The present investigation was carried out with a view to standardize the formulation and processing technology for the manufacture of Mozzarella Cheese Analogue (MCA) using rennet casein as the protein source, Rice bran oil + Safflower oil as a fat source along with other functional additives and flavouring.

The study was undertaken in eight phases which involved: Phase-I: Development of a formulation and standardizing the processing parameters for the preparation of MCA, Phase-II: Selection of acid, Phase-III: Selection of type of emulsifying salt in the MCA formulation, Phase-IV: Optimizing the proportion of emulsifying salt in the MCA formulation, Phase-V: Validating the need of Starch in the preparation of MCA, Phase-VI: Optimizing the level of rennet casein, emulsifying salts and acid in the MCA formulation, Phase-VII: Comparison of MCA with natural Mozzarella cheese (NMC), and Phase-VIII: Assessing the cost-effectiveness of MCA as against NMC.

The process standardized in our laboratory involved:

Dissolving the 2/3 quantity of dry mixture of rennet casein, starch, salt and cheese flavouring in hot (83°C) aqueous solution containing tri-sodium citrate and sodium hexa meta phosphate in a planetary mixer and addition of hot (65 °C) vegetable oil in the casein dough in three installment.

Part acidification of rennet casein-oil based slurry with citric acid solution while agitation.

Addition of remaining 1/3 quantity of dry mixing of casein blend and emulsification of hot (65°C) vegetable oil into the casein mass with continuous mixing in two installments, adding the rest portion of citric acid solution and heating the cheese mass to 80°C to obtain a stringy and plastic cheese mass which was cooled, packaged and subsequently cold stored.
The screening of various ingredients for their suitability and/or deciding their rate of addition was undertaken from Phase-I to Phase-VI. Use of 3.0 per cent pre-modified starch (instead of no starch), citric acid @ 0.60 per cent (instead of 0.6 per cent of lactic acid), 22.74 per cent of rennet casein (instead of 22.0 and 24.0 per cent casein) and 2.97 per cent of blend of emulsifying salt (instead of 2.50 and 3.0 per cent) comprising of tri-sodium citrate and sodium hexa meta phosphate in 1.5:2 proportion (instead of 1:2 ratio) in the formulation of MCA was found to be advantageous in terms of its baking properties.

The final formulation adopted based on the findings of Phase-I to Phase-VI and used subsequently in Phase-VII was: (i) Rennet casein - 22.74 per cent (w/w), (ii) Vegetable oil– 17.0 per cent (w/w), (iii) Modified starch - 3.0 per cent (w/w), (iv) Tri-sodium citrate – 1.27 per cent (w/w), (v) sodium hexa meta phosphate – 1.70 per cent (w/w), (vi) Citric acid – 0.60 per cent (w/w), (vii) Aged cheddar cheese bud flavour – 1.00 per cent (w/w), (viii) Common salt – 1.00 per cent (w/w) and, (ix) Water – 51.75 per cent (w/w).

The MCA and commercially available NMC were evaluated for their proximate composition, texture profile analysis, objective assessment of baking qualities and baking trial to assess its suitability as a pizza topping.

Manufacture of MCA is accomplished using just two equipments (viz., blender and cooker) requiring about 1/2 hr. of manufacture with reduced labour and energy requirement. On the other hand, manufacture of natural Mozzarella cheese (NMC) requires several equipments (viz., Pasteurizer, cheese vat with accessories, stretcher and molder, and brine tank) requiring minimum of 5½ h of manufacture (inclusive of brining) with relatively more number of labour and utilizing higher energy.

The MCA conformed to the FSSA standards for Mozzarella and Pizza cheeses. The MCA had significantly (P ≤ 0.05) lower fat, protein, salt and significantly higher ash as compared to those of NMC. The absence of cholesterol in MCA due to the use of vegetable oil may be advantageous in recommending it to health conscious people.

Evaluation of the baking qualities revealed that MCA had superior shredability, meltability and required significantly reduced time for melting in the baking oven but exhibited lower stretch, and exuded lower free fat compared to those of natural
Mozzarella cheese. Even though the stretch was lower in MCA as compared to NMC, it was considered adequate for pizza application.

When four day aged cheeses were evaluated as a topping on pizza pie, MCA was superior to NMC with regard to shredability as well as with regard to the sensory scores for appearance, melting and chewiness characteristics, when judged as a pizza topping. However, the NMC scored higher for flavour and stringiness compared to MCA. The total sensory score was significantly superior for analogue cheese compared to that of natural Mozzarella cheese. The MCA was cheaper than commercially available natural Mozzarella cheese by 23.0 per cent and thus quite cost effective.

Production of MCA seems lucrative for Indian cheese industry since consistent quality analogue cheese can be produced throughout the season or year using the same lot of dried rennet casein, with tremendous reduction in the manufacturing time and labor. Moreover, MCA can be used to impart functional and health benefits.

The formulation and the process standardized for Mozzarella cheese analogue is recommended for commercial/industrial exploitation.

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