

# QUANTIFICATION OF FUROSINE AND HYDROXYMETHYLFURFURAL IN SPANISH POWDERED INFANT FORMULAS (IFs)



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## INTRODUCTION

The **manufacture** of infant formulas (IFs) includes different steps such as blending of components, homogenization, pasteurization and spray-drying, along with **storage** having a great influence in their final **quality** [1]. In processes involving heat, reactions and/or interactions between constituents can give rise to a loss of nutritive value being this very important because IFs sometimes are the only source of **infant nutrition** during the first months of life. **Maillard reaction** (MR) is one of the main reactions causing deterioration of proteins during processing or storage of foods. Because IFs may contain high level of **carbohydrates and proteins**, MR plays an important role during elaboration from a nutritional point of view. Evaluation of the initial steps of MR provides very valuable information for processing control, since the reaction can be followed before any important nutritional damage takes place. Different compounds have been selected as indicators of different stages of MR being the **furosine** (2-furoylmethyl lysine) one the most used, in processed foods, as an index of **early stages** of MR. Besides, **hydroxymethylfurfural** (HMF) has been used as indicator of **advanced stages** as a result of excessive heating or storage [2].

## OBJECTIVE

The aim of this study was to assess the thermal damage of protein, by the measurement of **furosine** and **HMF**, in commercial **prebiotic-enriched infant formulas (IFs)**, representatives of the most popular marketed in Spain. Also, **influence of storage time (8 and 15 months)** at room temperature on MR has been studied.

## MATERIALS AND METHODS

**Starting and follow-up IFs**

**PREBIOTIC-ENRICHED IFs**

- Fructooligosaccharides, FOS (n=3)
- Galactooligosaccharides, GOS (n=7)
- GOS/FOS (n=6)

**IFs WITHOUT PREBIOTICS**

- With lactose (L) (n=4)
- Lactose-free (LF) (n=4)

**Protein from different origin:**

- Whey
- Whey protein hydrolysate
- Milk
- Soy

**CHARACTERIZATION**

- Dry matter (DM): 94.5 - 99.2%
- Water activity ( $a_w$ ): 0.07 - 0.28
- pH: 6.67 - 7.22
- Protein content (Kjeldhal method, 6.25 factor): 8.3 - 16.0%

**STORAGE**

Most representative IFs (n=10)

- L
- LF
- FOS
- GOS
- GOS/FOS

Room temperature, 8-15 months

**FUROSINE ANALYSIS [3]**

- Sample preparation:** Acid hydrolysis (HCl 8 N, 110 °C, 23 h) SPE extraction of furosine (activated Sep- Pack C<sub>18</sub>)
- Ion pair RP-HPLC-UV determination:** Furosine dedicated C<sub>8</sub> column at 35°C (250 mm × 4.6 mm × 5 μm) Detection UV: λ 280 nm

**MOBILE PHASE (1.2 mL/min)**

A: 0.4% acetic acid  
B: 0.4% acetic acid + 0.34% KCl

**GRADIENT ELUTION**

**HMF ANALYSIS [4]**

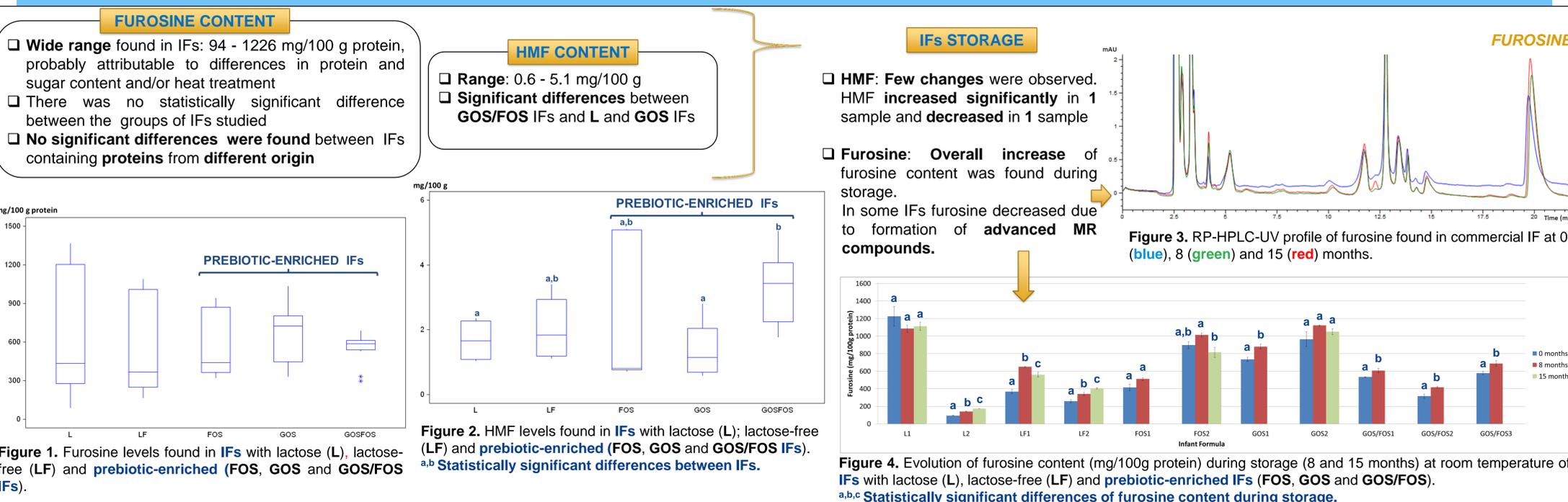
- Sample preparation:** Precipitation of fat and protein with Carrez reagents → **supernatants**
- HPLC-UV determination:** ACE5 C<sub>18</sub> column at 25°C (250 mm × 4.6 mm × 5 μm) Detection UV: λ 283 nm

**MOBILE PHASE (1.0 mL/min)**

A: Methanol/water (5:95)  
B: Methanol/water (80:20)

**GRADIENT ELUTION**

## RESULTS AND DISCUSSION



## CONCLUSIONS

- Great variability in furosine and HMF levels was found in commercial IFs.
- Scarce differences in furosine and HMF contents between IFs with and without prebiotics were observed.
- The high levels of furosine detected in some infant formulas may be attributable to excessive heat treatment during processing.
- Storage at room temperature of IFs did not produce important changes in the content of furosine and HMF.
- The use of these thermal indicators (furosine and HMF) allows establish quality of enriched-prebiotics IFs.

## References

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