Gas chromatographic determination of fatty acid composition in breast milk

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INTRODUCTION

- Human breast milk (HBM) provided by healthy, well-nourished, lactating mothers is unique and ideal food for neonates and infants, which provides a variety of nutrients, growth factors, immune components, and energy[1].
- One of the most important substances in HBM is fatty acids (FA). Approximately 85% are saturated FAs (SFA) and monounsaturated FAs (MUFA), the rest are polyunsaturated FAs (PUFA)[2].
- The fatty acid composition of HBM differs among lactating mothers' health conditions[2].

AIM

The aim of our study was to evaluate the fatty acid composition in breast milk of mothers with different health status by gas chromatography, coupled with a flame ionization detector (GC-FID).

MATERIALS AND METHODS

Human breast milk samples were represented four groups based on Hungarian mothers' health status:

- Normal Body Mass Index (nBMI) (n=8)
- Obese (O) (n=9)
- nBMI with Gestational Diabetes (nBMI+GD) (n=1)
- Obese with GD (O+GD) (n=1)

Sample preparation for GC-FID analysis

- Human breast milk sample preparation was based on a slightly modified ISO 16958:2015 reference method[3]

Determination of fatty acid composition of breast milk by GC-FID

Gas Chromatograph:

- Agilent 6890N GC-FID, Agilent 7683 autosampler

Chromatographic Parameters:

- Column: Phenomenex Zebron ZB-FAME (60 m x 0.25 mm x 0.20 µm)
- Injector: 250 °C Split mode, split ratio 50:1
- Carrier: H_2, flow rate 1.2 ml/min
- Temp. Prog: 100 °C (hold 3 min) rate 20 °C/min to 166 °C (hold 5 min), rate 1 °C/min to 180 °C, rate 10 °C/min to 240 °C (hold 3 min)
- Detector: FID, 260 °C

RESULTS

- **Figure 1**. Saturated FAs (SFA) were found in the highest level in HBM (SFA; 39-54%), followed by monounsaturated FAs (MUFA) (MUFA; 33-35%) and polyunsaturated FAs (PUFA) (PUFA; 12-26%). The total SFA content of HBM from the O mother groups were higher. The PUFA content was highest in O+GD group sample compared to samples from the other three groups. There was no difference in the MUFA content within four groups.

- **Figure 2**. The main FAs presented in HBM samples were oleic acid (C18:1 n-9c; 26-38%), palmitic acid (C16:0; 20-34%), and linoleic acid (C18:2 n-6c; 7-23%), followed by stearic acid (C18:0; 6-10%), myristic acid (C14:0; 5-8%), lauric acid (C12:0; 3-7%) and palmitoleic acid (C16:1 n-7c; 1.6-2.3%). All main FAs content were higher in O group samples, except for linoleic acid (C18:2 n-6c). One of the most interesting findings was palmitic acid (C16:0) showed the lowest, while linoleic acid (C18:2 n-6c) presented the highest level in O+GD HBM sample.

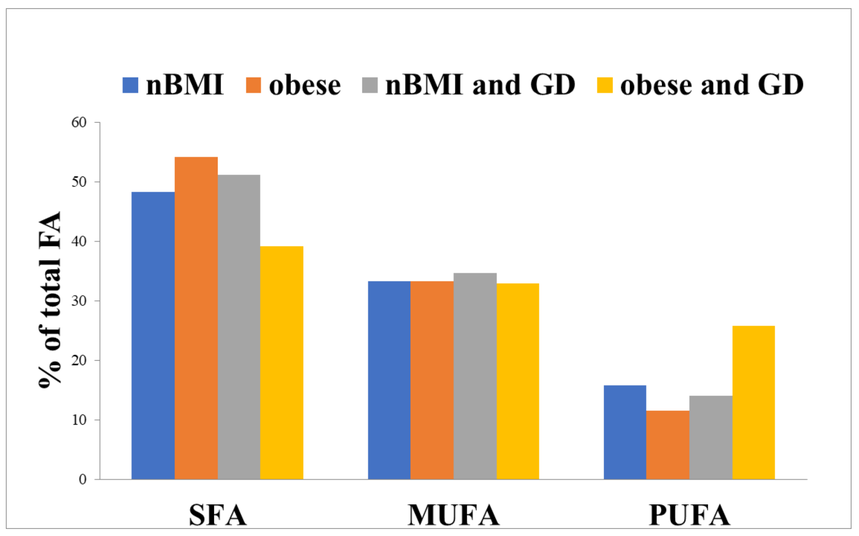

Figure 1. Total SFA, MUFA and PUFA content of breast milk

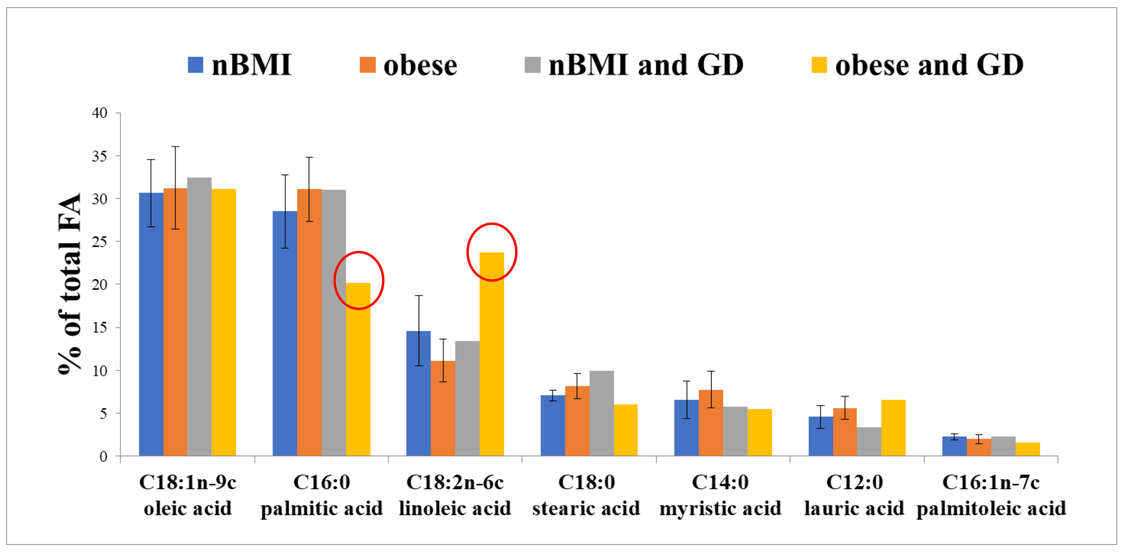

Figure 2. Fatty acid composition of breast milk.

CONCLUSION

Gas chromatography is an ideal method to analysis the fatty acids composition of HBM. We have found significant differences in the compositions of fatty acids in breast milk of mothers with different health status. The content of PUFA in HBM was lower in O group mothers, while the content of SFA was higher. Our findings highlight that the fatty acids composition of HBM was highly influenced by mothers' health status.

References

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Acknowledgements

The research was supported by the Association for Regional Cooperation in the Fields of Health, Science and Technology (RECOOP HST Association), RECOOP Grant # 016 Pregnant Obesity and GDM changing human milk secretory cytokines, and altering IgG-IgA N-glycans and fatty acids. We are also grateful for the Hungarian University of Agriculture and Life Sciences's Doctoral School of Food Science for the support in this study and the Stipendium Hungaricum scholarship provided to PhD student.