

# Influence of HP process at industrial scale on lipid fraction of whole milk and infant formula



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## INTRODUCTION

Over the last decade, the influence of hydrostatic pressure (HP) treatment on many constituents of milk has been established, however, milk fat components have received little attention with regard to HP induced changes. Therefore, the aim of the present work has been to study the fatty acid profile and lipid oxidative changes in raw milk and liquid infant formula samples submitted to HP treatments.

## MATERIALS AND METHODS

Raw whole milk samples were treated under different pressures (0, 250, 350, 450, 550 and 650 MPa) at 15°C and holding time 5 min. Samples of liquid infant formula (provided by ORDESA, Spain) were taken just before UHT treatment and pressurized to 650 MPa during 10 min at 15°C. Same commercial infant formula samples (UHT treated) were used for comparison. Lipids were extracted according to International Standard ISO-IDF 2001, and analyzed by different chromatographic techniques (GC-FID, GC-MS; HPLC-DAD; HPSEC). Fatty acid (FA) composition, especially long chain polyunsaturated (LCPUFA), the presence of trans FAs as well as the occurrence of lipid oxidation compounds and peroxide index were determined.



HP treatments have been carried out using an industrial size equipment (NCHyperbaric Wave 6000/120 model). This industrial size equipment is part of the Centre of New Technologies in Food Processing (CENTA-IRTA).

## RESULTS AND DISCUSSION

### HP treated raw milk.

Fatty acid composition of control and pressurized raw milk up to 650Mpa are shown in Fig.1 and Table 1. Slight variations among the various fatty acid fractions were found during the study but were not statistically significant and therefore not related to the processing by high pressure. Neither content values of major and minor FAs nor presence of oxidation compounds after pressurization were found to be different against to untreated samples.

### Processed infant formula.

Statistical results of infant formula study (Fig.2) indicated that the FA composition of pressurized samples was not significantly different from that of UHT heated-alone samples (Table 2). Although heat treatment tended to promote the formation of lipid oxidation compounds, the observed values did not increase by HP neither by UHT processing. Besides that, the peroxide value was under the normal range.

Table 1. Mean values and SD of fatty acid composition (% total FAME) of control and pressurized raw milk samples.

	CONTROL	650MPa
C4	3.31 ± 0.35	3.26 ± 0.31
C6	2.33 ± 0.12	2.33 ± 0.07
C8	1.43 ± 0.03	1.42 ± 0.03
C10	3.34 ± 0.04	3.31 ± 0.03
C10:1	0.31 ± 0.01	0.31 ± 0.01
C12	3.82 ± 0.01	3.78 ± 0.02
C14	10.72 ± 0.12	10.62 ± 0.03
C15:1	0.22 ± 0.02	0.22 ± 0.01
C14:1	1.00 ± 0.02	0.98 ± 0.02
C15:al	0.49 ± 0.01	0.49 ± 0.01
C15	1.03 ± 0.01	1.02 ± 0.01
C16:1	0.17 ± 0.01	0.17 ± 0.01
C16	28.58 ± 0.32	28.52 ± 0.24
C17:1	0.2 ± 0.03	0.19 ± 0.01
C16:1	1.92 ± 0.04	1.93 ± 0.02
C17:al	0.63 ± 0.05	0.61 ± 0.03
C17	0.48 ± 0.05	0.48 ± 0.03
C17:1	0.20 ± 0.10	0.23 ± 0.04
C18	7.35 ± 0.17	7.47 ± 0.20
IC18:1(6-8)	0.37 ± 0.07	0.31 ± 0.04
IC18:1(9-10)	0.67 ± 0.08	0.67 ± 0.07
IC18:1(11)	0.70 ± 0.10	0.75 ± 0.12
C18:1(c9)	21.58 ± 0.12	21.63 ± 0.21
C18:1(t15+c11)	0.88 ± 0.01	0.87 ± 0.02
C18:1(c12)	0.34 ± 0.02	0.33 ± 0.01
C18:1(c13)	0.09 ± 0.02	0.08 ± 0.01
C18:1(t16+c14)	0.28 ± 0.02	0.28 ± 0.02
C18:2(t,1)	0.28 ± 0.03	0.26 ± 0.03
IC18:2(c,1)	0.15 ± 0.08	0.19 ± 0.04
IC18:2(c,1)	0.26 ± 0.02	0.27 ± 0.02
C18:2(c9,c12)	3.53 ± 0.08	3.55 ± 0.03
C20	0.18 ± 0.08	0.21 ± 0.01
C18:3	0.38 ± 0.01	0.39 ± 0.01
CLA (c9,t11)	0.41 ± 0.01	0.41 ± 0.01
CLA	0.08 ± 0.01	0.09 ± 0.01
C20:4 (AA)	0.23 ± 0.03	0.24 ± 0.01
SFA	65.09	64.85
MUFA	28.44	28.48
PUFA	5.73	5.78

Figure 1. Fatty acid profile of pressurized raw milk sample by GC-FID

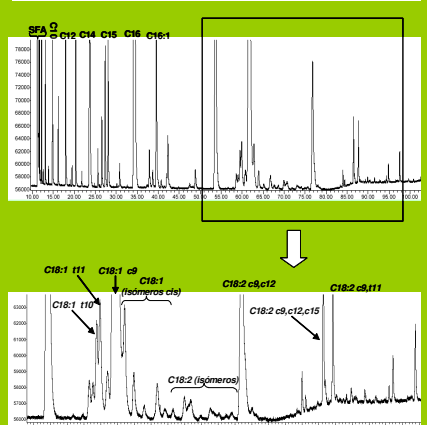
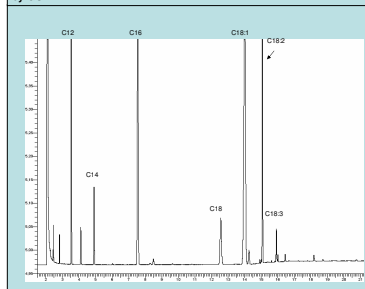


Table 2. Mean values and SD of fatty acid composition (% total FAME) of control, pressurized and UHT treated liquid infant formula sample

	Control	HP-650MPa	UHT
C8	0.68±0.01	0.67±0.01	0.68±0.01
C10	0.61±0.01	0.61±0.01	0.61±0.01
C12	7.61±0.14	7.58±0.11	7.62±0.03
C14	3.11±0.04	3.1±0.02	3.12±0.01
C15	0.05±0.01	0.05±0.01	0.05±0.01
C16	24.1±0.09	24.07±0.07	24.22±0.2
C17:1	0.18±0.03	0.16±0.01	0.16±0.01
C16:1	0.41±0.01	0.41±0.01	0.41±0.01
C17	0.08±0.01	0.09±0.01	0.09±0.01
C18	5.28±0.10	5.27±0.10	5.38±0.04
C18:1c9	39.28±0.13	39.35±0.22	39.01±0.37
C18:1	1.12±0.01	1.13±0.01	1.13±0.02
IC18:2	0.16±0.01	0.15±0.01	0.15±0.01
IC18:2	0.13±0.01	0.14±0.01	0.13±0.01
C18:2n6	14.42±0.03	14.42±0.09	14.46±0.12
C18:3n3	1.35±0.01	1.35±0.02	1.35±0.01
C20:1	0.30±0.01	0.31±0.01	0.31±0.01
C20:4n6	0.34±0.01	0.34±0.02	0.35±0.01
SFA	41.75±0.20	41.66±0.32	41.98±0.27
MUFA	41.12±0.13	41.20±0.23	40.86±0.38
PUFA	16.72±0.03	16.73±0.09	16.77±0.12

Figure 2. Fatty acid profile of pressurized liquid infant formula sample by GC-FID



## CONCLUSIONS

In general, the results obtained indicate that, the HP processing of the raw whole milk and infant formulas studied did not lead modifications of its fatty acid composition nor the presence of oxidation compounds. Therefore, no modification on milk lipid fraction is observed on pressure treatments up to 650 MPa.