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Impact of pasteurization and homogenization on the digestion of human milk: an in vivo study in the preterm infant

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Context



HOMOGENIZED

HM

Ensuring adequate growth of preterm newborns remains a challenge. When breastfeeding not possible \rightarrow pasteurized human milk from milk banks is preferentially administered. Holder pasteurization (62.5°; 30 min) is applied for sanitary reasons but may reduce fat absorption through the inactivation of milk endogenous lipases. Conversely, homogenization of Holder-pasteurized human milk (PHM) may improve fat absorption and weight gain.

Objective



 \rightarrow To investigate the impact of the homogenization and pasteurization of human milk on its gastric digestion in preterm infants

(Thomaz et al., 1999; Rayol et al., 1993; Martinez et al., 1987)

digestive kinetics?

ClinicalTrials.gov NCT02112331 **Experimental design** **Materials & Methods**

Multi-scale characterization of HM and digested samples



- Randomized controlled trial
- Hospitalized tube-fed preterm infants (GA < 32 wks)</p>

> 6-day experimental period; 2 independent groups



Biochemical composition: kinetics of lipolysis and proteolysis

Structural disintegration





Human Milk Gas and thin layer Titrimetry SDS-Page + densitometry; analyzer chromatography Cation exchange chromatography Instantaneous lipolysis level:

 \rightarrow % of free fatty acids vs. total acyl chains present at a given time

Lipolytic activity in gastric aspirates:

 \rightarrow Titration of butyric acid released from tributyrin at pH 4.5

and 37 °C (Gargouri et al., 1986)

% of intact protein remaining at a given time:

 \rightarrow Lactoferrin, α-lactalbumin, serum albumin, β-casein (data not shown here)

Confocal Laser light microscopy scattering Particle size distribution

Fluorescent probes:

 \rightarrow Proteins (FastGreen[®]), apolar lipids (Lipidtox[®]) and polar lipids (Rhodamine-PE[®])

 \rightarrow Results were expressed as means ± SD P < 0.001 (***); P < 0.01 (**); P < 0.05 (*);P > 0.05 (NS).

GROUP A

Pasteurization affected the emulsion disintegration of HM

Particle size distribution

milks

8

Raw HM -



Results

But did not impact gastric lipolysis



Lipolytic activity

 \rightarrow Pre-lipolysis occurred

activity

17.5±2.9



Homogenization affected the initial structure and the emulsion disintegration of HM



 $4.1 \pm 1.2 \text{ m}^2/\text{g}$ to $25.5 \pm 3.8 \text{ m}^2/\text{g}$ of fat \rightarrow The lipid fraction kept its initial structure all over the gastric digestion (native globules vs. blend of droplets)

> \rightarrow Past HM and P+Homog HM (n = 4 pools): same macronutrients composition, same pre-lipolysis degree (4.4 ± 1.0%) but different structure

> > \rightarrow Hormonal feedback triggered by higher lipolysis level

 \rightarrow Difference of colloidal behavior

Conclusion

> The initial structure of HM modulated the hydrolysis kinetics (lipolysis and proteolysis) and the emulsion disintegration during the gastric digestion in preterm infants

> Overall, *in vivo* data gathered here are crucial for a better understanding of milk neonatal digestion and help supporting the nutritional management of preterm infants.

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