



STUDY ON CORRELATION AMONG SENSORY, PHYSICAL AND NUTRITIONAL QUALITIES OF MULTI-GRAIN DALIA FORMULATED FROM CEREAL AND LEGUME GRAINS

RANA GAJENDRA KUMAR^{1*}, SINGH YOGENDRA², DUBEY A.D.¹ AND KHAN M.A.¹

¹Department of Food Science and Technology, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur 482004, MP, India

²Department of Plant Breeding and Genetics, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur 482004, MP, India

*Corresponding Author: Email- rana93g@gmail.com

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Abstract- Dalia is an astonishing breakfast meal that is packed with minerals, vitamins, an amazing amount of protein, energy, carbohydrates and dietary fiber, due to the supplementation of oat and green gram. The present investigations on "Study on correlation among Sensory, physical and nutritional qualities of multi-grain Dalia formulated from a mixture of cereals and legumes, grains" were carried out in the department of Food Science and Technology, College of Agriculture, J.N.K.V.V., Jabalpur MP. The results revealed of correlation analysis that taste of multigrain Dalia had significant and positive correlation with majority studied traits. The highest positive correlation was observed between calcium and iron index. The significantly positive correlations were also observed between water absorption capacity (%) and phosphorus (%), taste and phosphorus (%), taste and ash (%), taste and overall acceptability, crude protein (%) and cooking time (minute) and others, whereas water absorption capacity (%) and carbohydrate (%), ash (%) and carbohydrate (%) and bulk density (g/ml) and water absorption capacity (%) was significant but these attributes showed negative relationship among themselves. In general, a significant positive correlation was observed between above mentioned qualitative parameters of multigrain Dalia. However, most of the parameters during the study were showed negative and non-significant correlation.

Keywords- Cereal and pulses, Standardization, Proximate analysis, Sensory study.

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Introduction

Multigrain mix nutrition Dalia is an astonishing breakfast meal that is packed with minerals, vitamins, an amazing amount of protein, Energy, carbohydrates and dietary fiber. Multi Grain Dalia is a whole grain product. Its key benefit lies in its nutritional value that helps in lowering cholesterol, and hence aids weight-loss. It is very delicious in taste, with a mildly sweet nut like flavour and contains a myriad of beneficial nutrients. It is nearly 15% of Proteins, which contains high amount of fiber, B-Complex Vitamins including Niacin, Thiamin and Riboflavin, essential Amino Acids, Methionine, Lecithin and some Vitamin E.

In recent years, a wide range of processed foods in ready-to-eat form has been marketed with increased interest in health foods. Consumers also now believe in health benefits or nutrition as being desirable food qualities. Breakfast cereals have potential to contribute as nutritious food because of dietary fiber and other health significant bioactive compounds in whole grains. In addition to whole grain benefits, multigrain concept can provide breakfast foods with a number of benefits associated with these grains. This multigrain blend helps to mix different whole grains to maximize their nutritional, functional and sensory properties. Apart from health significance, convenience is also a recent trend in international as well as the Indian food market. Convenience products are quick and easy to prepare, thus, saves cooking time and require few cooking skills [1].

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, [2]. Therefore, the combination of cereals and pulses in formulation of Dalia gives a nutritious food containing all the amino acids.

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. It is also consumed as a savoury 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 300-850 µm [3].

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 [4], [5]. 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. And par work has entitled a Shelf life prediction model for the instant multigrain Dalia mix, is also reported by [6]. Hence, with this view, the present investigation was undertaken.

Materials and Methods

The investigations on "Study on correlation among Sensory, physical, and nutritional qualities of multi-grain Dalia formulated from cereal and legume grains" 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

Wheat and green gram were cleaned to remove the dirt, dust and foreign matter by winnowing. The cleaned grains were then ground in vertical metallic disc grinder consisting of one stationary and one rotating discs, and sieved using sieves of different sizes to obtain coarse grits of similar size. The oat grains were milled to remove the shells, cleaned and polished to obtain clean grains. The grains were then subjected for further grinding to obtain grits. The particle size of the grits was varied by adjusting the clearance between the plates. Fine flour was

removed by sieving and particle size distribution of grits was determined by passing it through standard sieves of different mesh size (22, 25, 30, and 44).

Table-1 Different combinations of cereal and legume grains for the manufacture of multigrain Dalia

Combinations	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

Development and standardization of multigrain Dalia

Preliminary studies were conducted to standardize the formulation for the development of the different cereal-pulses based Dalia. Multigrain 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.

Sensory evaluation (properties):- All the combinations of Dalia were cooked respectively in boiling water at a ratio of grits to water 1:8 (w/v). The sensory 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 [7]. **Physical properties:-** The bulk density is calculated by the method as suggested by [8]. The water absorption capacity was determined by the method given by [9]. The cooking time was determined by the method given by [10]. The moisture was analyzed using the MBS4 moisture analyzer at 100°C for 10 minutes. **Proximate Composition Analysis** The moisture content, fat content and crude protein contents of the samples were estimated by the standard methods and the total carbohydrate in the samples was estimated by hydrolysis method as described by [11]. The fibre content was determined by fibra plus – operational procedure for crude fibre. **Total Energy Value calculation:-** The total energy values were calculated by using the values 4, 4, and 9 for protein, carbohydrate and fat, respectively as follows: Total energy (kcal/100g) = [(% available carbohydrates x 4) + (% protein x 4) + (% fat x 9)]. **Minerals Composition Analysis:-** Minerals content of Dalia were obtained by calculation using table values [12]. 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 correlation coefficient (r) was calculated as suggested by [13] with the following formula.

$$\text{Correlation coefficient (r)} = \frac{\frac{\sum XY}{n} - \frac{(\sum X) \times (\sum Y)}{n}}{\sqrt{\frac{\sum Y^2 - (\sum Y)^2}{n} \times \frac{\sum X^2 - (\sum X)^2}{n}}}$$

Results and Discussion

Correlation analysis for Appearance and colour, Aroma, Taste, Texture, Overall acceptability, Bulk density (g/ml), Water absorption capacity (%), Cooking time (minute), Moisture Content (%), Crude Protein (%), Crude Fat (%), Ash (%), Carbohydrate (%), Crude Fiber (%), Energy Value (Kcal), Calcium (%), Phosphorus (%), Iron (%) are presented in [Table-2]. Results of correlation analysis showed that Taste of multigrain Dalia had significant and positive correlation with majority studied traits. The highest positive correlation was observed between Calcium and Iron index ($r = 0.986^{**}$), between Aroma and Texture ($r = 0.921^{**}$) and between Bulk density and Cooking time (minute), ($r = 0.908^{**}$). Also results showed that significantly positive correlations were between Water absorption capacity (%) and Phosphorus (%), ($r = 0.894^{**}$), Taste and Phosphorus (%) ($r = 0.872^{**}$), Taste and Ash (%) ($r = 0.872^{**}$), Taste and Overall

acceptability ($r = 0.869^{**}$), Appearance and colour and Aroma ($r = 0.854^{**}$), Crude Protein (%) and Cooking time (minute), ($r = 0.852^{**}$), Appearance and colour and Texture ($r = 0.828^{**}$), Appearance and colour and Overall acceptability ($r = 0.817^{**}$), Texture and Overall acceptability (%) ($r = 0.803^{**}$), Taste and Water absorption capacity (%) ($r = 0.785^{**}$), Crude Protein (%) and Calcium (%) ($r = 0.775^{**}$), Calcium (%) and Phosphorus (%) ($r = 0.747^{**}$), Cooking time (minute) and Crude Protein (%) ($r = 0.744^{**}$), Ash (%) and Phosphorus (%) ($r = 0.730^{**}$), Crude Fat (%) and Phosphorus (%) ($r = 0.708^{**}$), Texture and Crude Protein (%) ($r = 0.708^{**}$), Water absorption capacity (%) and Ash (%) ($r = 0.706^{**}$), Taste and Calcium (%) ($r = 0.687^{**}$), Water absorption capacity (%) and Crude Fat (%) ($r = 0.686^{**}$) and Texture and Iron (%) ($r = 0.674^{**}$) whereas Water absorption capacity (%) and Carbohydrate (%) ($r = -0.911^{**}$), Ash (%) and Carbohydrate (%) ($r = -0.902^{**}$) and Bulk density (g/ml) and Water absorption capacity (%) ($r = -0.671^{**}$) was significant but these attributes showed negative relationship among themselves. In general, a significant positive correlation was observed between above mentioned qualitative parameters of multigrain Dalia. However, most of the parameters during the study were showed negative and non-significant correlation. Singh et al., (2013) [6] also observed the Interrelationship between different physicochemical and sensory changes of Instant Multigrain Dalia.

Conclusion

It was concluded from the results of correlation analysis that taste of multigrain Dalia had significant and positive correlation with majority studied traits. The highest positive correlation was observed between calcium and iron index. The significantly positive correlations were also observed between water absorption capacity (%) and phosphorus (%), taste and phosphorus (%), taste and ash (%), taste and overall acceptability, crude protein (%) and cooking time (minute) and others, whereas water absorption capacity (%) and carbohydrate (%), ash (%) and carbohydrate (%) and bulk density (g/ml) and water absorption capacity (%) was significant but these attributes showed negative relationship among themselves. In general, a significant positive correlation was observed between above mentioned qualitative parameters of multigrain Dalia. However, most of the parameters during the study were showed negative and non-significant correlation.

Conflict of Interest: None declared

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Table-2 Correlation matrix among Sensory, Physical, and Nutritional qualities of multi-grain Dalia formulated from a mixture of cereals and legumes grains

Vars.	Sensory qualities					Physical qualities				Nutritional qualities								
	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀	X ₁₁	X ₁₂	X ₁₃	X ₁₄	X ₁₅	X ₁₆	X ₁₇	X ₁₈
X ₁	1	0.854**	0.618	0.828**	0.817**	0.119	0.292	0.330	-0.540	0.412	-0.172	0.490	-0.316	0.337	-0.494	0.653	0.519	0.637
X ₂		1	0.238	0.921	0.649	0.379	-0.143	0.513	-0.443	0.457	-0.484	0.017	0.189	0.336	-0.382	0.405	0.086	0.469
X ₃			1	0.460	0.869**	-0.344	0.785*	-0.076	0.087	0.437	0.563	0.872**	-0.876**	0.054	-0.408	0.687*	0.872**	0.599
X ₄				1	0.803**	0.379	0.043	0.520	-0.153	0.708*	-0.132	0.116	-0.010	0.234	-0.242	0.615	0.313	0.674*
X ₅					1	-0.134	0.507	0.148	-0.011	0.566	0.201	0.627	-0.535	0.193	-0.528	0.630	0.641	0.604
X ₆						1	-0.6717*	0.908**	-0.021	0.617	-0.240	-0.467	0.545	-0.404	0.408	0.391	-0.284	0.521
X ₇							1	-0.605	-0.033	-0.064	0.686*	0.706**	-0.911**	0.408	-0.106	0.372	0.894	0.230
X ₈								1	0.014	0.744*	-0.268	-0.153	0.368	-0.548	0.032	0.501	-0.198	0.620
X ₉									1	0.383	0.545	-0.077	-0.050	-0.558	0.228	-0.058	-0.082	-0.016
X ₁₀										1	0.30596	0.129	-0.098	-0.418	0.099	0.775*	0.307	0.852**
X ₁₁											1	0.412	-0.719*	-0.176	0.397	0.462	0.708*	0.386
X ₁₂												1	-0.902**	-0.102	-0.583	0.495	0.730*	0.377
X ₁₃													1	-0.039	0.235	-0.521	-0.896**	-0.383
X ₁₄														1	-0.020	-0.149	0.238	-0.203
X ₁₅															1	0.078	-0.013	0.114
X ₁₆																1	0.747*	0.986*
X ₁₇																	1	0.636
X ₁₈																		1

* and ** sign indicates significant at 0.05 and 0.01 level of significance respectively

Legends: X₁: Appearance and colour, X₂: Aroma, X₃: Taste, X₄: Texture, X₅: Overall acceptability, X₆: Bulk density (g/ml), X₇: Water absorption capacity (%), X₈: Cooking time (minute), X₉: Moisture Content (%), X₁₀: Crude Protein (%), X₁₁: Crude Fat (%), X₁₂: Ash (%), X₁₃: Carbohydrate (%), X₁₄: Crude Fiber (%), X₁₅: Energy value (Kcal), X₁₆: Calcium (mg/100g of Dalia), X₁₇: Phosphorus (mg/100g of Dalia), X₁₈: Iron (mg/100g of Dalia).