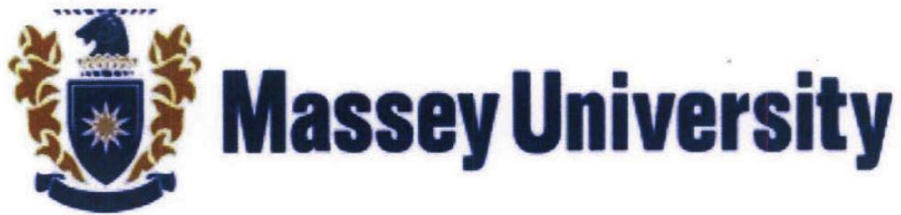


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**STUDIES ON THE EFFECTS OF HEAT AND HIGH  
PRESSURE TREATMENTS ON FAT GLOBULE  
SURFACE LAYERS IN RECOMBINED MILK**



**A thesis presented in partial fulfilment of the requirements for the degree  
of Doctor of Philosophy**

**in**

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## ABSTRACT

The present study examined the effects of heat treatment, high pressure (HP) treatment or combined heat and HP treatments, either before or after homogenization, on recombined milk systems. The main focus was to explore the changes induced by these treatments on the surface layers of recombined fat globules, milk proteins and rheological properties of acid gels.

Heat treatments caused denaturation of whey proteins; the degree of denaturation was dependent on temperature, holding time and to a lesser extent on the placement of heat treatment. Recombined milks that underwent heat treatment before or after homogenization had similar levels of whey protein denaturation. The amounts of caseins and denatured whey proteins adsorbed on the surface of fat globules of recombined milk heated before homogenization were significantly lower than those heated after homogenization, indicating different interaction mechanisms in these two systems.

Increases in treatment pressure used in HP treatment resulted in decreased amounts of caseins, while whey proteins adsorbed onto the surface layers of fat globules increased. This was probably due to the dissociation of casein micelles under HP treatment and the interactions between HP-induced denatured whey proteins and casein particles on the surface layers of fat globules.

Combined heat and HP treatments induced changes on adsorbed caseins and whey proteins on fat globule surface layers. HP treatment induced additional denaturation of whey proteins in heated milks, resulting in slightly increased amounts of denatured whey protein adsorbed onto the surface layers.

Gelation pH, final  $G'$  and yield stress values of acid gels prepared from recombined milks heated before or after homogenization were dependent on temperature, holding time and the placement of heat treatment. These changes were attributed to the extent of denaturation of the whey proteins and their interactions with casein particles adsorbed onto the fat globule surface and in the serum. Differences in acid gels prepared from recombined milks heated before and after homogenization were

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attributed to the relative proportions of caseins and whey proteins at the surface layers of fat globules resulting in different interactions with protein strands in the gel network.

The acid gels prepared from recombined milks HP-treated either before or after homogenization had shorter gelation times, higher gelation pH, final  $G'$  and yield stress values compared with untreated recombined milk and the effects were dependent on treatment pressure, temperature, holding time and the placement of HP treatment. The denaturation of whey proteins and their interactions with casein particles were responsible for these changes. In HP-treated recombined milks the proportions of caseins and denatured whey proteins adsorbed onto the surface layers of fat globules had significant effects on the acid gel structure. When HP treatment was applied after homogenization, the proteins on the surface layer were present as a layer which might provide better sites for the interactions with the protein strands in the gel matrix.

The application of these processing treatments to recombined milk could provide new avenues to the dairy industry for manufacturing novel products with enhanced texture and nutritional properties.

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