



Development of Chicken Meat Powder Incorporated Instant Idli Mixes

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ABSTRACT

A study was conducted to standardize the instant rice idli mix and instant semolina idli mix incorporated with chicken meat powder (CMP), simultaneously. The control sample of rice idli mix was prepared using rice grit, salt, spice mix, sodium bicarbonate, citric acid, sodium carbonate and dry curry leaves and the control semolina idli mix was prepared by replacing the rice grit with semolina. Three different levels of chicken meat powder viz. 10%, 20% and 30% were tried for development of both rice and semolina idli mixes. The developed products were selected on the basis of sensory attributes and evaluated for their physicochemical properties. Incorporation of chicken meat powder in rice idli mix at 20% level and in semolina idli mix at 30% level were found to be optimum for development of idlies. CMP incorporation in both the idli mixes decreased the percent moisture content and increased the protein, fat and ash content significantly. The percent protein content of reconstituted idlies prepared from rice idli mix incorporated with 20% CMP and semolina idli mix incorporated with 30% CMP increased significantly from 3.38 to 8.28 and from 4.49 to 12.50, respectively. However, cooking yield of both rice and semolina idlies was decreased and the pH value were increased significantly on incorporation of CMP. Hence, we conclude that by incorporating 20% and 30% CMP in rice and semolina instant idli mixes, respectively both the overall acceptability score and amount of nutrients were improved.

Keywords: Rice, semolina, idli mixes, chicken meat powder, quality.

Growing urbanization coupled with new pressures on the times of house wives, changing socio-economic status and lifestyles have contributed to the enhanced consumption of processed and convenience meat products (Kumar *et al.*, 2001). Meat based convenience foods in comparison to processed cereal/fruit products satisfy the palate even at a lesser quantity (Sahu and Mahapatra, 1992). Convenience foods just require a minimum handling, such as mild heating/warming for ready-to-reconstitute or instant mixes or rehydration in hot/cold water for dehydrated foods (Premavalli, 2000). A wide spectrum of ready-to-eat and instant convenience mixes which find an immense use and application not only in defense but also in civilian sector includes precooked dehydrated convenience foods (Sharma and Bawa, 2003).

The traditional Indian diet comprises of three important components viz., rice, pulses and vegetables and to a lesser extent, meat. As they require long cooking time particularly at high altitudes, these foods as such cannot find a place in the ration packs. Therefore, the precooked dehydrated products having short reconstitution time have been developed. These products are used either as such after rehydration or for the development of convenience foods like *pulav* (vegetarian and non-vegetarian), omelette mix, cutlet mixes (vegetarian and non-vegetarian), hamburger mixes, stew mixes and various types of sauces (Sharma, 1984).

Fermented foods of traditional nature are known for their taste, nutritive value and therapeutic properties. The diversity of the population of India has given rise

to a large number of traditional fermented foods which have been extensively reviewed (Soni and Sandhu, 1990; Achaya, 1994). Among several of the Indian traditional fermented foods, idli, is pre-fermented and steam-cooked rice (milled) and dehulled blackgram dhal product and a favourite breakfast and snack food in south India. Its soft and spongy texture, attractive appearance, appetizing taste and flavour with a characteristic odour, together with its easy digestibility and good nutritive value contribute to its increasing popularity in other parts of India and also in some countries outside (Radhakrishnamurthy *et al.*, 1961; Nagarathnamma and Siddappa, 1965; Steinkraus *et al.*, 1967; Reddy, 1981; Iyer and Ananthanarayan, 2008). From the nutritional and health point of view, idli appears to be an ideal human food for all ages and at all times (Jama and Varadaraj, 1999). Idli is used as a weaning food in many families and as a main dish in soft diets in South Indian hospitals because of its soft texture (Joseph and Swanson, 1992).

Meat is an excellent source of high quantity and quality of proteins and is known for its satiating characteristics. It also provides good amount of minerals and vitamins (Chan, 2004; Biesalski, 2005). Incorporation of chicken meat in patties has been demonstrated (Kumar *et al.*, 2014). Study has also been conducted to understand the sensory attribute of chicken meat rolls and patties incorporated with the combination levels of rice bran and psyllium husk (Mehta *et al.*, 2013). Chicken meat powder has been used in developing chicken soup mix and chicken enriched noodles to improve the nutritional quality of the products (Deswal, 2003; Kumar, 2009). Hence, the study was planned to develop instant idli mixes incorporated with chicken powder by utilizing spent hen meat.

MATERIALS AND METHODS

Semolina, rice grit, common salt, ENO Powder (5g of Eno powder contains: Sodium bicarbonate 2.32g, Citric acid 2.18 g and Anhydrous sodium carbonate 0.50 g.), Ground nut oil and spice mix ingredients were procured from local market.

Spice mix ingredients were cleaned, dried (in hot air oven at $45\pm 2^{\circ}\text{C}$ for 2 hours), ground, sieved and the fine powder form of spice mix was obtained that contained white pepper 66.66% (W/W), soanath 16.66% (W/W), black cardamom 6.0% (W/W), roasted rai (*Brassica nigra*) seed

10.0% (W/W) and asafetida 0.66% (W/W).

The spent hen (white leghorn) of the same age (about 1.5 years) group and reared under similar conditions were procured from a local poultry farm for the study.

For making curd, standard milk was procured from the Department of Livestock Products Technology, College of Veterinary Sciences, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar. Then it was strained, boiled and cooled up to 45°C then inoculated with curd for 6 hours.

Curry leaves were procured from kitchen garden, Chaudhary Charan Singh Haryana Agricultural University, Hisar. The green healthy curry leaves were sorted and washed by dipping in water for one minute. The procedure was repeated till the leaves are devoid of dirt and soil. Cleaned curry leaves were spread over the aluminum trays and dried at 60°C for 4 hours then stored in air tight food grade plastic jars at an ambient temperature ($30\pm 2^{\circ}\text{C}$) for further use in instant idli mixes preparation.

Spent hens were slaughtered scientifically/ humanely under hygienic conditions. Carcasses were deboned manually and deboned meat was packaged in low density polyethylene (LDPE) bags and stored in a deep freezer at $-18\pm 1^{\circ}\text{C}$ for further studies.

The deboned frozen meat was minced in an electric meat mincer and then thoroughly kneaded minced meat was traditionally cooked for about 35 minutes till the meat was thoroughly browned as per recommendation of Bate-Smith *et al.* (1943). The precooked meat mince was dried in a cabinet tray drier at 60°C for 9 hours, ground, air tight packaged in low density polyethylene (LDPE) bags (Kharb and Ahlawat, 2010). The chicken meat powder (CMP) was stored in air tight plastic jars at an ambient temperature ($30\pm 2^{\circ}\text{C}$) for further use in instant idli mix preparation.

The two control samples of idli mixes were prepared using rice grit and semolina (100g each, separately), 2% spice mix, 2% salt, 2% ENO powder and 0.25% dried curry leaves and uniformly mixed. The chicken meat powder (CMP) was incorporated at 10, 20 and 30% levels by replacing rice grit and semolina in both the control samples separately (Table 1).

Instant idli mixes were mixed with equal amount of curd and water and mixed properly to make a batter of dropping

Table 1. Levels of chicken meat powder (CMP) with semolina and rice grit

Treatment	Semolina (g)	Rice grit (g)	CMP (g)
Control Semolina idli mix	100	-	-
Semolina idli mix with 10% CMP	90	-	10
Semolina idli mix with 20% CMP	80	-	20
Semolina idli mix with 30% CMP	70	-	30
Control Rice idli mix	-	100	-
Rice idli mix with 10% CMP	-	90	10
Rice idli mix with 20% CMP	-	80	20
Rice idli mix with 30% CMP	-	70	30

2% spice mix, 2% salt, 2% ENO powder and 0.25% dried curry leaves were incorporated in all treatments

consistency. Batter poured in previously greased (with groundnut oil) idli molds (made up of aluminium) and put in pressure cooker consisting of boiling water at the bottom. Steam cooking (without weight) was carried out for 15 minutes.

Reconstituted idlies were selected on the basis of sensory scores using 9-point hedonic scale (Nelson and Trout, 1964) by a semi-trained panel of 9 judges. The selected products were evaluated for their cooking yield, proximate composition (AOAC, 2000), and pH (Trout *et al.*, 1992). Tryptophan content (Mertz *et al.*, 1975) and amino acids of idli mixes and reconstituted idlies were analyzed using high performance liquid chromatography (HPLC) as per AOAC (2005) methods.

Data obtained were subjected to Duncans multiple range test as per Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

Reconstituted idlies prepared from rice and semolina idli mixes were subjected to sensory analysis for finding out the acceptable level of incorporation of chicken meat powder.

Colour and appearance score of rice idlies incorporated with 20% CMP were comparable to control but incorporation of 30% CMP significantly decreased the colour and appearance, texture and overall acceptability scores of rice idlies. The similar trends in sensory scores of semolina based idlies were also observed on incorporation of CMP at different levels but overall acceptability score of semolina idlies was increased insignificantly from 7.56 (control) to 8.00 with incorporation of CMP up to 30% (Table 2).

Table 2. Sensory evaluation of reconstituted idlies for selection of CMP level (n=9)

Treatments	Colour and appearance	Flavour	Texture	Overall acceptability
Rice idli				
Control	8.22 ^a ±0.15	7.44 ^c ±0.18	8.22 ^a ±0.15	8.00 ^a ±0.17
Idli with 10% CMP	7.78 ^a ±0.15	7.67 ^{bc} ±0.29	7.67 ^{ab} ±0.17	8.11 ^a ±0.11
Idli with 20% CMP	7.78 ^a ±0.28	8.22 ^{ab} ±0.15	7.44 ^b ±0.24	8.11 ^a ±0.20
Idli with 30% CMP	6.78 ^b ±0.28	8.33 ^a ±0.17	6.22 ^c ±0.32	6.56 ^b ±0.18
Semolina idli				
Control	8.00 ^a ±0.17	7.78 ^a ±0.32	8.00 ^a ±0.17	7.56 ^a ±0.24
Idli with 10% CMP	7.44 ^{ab} ±0.18	8.00 ^a ±0.24	7.56 ^{ab} ±0.18	7.88 ^a ±0.22
Idli with 20% CMP	7.44 ^{ab} ±0.24	8.00 ^a ±0.00	7.44 ^b ±0.18	8.11 ^a ±0.20
Idli with 30% CMP	7.33 ^b ±0.24	8.22 ^a ±0.15	7.44 ^b ±0.18	8.00 ^a ±0.17

Means±SE with different superscripts in a column wise differ significantly (P≤0.05).

CMP (chicken meat powder)

The colour score of rice idlies incorporated with CMP upto 20% level was slightly decreased but with 30% CMP incorporation, the colour score significantly decreased in all as compared to control which was below than moderately liked (7.00). However, the colour scores of semolina idlies incorporated with 30% CMP was also declined (7.33) but it was still higher than moderately liked colour score. The

similar trend in decreased texture scores was also observed in both the products might be due to decreased binding property of chicken meat powder. Mackie (1994) reported that gelling functionality of meat proteins is generally reduced greatly after dehydration and Vishakha (2006) reported that colour and appearance scores of semolina based idli mixes were not much affected with addition of other (40% maize grits) ingredients. However, Nazni and Shalini (2010) observed no significant difference in colour and flavour scores in rice idli with incorporation of pearl millet up to 31.5% but higher flavour score in both rice and semolina based idlies with CMP incorporation was recorded in the study and that was due to meaty flavour of CMP in the developed products. Overall acceptability scores of the rice based idlies with 20% CMP and semolina based idlies with 30% CMP incorporation were comparable with control samples and hence selected for further studies.

The per cent moisture content of control rice and semolina based idli mixes were found to be 10.51% and 12.57%, respectively, which significantly decreased to 9.34% and 10.52% on incorporation of CMP at 20% and 30% levels, respectively (Table 3). Significant decrease in moisture content of CMP incorporated idli mixes as compared to their control idli mixes was attributed to low moisture content of CMP as compared to rice grit and semolina flour.

Protein content of control rice and semolina idli mixes were found to be 8.75% and 11.23%, respectively, which significantly increased to 21.30% and 31.99% on incorporation of CMP at 20% and 30% level, respectively. Similarly, crude fat and ash contents were also increased in both the rice and semolina based idli mixes on addition of CMP and the highest crude protein, crude fat and ash contents were observed in semolina idli mix with 30% CMP. The similar trends of moisture decline and protein, fat and ash content improvement were also observed in both rice and semolina based reconstituted idlies on incorporation of CMP at 20% and 30% level, respectively (Table 3).

The higher protein, fat and ash content of CMP incorporated idli mixes as compared to control idli mixes may be attributed to quantitative higher protein, fat and ash content and low moisture content of chicken meat powder as compared to rice and semolina flours.

The pH of control rice idli mix and control semolina idli mix was found to be 5.63 and 5.38 which increased significantly to 5.85 and 5.96 on incorporation of CMP at 20% and 30% level, respectively. Whereas the pH of control reconstituted rice based and semolina based idlies was found to be 5.71 and 5.46 which increased significantly to 5.98 and 6.14 on incorporation of CMP at 20% and 30% levels, respectively (Table 3).

Table 3. Proximate composition and properties of instant idli mixes and reconstituted idlies incorporated with CMP (% wet basis) (n=6)

Parameters (%)	Idli mix			
	Control rice idli mix	Rice idli mix with 20% CMP	Control semolina idli mix	Semolina idli mix with 30% CMP
Moisture	10.51 ^b ±0.04	9.34 ^c ±0.05	12.57 ^a ±0.03	10.52 ^b ±0.02
Crude protein	8.75 ^d ±0.08	21.30 ^b ±0.23	11.23 ^c ±0.08	31.99 ^a ±0.19
Crude fat	1.24 ^d ±0.02	3.36 ^b ±0.02	1.40 ^c ±0.02	4.81 ^a ±0.07
Ash	2.42 ^d ±0.01	3.34 ^b ±0.00	2.56 ^c ±0.03	3.63 ^a ±0.03
pH	5.63 ^c ±0.03	5.85 ^b ±0.03	5.38 ^d ±0.03	5.98 ^a ±0.02

Parameters	Reconstituted idlies			
	Control rice idli	Rice idli with 20% CMP	Control semolina idli	Semolina idli with 30% CMP
Moisture (%)	66.65 ^a ±0.27	65.39 ^b ±0.16	66.58 ^a ±0.16	65.88 ^b ±0.05
Crude protein (%)	3.38 ^d ±0.05	8.28 ^b ±0.07	4.49 ^c ±0.03	12.50 ^a ±0.09
Crude fat (%)	0.78 ^d ±0.02	1.90 ^b ±0.02	0.83 ^c ±0.02	2.06 ^a ±0.02
Ash (%)	1.00 ^d ±0.01	1.13 ^b ±0.02	1.07 ^c ±0.02	1.23 ^a ±0.01
pH	5.71 ^c ±0.01	5.98 ^b ±0.01	5.46 ^d ±0.02	6.14 ^a ±0.01
Cooking yield (%)	103.17 ^a ±0.12	102.60 ^a ±0.16	101.54 ^b ±0.33	100.79 ^c ±0.24

Means±SE with different superscripts in a row differ significantly (P≤0.05).

CMP (chicken meat powder)

It was found that pH of idli mixes and idlies incorporated with CMP was higher as compared to their control idli mixes and idlies. This could be attributed to high pH (6.15) of CMP (Kharb, 2002) as compared to 5.5 pH of both semolina and white rice 5.5 (www.rense.com).

pH of reconstituted idlies was observed higher than instant idli mixes (Table 3). As suggested by Babu *et al.* (1994) an increase of 0.3 to 0.4 units in pH on cooking chicken meat might be due to change in the net charge of proteins due to denaturization.

Cooking yield was decreased on incorporation of CMP in both the reconstituted idli products. Addition of CMP decreased the cooking yield of both rice and semolina idlies, as compared to their controls (Table 3). Higher cooking yield in control rice and semolina idlies might be due to higher starch content as compared to CMP incorporated idlies, which hold water during steam cooking. Ravi *et al.*, (2010) reported 120% cooking yield in *dhokla* prepared using semolina and bengal gram dal. Secondly, lower cooking yield in CMP incorporated idlies might be due to poor rehydration of CMP during steam cooking due to higher fat content as compared to control idlies and decreased water holding capacity of CMP.

Table 4. Amino acid composition (% CP) of developed idlies.

Treatments	Lysine (g/100g CP)	Tryptophan (g/100g CP)	Threonine (g/100g CP)
Control rice idli mix	1.93	0.66	1.82
Rice idli mix with 20% CMP	3.34	1.13	2.16
Control semolina idli mix	1.86	1.23	2.17
Semolina idli mix with 30% CMP	4.19	2.71	2.81
Control rice idli	2.49	0.85	2.23
Rice idli with 20% CMP	4.05	1.29	3.04
Control semolina idli	2.41	1.61	2.49
Semolina idli with 30% CMP	4.71	3.26	3.29

CMP (chicken meat powder); CP (crude protein)
Values are average of duplicate samples.

Lysine content of semolina idli mix with 30% CMP (4.19 g/100g crude protein) and rice idli mix with 20% CMP (3.34 g/100g crude protein) was found to be higher and almost double as compared to that of their control samples. Similarly, lysine content of reconstituted semolina idli with 30% CMP (4.71 g/100g crude protein) and rice idli with 20% CMP (4.05 g/100g crude protein) was found to be almost double to that of their controls (2.41 and 2.49 g/100g crude protein, respectively). The similar trends for increase in tryptophan and threonine content of semolina (30% CMP) and rice (20% CMP) idli mixes and reconstituted idlies were recorded and found significantly higher as compared to their control samples, respectively (Table 4).

Higher lysine, tryptophan and threonine content of CMP incorporated idli mixes was due to chicken meat powder, whereas higher lysine, tryptophan and threonine content of developed reconstituted idlies due to chicken meat powder and curd used during reconstitution. Similar increased amino acids were reported by Padhye and Salunkhe (1978) in unfermented and fermented idli, respectively, using black gram and rice (1:1).

It is concluded that both rice and semolina instant idli mixes incorporated with chicken meat powder 20% and 30%, respectively, can be developed with an improved overall acceptability score and contributing good amount of nutrients especially protein in reconstituted idlies.

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