Selection of Levels of Maltodextrin to Improve the Sensory and Textural Properties of Omega-3- and Fiber-Enriched Low Fat Buffalo Milk

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A study was conducted to determine the level of maltodextrin to be added in low fat buffalo milk enriched with omega-3 fatty acids and fiber, as an encapsulating agent and also to improve its sensory and textural properties. Buffalo milk was standardized to 2% fat and supplemented with omega-3 fatty acids (alpha linolenic acid (ALA), docosahexanoic acid (DHA)) and fiber (partially hydrolysed guar gum). Maltodextrin was added at four different levels (2, 3, 4 and 5%) and its effect on the flavor, mouthfeel and viscosity of the product were evaluated. Maltodextrin at 3% led to maximum flavor score in the supplemented low fat milk. Mouthfeel improved, though not significantly, with increasing levels of maltodextrin, while viscosity did not improve upon addition of beyond 3% level of maltodextrin.

Keywords: Chhana Sandesh, Rheology, Arrhenius equation, Activation Energy

An effective approach to increase the intake of omega-3 fatty acids is the enrichment of frequently consumed foods such as fluid milk with purified algal and vegetable oils rich in these fatty acids. But this is not easy because the PUFAs sources are highly unstable and susceptible to autoxidation, resulting in rancidity in the product. Storage at refrigerated temperatures for short duration in light- and air-impermeable packages can prevent oxidation of PUFAs. While milk fat serves as a medium for omega-3 fortification, addition of maltodextrin may provide protection from oxidation by encapsulation. In addition, it may also improve the flavor and mouthfeel of the product, owing to its bulking properties and thus be a successful fat replacer.

Buffalo milk from the Cattle Yard of National Dairy Research Institute, Karnal was standardized to 2% fat. Algal oil (DHAidTM, Lonza Group Ltd., Switzerland) as the source of DHA and EPA and refined flax seed oil were obtained from S.A. Pharmaceuticals Ltd. and Kamani Oil Industries Pvt. Ltd., Mumbai, respectively. Partially hydrolysed guar gum (PHGG) under the trade name Sunfiber® purchased from Taiyo Lucid Pvt. Ltd., Mumbai was used as the source of dietary fiber. Maltodextrin (DE 16-20) was procured from Ridhi-Sidhi Gluco Bios Ltd., New Delhi. Fortified milk was prepared by mixing calculated quantities of maltodextrin (2, 3, 4 and 5% w/v), PHGG (1% w/v), oil mix (1% v/v; algal oil and flax seed oil in the ratio 1:4) and buffalo milk cream (to obtain a final fat content of 2%), with buffalo skim milk, homogenizing (140/35 kg/cm²) and heat treatment (80°C/no hold) before packaging and storage. Total solids (TS) and fat were determined as described by AOAC (2000). The product was evaluated by a panel of trained personnel for sensory characteristics using 9-point hedonic scale as delineated by Shone et al. (1977). Data were recorded as mean of four independent replicates prepared on different days and analyzed for significant main treatment effects by the analysis of variance (ANOVA).

The effect of levels of maltodextrin on the product is presented in Table 1. Flavour score of the fortified milk (5.06) was significantly lower than that of the control sample (7.32). Addition of maltodextrin improved the flavor scores (maximum 6.21 at 3% level), though varying the

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levels had no significant effect. Mouthfeel improved, albeit not significantly with increasing levels of maltodextrin, while viscosity did not improve beyond 3% level of maltodextrin. The fat content in the samples containing maltodextrin decreased while TS increased, with increasing quantities of maltodextrin.

Maltodextrin forms gels and retains water and is used in food industry as a body and texture modifier, either for gelation, water retention or substitution of fat (Alexander, 1995). They perform multifaceted functions in food systems including bulking, adding texture and body, forming films, binding flavour and fat, serving as oxygen barriers, aiding dispersability and solubility and as product extenders (Setser and Racette, 1992). The current results confirm the texture enhancing and bulking properties of maltodextrin, as its addition led to improvement in flavor, mouthfeel and viscosity of the product. The quantity of fat extracted from milk reduced with the increase in levels of maltodextrin, which may be due to the incomplete extraction of fat bound by maltodextrin. The direct extraction of composite foods with ether as was followed here, gives fat values considerably less than those for the combined fat of the ingredients composing the product, as indicated by subsequent modifications to the process. The standard method of total lipid extraction suggested by Bligh and Dyer (1959) was modified later as AOAC (1990) and further by Phillips et al. (1997) who suggested steps to reduce the analysis time for food composites. The presence of maltodextrin and PHGG may be the reason for the reduced fat in the composite product in this study. This is further corroborated by the lower fat content in the fortified sample containing only PHGG and no maltodextrin as compared to the control. It is evident that the fat extraction protocol used in the present study was unable to extract completely, the fat from the bound form, indicating that improved methods may be needed for complete release of the fat. The increase in TS was due to added maltodextrin and dietary fiber.

REFERENCES