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Shelf-Life of Developed Instant Idli Mixes Incorporated with Chicken Meat Powder

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ABSTRACT

A study was conducted to evaluate the shelf life of developed instant rice idli mix incorporated with 20% chicken meat powder (CMP) and instant semolina idli mix incorporated with 30% CMP under laboratory conditions. 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. The products were packed in low density polyethene bags and stored at an ambient temperature (30±2°C) for 90 days and samples were drawn at an interval of 0, 15th, 30th, 60th and 90th day to assess their shelf life. TBA values of CMP incorporated idli mixes were higher than their controls during storage. Moreover, TBA and pH values increased in all idli mixes during storage up to 90 days at an ambient temperature (30±2°C). The reconstituted idlies had desirable organoleptic properties as indicated by the taste panel studies. It is concluded that the rice idli mix incorporated with 20% CMP and semolina idli mix incorporated with 30% CMP could be stored for 60 days and 90 days, respectively, without any significant deterioration in microbiological quality and with acceptable sensory attributes.

Keywords: Rice, semolina, idli mixes, chicken meat powder, shelf-life

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).

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). This valuable food is spoiled readily unless held at temperature in range of 0°C and problem becomes more acute where cold storage facilities in retail sector are absent or deficient.

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).

Dried products are preferred due to saving in storage spaces, easy transport, useful in natural disasters such as cyclones, floods and earthquakes. 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 with an objective to study the shelf life of developed instant idli mixes incorporated with chicken powder by utilizing spent hen meat was undertaken.

MATERIALS AND METHODS

The developed instant rice idli mix incorporated with 20% CMP and semolina idli mix incorporated with 30% CMP were prepared under laboratory conditions. The levels of CMP were selected on the basis of previous study (Bishnoi, 2012). The control sample of rice/ Semolinaidli mix were prepared using 100g rice grit/ semolina, 2g common salt, 2g ENO Powder, 2g spice mix and 0.25g dry curry leaves. The products were packed in low density polyethene bags and stored at an ambient temperature (30±2°C) for 90 days. The samples were drawn at 0, 15th, 30th, 60th and 90th day of storage to study the shelf life of the products.

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.

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

Table 1. The pH and TBA Value (mg malonaldehyde/kg) of instant idli mixes stored at 30±2°C

Storage period (days)	Control rice idli mix	Rice idli mix with 20% CMP	Control semolina idli mix	Semolina idli mix with 30% CMP
		pH Value		
0	5.63^{cA} ±0.03	5.85^{bA} ±0.03	5.38^{dA} ±0.03	5.96^{aA} ±0.02
15	5.63^{cA} ±0.02	5.86^{bA} ±0.03	5.38^{dA} ±0.02	5.97^{aA} ±0.02
30	5.64^{cA} ±0.03	5.86^{bA} ±0.03	5.38^{dA} ±0.03	5.97^{aA} ±0.03
60	5.64^{cA} ±0.03	5.87^{bA} ±0.03	5.39^{dA} ±0.03	5.98^{aA} ±0.03
90	5.65^{cA} ±0.03	5.87^{bA} ±0.03	5.40^{dA} ±0.03	5.98^{aA} ±0.03
		TBRAS Value (mg malonaldehyde/kg)		
0	0.11^{dC} ±0.01	0.40^{bC} ±0.02	0.17^{cD} ±0.01	0.53^{aD} ±0.01
15	0.14^{dBC} ±0.01	0.43^{bBC} ±0.01	0.19^{cCD} ±0.01	0.59^{aC} ±0.02
30	0.16^{dAB} ±0.01	0.45^{bB} ±0.01	0.21^{cBC} ±0.01	0.63^{aB} ±0.02
60	0.17^{dAB} ±0.01	0.46^{bB} ±0.01	0.23^{cAB} ±0.01	0.66^{aAB} ±0.02
90	0.18^{dA}±0.01	0.53^{bA}±0.01	0.25^{cA} ±0.01	0.69^{aA} ±0.02

(n=6), Mean± SE, CMP (chicken meat powder)

Means with different small superscripts in a row and capital superscripts in a column differ significantly (P<0.05).

The pH (Trout *et al.* 1992), TBA value (Witte *et al.* 1970), sensory evaluation (9-point hedonic scale, with 9 semi-trained panelists), microbiological quality (APHA, 1984) were evaluated. The experiment was replicated thrice in duplicate and data obtained were subjected to analysis of variance using completely randomized design. Duncans multiple range test was used for finding out significance difference in the mean values, as per Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

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 on 0 day (Table 1). Increase in pH of idli mixes incorporated with CMP as compared to their control idli mixes may be attributed to high pH (6.15) of CMP (Kharab, 2010) as compared to 5.5 pH of both semolina and white rice grit (www.rense.com). No significant difference was noticed in pH values of idli mixes up to 90 days of storage. A non significant increase in pH noticed during storage might be due to breakdown of proteins by microbes.

The TBA values of control rice idli mix and control semolina idli mix was found to be 0.11 and 0.17mg malonaldehyde/kg which increased significantly to 0.40 and 0.53mg malonaldehyde/kg on incorporation of CMP at 20% and 30% level, respectively, on 0 day (Table 1). TBA values increased significantly in all the control and developed product samples as the storage period increased. As the storage period increased, TBA values indicating oxidative rancidity increased in all the types of idli mixes. Rancidity usually develops during storage of food products due to reaction between available oxygen and fat.

Rice idli mix with 20% CMP had a significantly lower TBA value than semolina idli mix with 30% CMP on 90th day. This might be due to lower CMP incorporation and lower fat content in rice rava as compared to semolina. The fat content in CMP, rice rava and semolina was 10.56%, 0.88% and 1.20%, respectively (Bishnoi, 2012). Deswal (2003) reported that TBA value of instant chicken soup mix with and without preservatives varies from 0.68 to 0.90 and 0.70 to 0.95 mg malonaldehyde/ Kg, respectively during storage upto 60 days. Kharb and Ahlawat (2010) reported that precooked dehydrated spent hen meat mince have 0.84 to 1.16 mg melonaldehyde/kg (TBA value) during storage at ambient temperature up to 60 days.

Yadav and sharama (2007) reported TBA value varies from 0.039 to 0.132 and 0.039 to 0.156 in soy-fortified instant soojihalwa mix stored up to 6 months at 23±2°C and 37°C temperature, respectively. Yadav et al. (2008) also reported TBA value varies from 0.047 to 0.151 and

Table 2: Standard plate count and yeast and mould count (cfu/g) of instant mixes stored at 30±2°C

Storage Period (days)	Control rice idli mix	Rice idli mix with 20% CMP	Control semolina idli mix	Semolina idli mix with 30% CMP
	Standard plate count (cfu/g)			
0	8.2×10^2	1.3×10^3	1.8×10^3	3.2×10^3
15	9.1×10^2	1.5×10^3	2.1×10^3	3.7×10^3
30	1.0×10^3	1.7×10^3	2.3×10^3	4.4×10^3
60	3.2×10^3	5.1×10^3	6.4×10^3	1.5×10^4
90	5.2×10^3	9.5×10^3	8.9×10^3	2.2×10^4
	Yeast and mould count (cfu/g)			
0	1.0×10^1	1.3×10^1	1.1×10^1	1.4×10^1
15	1.3×10^1	1.7×10^1	1.4×10^1	1.9×10^1
30	1.6×10^1	2.0×10^1	1.7×10^1	2.3×10^1
60	1.8×10^1	2.3×10^1	2.0×10^1	2.7×10^1
90	2.2×10^1	2.8×10^1	2.3×10^1	3.2×10^1

Values are means of two plates, CMP-Chicken meat powder.

Table 3. Sensory score of reconstituted idlies form idli mixes stored at 30±2°C

(n=9)

Days	Control rice idli	Rice idli with 20% CMP	Control semolina idli	Semolina idli with 30% CMP
		Colour and appearance		
0 Day	8.22^{aA} ±0.15	7.78^{abA} ±0.15	8.00^{aA} ±0.17	7.33^{bA} ±0.24
15 Day	8.22^{aA} ±0.15	7.78^{abA} ±0.15	8.00^{aA} ±0.17	7.33^{bA} ±0.24
30 Day	8.22^{aA} ±0.15	7.78^{aA} ±0.15	8.00^{aA} ±0.17	7.22^{bA} ±0.22
60 Day	8.11^{aA} ±0.11	7.67^{abA} ±0.29	7.89^{aA} ±0.11	7.22^{bA} ±0.22
90 Day	8.11^{aA} ±0.11	7.56^{abA} ±0.29	7.78^{aA} ±0.15	7.11^{bA} ±0.20
		Flavour		
0 Day	7.44^{bA} ±0.18	8.22^{aA} ±0.15	7.78^{abA} ±0.32	8.22^{aA} ±0.15
15 Day	7.44^{bA} ±0.18	8.11^{aA} ±0.11	7.78^{abA} ±0.32	8.11^{aA} ±0.11
30 Day	7.44^{bA} ±0.18	8.11^{aA} ±0.11	7.78^{abA} ±0.32	8.00^{abA} ±0.17
60 Day	7.22^{bA} ±0.15	7.33^{abB}±0.17	7.67^{abA} ±0.29	7.89^{aA} ±0.11
90 Day	7.22^{aA} ±0.15	6.89^{aC}±0.11	7.33^{aA} ±0.24	7.33^{aB} ±0.24
		Texture		
0 Day	8.22^{aA} ±0.15	7.44^{bA} ±0.24	8.00^{abA} ±0.17	7.44^{bA} ±0.18
15 Day	8.22^{aA} ±0.15	7.44^{bA} ±0.24	8.00^{abA} ±0.17	7.44^{bA} ±0.18
30 Day	8.22^{aA} ±0.15	7.33^{bA} ±0.24	7.89^{aA} ±0.11	7.22^{bA} ±0.15
60 Day	8.22^{aA} ±0.15	7.22^{bA} ±0.22	7.89^{aA} ±0.11	7.22^{bA} ±0.15
90 Day	8.11^{aA} ±0.11	7.22^{bA} ±0.22	7.89^{aA} ±0.11	7.11^{bA} ±0.20
		Overall acceptability		
0 Day	8.00^{aA} ±0.17	8.11^{aA} ±0.20	7.56^{aA} ±0.24	8.00^{aA} ±0.17
15 Day	8.00^{aA} ±0.17	8.11^{aA} ±0.20	7.56^{aA} ±0.24	7.89^{aA} ±0.11
30 Day	7.89^{aA} ±0.20	7.89^{aA} ±0.20	7.44^{aA} ±0.24	7.89^{aA} ±0.11
60 Day	7.78^{aA} ±0.15	7.78^{aA} ±0.15	7.33^{aA} ±0.17	7.78^{aA} ±0.15
90 Day	7.78^{aA} ±0.15	6.33^{bB} ±0.24	7.33^{aA} ±0.17	7.56^{aA} ±0.18

Means ±SE with different small superscripts in a row and capital superscripts in a column in each group differ significantly (P<0.05).
CMP (chicken meat powder).

0.047 to 0.167 in soy-fortified instant upma mix stored up to 6 months at ambient (15-35°C) and 37°C temperature, respectively.

The standard plate count (SPC) for control rice idli mix was 8.2×10^2cfu/g on Day 0. On Day 15 and Day 30 there was practically no increase in the SPC, the values were 9.1×10^2 and 1.0×10^3cfu/g, respectively. However, subsequently the SPC roseupto 5.2×10^3cfu/g on Day 90. SPC values for control semolina idli mix was 1.8×10^3cfu/g on Day 0 and rose upto 8.9×10^3cfu/g on Day 90.SPC values in rice idli mix with 20% CMP increased from 1.3×10^3 to 9.5×10^3cfu/g at 0 to 90 day and that for 30% CMP incorporated semolina idli mix increased from 3.2×10^3 to 2.2×10^4cfu/g.

Yeast and mould count (YMC) for control rice idli mix was 10 cfu/g on Day 0. On Day 15 and Day 30 there was practically no increase in the YMC, the values were 13 and 16 cfu/g, respectively. However, subsequently the YMC rose upto 22 cfu/g on Day 90. YMC values for control semolina idli mix was 11 cfu/g on Day 0 and rose upto 23 cfu/g on Day 90. YMC values in rice idli mix with 20% CMP increased from 13 to 28 cfu/g at 0 to 90 day and that for 30% CMP incorporated semolina idli mix increased from 14 to 32 cfu/g. Standard plate count and yeast and mould count increased during storage study and differentiable counts were observed after 30th day of storage the counts were within the safety limits up to the end of storage.

Higher standard plate and yeast and mould counts in CMP incorporated idli mixes as compared to control mixes might be due to contamination during processing of CMP. Difference in standard plate counts and yeast and mould count of control rice idli mix and control semolina idli mix might be due to difference in initial microbial load and moisture content of raw rice grit and semolina, whereas difference in rice idli mix with 20% CMP and semolina idli mix with 30% CMP might be due to synergistic effect of quantitative difference of CMP incorporation, difference in initial microbial load and moisture content of raw rice grit and semolina. Higher pH (near to neutral) of CMP incorporated idli mixes as compared to control idli mixes might be a reason for higher microbial counts in CMP incorporated idli mixes. Hobbes and Greene (1976) reported acceptable limit of aerobic bacteria and yeast and moulds varies from 10^4 to10^6 and 0 to 10^2, respectively, in raw cereals. Frazier and Westhoff, (1978) reported that meat products are considered spoiled when microbial population exceeds 10^6 or more. Yeast and mould count in cereal grains should be less than 10^4 cfu/g (FDA, 2013).All the idli mixes had standard plate and yeast and mould count, below 10^5 and 10^2, respectively. So all idli mixes were acceptable even after whole period of storage (90 days) although microbial count were slightly increased during the storage period.

The colour and appearance scores of control rice idlies (8.22), rice idlies with 20% CMP (7.78) and control semolina idlies (8.00) were significantly higher as compared to semolina idlies with 30% CMP (7.33). Mean scores of colour and appearance of control rice idli and rice idli with 20% CMP did not differ significantly but colour and appearance scores of control semolina idli and semolina idli with 30% CMP differ significantly on 0 day. During storage upto 90th day, non significant decline in colour and appearance scores was observed either in control or CMP incorporatedidlies. Vishakha (2006) reported semolina idli mixes with 40% maize grits of different maize varities showed non-significant difference in colour and appearance scores of reconstituted idlies. Similarly Nazni and Shalini (2010) observed incorporation of pearl millet up to 31.5% in rice idli had no significant difference in colour and flavour scores. The flavour scores were increased significantly with incorporation of CMP in rice based and semolina based idlies. The flavour scores of rice idli with 20% CMP started declining during storage and on 60^{th} day, significant decline in score was observed as compared to 0 day, whereas on 90^{th} day flavour score was 6.89 which is lower than 7.00 i.e. moderately acceptable. On the other hand, significant decline in flavour scores was observed in semolina idli with 30% CMP on 90^{th} day but the scores were above moderately acceptable (7.33).

Mean scores of texture of control rice idlies non significantly higher as compared to control semolina idlies and no significant difference were observed during storage upto 90 days. Texture scores of rice idlies with 20% CMP and semolina idlies with 30% CMP were non significantly different during storage upto 90 days. Incorporation of CMP significantly declined the texture scores of both (rice and semolina based) idlies and it decreased as the storage period increased. Mackie (1994) reported that gelling functionality of meat proteins is generally reduced greatly after dehydration. Vishakha (2006) reported semolina idli mixes with 40% maize grits of different maize varities showed significant decline in texture scores of reconstituted idlies. Similarly Nazni and Shalini (2010) observed incorporation of pearl millet up to 31.5% in rice idli had significant decline in texture and overall acceptability. Non significant change in overall acceptability scores of control and CMP incorporated idlies were observed up to 90th day, except rice idli with 20% CMP, which showed a significantly lower overall acceptability score (6.33).

It is concluded that the rice idli mix incorporated with 20% CMP and semolina idli mix incorporated with 30% CMP could be stored for 60 days and 90 days, respectively, with acceptable sensory attributes and without any significant deterioration in microbiological quality.

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