



Research Article

Effect of incorporation of little millet (*Panicum miliare*), flaxseed (*Linum usitatissimum*) and black gram (*Vigna mungo*) powders on physico-chemical attributes of ready to cook idli mix

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Abstract

Idli is a traditional fermented steamed product having a soft and spongy texture and is widely consumed as a breakfast food item in India. In the present investigation, idli mix was prepared using different combinations of Rawa, Little Millet, Flaxseed Powder and Black Gram. Rawa and Little Millet was added in the ratio of 90:10, 80:20, 70:30, 60:40, 50:50, 40:60, 30:70, 20:80, 10:90 and 00:100 and 5 percent flaxseed powder was added to each. Physico-chemical analysis shows that with the increase in little millet powder, fat content, ash content, crude fiber content, loose bulk density, packed bulk density and flowability increased. Protein content, carbohydrate content, total solids content and acidity content decreased with increase in the little millet powder. Idli mix powder based on little millet have enhanced nutritional properties as little millet contribute to increased fiber content, increased vitamin and mineral content.

Keywords black gram, flaxseed, idli mix, little millet, physico-chemical properties

Introduction

Ready-to-cook foods required few steps for processing like frying, cooking, dilution and reconstitution before consumption for example, rava idli mix, gulab jamun mix, etc. [1]. Idli is a fermented breakfast food of India which is especially popular in South India. This is a widely consumed breakfast food and is known for its organoleptic characteristics and nutritional value. [2-5]. Currently, the production and export of ready-to-cook idli mix and idli batter in India is a growing business with exports to various Asian.

In India, Little millet is one of the important staple cereal crops mainly grown in Karnataka and Tamil Nadu. In spite of being the largest producer of millets, its economic importance remains very low. Under such a situation, millet-based products can diversify the utilization of this crop and may help in gaining more economic importance for this crop. Millets are grains that are used for food, feed and forage. Little millets are major source of dietary fibres, are non-glutinous and are considered to be less allergenic. Little millet has 5.2 g fat, 9.8g protein, 61g carbohydrate, 7.7g crude fiber, 220mg phosphorus and 9.3mg iron /100 gm which are comparable to cereals and other millets.

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B-vitamins, minerals like calcium, iron, zinc, and potassium are all found in little millet. Fiber present in little millet is responsible for its low glycaemic index and a recent study conducted on little millet indicated that it exhibits hypoglycaemic effect due to its higher proportion of fiber [6]. It has a significant role in providing significant amounts of antioxidants and phytochemicals in the diet [7-8]. Little millet contains a lot of phytochemicals and has a lot of antioxidants. It is high in dietary fibre, which helps to prevent hyperglycemia, lower cholesterol, and relieve indigestion. It lowers the risk of heart attacks, improves digestion, and protects against breast cancer and children asthma. Black gram has a mucilaginous material which makes it a valuable ingredient in idli preparation. The chief proteins present in black gram are albumins and globulins and glutelins. Black gram has a major role in idli fermentation as a source of microorganisms and as fermenting substrate [9].

Flaxseed has been used as a precious nutritional food grain and traditional medicine in human diets for thousands of years and more recently it has been used as a source of nutraceuticals and identified as a functional food, whose benefits on health are generally attributed to high concentration of linolenic acids (Omega 3) and lignans as well as significant quantities of dietary fiber including soluble and insoluble fibers [10]. The present study was undertaken to prepare ready to cook idli mix by incorporation of little millet, Flaxseed and black gram powder in different ratios and to study its effect on physico-chemical of idli mix.

Methodology

Procurement of raw materials

Little millet, Flaxseed, rawa, black gram, salt, mustard seed, curry leaves, baking powder and oil were collected from local stores of Prayagraj. All reagent used for analysis were of AR grade.

Treatment combinations

Mixture of Rawa and Little Millet powder (65 %), Flaxseed Powder @ 5%, Black gram powder @ 20%, Salt @ 2 %, mustard seed @ 1 %, curry leaves @ 1 %, baking powder @ 2 %, and oil @ 4 % were added for formulation of the treatments. Samples prepared from ten treatments viz., T₁F₁, T₂F₁, T₃F₁, T₄F₁, T₅F₁, T₆F₁, T₇F₁, T₈F₁, T₉F₁ and T₁₀F₁ in which Rawa and Little Millet was added in the ratio 90:10, 80:20, 70:30, 60:40, 50:50, 40:60, 30:70, 20:80, 10:90 and 00:100.

Preparation of ready to cook idli mix

Different ingredients like little millet powder, flaxseed powder, rawa and black gram powder were added in different ratios as per treatments combination and then they were mixed properly. Oil @ 4% was added to a hot pan in which curry leaves, mustard seeds were roasted. The mixture of rawa, little millet powder, flaxseed powder and black gram powder (as mentioned in treatment) were mixed with curry leaves, mustard seed and then roasted at 90°C for 5 minutes. Salt @ 2 %, and baking powder @ 2 %, was also added. The mixture was allowed to cool and then filled into sanitized aluminium laminate pouches, sealed and kept for storage at room temperature.

Physico-chemical and microbiological analysis

Idli mix powder samples were analyzed for fat, protein, carbohydrate and crude fiber content by following the method of AOAC [11] for wheat flour which certain modification. Determination of ash content was done as per procedure of AACC [12]. Total solids of idli mix powder were determined as per procedure laid down in Rangana [13]. Titratable acidity of idli mix powder was carried out as per procedure of Rangana [13]. The Loose Bulk Density and Packed Bulk Density of the idli mix powder were estimated as per procedure of Mpotokwane [14]. Flowability of the idli mix powder was estimated as Hausner ratio. Wettability of the idli mix powder were estimated as per procedure of Onwuka [15]. Standard plate count and Coliform count of idli mix powder were determined as per the procedure of Morton [16]. Yeast and Mold count of idli mix powder was estimated as per the



procedure of Batool et al., [17].

Statistical analysis

Data was analysed using Analysis of Variance (ANOVA) at 5 percent level of significance and critical difference (CD) in WASP software (Factorial design) and MS office, 2007.

Results and Discussion

Effects of variation of little millet powder on fat content of ready to cook idli mix

Fat content of different samples of different treatments was found to range from 6.90 to 9.30 percent. The fat percentage of T1F1, T2F1, T3F1, T4F1, T5F1, T6F1, T7F1, T8F1, T9F1 and T10F1 was found to be 6.9, 7.16, 7.43, 7.69, 7.96, 8.23, 8.49, 8.76, 9.03 and 9.3 percent respectively. With increase in the little millet powder, the fat percentage increased significantly ($P < 0.05$). The fat percentage increased mainly because of the increased fat content of little millet which is around 5.2 percent. Farheentaj et al. [18] had also reported similar finding in ready to cook idli mix prepared from Proso millet. The Proso millet based idli mix contained 7.43 percent fat content. Pradeep [19] had also reported similar finding in ready to cook idli mix prepared from kodo millet. The kodo millet based idli mix contained 4.10 percent fat content

Effects of variation of little millet powder on protein content of ready to cook idli mix

Protein content of different samples of different treatments was found to range from 12.25 to 14.18 percent. The protein percentage of T1F1, T2F1, T3F1, T4F1, T5F1, T6F1, T7F1, T8F1, T9F1 and T10F1 was found to be 14.18, 13.97, 13.75, 13.54, 13.32, 13.11, 12.89, 12.68, 12.46 and 12.25 percent respectively. With increase in the little millet powder, the protein percentage decreased significantly ($P < 0.05$). Farheentaj et al., [18] had also reported similar finding in ready to cook idli mix prepared from Proso millet. The Proso millet based idli mix contained 9.71 percent protein content. Pradeep [19] had also reported similar finding in ready to cook idli mix prepared from Kodo millet. The Kodo millet based idli mix contained 14.44 percent protein content.

Effects of variation of little millet powder on carbohydrate content of ready to cook idli mix

Carbohydrate content of different samples of different treatments was found to range from 52.81 to 59.89 percent. The carbohydrate percentage of T1F1, T2F1, T3F1, T4F1, T5F1, T6F1, T7F1, T8F1, T9F1 and T10F1 was found to be 59.89, 59.1, 58.31, 57.53, 56.74, 55.96, 55.16, 54.38, 53.59 and 52.81 percent respectively. With increase in the little millet powder the carbohydrate percentage decreased significantly ($P < 0.05$). Farheentaj et al., [18] had also reported similar finding in ready to cook idli mix prepared from Proso millet. The Proso millet based idli mix contained 51.12 percent carbohydrate content. Pradeep [19] had also reported similar finding in ready to cook idli mix prepared from Kodo millet. The Kodo millet based idli mix contained 65.72 percent carbohydrate content.

Effects of variation of little millet powder on ash content of ready to cook idli mix

Ash content of different samples of different treatments was found to range from 1.24 to 4.27 percent. The ash percentage of T1F1, T2F1, T3F1, T4F1, T5F1, T6F1, T7F1, T8F1, T9F1 and T10F1 was found to be 1.24, 1.57, 1.91, 2.24, 2.58, 2.91, 3.25, 3.58, 3.92 and 4.27 percent respectively. With increase in the little millet powder, the ash percentage increased significantly ($P < 0.05$). The ash percentage increased mainly because of the increased ash content of little millet which is around 5.4 percent. Farheentaj et al., [18] had also reported similar finding in ready to cook idli mix prepared from Proso millet. The Proso millet based idli mix contained 1.52 percent ash content. Pradeep [19] had also reported similar finding in ready to cook idli mix prepared from Kodo millet. The Kodo millet based idli mix contained 4.42 percent ash content.



Effects of variation of little millet powder on total solids content of ready to cook idli mix

Total solids content of different samples of different treatments was found to range from 78.63 to 82.21 percent. The total solids percentage of T1F1, T2F1, T3F1, T4F1, T5F1, T6F1, T7F1, T8F1, T9F1 and T10F1 was found to be 82.21, 81.8, 81.4, 81, 80.6, 80.21, 79.79, 79.4, 79 and 78.63 percent respectively. With increase in the little millet powder, the total solid percentage decreased significantly ($P < 0.05$).

Effects of variation of little millet powder on titratable acidity (citric acid) content of ready to cook idli mix

Titrate acidity of different samples of different treatments was found to range from 0.46 to 0.67 percent citric acid. The titrate acidity percentage of T1F1, T2F1, T3F1, T4F1, T5F1, T6F1, T7F1, T8F1, T9F1 and T10F1 was found to be respectively 0.67, 0.66, 0.63, 0.6, 0.59, 0.57, 0.53, 0.5, 0.48 and 0.46 percent citric acid respectively. With increase in the little millet powder, the titrate acidity percentage decreased significantly ($P < 0.05$).

Effects of variation of little millet powder on crude fiber content of ready to cook idli mix

Crude fiber content of different samples of different treatments was found to range from 6.67 to 8.84 percent. The crude fiber percentage of T1F1, T2F1, T3F1, T4F1, T5F1, T6F1, T7F1, T8F1, T9F1 and T10F1 was found to be 6.67, 6.91, 7.15, 7.4, 7.64, 7.87, 8.12, 8.35, 8.6 and 8.84 percent respectively. With increase in the little millet powder, the crude fiber percentage increased significantly ($P < 0.05$). The crude fiber percentage increased mainly because of the increased crude fiber content of little millet which is around of 5.2 percent. Pradeep [19] had also reported similar finding in ready to cook idli mix prepared from Kodo millet. The Kodo millet based idli mix contained 5.4 percent crude fiber content.

Effects of variation of little millet powder on loose bulk density (g/ml) of ready to cook idli mix

Loose bulk density of different samples of different treatments was found to range from 0.646 to 0.681 g/ml. The loose bulk density of T1F1, T2F1, T3F1, T4F1, T5F1, T6F1, T7F1, T8F1, T9F1 and T10F1 was found to be 0.646, 0.650, 0.654, 0.657, 0.661, 0.665, 0.669, 0.673, 0.677 and 0.681 g/ml respectively. With increase in the little millet powder increased, the loose bulk density increased non-significantly ($P > 0.05$). The result of loose bulk density of the idli mix powder samples are presented in figure 1.

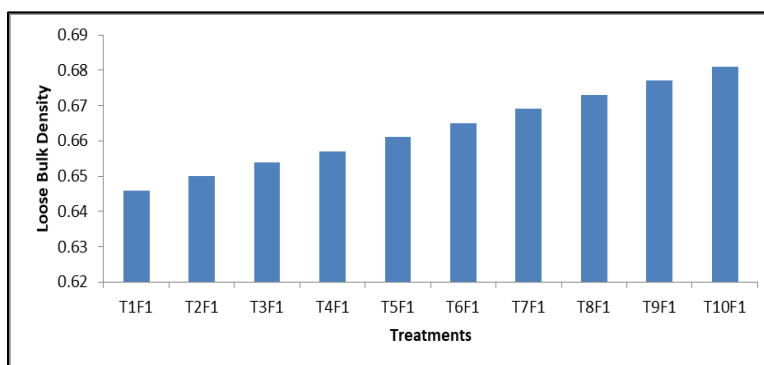


Figure 1. Graph showing effects of variation of little millet powder on loose bulk density (g/ml) of ready to cook idli mix

Effects of variation of little millet powder on packed bulk density (g/ml) of ready to cook idli mix

Packed bulk density of different samples of different treatments was found to range from 0.708 to 0.772 g/ml. The packed bulk density of T1F1, T2F1, T3F1, T4F1, T5F1, T6F1, T7F1, T8F1, T9F1 and T10F1 was found to be 0.708, 0.715, 0.722, 0.729, 0.736, 0.743, 0.751, 0.758, 0.765 and 0.772 g/ml respectively. With increase in the little millet powder, the packed bulk density increased significantly ($P < 0.05$). The result of packed bulk density of the idli mix powder samples are presented in figure 2.

Effects of variation of little millet powder on flowability (Hausner Ratio) of ready to cook idli mix

Flowability of different samples of different treatments was found to range from 1.095 to 1.133. The flowability of T1F1, T2F1, T3F1, T4F1, T5F1, T6F1, T7F1, T8F1, T9F1 and T10F1 was found to be 1.095, 1.100,

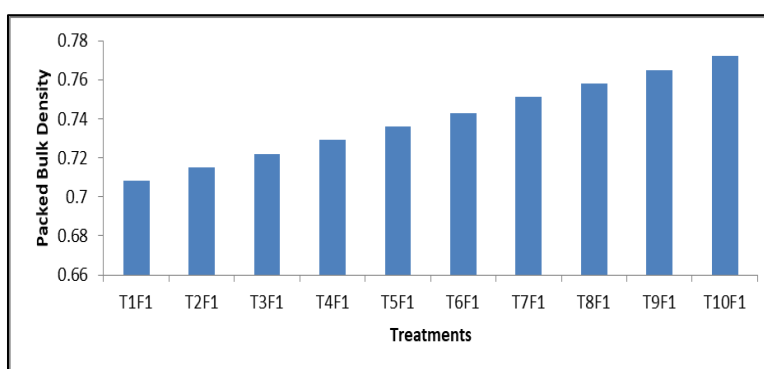


Figure 2. Graph showing effects of variation of little millet powder on packed bulk density (g/ml) of ready to cook idli mix

1.103, 1.109, 1.113, 1.117, 1.122, 1.126, 1.129 and 1.133 respectively. With increase in the little millet powder, the flowability increased non-significantly ($P > 0.05$). The result of flowability of the idli mix powder samples are presented in figure 3.

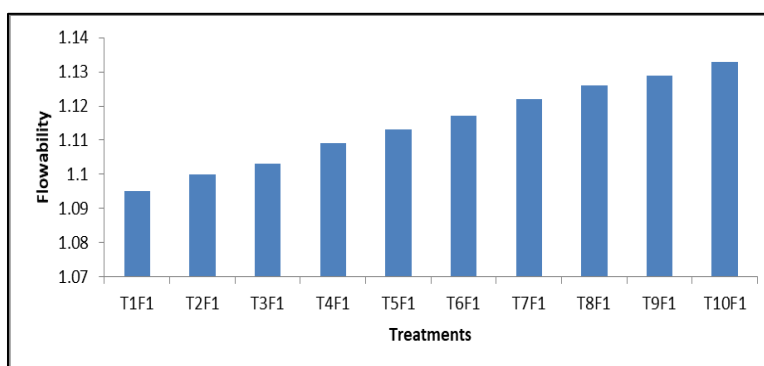


Figure 3. Graph showing effects of variation of little millet powder on flowability (Hausner Ratio) of ready to cook idli mix

Effects of variation of little millet powder on wettability (seconds) of ready to cook idli mix

Wettability of different samples of different treatments was found to range from 10.37 to 15.50 seconds. The wettability of T1F1, T2F1, T3F1, T4F1, T5F1, T6F1, T7F1, T8F1, T9F1 and T10F1 was found to be 13.57, 12.51, 10.37, 11.50, 11.41, 15.50, 13.22, 14.58, 12.46 and 11.08 seconds respectively. With increase in the little millet powder, the wettability of different samples differ

significantly ($P < 0.05$). The result of wettability of the idli mix powder samples are presented in figure. 4.

Microbial analysis

Standard plate count ($\times 10^3$ cfu/g), Yeast and mould count ($\times 10^1$ cfu/g) and Coliform count ($\times 10^1$ cfu/g) are being presented graphically. The result of standard plate count, yeast and mould count and coliform count of the idli mix powder samples are presented in figure. 5.

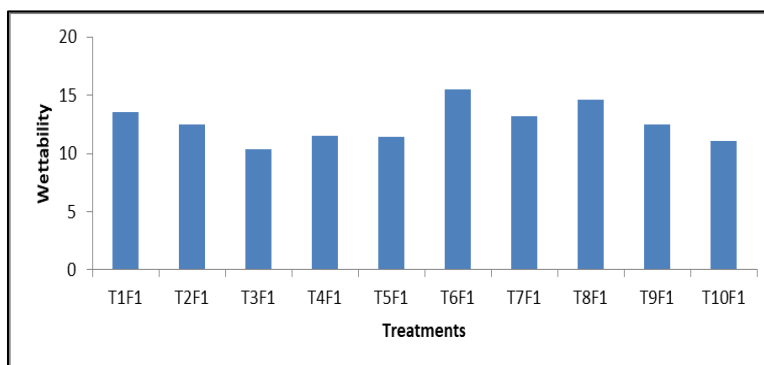


Figure 4. Graph showing effects of variation of little millet powder on wettability (seconds) of ready to cook idli mix

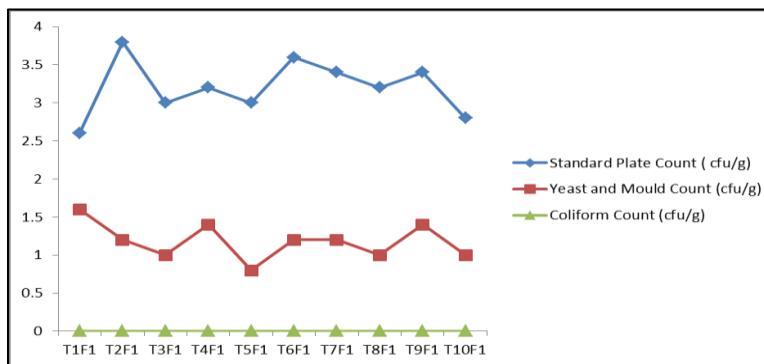


Figure 5. Graph showing effects of microbial characteristics of idli mix

Conclusion

From this study it may be concluded that ready to cook idli mix can be supplemented with little millet powder, flaxseed powder, rawa and black gram powder for enhancing the nutritional properties of the developed product. There is a great scope of manufacturing of ready to cook idli mix supplemented with little millet powder, flaxseed powder, rawa and black gram powder as it is supposed to have low glycemic index as compared to plain ready to cook idli mix. The traditional method being identical to developed method of preparation, therefore its adaptability and acceptability is expected to be higher.



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