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Nutrient Characteristics Evaluation of Traditional Indian Rice Based Fermented Product of Global Importance

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Abstract

Good nutrition is very important in every stage of life. To achieve good nutrition, it is important to learn more about the sources and functions of nutrients. Rice (*Oryza sativa* L.), a major source of dietary energy, is extensively consumed as staple food in the world. Idli, although initially originated in south India as breakfast food, but has gained wide recognition throughout the country and now forms a part of global cuisine due to its soft spongy texture, characteristic sour taste and an attractive aroma. Idli is included in the staple diet of people living in the southern part of India. It is usually made from readily available rice in the market. The fermented foods are easily digestible at all group of age. Instant products are easy for preparation so people should prefer these products. These products are easily available in the market at different cost. Ready to cook products are popular among the people because of their high nutritive value as well as low cost. Herein we aimed to assess the nutrient characteristics of traditional Indian breakfast Idli varieties sold over road-side in Bengaluru district headquarter of Karnataka state. Results delineated that the moisture content of Idli variety WHTIdl was found to be highest i.e., 61.58% followed by 58.20%, 49.85%, and 46.20% in BMIdl, YELIdl, and DSHIdl varieties respectively. The fat content of Idli variety YELIdl was found to be highest i.e., 0.67g followed by 0.64g, 0.59g, and 0.56g in BMIdl, WHTIdl, and DSHIdl varieties respectively. The protein content of Idli variety YELIdl was found to be highest i.e., 6.85g followed by 6.15g, 5.64g, and 4.85g in WHTIdl, BMIdl, and DSHIdl varieties respectively. The crude fibre content of Idli variety BMIdl was found to be highest i.e., 1.28g followed by 1.05g, 0.98g, and 0.85g in DSHIdl, WHTIdl, and YELIdl varieties respectively. The ash content of Idli variety YELIdl was found to be highest i.e., 1.48g followed by 1.38g, 1.25g, and 1.18g in BMIdl, WHTIdl, and DSHIdl varieties respectively. The carbohydrate content of Idli variety DSHIdl was found to be highest i.e., 47.21g followed by 41.15g, 34.14g, and 30.43g in YELIdl, BMIdl, and WHTIdl varieties respectively. In conclusion, the findings of our study demonstrated that the YELIdl Idli variety sold at road- side in Bengaluru district

headquarter was rich in fat, protein, and ash contents. While, moisture, crude fibre, and carbohydrate contents were rich in WHTIdl, BMIdl, and DSHIdl verities respectively.

Keywords: Idli, Rice, Carbohydrate, Protein, Fat, Crude fibre, Ash

Introduction

Good nutrition is very important in every stage of life. To achieve good nutrition, it is important to learn more about the sources and functions of nutrients. Energy has close association with body weight. When our energy intake is greater than energy output, body weight goes up. Therefore, it is important to pay attention to the balance between energy intake and output in order to maintain a healthy body weight.[1]

Rice (*Oryza sativa* L.), a major source of dietary energy, is extensively consumed as staple food in the world. It ranked third in terms of its worldwide total production of 505 million tonnes in 2020-21 next to corn and wheat.[2] Different rice-based processed food items *viz.* boiled, beaten, puffed and popped rice are consumed in breakfast, lunch and dinner by different sections of people in India.[3] There is ample evidence to indicate that food items derived from mixed ingredients (cereal and legume) are much superior to those obtained only from cereals. Idli, a product of mixed ingredients, is generally prepared from an auto-fermented batter of 3 parts white rice and 1-part black gram (*Vigna mungo* L.) dal.[4] Idli, although initially originated in south India as breakfast food, but has gained wide recognition throughout the country and now forms a part of global cuisine due to its soft spongy texture, characteristic sour taste and an attractive aroma. The surface-active protein (globulin) and arabinogalactan (polysaccharide) in black gram are known to impart soft spongy texture of Idli.[5]

During the process of natural fermentation some nutrients such as water-soluble Vitamin B with Vitamin C have been increased. Researcher revealed that the procedure of batter fermentation of rice and legumes decrease phytate as well as tannin content.[6-8] During the process of fermentation microorganism *Streptoccous thermophilus* and *Leuconostoc mesenteroides* both produce lactic acid with carbon dioxide in anaerobic condition that leaven the product.[9-10] Findings of phytate breakdown in dough of bread and decrease the content of trypsin inhibitor in some fermented legume.[11,12]

Instant products are easy for preparation so people should prefer these products. These products are easily available in the market at different cost. Ready to cook products are popular among the people because of their high nutritive value as well as low cost.[13] Moreover, functional foods and energy-rich foods have been designed to cover basic needs such as macronutrient and micronutrient for consumers to fulfill their additional nutritional and physical benefits.[14] Idli is included in the staple diet of people living in the southern part of India. It is usually made from readily available rice in the market. The fermented foods are easily digestible at all group of age.[15] Hence, in the present study we aimed to assess the nutrient

characteristics of traditional Indian breakfast Idli varieties sold over road-side in Bengaluru district headquarter of Karnataka state.

Materials and Methods Road-side Idli Samples

About 1 served plate (4-5 numbers) of Idli varieties *viz.* BMIdl, WHTIdl, YELIdl, and DSHIdl sold at road-side in different areas of Bengaluru district headquarter like Bommasandra, Whitefield, Yelahanka, and Dasarahalli respectively were procured and brought to the laboratory for the nutrient characteristics analysis.

Nutrient Characteristics Analysis

Moisture content determination

The moisture content of the four different varieties of Idli *viz.* BMIdl, WHTIdl, YELIdl, and DSHIdl was determined as per the method described in Association of Official Analytical Chemists (AOAC, 2000).[16]

$$\text{Moisture content (\%)} = \frac{(w_2 - w_1) - (w_2 - w_3) \times 100}{(w_2 - w_1)}$$

Where,

W1: Initial weight of the empty petridish (g)

W2: Weight of the petridish + Idli sample before drying (g) W3: Weight of the petridish + Idli sample after drying (g) ***Crude fat content determination***

The crude fat content of the four different varieties of Idli *viz.* BMIdl, WHTIdl, YELIdl, and DSHIdl was determined as per the method described in Association of Official Analytical Chemists (AOAC, 2000).[16] Soxhlet apparatus was used to determine crude fat content of the Idli samples. The crude fat (%) was calculated using the following formula:

Crude fat (%) = Weight of ether extract (g)/Weight of sample (g) X 100

Protein content determination

The protein content of the four different varieties of Idli *viz.* BMIdl, WHTIdl, YELIdl, and DSHIdl was determined as per the method described in Association of Official Analytical Chemists (AOAC, 2000).[16]

- Place the samples of Idli varieties (0.5-1.0 g) in digestion flask.
- Add 5 g Kjedahl catalyst and 200 ml of conc. H_2SO_4.
- Prepare a tube containing the above chemical except sample as blank. Place flasks in inclined

position and heat gently until frothing ceases. Boil briskly until solution clears.

- Cool and add 60 ml of distilled water cautiously.
- Immediately connect flask to digestion bulb on condenser and with tip of condenser immersed in standard acid and 5-7 drops of mix indicator in receiver. Rotate flask to mix content thoroughly; then heat until all NH_3 is distilled.
- Remove receiver, wash tip of condenser and titrate excess standard acid distilled with standard NaOH solution.

Percentage of nitrogen and protein was calculated by the following equations:

$$Nitrogen\ (\%) = T_S\text{-}T_B \times Normality\ of\ acid \times 0.014) / Weight\ of\ sample\ (g) \times 100$$

Where,

T_S - Titre volume of the sample (ml) T_B - Titre volume of Blank (ml), 0.014-M eq. of N

$$Protein\ (\%) = Nitrogen \times 6.25$$

Where,

6.25-The protein-nitrogen conversation factor

Crude fibre content determination

The crude fibre content of the four different varieties of Idli *viz.* BMIdl, WHTIdl, YELIdl, and DSHIdl was determined as per the method described in Association of Official Analytical Chemists (AOAC, 2000).[16] The crude fibre (g) was calculated using the following formula:

$$Crude\ fibre\ (\%) = (100\text{-}(moisture + fat)) x\ A \times 100/W1$$

Where;

W1 = Weight of the Idli samples

W2 = Weight of the crucible + Idli samples before heating at 600°C W3 = Weight of the crucible + Idli sample after heating at 600°C W2–W3 = A = Weight of crude fibre

Ash content determination

The ash content of the four different varieties of Idli *viz.* BMIdl, WHTIdl, YELIdl, and DSHIdl was determined as per the method described in Association of Official Analytical Chemists (AOAC, 2000).[16] Drying the Idli samples (5g) at 100°C and churned over an electric heater. It was then ashes in muffle furnace at 550°C for 5 hrs. Ash content was calculated using the following formula:

Ash content (%) = Weight of ash (g)/Weight of sample (g) X 100

Total carbohydrate

The total carbohydrate content of the Idli varieties was determined as total carbohydrate by difference, calculated by subtracting the measured protein, fat, ash and moisture from 100.[16] **Results**

The results of moisture (%) content of Idli varieties *viz.* BMIdl, WHTIdl, YELIdl, and DSHIdl sold at road-side of Bengaluru district headquarter was represented in Table 1 and plotted in Figure 1. Results delineated that the moisture content of Idli variety WHTIdl was found to be highest i.e., 61.58% followed by 58.20%, 49.85%, and 46.20% in BMIdl, YELIdl, and DSHIdl varieties respectively.

Table 1. Moisture content of Idli varieties sold at road-side of Bengaluru district headquarter

Nutrient Composition	BMIdl Variety	WHTIdl Variety	YELIdl Variety	DSHIdl Variety
Moisture (%)	58.20	61.58	49.85	46.20

Values were expressed as Mean; n=3

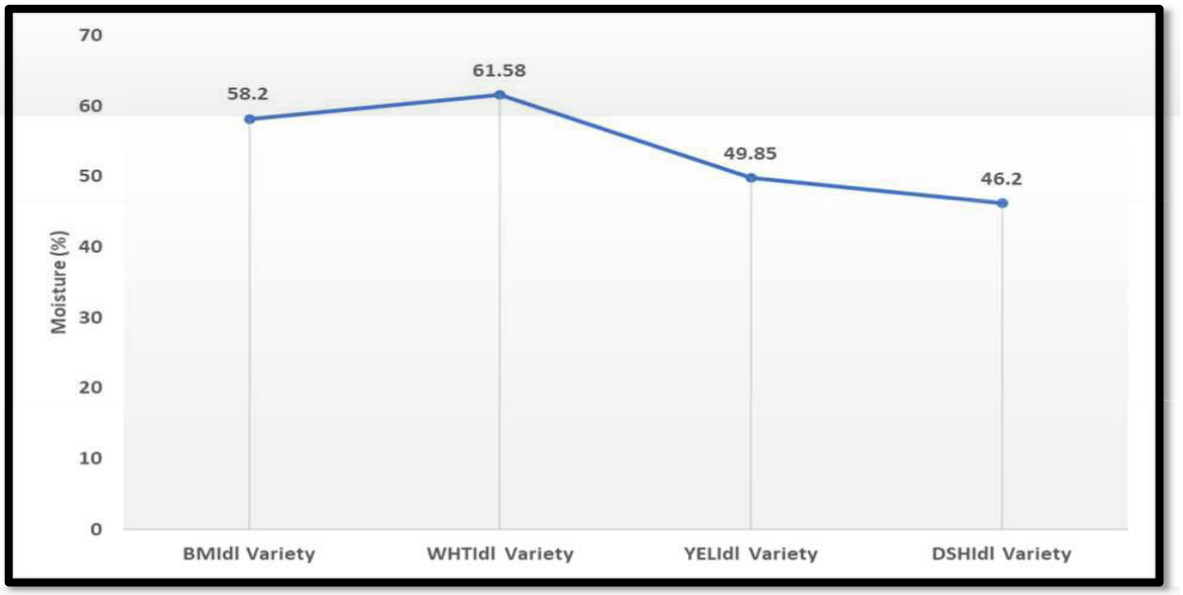

Figure 1. Moisture content of Idli varieties sold at road-side of Bengaluru district headquarter

The results of fat (%) content of Idli varieties *viz.* BMIdl, WHTIdl, YELIdl, and DSHIdl sold at road-side of Bengaluru district headquarter was represented in Table 2 and plotted in Figure 2. Results delineated that the fat content of Idli variety YELIdl was found to be highest i.e., 0.67% followed by 0.64%, 0.59%, and 0.56% in BMIdl, WHTIdl, and DSHIdl varieties respectively.

Table 2. Fat content of Idli varieties sold at road-side of Bengaluru district headquarter

Nutrient Composition	BMIdl Variety	WHTIdl Variety	YELIdl Variety	DSHIdl Variety
Fat (%)	0.64	0.59	0.67	0.56

Values were expressed as Mean; n=3

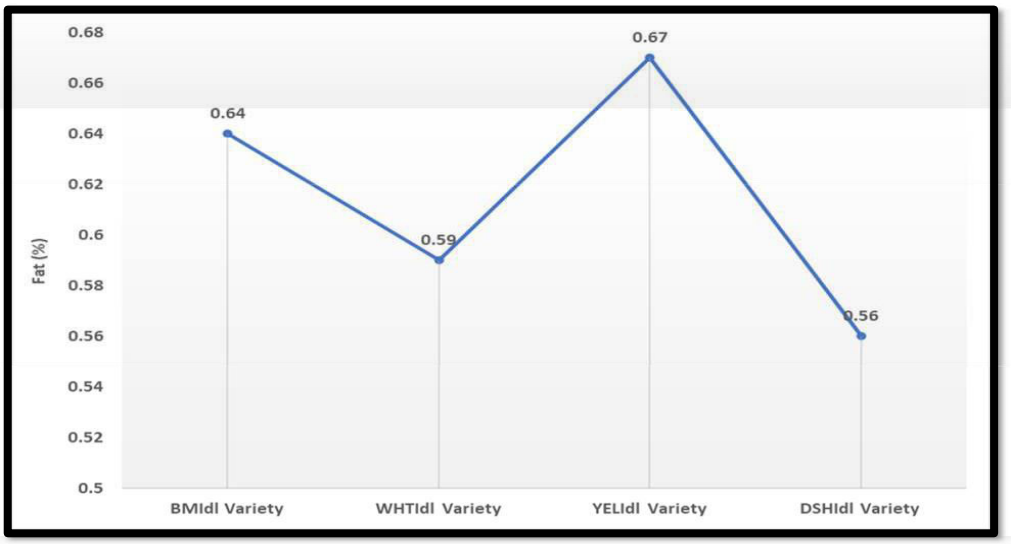

Figure 2. Fat content of Idli varieties sold at road-side of Bengaluru district headquarter

The results of protein (%) content of Idli varieties *viz.* BMIdl, WHTIdl, YELIdl, and DSHIdl sold at road-side of Bengaluru district headquarter was represented in Table 3 and plotted in Figure 3. Results delineated that the protein content of Idli variety YELIdl was found to be highest i.e., 6.85% followed by 6.15%, 5.64%, and 4.85% in WHTIdl, BMIdl, and DSHIdl varieties respectively.

Table 3. Protein content of Idli varieties sold at road-side of Bengaluru district headquarter

Nutrient Composition	BMIdl Variety	WHTIdl Variety	YELIdl Variety	DSHIdl Variety
Protein (%)	5.64	6.15	6.85	4.85

Values were expressed as Mean; n=3

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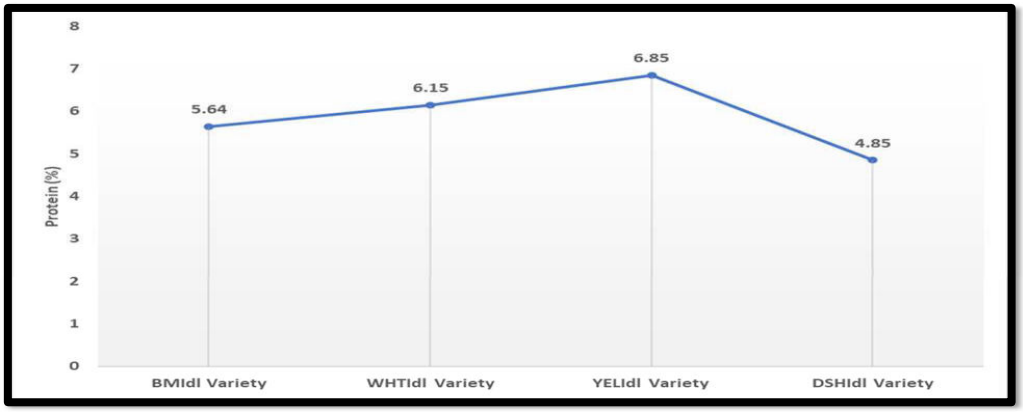

Figure 3. Protein content of Idli varieties sold at road-side of Bengaluru district headquarter

The results of crude fibre (%) content of Idli varieties *viz.* BMIdl, WHTIdl, YELIdl, and DSHIdl sold at road-side of Bengaluru district headquarter was represented in Table 4 and plotted in Figure 4. Results delineated that the crude fibre content of Idli variety BMIdl was found to be highest i.e., 1.28% followed by 1.05%, 0.98%, and 0.85% in DSHIdl, WHTIdl, and YELIdl varieties respectively.

Table 4. Crude fibre content of Idli varieties sold at road-side of Bengaluru district headquarter

Nutrient Composition	BMIdl Variety	WHTIdl Variety	YELIdl Variety	DSHIdl Variety
Crude fibre (%)	1.28	0.98	0.85	1.05

Values were expressed as Mean; n=3

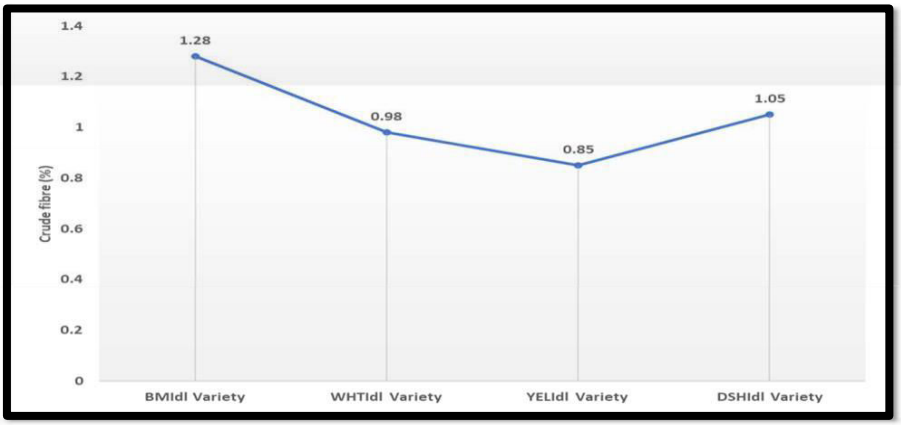

Figure 4. Crude fibre content of Idli varieties sold at road-side of Bengaluru district headquarter

The results of ash (%) content of Idli varieties *viz.* BMIdl, WHTIdl, YELIdl, and DSHIdl sold at road-side of Bengaluru district headquarter was represented in Table 5 and plotted in Figure 5. Results delineated that the ash content of Idli variety YELIdl was found to be highest i.e., 1.48% followed by 1.38%, 1.25%, and 1.18% in BMIdl, WHTIdl, and DSHIdl

varieties respectively.

Table 5. Ash content of Idli varieties sold at road-side of Bengaluru district headquarter

Nutrient Composition	BMIdl Variety	WHTIdl Variety	YELIdl Variety	DSHIdl Variety
Ash (%)	1.38	1.25	1.48	1.18

Values were expressed as Mean; n=3

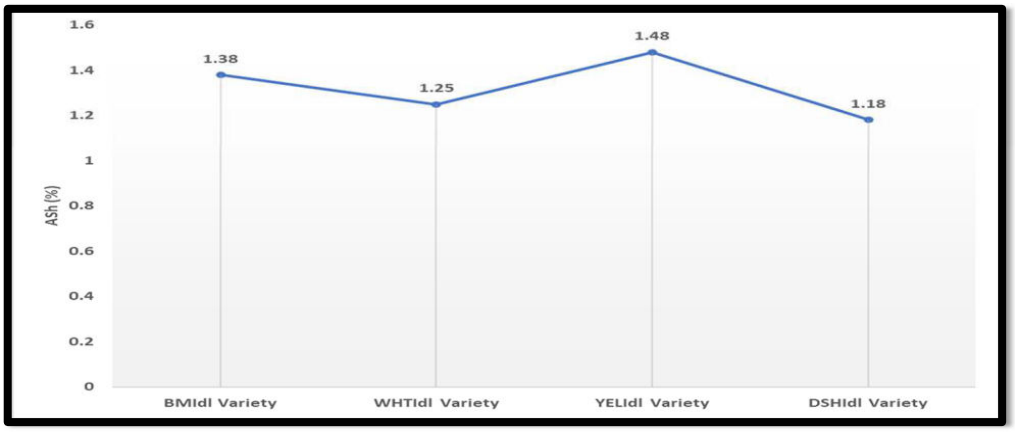

Figure 5. Ash content of Idli varieties sold at road-side of Bengaluru district headquarter

The results of carbohydrate (%) content of Idli varieties *viz.* BMIdl, WHTIdl, YELIdl, and DSHIdl sold at road-side of Bengaluru district headquarter was represented in Table 6 and plotted in Figure 6. Results delineated that the carbohydrate content of Idli variety DSHIdl was found to be highest i.e., 47.21% followed by 41.15%, 34.14%, and 30.43% in YELIdl, BMIdl, and WHTIdl varieties respectively.

Table 6. Carbohydrate content of Idli varieties sold at road-side of Bengaluru district headquarter

Nutrient Composition	BMIdl Variety	WHTIdl Variety	YELIdl Variety	DSHIdl Variety
Carbohydrate (%)	34.14	30.43	41.15	47.21

Values were expressed as Mean; n=3

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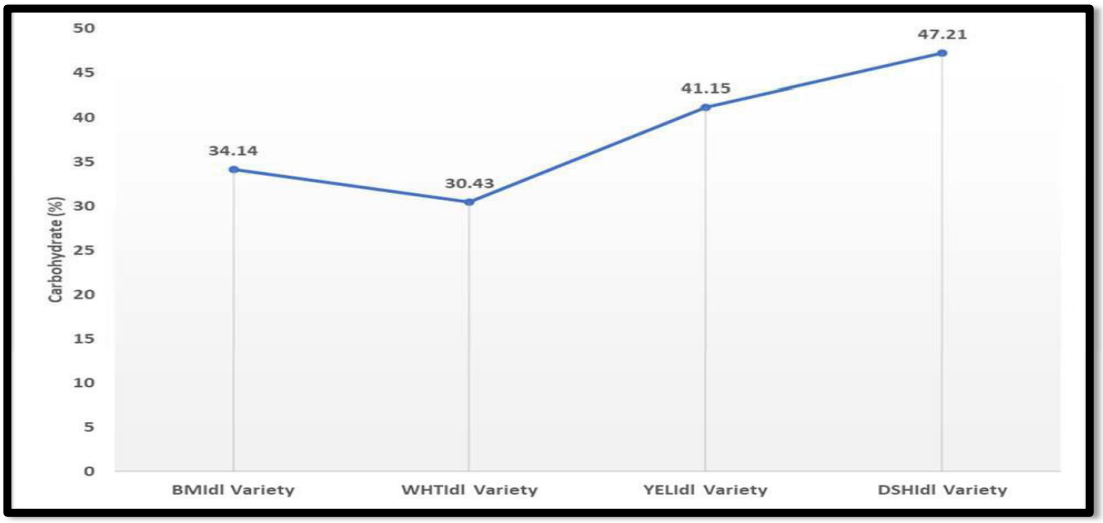

Figure 6. Carbohydrate content of Idli varieties sold at road-side of Bengaluru district headquarter

Discussion

Nutritional requirements for humans are changing from day-to-day in order to make bodies resistant to many diseases. In connection to this, the daily intake of dietary supplements is varied from person to person depending upon their inherent body nature.[17] India has a versatile culture heritage of traditional food. In the present days the traditional food is transformed with addition of nutritional aspects and made available to consumer on commercial scale. The traditional foods alone occupy large portion of meal as they are rich in vitamins, proteins, carbohydrates satisfying the nutritional requirements of human beings.[18]

Most of traditional delicacies preparation included the prominent step, fermentation. Fermentation is the process where the raw materials are subjected to microbial activity to produce required biochemical reactions leading to altering the quality of final food products. Fermented foods are rich in proteins and amino acids which make them always superior to the common cooked foods. Fermented foods have higher nutrition and digestibility. Fermentation process has always played the role in lowering the anti-nutritional factors like tannin and phytic acid in the food grains. Natural fermentation induces phytate hydrolysis through the action of microbial phytase enzymes originating from the micro flora on the surface of cereals and legumes, thereby reducing the phytate. Fermentation of a batter in the preparation of Idli, enhanced the protein quality and the bioavailability of minerals.[19,20] In South India, Idli is consumed as breakfast which is a steamed rice cake from fermented batter of rice and blackgram which are known as traditional fermented foods.[21] Hence, herein we aimed to evaluate the nutrient characteristics of traditional Indian breakfast Idli varieties sold over road- side in Bengaluru district headquarter of Karnataka state.

In our study determination of moisture content in different varieties of Idli *viz.* BMIdl, WHTIdl, YELIdl, and DSHIdl sold at road-side in Bengaluru district headquarter revealed that the moisture content of Idli variety WHTIdl was found to be highest i.e., 61.58%. These findings were comparable with the literature findings reported by various other research

investigators in the literature.[17,22] Furthermore, Suman et al., reported the results of comparison of moisture contents of foxtail millet and rice which represented that foxtail millet had lower moisture content than rice. This explains the decrease in moisture content of Idli prepared by incorporation of foxtail millet.[22]

In this study the estimation of fat composition in different varieties of Idli *viz.* BMIdl, WHTIdl, YELIdl, and DSHIdl sold at road-side in Bengaluru district headquarter delineated that the fat content of Idli variety YELIdl was found to be highest (0.67%). In contrast to our findings on fat content of Idli varieties, Suman et al., revealed that the different products formulated with foxtail and barnyard millet were higher in fat content than the rice products.[22] The results of protein content of Idli varieties *viz.* BMIdl, WHTIdl, YELIdl, and DSHIdl sold at road-side of Bengaluru district headquarter depicted that the protein content of Idli variety YELIdl was found to be highest (6.85%). Anju and Sarita, revealed that products that are prepared from foxtail millet had more protein compared to wheat flour.[23] According Hassan et al., the fermentation process which causes to increase the availability of protein content.[24] In accordance with Hassan et al., the fermentation process which is used in the preparation of YELIdl batter effectively increased protein content.

Furthermore, results of crude fibre content of Idli varieties *viz.* BMIdl, WHTIdl, YELIdl, and DSHIdl sold at road-side of Bengaluru district headquarter delineated that the crude fibre content of Idli variety BMIdl was found to be highest (1.28%). Anju and Sarita, revealed that products that are prepared from foxtail millet had more crude fibre compared to wheat flour.[23] Dhumketi et al., revealed the results in contrary that the crude fibre content decreased with the increase in foxtail millet content.[25] The results of ash content of Idli varieties *viz.* BMIdl, WHTIdl, YELIdl, and DSHIdl sold at road-side of Bengaluru district headquarter revealed that the ash content of Idli variety YELIdl was found to be highest (1.48%). Dhumketi et al., revealed that in preparation of upma mix with incorporation of foxtail millet semolina, the ash content increased as the foxtail millet content increased.[25] The results of carbohydrate (%) content of Idli varieties *viz.* BMIdl, WHTIdl, YELIdl, and DSHIdl sold at road-side Bengaluru district headquarter depicted that the carbohydrate content of Idli variety DSHIdl was found to be highest (47.21%). As per Krishnamoorthy et al., presence of rice which is rich in starch might be a contributing factor for high carbohydrate content.[17]

Conclusion

In conclusion, Idli forms a part of global cuisine due to its soft spongy texture, characteristic sour taste and an attractive aroma. The findings of our study demonstrated that the YELIdl Idli variety sold at road-side in Bengaluru district headquarter was rich in fat, protein, and ash contents. While moisture, crude fibre, and carbohydrate contents were rich in WHTIdl, BMIdl, and DSHIdl verities respectively.

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