

## Development of Fibre Rich Biscuits from Corn Bran

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### **Abstract**

Corn Bran is cheaply available rich source of Dietary Fibres, which contributes to many health effects. The aim of present study was to develop fibre rich biscuits by incorporating Corn Bran. The Corn Bran were defatted, ground and incorporated into control biscuits at different level 5, 10, 15, 20, 25 and 30% by replacing Maida. The prepared biscuits were analyzed for various physical, chemical and sensory parameters or characteristics. The diameter, thickness, weight, volume and density of corn bran powder incorporated biscuits were found to be greater while spread ratio and spread factor was observed to be less as compare to control biscuits. Chemical parameter point of view, slight decrease in Moisture, Fat and Carbohydrate whereas increase in Ash, Protein and Fibres was observed after incorporation of Corn Bran into Control Biscuits. The sensory evaluation of prepared fibre rich biscuits suggested maximum 20 % level of incorporation of Corn Bran in control biscuits formulation without deviating much in overall sensory acceptability. The study concludes that it is possible to prepare acceptable quality (physically, chemically and sensory acceptable) fibre rich biscuits by exploiting corn bran, provided it's powder is incorporated to the level not more than 20 % in control biscuits formulation.

**Keywords:** Dietary Fibres, Corn Bran, Biscuits, Sensory evaluation

### **1. Introduction**

India rank 3<sup>rd</sup> in the production of Corn. The Corn Bran is the major waste arising from Corn [1] which is found to contain high Dietary Fibres. Intake of Dietary Fibres from diet is essential for human body as dietary fibre helps in carrying out normal body functioning in all category and age group people like Old age people, Teenagers, Children's, Pregnant and Lactating Woman. The daily recommended intake of fibre is 30g/day.

#### **1.1 Fibre Rich Biscuits as Functional Food:**

The term Functional Foods are those foods, which apart from providing nutrition offering various health benefits to human by treating or preventing the risk of diseases and health problem [2]. Fibers plays very important role in our digestion and thus contribute and enhance the overall human health. Dietary Fibres showing many health benefits toward treating and prevention of Laxation, Obesity, Colon Cancer and Diabetics, Blood lipid profile, Appendix, Coronary Heart Diseases etc. Now a day's Appendix is rapidly growing health issue in children and young people due to lack of Dietary Fibres in diet and the medical experts are looking at the fibre rich food products as possible preventive approach to deal the problem. Biscuits are lovable by all age group people and inexpensive, Ready- to -eat food product. Biscuits are rich source of Fat, Minerals, Carbohydrate and its sensory characteristics are found to be suitable for incorporation of dietary fibres. In preparation of fibre rich biscuits the refined wheat flour (Maida) is replaced by natural plant fibres powder [3-6].

**1.2 Corn Bran as a Source of Fibres:**

Among all the production of Corn the major waste arises is of Corn Bran which is mostly used as animal feed. Corn Bran is thus a by product achieved after Corn milling. Corn Bran is found to contain low Fat and high Total Dietary Fibres. As corn bran is cheaply available and rich in fibre hence can be tried as alternative for preparing fibre rich food product for giving value addition [7, 8].

The present study was carried out to develop fibre rich biscuits by incorporating Corn Bran Powder in the formulation of control biscuit.

**2. Materials and Methods**

The different chemicals and raw materials required for the preparation of Biscuits like Corn Bran, Maida, Skimmed Milk Powder, Sodium Bicarbonate, Liquid Glucose Ammonium Bicarbonate, Fat, Flavour, Salt and Sugar were purchased from local market of Jalgaon. The Corn Bran was purchased at Rs. 2/- per Kg from standard supplier.

**2.1 Preparation of Corn Bran Shells De-fated Powder:**

The Corn Bran was treated in Soxhlet Assembly for the purpose of de-fatting by using Petroleum Ether. The defatted sample was then collected and dried in Hot Air Oven at 105<sup>o</sup>c for 6 hr. The obtained dried, defatted sample of corn bran ground by using home grinder and sieved by 105 micron sieve to achieve uniform particle size. The prepared Corn Bran powder was stored in HDPE bags for using in the further work.

**2.2 Preparation of Control Biscuits:**

The Control Biscuits were made by using Maida at Laboratory Level. The ingredient used for preparation of control biscuits is shown in Table 1 and Table 2 is showing the process parameters used for baking biscuits, which was set by trial and error method [9].

**Table 1. Formulation for Making Control Biscuits**

Ingredients	Quantity
Maida (g)	300
Sugar (g)	180
Fat (g)	120
Skimmed Milk Powder (g)	24
Sodium Bicarbonate (g)	9
Ammonium Bicarbonate (g)	0.3
Liquid Glucose (g)	30
Invert Sugar Syrup (g)	30
Flavour (ml)	1.2
Salt (g)	1.2
Water (ml)	72

**Table 2. Process Parameter Maintained for Biscuit Making in Laboratory**

Parameters	Value
Pre-mixing time (min.)	10
Mixing time (min.)	10
Holding time (min.)	10
Forming dough weight (g)	9.3
Forming dough diameter (mm)	56
Forming dough thickness (mm)	5.6
Baking temperature ( <sup>o</sup> c)	180

Baking time (min.)	12
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**2.3: Preparation of Corn Bran Incorporated Biscuits:**

The de-fatted Corn Bran Powder was incorporated in prepared Control Biscuits by replacing Maida at level of 5 %, 10 %, 15 %, 20 %, 25 % and 30 %. The level of water in the control biscuits formulation was gradually increased as the level of Fibre incorporation increased, while there was no change in quantity of other ingredients added in formulation and process parameter as compared to Control biscuit (made without Corn Bran). The surface of fibre incorporated biscuits was observed to be dry as compared to control biscuits hence the level of water was increased in the formulation. The prepared fortified biscuits then analyzed for their physical, chemical and sensory evaluation.

**2.4: Evaluation of Prepared Biscuits.**

The prepared control biscuits and Corn Bran incorporated biscuits were analysed for various physical parameters like diameter, thickness, weight, spread ratio, spread factor, volume density etc. using standard method. The biscuits were assess for chemical parameters like moisture, ash, fat, acidity of extracted fat, protein, acid insoluble ash, carbohydrate and energy value etc. using standard method of analysis. The sensory evaluation of biscuits were carried out on Hedonic scale by 10 semi trained panel members on the basis of Aroma, Colour, Texture, Taste, Appearance and Overall Acceptability from the level of 0% incorporation to 30 % of Corn Bran Powder [10-13].

**3. Results and Discussions:**

Table 3 is showing the analysis result of Corn Bran Powder prepared in laboratory. The result revelled that Corn Bran Powder was in rich fibre as found to contain around 76 % fibre.

**Table 3. Analysis Results of Prepared Corn Bran Powder**

Parameter	Result
Moisture Content %	5.01± 2.73
Ash %	2.42± 0.025
Protein %	8.43± 0.98
Carbohydrate%	84.14
Reducing Sugar %	3.57± 0.015
Non-reducing sugar%	5.57±0.012
Total Sugar%	7.47±0.12
Crude Fibre%	76.15±0.08
Cellulose %	33.53± 2.31
Hemicellulose %	41.73± 1.71
Lignin %	4.48± 0.5
Pectin %	0.63±0.2

(Values are means of three determination ± standard deviation)

Effect of different level of Corn Bran Powder incorporation on physical characteristic of Control Biscuits is shown in Table 4. It was observed as the level of Corn Bran Fibre incorporation increased in Control Biscuits, the diameter, thickness, weight, volume and density of biscuits also increased, similar type of result was also reported by H. Parveen et, al, 2017 [14] while preparing Fibre Rich Biscuits by incorporating Carrot and Beetroot Pomace Powder as source of fibre. However the spread ratio and spread factor of incorporated biscuits were found to be decreased.

**Table 4. Effect of Different level of Corn Bran Powder Incorporation on Physical Characteristics of Control Biscuits**

Parameter	Level of Corn Bran Fortification						
	0%	5%	10%	15%	20%	25%	30%
Diameter (mm)	55.23 ±0.23	55.35 ±0.16	55.55 ±0.17	55.62 ±0.20	55.68 ±0.21	55.78 ±0.3	55.92 ±0.19
Thickness (mm)	5.20 ±0.24	5.30 ±0.24	5.51 ±0.16	5.78 ±0.16	5.86 ±0.16	5.90 ±0.11	5.94 ±0.11
Spread Ratio	10.62	10.44	10.08	9.62	9.50	9.45	9.41
Spread Factor	100	9.83	9.49	9.05	8.94	8.89	8.86
Weight (g)	8.34 ±0.06	8.42 ±0.21	8.48 ±0.14	8.53 ±0.03	8.61 ±0.26	8.69 ±0.22	8.74 ±0.14
Volume (cm <sup>3</sup> )	9.13 ±0.13	9.86 ±1.09	10.08 ±1.18	10.15 ±1.15	10.67 ±1.60	10.78 ±1.35	11.36 ±1.58
Density (g/cm <sup>3</sup> )	0.91 ±0.10	1.17 ±0.10	1.18 ±0.21	1.18 ±0.89	1.30 ±0.092	1.34 ±0.088	1.39 ±0.09

(All values are means of twenty determination ± standard deviation)

**Table 5. Effect of Different Level of corn Bran Powder Incorporation on Chemical Characteristics of Control Biscuits**

Parameters	Level of Corn Bran Fortification						
	0%	5%	10%	15%	20%	25%	30%
Moisture Content %	3.28 ± 2.12	3.52 ± 0.24	3.23 ± 0.42	3.05 ± 0.75	2.94 ± 0.71	2.45 ± 3.42	2.42 ± 1.04
Ash %	0.36 ± 0.01	0.37 ± 0.02	0.38 ± 0.01	0.38 ± 0.02	0.37 ± 0.02	0.39 ± 0.0	0.38 ± 0.01
Fat %	21.41 ± 0.72	21.03 ± 0.89	20.70 ± 0.15	20.48 ± 0.23	20.48 ± 0.01	20.11 ± 0.19	19.14 ± 0.095
Acidity of Extracted Fat %	0.27 ± 0.5	0.32 ± 0.4	0.33 ± 0.6	0.34 ± 0.7	0.36 ± 0.8	0.37 ± 0.2	0.07 ± 0.4
Protein %	8 ± 0.25	8.12 ± 0.16	8.12 ± 0.18	8.14 ± 0.09	8.18 ± 0.0	8.21 ± 0.4	8.28 ± 0.04
Crude Fibre %	1.88 ± 0.02	5.82 ± 0.23	9.64 ± 0.16	13.38 ± 0.27	17.26 ± 0.11	20.92 ± 0.06	24.76 ± 0.01
Carbohydrate %	66.54	69.42	57.93	67.68	50.77	68.93	44.06
Acid Insoluble Ash %	0.031 ± 0.21	0.036 ± 0.11	0.038 ± 0.34	0.040 ± 0.05	0.039 ± 0.22	0.038 ± 0.04	0.040 ± 0.00
Energy (Kcal/100gm)	477.62	502.85	489.50	487.60	450.12	420.55	390.26

(Values are means of three determination ± standard deviation)

Effect of different level of corn bran powder incorporation on chemical characteristic of control biscuits is shown in table 5. The chemical analysis result was showing no

significant deviation in moisture, ash, fat, acidity of extracted fat, protein, acid insoluble ash and energy value in fibre rich biscuits and control. However the significant difference in crude fibre and carbohydrate was found in fibre rich biscuits and control biscuits.

As per the sensory analysis, the highest Overall Acceptability was received by 20% Corn Bran incorporated Biscuits next to Control Biscuits. The sensory score was found to be less for 25% and 30% level Corn Bran incorporated Biscuits. The reason for the same was the development of roughage on the surface of Biscuits, slight inferior taste and darkening of colour, with higher level of fibre source incorporation.

**Table 6. Effect of different Level of Corn Bran Powder Incorporation on Sensory Characteristics of Control Biscuits**

Parameters	control	5%	10%	15%	20%	25%	30%
Aroma	8.4 ± 0.52	8.6 ± 0.8	8 ± 0.6	8 ± 0.6	8.4 ± 0.51	7.5 ± 0.52	7.3 ± 0.48
Color	8.8 ± 0.31	8.2 ± 0.72	8.4 ± 0.52	8.2 ± 0.42	8.8 ± 0.51	8.1 ± 0.31	8 ± 0.0
Texture	8.4 ± 0.0	8.9 ± 0.31	8.6 ± 0.51	8.6 ± 0.51	8.6 ± 0.32	8.1 ± 0.31	8 ± 0.0
Taste	8.6 ± 0.42	8.1 ± 0.87	8.1 ± 0.31	7.7 ± 0.67	8.2 ± 0.48	7.1 ± 0.31	7 ± 0.0
Appearance	8.6 ± 0.0	8.4 ± 0.31	8.3 ± 0.56	7.9 ± 0.31	8.3 ± 0.48	7.8 ± 0.51	7.1 ± 0.048
Overall Acceptability	8.7 ± 0.52	8.1 ± 0.31	8 ± 0.2	8 ± 0.2	8.5 ± 0.45	7.4 ± 0.51	7 ± 0.0

(Values are means of 10 determination ± standard deviation)

### 5. Conclusion

Following are the conclusions drawn from said study:

1. Corn Bran was appropriate source for producing fibre rich powder, and the prepared defatted Corn Bran powder was suitable for incorporation in control biscuits for making them fibre rich biscuits.
2. The incorporation of Corn Bran powder in the formulation of control biscuits brought deviation in physical parameters by increasing diameter, thickness, volume, density and weight and decreasing Spread ratio and Spread factor.
3. Incorporation of Corn Bran in the formulation of Control Biscuit increased the fibre content in the biscuits proportionately depending upon the level of incorporation, without affecting much other chemical parameter.
4. Incorporation of Corn Bran in the formulation of Control Biscuit adversely affected the sensory characteristics of Control biscuits (darkening of colour, hardening of texture and slight inferior taste), with increasing level of incorporation.
6. The maximum level of Corn Bran Powder that can be incorporated in the formulation of Control Biscuit without bringing much change in Overall Acceptability is 20%.

## 6. References

- [1] L. Wang, H. M Liu, A. J. Xie, C. Y Zhu and G.Y. Qin, "Dietary Fiber Extraction from Defatted Corn Hull by Hot-Compressed Water", Polish Journal of Food and Nutrition Sciences, vol. 68, no. (2), (2018), pp.133-140.
- [2] D. M. Martirosyan and J. A Singh, "New Definition of Functional Food by FFC: What Makes A New Definition Unique? Functional Foods in Health and Disease", vol. 5, no. (6), (2015), pp. 209-223.
- [3] J. W. Anderson, P. Baird, R. H. Davis, S. Ferreri, M. Knudtson, A. Koraym, and C. L Williams, "Health Benefits of Dietary Fiber. Nutrition Reviews, vol. 67, no. 4, (2009), pp. 188-205.
- [4] F. Yangilar, "The Application of Dietary Fibre In Food Industry: Structural Features, Effects on Health and Definition, Obtaining and Analysis of Dietary Fibre: A Review", Journal of Food and Nutrition Research, vol. 1, no.3, (2013), pp. 13-23.
- [5] H. Hanai, , M. Ikuma., Y. Sato, , T. Iida, , Y. Hosoda., I. Matsush and E. Kaneko, "Long-Term Effects of Water-Soluble Corn Bran Hemicellulose on Glucose Tolerance In Obese And Non-Obese Patients: Improved Insulin Sensitivity And Glucose Metabolism in Obese Subjects". Bioscience, biotechnology, and biochemistry, vol. 61, no.8, (1997), pp. 1358-1361.
- [6] H. P. S. Nagi, J Kaur, B. N. Dar and S. Sharma, "Effect of Storage Period and Packaging on The Shelf Life of Cereal Bran Incorporated Biscuits", American Journal of Food Technology, vol. 7, no. 5, (2012), pp. 301-310.
- [7] O. A. Adeeyo, O. M. Oresangun and T. E.Oladimeji, "Compositional Analysis of Lignocellulosic Materials: Evaluation of an Economically Viable Method Suitable For Woody and Non-Woody Biomass", American Journal of Engineering Research (AJE), vol. 4, no. 4, (2015), pp. 14-19.
- [8] D. J. Rose, G. E. Inglett and S. X. Liu, "Utilisation of Corn (Zea Mays) Bran and Corn Fiber in The Production of food Components", Journal of the Science of Food and Agriculture, vol. 90, No. 6, (2010), pp. 915-924.
- [9] V. R.Parate, D. K.. Kawadkar and S. S. Sonawane, "Study of Whey Protein Concentrate Fortification In Cookies Variety Biscuits", International journal of food engineering, vol.7, no. 2. (2011), pp. 1-12.
- [10] C.S. Freitas, D.R. Valente and S.P. Cruz "Physical, Chemical and Sensory Characteristics of Cookies Made of Pumpkin Seed Flour (PSF) And Baru Seed Flour (BSF) For Celiac Disease", Vol. 9, no. 4, (2014), pp 1003-1018.
- [11] O. Junior, N. M. B.Costa, H. S. D Martino and M. C. D Paes, "Chemical Composition and Effects of Micronized Corn Bran on Iron Bioavailability in Rats", Food Science and Technology, vol. 34, no. 3, (2014), pp. 616-622.
- [12] S. Ranganna," Handbook of Analysis and Quality Control for Fruit and Vegetable Products", New Delhi, Tata McGraw Hill Publishing Company Limited, (1986).
- [13] V.R. Parate., A.S., Sadaphal and M.I. Talib, "Development of Protein Enriched Biscuits by Incorporating Soy Nuggets Powder", International Journal of Engineering & Technology Research, vol. 4, no. 4, (2016), pp. 20-31.
- [14] H. Pareveen, A. Bajpai, S. Bhatia and S. Singh. "Analysis of Biscuits Enriched with Fibre by Incorporating Carrot and Beetroot Pomace Powder", Indian Journal of Nutrition and Dietetics, vol. 54, no.4, (2017), pp. 402-413.