia was observed in table. Highest calcium content was found in T_5 whereas minimum was found in control multigrain Dalia. Data showed that the supplementation of green gram and oat grits increased the calcium content in all multigrain Dalia. This might be due to rich source of calcium in those grits. Similar findings have been reported by **Kanu et al. (2009)** in cereal-based porridge mixed.

Phosphorus *:* The data presented in table revealed that maximum phosphorus content was noted in T_1 formulated multigrain Dalia whereas minimum was found in control multigrain Dalia. As evident from table that phosphorus content increased with the supplementation of oat grits in all multigrain Dalia. Similar findings have been found by **Nicole et al. (2010)** in ready to eat composite porridge flours. *Iron:* Maximum iron content was found in T_5 whereas minimum was found in oat (at 30%) supplemented multigrain Dalia. Supplementation of green gram grits had increased the iron content in multigrain Dalia. This might be due to the incorporation of rich source of iron content grits. Similar findings have been obtained by **Camire (2002)** in blended weaning foods. Thus addition of oat and Green gram grits could recommended for nutritional improvement of the multigrain Dalia especially from minerals point of view.

Organoleptic properties of multigrain Dalia-Appearance and colour *:* Appearance and colour was found significantly affected with the proportion of the grits of different grains formulations (Table 1) Maximum colour and appearance score (8.90) was found in T_5 (wheat + green gram + oat) at the ratio of (60:30:10) whereas minimum (6.65) was found in T_3 (wheat+oat) at the ratio 80:20. The data revealed that decreased the ratio of oat grits from decreased the mean scores for colour and appearance of multigrain Dalia. T_3 and T_5 multigrain Dalia were statistically at par with each other.

Aroma *:* The mean scores for flavour of the Dalia were statistically at par for T_2 and T_6 at 6.85 and 6.58 respectively. The T_6 combination was found to be scored lowest (6.58) while the highest score (8.87) was obtained in T5 and T4 respectively.

Taste *:* The data depicts in Table 5 revealed that, the mean scores for taste ranged from 7.12 to 7.96. The mean scores for taste of multigrain Dalia were above the acceptable limit with the lowest score (7.12) obtained from

T_1 multigrain Dalia against the highest score (7.96) in T_5 multigrain Dalia. The control wheat Dalia had got means score value 7.07 it was at par with T_4 (7.97) and T_5 (8.43). Supplementation of green gram increased the mean scores for taste of multigrain Dalia.

Texture *:* An appraisal of table 5 showed that, the treatment T_5 got the highest value 8.87 against T3 at 6.65. The treatment T_3 got the lower value (6.65), and T5 got highest value (8.87). and the treatment T3,T2,T1,T6,T4, and T5 rated 6.65,6.90,7.05,7.13,7.91 and 8.87 in ascending order respectively.

Overall acceptability *:* All the Dalia were acceptable and combination T_5 (wheat 60%+green gram 30%+oat 10%) was superior to others with the highest value at 8.59. Control Dalia with the score (7.18) was got 5th rank and Treatment T2 scored lowest value at 7.03.

Shelf life of the multigrain Dalia *:* The storage of the best multigrain Dalia was selected from three bases Dalia. Dalia was packed in polyethylene bags and laminated bags kept at regular intervals for 0, 1, 2 and 3 months at ambient condition.

Moisture content *:* The tables showed that the moisture content slightly increased with increasing the storage period in all formulated multigrain Dalia in both type of packaging materials. Maximum moisture content was found in control T1 sample in polyethylene packaging material after 90 days of storage, whereas minimum was found in T_5 formulated multigrain Dalia in both type of packaging materials at initial stage of storage and moisture content increased with increases the storage time. It can be attributed to greater protection against water vapour, though polyethylene bags seem to be comparatively more permeable to water vapour. A similar finding was reported by **Khan et al. (2012)** in instant wheat porridge.

Overall acceptability *:* The overall acceptability of multigrain Dalia was significantly affected by different processing variables and declined with increase of storage period. The highest mean scores for overall acceptability of multigrain Dalia was found in T_5 formulated multigrain Dalia in both packaging material at initial stage of storage. The minimum mean score value was recorded in T_1 multigrain Dalia in polyethylene bags after 90 days of storage. The overall acceptability of formulated multigrain Dalia stored in laminated bags had better results as compared to polyethylene bags. The higher values in polyethylene bags might be due to high moisture absorption and permeability of atmospheric gases involved in reduction of colour and flavour. These findings in agreement with the results of **Khanam et al. (2011)** in supplementation of food formulation.

Conclusion

On the basis of findings it was concluded that Green gram and oat blended multigrain Dalia could be considered the best from both physical and nutritional quality point of view. The multigrain Dalia at the ratio of 60:30:10 with wheat + Green gram + oat (T_5) was good in terms of protein and minerals. Supplementation of oat grits increased the amount of calcium, phosphorus, iron, fibers and calorific value in multigrain Dalia. and have excellent overall acceptability and organoleptically acceptable. Shelf life of the T_5 formulated multigrain Dalia was found to be best in both packaging materials (polythene and laminated) for the period of the three months at ambient temperature. Hence it was concluded that low cost high protein energy multigrain Dalia could be developed. Efforts should also be made to suggestion for transfer this technique to house hold women for cottage level. Multigrain Dalia helps to alleviate the protein malnutrition problem in India.

Table 1. Different combinations of cereal and legume grains for the formulation of multigrain Dalia.

Treatment	Wheat (%)	Green gram (%)	Oat (%)
T_1	100	-	-
T_2	80	20	-
T_3	80	-	20
T_4	70	15	15
T_5	60	30	10
T_6	50	20	30

Table 2. Physical and functional attributes of multigrain Dalia as influenced by Mixture of cereals and legume.

Treatments	Bulk density (g/ml)	Water absorption capacity (%)	Cooking time (minute)	Moisture Content (%)
T1	0.72	250.75	15.43	11.00
T2	0.74	254.50	16.25	10.60
T3	0.67	270.14	14.48	10.59
T4	0.71	268.02	15.17	9.79
T5	0.72	268.42	16.21	10.75
T6	0.69	284.19	14.54	10.96
SEm ±	0.02	3.35	0.87	0.38
CD at 5%	0.04	9.77	2.52	1.10

Table 3. Proximate parameters (%) of multigrain Dalia as influenced by Mixture of cereals and legume.

Treatments	Proximate parameters (%)					
	Crude Protein	Crude Fat	Ash	Carbohydrate	Crude Fiber	EV (Kcal)
T_1	12.85	1.78	1.70	70.18	3.38	349.90
T_2	13.57	2.36	2.22	68.19	2.44	350.59
T_3	10.64	2.06	2.58	66.82	3.30	328.28
T_4	11.73	1.52	2.19	68.08	4.38	343.08
T_5	15.79	2.45	2.60	66.81	3.12	332.04
T_6	13.17	4.06	2.44	65.65	3.58	354.63
SEm ±	0.77	0.26	0.20	1.46	0.33	10.85
CD at 5%	2.25	0.76	0.59	4.25	0.95	31.61

Table 4. Mineral contents of multigrain Dalia as influenced by Mixture of cereals and legume.

Treatments	Minerals (mg/100g of Dalia)		
	Calcium	Phosphorus	Iron
T_1	41.02	306.12	5.28
T_2	75.74	319.26	6.26
T_3	42.32	320.60	5.04
T_4	68.04	327.40	5.93
T_5	94.10	333.40	6.84
T_6	78.62	341.52	6.18
SEm ±	0.44	0.20	0.13
CD at 5%	1.30	0.60	0.37

Table 5. Organoleptic properties of multigrain Dalia as effected by different mixture of cereals and legume.

Treatments	Appearance & colour	Aroma	Taste	Texture	Overall acceptability	Average Mean
T_1	**7.05**	**7.10**	**7.25**	**7.42**	**7.24**	7.21
T_2	**7.42**	**6.76**	**7.41**	**6.98**	**7.12**	7.15
T_3	**7.49**	**6.65**	**7.61**	**6.69**	**7.51**	7.19
T_4	**8.49**	**7.74**	**7.51**	**7.86**	**7.62**	7.84
T_5	**8.81**	**7.99**	**7.91**	**8.71**	**8.42**	8.36
T_6	**7.46**	**6.51**	**7.78**	**7.19**	**7.67**	7.52
SEm ±	**0.15**	**0.20**	**0.20**	**0.23**	**0.18**	0.19
CD at 5%	**0.42**	**0.59**	**0.59**	**0.67**	**0.52**	0.55

Table 6. Effect of storability on the acceptability of packed multigrain Dalia.

Packaging material	Treatments	Period of storage (Days)				Average Mean
		0	30	60	90	
Polyethylene bags	T_1	7.07	7.00	6.90	6.78	**6.93**
	T_5	8.43	8.41	8.39	8.37	**8.40**
Laminated pouches	T_1	7.07	7.07	6.94	6.85	**6.98**
	T_5	8.43	8.42	8.40	8.39	**8.41**

Table 7. Changes in moisture content of multigrain Dalia in following packaging (pouches) during storage.

Packaging material	Treatments	Period of storage (Days)				Average Mean
		0	30	60	90	
Polyethylene bags	T_1	11.00	11.09	12.30	12.60	**11.74**
	T_5	10.57	10.63	10.70	10.79	**10.67**
Laminated pouches	T_1	11.00	11.04	12.00	12.20	**11.56**
	T_5	10.57	10.59	10.68	10.71	**10.63**

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