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Effect of Germination on Nutritional and Organoleptic Properties of Multigrain Dalia

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Abstract

Germination of grains increases amount and quality of nutrient in the grains and incorporation of oat makes Dalia rich in dietary fiber which is valuable in recent because it is beneficial for heart patients. The present study investigated effects of germination on nutritional quality of the Wheat, Green gram and Oat grits. The Wheat and Green gram were procured from local market, while oat was procured from the Department of Plant Breeding and Genetics, J.N.K.V.V., Jabalpur. The samples were analyzed for nutritional and organoleptical properties by using standard methods. results revealed that, germinated Green gram and Oat blended Multigrain Dalia could be consider the best from both nutritional and point of view. The Multigrain Dalia at the ratio of 50:20:30 (T_6) with Wheat + Oat + Green gram was good in terms of protein, crude fiber and minerals.The finding concluded that the employed processing methods, particularly germination, influenced the chemical composition of the germinated multigrain Dalia in terms of protein, fibre and mineral content and reduction of anti-nutrient composition.

Keywords : Germination, cereals, pulses, Nutritional and Organolaptic properties.

Introduction

Malnutrition, a state of improper nutrient balance in the body affects health and aggravates many infectious diseases. In India, protein energy malnutrition is still a major problem in all the segments of population. 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. The critical period where children develop malnutrition coincides with the introduction of complementary foods, which are nutritionally inadequate in many developing countries (Khanam et al., 2011).Wheat is a good source of thiamine and nicotinic acid, but is relatively poor in riboflavin. Wheat 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. 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). Oats are generally considered 'healthy' or a health food being touted commercially as 'nutritious'. The discovery of the healthy cholesterol lowering properties has led to wider

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appreciation of oat as human food. Oat contains cereal protein globulin and also legume protein avenalin, as the major protein (80%), It is twice richer in protein, four times richer in calcium as compared to other grains (Gopalan et al., 1996). Mung bean is an excellent source of protein (27%), and its essential amino acid composition compares favourably with that of soybean, kidney bean and FAO/WHO reference protein (El-Adawy, 1996; Fan & Sosulski, 1974; Thompson et al. 1976, 1976). The food legumes are major sources of protein and other nutrients in the diets of many developing countries. However, their role appears to be limited by several factors (Elias and Bressani) including low protein digestibility and flatulence .In many parts of the world, legumes are often consumed after germination, during which process the proteins are hydrolyzed to peptides and amino acids, due to protease activity, while the carbohydrates are converted to simpler sugars. Germination is a natural process occurred during growth period of seeds in which they meet the minimum condition for growth and development (Sangronis et al., 2006). During this period, reserve materials are degraded, commonly used for respiration and synthesis of new cells prior to developing embryo (Vidal et al., 2002).Several studies on the effect of germination on legumes found that germination can increase protein content and dietary fiber, reduce tannin and phytic acid content and increase mineral bioavailability (Rao and Prabhavathi, 1982; Hussein and Ghanem, 1999; Ghavidel and Prakash, 2007). In cereal grains, germination increase oligosaccharides and amino acids concentration as observed in barley (Rimsten et al.,2003), wheat (Yang et al., 2001), oat (Mikola et al.,2001) and rice (Manna et al., 1995). Legumes and cereals were used as these food groups provide significant amount of macro- and micronutrients to human. Therefore, this study aims to study the effect of germinated grain mixture of legume (Mung) and cereals (wheat and oat) on proximate content and quality of multigrain Dalia.

Materials and method

The present investigations on “Effect of germination on nutritional and organolaptic properties of multigrain Dalia” were carried out in the department of Food Science and Technology, College of Agriculture, J.N.K.V.V., Jabalpur (M.P.)

Germination process : Grain of the legume and cereals were steeped for 12 hr at 25ºC in excess water, which was changed after 4 and 8 hr. After steeping, the legumes were germinated for 60 additional hr (three days total) in a control cabinet (23ºC, 100 % RH) that provide automatic rising and draining every 2 hr, as described by Hsu et al (1980).

Preparation of germinated multi grain Dalia

We took Raw Grains (after winnowing) after sorting, cleaning and washing grains were Soaked/Steeped for 12 hr at 25°C then sprouted (23°C,100%rh) after that washed/drained then oven drying was done for 7-8 hr, at 60°C . Dry Milling, Sieving were done before standardizing the size of grits. After that then weighing, blending and cooking process completed.

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

Cooking time : The cooking time was determined by the method given by Mundra (2009).

Proximate Composition Analysis : The crude protein, crude fat, total ash content was determined 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 multigrain 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 multigrain 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).

Organoleptic properties : All the combinations of Dalia were cooked respectively in boiling water at a ratio of grits to water 1:8 (w/v). The Organolaptic 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).

Results and Discussion

Proximate Composition of Multigrain Dalia - Crude protein : Protein percentage increased with incorporation of legumes grits with the good bioavailability due to

germination. Results showed that maximum protein content was found in T_5 (18.30%) formulated multigrain Dalia, whereas minimum was found in T_1 (13.02%) multigrain Dalia. Different combination of multigrain Dalia supplemented with 20% Green gram grits was significantly superior to 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 germinated pulses supplemented multigrain Dalia. However, a significant increase was observed in germinated oat supplemented multigrain Dalia at the 30% level in T_6. This might be due to supplementation or fat rich grit of germinated 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 T_2 multigrain Dalia were significantly different from other multigrain Dalia. This might be due to supplementation of 20% 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 was T_1 Multigrain Dalia whereas minimum was found in T_6 multigrain Dalia and. carbohydrate content was decreased with supplementation of pulses and germination of grains because carbohydrate was consumed as food during germination in all multigrain Dalia. Similar findings have been supported by Donkor et al.(2012) in germinated grains.

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 T_2. 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_5 formulated multigrain Dalia, whereas minimum was found in T_3. Data revealed 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 Germinated Multigrain Dalia—
Minerals : It is obvious from the tables that incorporation of multigrain grits had different effect on the minerals content of supplement multigrain Dalia as compared to without supplemented multigrain 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_5 formulated multigrain Dalia whereas minimum was found in T_3 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 (RTE) composite porridge flours.

Iron : Maximum iron content was found in T_6 whereas minimum was found in T_1 Dalia. Supplementation of germinated oat 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.

Organolaptic 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 3) Maximum colour and appearance score (8.16) was found in T_6 (wheat + oat + green gram) at the ratio of (60:30:20) whereas minimum (7.30) was found in T_1 Dalia. The data revealed that decreased the ratio of oat grits from decreased the mean scores for colour and appearance of multigrain Dalia. T_6 and T_1 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 6.86 and 8.07 respectively.

Taste : The data depicts in Table 3 revealed that, the mean scores for taste ranged from 7.11 to 8.26. The mean scores for taste of multigrain Dalia were above the acceptable limit with the lowest score (7.12) obtained from T_3 multigrain Dalia against the highest score (8.26) in T_6 multigrain Dalia. The control wheat Dalia had got means score value 7.31 it was at par with T_4 (7.26) and T_5 (8.43). Supplementation of germinated oat increased the mean scores for taste of multigrain Dalia.

Texture : An appraisal of table 3 showed that, the treatment T_6 got the highest value 8.03 and the treatment T_3 got the lower value (6.96).

Overall acceptability : All the Dalia were acceptable and combination T_6 (wheat 50%+ oat 30%+ green gram20%) was superior than others with the highest value at 8.22. Control Dalia with the score (7.46) was got 3rd rank and Treatment T_4 scored lowest value at 6.79.

Conclusion

On the basis of findings it was concluded that oat and Green gram blended multigrain Dalia could be considered the best from both physical and nutritional quality point of view comparatively control Dalia. The multigrain Dalia at the ratio of 50:20:30 with wheat + oat Green gram + (T_6) was good in terms of protein, fibre and minerals. Supplementation of oat grits increased the amount of calcium, phosphorus, iron, fibers and calorific value in multigrain Dalia, and has excellent overall acceptability and ally acceptable. Hence it was concluded that low cost high protein, energy and fibre containing germinated 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 and abroad.

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

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

Table2. Proximate parameters (%) of multigrain Dalia as influenced by Mixture of germinated cereals and legume

Treatments	Proximate parameters (%)					Energy Value (Kcal)
	Crude Protein	Crude Fat	Ash	Carbohydrate	Crude Fiber	
T_1	13.02	1.83	2.28	**76.92**	5.82	376.07
T_2	16.50	1.72	**2.49**	75.86	7.41	379.35
T_3	13.19	3.05	2.03	75.49	8.45	372.32
T_4	15.76	2.70	2.25	71.40	9.04	375.70
T_5	**18.30**	2.44	2.44	69.72	9.46	**379.48**
T_6	16.66	**3.66**	2.16	67.79	**11.65**	373.76
SEm ±	1.27	0.37	0.35	1.67	0.38	3.06
CD at 5%	3.71	1.07	1.01	4.86	1.10	8.90

Table3. Mineral contents of multigrain Dalia as influenced by Mixture of germinated cereals and legume

Treatments	Minerals (mg/100g of Dalia)		
	Calcium	Phosphorus	Iron
T_1	51.10	386.07	8.21
T_2	58.50	390.34	8.43
T_3	60.73	385.84	8.78
T_4	63.86	388.92	8.70
T_5	67.25	**392.08**	9.04
T_6	**73.60**	389.49	**9.36**
SEm ±	1.48	3.79	0.28
CD at 5%	4.30	11.05	0.82

Table 4. Organolaptic properties of multigrain Dalia as effected by different mixture of germinated cereals and legume

Treatments	Appearance & colour	Aroma	Taste	Texture	Overall acceptability	Average Mean
T1	7.30	7.42	7.31	7.03	7.46	7.25
T2	7.56	6.86	7.56	7.10	7.17	7.28
T3	7.32	7.26	7.11	6.96	7.64	7.47
T4	7.64	7.12	7.26	7.33	6.79	7.40
T5	7.62	7.41	7.43	7.00	7.58	7.46
T6	**8.16**	**8.07**	**8.26**	**8.03**	**8.22**	**8.34**
SEm ±	0.37	0.52	0.25	0.45	0.31	0.10
CD at 5%	1.08	1.52	0.73	1.30	0.90	0.30

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