The Effect of Milkfat Melting Properties on Chemical and Physical Properties of 20% Reformulated Cream

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(ABSTRACT)

Skim, sweet buttermilk, and butter derived aqueous phase components were used to re-emulsify low-melt and medium-melt fraction butteroils to yield 20% milkfat creams. The implications of separation temperature in obtaining components, melting point characteristics, and formulation on the chemical and physical properties of reformulated and natural creams were analyzed. Transmission electron microscopy indicated that both reformulated and natural creams were oil-in-water emulsions, demonstrating lipid globules surrounded by surface material. Chemical analysis of components proved that sweet buttermilk and butter-derived aqueous phase components had significantly higher (p less than or equal to 0.01) amounts of cholesterol and phospholipid than skim milk, resulting in creams formulated with sweet buttermilk and butter-derived aqueous phase creams having significantly higher (p less than or equal to 0.01) amounts of cholesterol and phospholipid than creams formulated with skim milk. Butter-derived aqueous phase had higher (p less than or equal to 0.01) amounts of lipid, cholesterol, and phospholipid than sweet buttermilk. However, skim component had higher (p less than or equal to 0.01) amounts of protein than butter-derived aqueous phase. When compared to natural creams, creams consisting of sweet buttermilk and butter-derived aqueous phase components had similar amounts of total phospholipid and amount of phospholipid adsorbed to lipid globules than creams consisting of skim component. Creams consisting of skim component had higher (p less than or equal to 0.01) amounts of protein than natural cream. Reformulated creams having low-melt fraction butteroil had higher (p less than or equal to 0.01) amounts of cholesterol. For reformulated creams, creams processed from components obtained by 49^{o}C separation had significantly higher (p less than or equal to 0.01) amounts of cholesterol than like creams manufactured from 55^{o}C separation components.

Creaming stability, viscosity, feathering, and sensory quality of reformulated and natural creams were analyzed over a 13 day storage period at 3.3^{o}C. Formulation, separation temperature, or melting point characteristics did not significantly (p greater than 0.01) affect creaming stability of reformulated and control creams homogenized at 13.6/3.4 MPa. The day within storage period, however, was a significant factor (p less than or equal to 0.01) in determining creaming stability of reformulated and natural creams. All creams displayed typical non-Newtonian behavior at 7^{o}C, displayed by hysteresis curves in which viscosity decreased as shear rate increased. Formulation and separation temperature used to obtain components did not have a significant (p greater than 0.01) effect on viscosity; however, all creams formulated with medium-melt fraction butteroil had significantly (p less than or equal to 0.01) higher apparent viscosity values than

creams with low-melt fraction butteroil at shear rate 692.48 s^{-1} and at 1384.96 s^{-1} and 2769.92 s^{-1} for creams formulated with skim component. Regardless of formulation, separation temperature, and melting point characteristics, all creams feathered in a pH range of 4.70-5.09. Reformulated and natural creams met sensory quality specifications as determined by the In/Out Method of Specification, except for creams formulated with skim milk and low-melt fraction butteroil which were characterized as having oxidized flavors. Creams formulated with buttermilk and butter derived aqueous phase had more comparable physical properties to natural creams than skim milk creams.

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Dedication

I dedicate this thesis to my parents, Mrs. Anne E. Scott and the late Mr. Lawrence L. Scott. I am most grateful for their financial and spiritual support and guidance throughout my life. Thanks for believing in me and teaching me the power of believing in myself and prayer.

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