Print ISSN : 0972-8813
e-ISSN : 2582-2780

[Vol. 22(3) September-December 2024]

Pantnagar Journal of Research

(Formerly International Journal of Basic and Applied Agricultural Research ISSN : 2349-8765)



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https://doi.org/10.67063/pjr.vol.24.issue.03.10

Glycemic index of maize flour mixes

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ABSTRACT: The present study was aventure for the quality evaluation of Maize flour mixesfor its flat chapati called "Roti". Findings of the survey revealed that all the subjects consumedblended flourRoti but the type of grain selected and proportion used varied. Blended flour was developed for most commonly consumed grains i.e., Maize (M) with bengalgram (B) in the proportion of 3: 2 and with Bengalgram and Barley (BY) 3: 1: 1. After several repetitions of different proportions by preparing *Roti*, its acceptability was judged (scores > 6.5) by panel of judges using nine point hedonic scale. A preparation of blended flour roti was standardized for its carbohydrate content (40g/serve), serving size, cooking time, cooked weight and water required for preparing the dough. Developed composite flour provided70-77 per cent of energy from carbohydrate and were the good sources of fibre (2.10-3 g%). Protein quality of the composite flour was better than the plain flour (Protein quality -7, 11& 11 NDP cal% respectively). Developed flour was stored in 1 kg capacity flour bags at room temperature for a period of three months. Shelf life parameters revealed that free fatty acids and peroxides were in the safe limits. Acceptability of *roti* remained same for M and its blends. Nutritional status of the subjects revealed that majority (43%) of them were in the category of overweight and obesity, waist hip ratio confirmed the abdominal obesity (> 0.85) in the females. Glucose tolerance test was conducted with 40g glucose and test recipe i.e., blended flour Roti with chutney on selected subjects asGTT manner to determine the Glycemic index (GI) of blended flours. GI was lower for blended flours than the plain flour. Blend of Maize with Bengalgram and Barley were the best as their GI was lowest. The acceptability of M + B composite flour was for longer duration upto 3 months and its GI was also lowest, therefore, for commercial purpose this blend was recommended.

Key words: Blended flour, Glycemic Index, Maize

Maize is one of the most relished grain of Rajasthan.It is abundantly grown in Mewar region of southern Rajasthan. Rajasthan has the largest area of maize in India i.e. 1million ha with production of 1.1 million tonnes and productivity of 1, 100 kg/ha.(https: //icar.org.in.)Chittorgarh, Banswara, Dungarpur, Rajsamand, Udaipur, Bhilwara, Sirohi are the main growing regions of Rajasthan. Rajasthan state contributes 9 percent part of total Indian maize production. (https: // iimr.icar.gov.in).Although maize is grown in specifically in these regions but it is liked and loved to eat all over the state. It is consumed in the form of processed products, various traditional preparations of particular occasion, supplementary foods, geriatric foods and many more. Maize is full of nutrients but as compare to other millets and cereals its nutrition profile is poor. Maize alone is not sufficient to provide adequate nutrition to the body so it should be enriched and fortified. It can be done by development of new preparations by adding some nutritious and compatible foods in it. It is one of the most practical approach, which is not only easy at household level but also for a layperson to follow it to consume. As per the new dietary guidelines by ICMR 2024, Cereals are the second large contributory food group for human consumption after fruits and vegetables. If food is consumed skillfully and smartly than many of diseases can be controlled easily. In Indian dietary pattern flour's bread called "Roti": It is the main meal component in a day. Primarily Roti should be nutritious for that, respective flour must be enriched and fortified. Manually mixed flours are mainly popular to consume. Composite flour preparations also advised by experts to manage the diseased conditions as Cardio vascular diseases, Obesity and Diabetes etc. Therefore, the present study was planned to develop and standardize the maize-based composites not only to provide variation in maize based preparations

but also a strong option of health oriented diet.

MATERIALS AND METHODS

Initially household survey was conducted to collect information regarding consumption pattern of blended flour used for the preparation of Roti by the diabetics. After several trials, a preparation of blended flour Roti was standardized. Maize (variety -Mahi Kanchan) was mixed with Bengal Gram (Variety-Dahod Yellow) and /or barley (Variety RD2035). Blended flour was grinded, packed in hand stitched cotton bags and analyzed for physical characteristics, nutrient composition, sensory and keeping quality for a period of 3 months at room temperature. A preparation was standardized for 40g carbohydrate per serve, cooking time of preparation, cooked weight and water required for preparing the dough. Flours were packed in 1kg capacity hand stitched cotton bags and stored at room temperature. Flours analyzed for physical characteristics, nutrient composition, sensory and keeping quality for a period of 3 months using standard procedures (AOAC, 1965). Subjects those were regularly attending/in contact of the govt hospital were selected for study. Prior consent was taken from subjects to conduct the study. Selected subjects were well versed about the study. Nutritional and health Information of subjects were collected to measure the Glycemic Index (Gl) of the blended flours. Glucose tolerance test (GTT) was conducted to assess the blood glucose level of the subjects and test preparations were fed in the same manner (GTT). Blood glucose response was measured. Incremental area under the curve was collected and glycemic Index was calculated by standard method (Wolver and Jenkins, 1986).

RESULTS AND DISCUSSION

The present study was an initiative to develop maize based flour blends. Findings of the survey revealed that blended flour roti was consumed by the majority of the subjects in daily routine as well as in diseased condition as for obesity, diabetes etc. Blends were generally made by addition of bengalgram, barley, sorgum, bajara etc. Most popular composition was wheat, Bengalgram and Barley. After several trials of different proportions for preparation of blended flour roti, Sensory parameters were evaluated in acceptable range (scores>6.5) by selected panel of judges using nine point hedonic scale. Maize blends were prepared to mix Maize with Bengalgram in a proportion of 3: 2 and Maize with Bengalgram and Barley in a proportion of 3: 1: 1. (Bejlanietal., 1993) also reported the combination of Wheat, Barley and Bengalgram in equal proportion which was found suitable supplement for prevention and treatment and diabetes. Ancient medical text prescribed addition of Barley in the traditional cereal pulse mixture for maintaining blood glucose in diabetes. As per the results of nutrition quality showed that developed flours contained 70-77.8percent of carbohydrate and have appreciable amount of fibre (2-3gm). Protein quality was better than plain flours (Protein quality -7, 11, 7NDPCAL %)(Table-1, 2, 3).Blended flour mixes contained highest amount of Phenylalanine and Tyrosine amino acids.

Shelf life parameters showed changes in the values but remained in safe limits (Fig1-4)

As per the findings related to nutrition and health profile of the subjects abdominal obesity was observed in female a subject which is a risk factor

Table 2: Protein Quality of Maize Flours

S.No	Flours	Protein(g)	NDPCal%	Protein Cal%
1	M	10.1	7.6	12.9
2	M+B	15.7	11.6	15.4
3	M+B+BY	12.6	11.4	14.3

Table 1: Nutrient composition of Maize flours(g/100g)

SNo	Flour	Moisture	Protein	NDPCal%	Fat	Ash	Fibre	Carbohydrate	Energy(Kcal)
1	M	7.96	10.19	7	0.96	0.98	2.10	77.81	361
2	M+B	8.69	15.73	11	1.11	1.21	2.90	70.36	354
3	M+B+BY	9.08	12.63	7	1.08	0.91	3.00	73.30	353

Table 3: Chemical Score of the Maize flours

S.No.	Flour	Lysine	Tryptophan	Phenylalanine+ Tyrosine	Methionine+ cystine	Threonine	Leucin	Isoleucine	Valine
1	M	59	67	139	100	112	164	96	97
2	M+B	95	75	278	148	166	242	142	143
3	M+B+BY	80	90	138	91	194	142	105	98

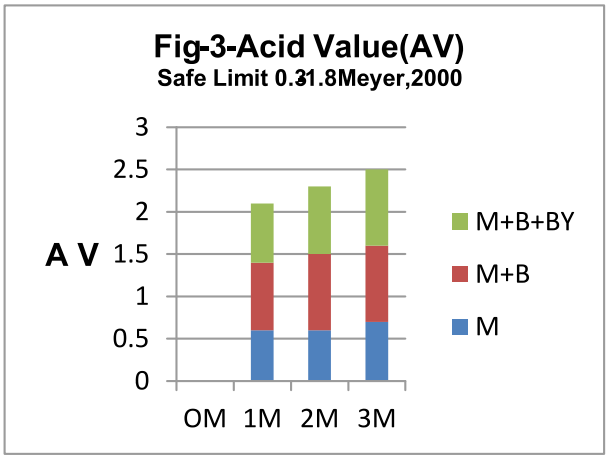
for non-communicable diseases.Glycemic Index of blended flour was better than plain flour (Table 4).

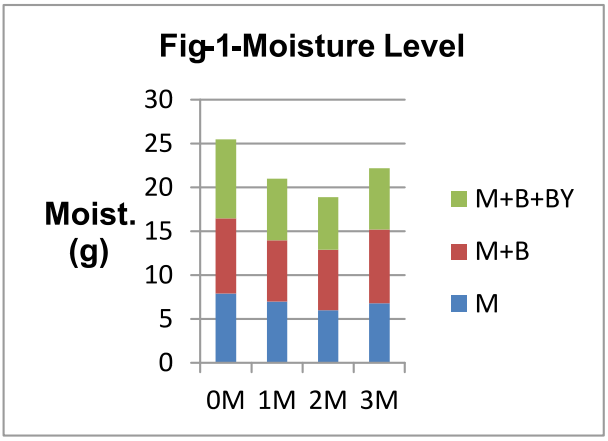
Glycemic Index of Maize and Bengal gram was lower than Maize with Bengal gram and Barley.

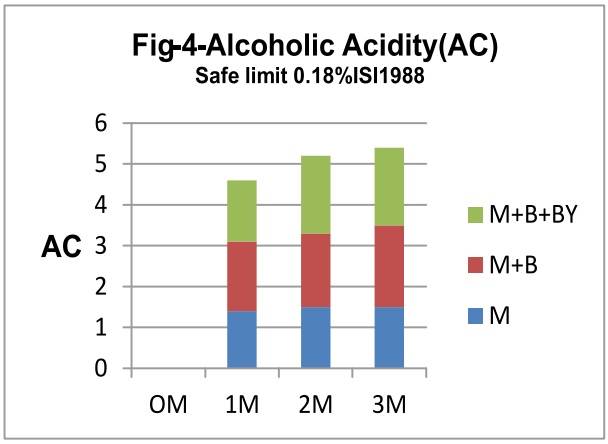
Table 4: Glycemic Index (GI) of Maize flours

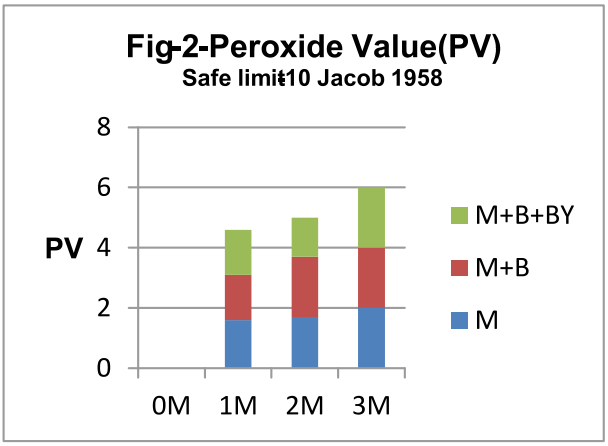
S.No	Flour	Diabetic Condition	Normal Condition	Overall Value
1	M	89±35.28	58±9.02	74±22.15
2	M+B	60±15.80	55±16.55	58±16.17
3	M+B+BY	83±17.95	34±3.46	59±10.70

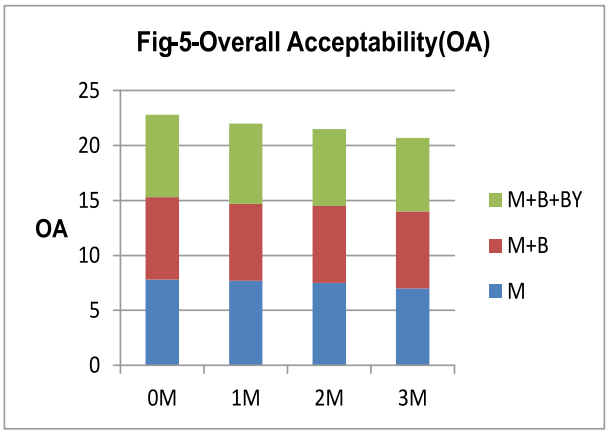
M-Maize B-Bengal gram By-Barley











But the blend with Bengalgram and Barley had shelf life and acceptability for 3 months and lower Glycemic Index also so it was found best for commercialization. In a study by (Saloni and Usha, 2020), also suggested low glycemic index food for consumption during normal and diseased condition on priority. It was revealed in the trials that alkali tested Maize and boiled Maize grain was lower (77.84 ± 0.23) and (78.09 ± 0.53) Glycemic index as compared to roasted and control maize grain (82.13 ± 0.53) and (89.4 ± 0.33) respectively. After addition of whole Bengal gram in Maize, Glycemic Index was reduced in boiled Maize (69.29 ± 0.21) and alkali treated Maize (69.48 ± 0.41) as compared to roasted Maize (72.46 ± 0.33) and control Maize (75.67 ± 0.27).In another studies, (Mitaigir, 2021)reported the blended flours prepared by soy flour, chickpea flour, soybean flour and wheat were high in protein, ash, amino acids and compounds such as Zn, Cu, K, Mg, Ca. Blended flours were recommended due to potential for vitamins, minerals, antioxidants and dietary fiber.. These were helpful to control lifestyle disorders like Diabetes, Cardiovascular diseases, Hypertension, Cancer, Atherosclerosis, Ischemic stroke, Obesity, Coeliac disease, Alzheimer's and many other diseases and disorders when consumed frequently in long run.

CONCLUSION

Maize and its blended flours are scientifically studied flour proportions those are not only nutritious but also an effective proportion to manage the non-communicable lifestyle diseases. These can easily prepared at household level and effective choice to achieve household nutrition security. It is best option of nutritious flour for maize growing areas and Maize eaters. Blends can prepare by less cumbersome, less tedious method and free from highly technical procedures, which proves high potential for commercialization also.

ACKNOWLEDGEMENTS

The author is indebted to Director General ICMR New Delhi for providing financial support to conduct research smoothly.

REFERENCES

AOAC (1965). Official method of analysis, Association of official analytical chemicals.Washington, DC.

Bijalani, R. L., Narain, J.P., Shukla K., Kochhar K.P., Puri, P., Karmarker, M.G. and Bala.S.(1993). Glycemic and metabolic responses to a traditional cereal legume mixture. *Asia. Pacific J. Clin.Nutr.*, 243-251.

Saloni Chauhan and Usha Sin. (2020). Changes in Glycemic Index in Maize Based Flour Before and After Processing under in vitro Condition. International Journal of Current Microbiology and Applied Sciences, 9(10): 1600-1606

Dietary Guidelines for Indians.2024.NIN, ICMR, New Delhi

https**:** //icar.org.in**.**

https: //iimr.icar.gov.in

Mitaigiri, TaffreedaBanua., Jaspreet, Kaura., Vishesh, Bhadariyab., Jyoti, Singha and Kartik Sharma(2021). Role of consumption of composite flour in management of lifestyle disorders. *Plant Archives*, 21(2): 201-214.

Wolver T.M.S. and Jenkins J.A.D. (1986). The use of the glycemic index in predicting the blood glucose response to mixed meals. *Am. J. Clin. Nut.*, 43: 167-172.

Received: November 08, 2024
Accepted: December 03, 2024