A close-up photograph of laboratory glassware. In the foreground, a round-bottom flask is filled with a purple liquid. To its right, a blue flask is partially visible. In the background, a red flask and a yellow flask are also present. The scene is brightly lit, creating reflections on the glass surfaces.

PHYSICAL CHEMISTRY 2018

*6<sup>th</sup> Workshop*

# SPECIFIC METHODS FOR FOOD SAFETY AND QUALITY

*September 27<sup>th</sup> 2018, Vinča Institute of Nuclear Sciences, Belgrade, Serbia*

**PROCEEDINGS**

# 6<sup>th</sup> WORKSHOP: SPECIFIC METHODS FOR FOOD SAFETY AND QUALITY

September 27<sup>th</sup>, 2018, Belgrade, Serbia

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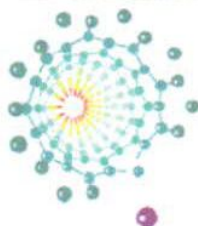


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## LACTOSE AND D-GALACTOSE CONTENT IN INFANT FORMULAS AND MOTHER'S MILK

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### ABSTRACT

Lactose and D-galactose are energy-providing macronutrient found in the mother's milk, but their concentration can be affected by different factors related to mother. The aim of this work was to determine lactose and D-galactose content in infant formulas produced in Serbia and mother's milk. The obtained results indicated that lactose and D-galactose content of mother's milk were similar to mother's milk in other countries, and results of infant formulas were in accordance to declared values and nutritive requirements.

### INTRODUCTION

Human milk is the best food for babies and a gold standard in infant nutrition [1]. Its composition is variable, but it contains all nutrients to satisfy baby's need for macro and micronutrients. The carbohydrate fraction of human milk is composed of lactose (90-95%) and oligosaccharides (5-10%). Lactose is a main source of energy of mother's milk, and its concentration increase during lactation time, from colostrum to mature milk (55 g/L to 70 g/L in mature milk) [1]. D-galactose has crucial role in energy production and metabolism, and is structural element in complex molecules. The galactosylation of complex molecules is important for early human development. D-galactose has an important role in maintaining a healthy gastrointestinal tract [2].

While mother's milk is the recommended feeding for all infants, including preterm infants, its variable composition makes estimating nutrients intake difficult. Lactose and D-galactose are energy-providing nutrient found in breast milk, but their concentration can be affected by different factors related to mother body mass index (BMI), duration of

lactation [3]. The premature infant population is very heterogeneous with differing nutrient needs based on the stage of prematurity. Milk from women who deliver prematurely differs from that of women who deliver at term, and it is caused by a variety of reasons including early interruption of pregnancy and variable hormonal profile [4]. When mother cannot breastfeed, infant formula is specially designed to fulfill babies all nutritive requirements [5].

The aim of this work was to determine lactose and D-galactose content of infant formula and mother's milk.

## EXPERIMENTAL

*Collections of milk samples.* Mother's milk (MM) samples were collected as a pool sample from 10 healthy women in the 9<sup>th</sup> week of lactation, after uncomplicated delivery. Mother's milk samples from women after preterm delivery (PMM) were collected from 10 healthy women in the 3<sup>rd</sup> week of lactation. Samples were kept frozen at -20 °C until analysis. The study protocol was approved by the Research Ethics Board of the Institute for Neonatology.

Three different infant formulas supplemented with prebiotics (IF) (produced in Serbia) were used: IF 1 - the milk formula for the nourishment of younger age infants, IF 2 - follow on milk for infants from 6 to 12 months, IF 3 - milk for young children after 12 months. Additionally, two special infant formulas were tested: IF PRE - special formula for preterm and low weight infants (fulfill the heightened nutritional requirements of premature infants) and IF FL - special lactose free milk formula (for nutrition of infants and young children suffering from lactose intolerance and diarrhea).

Spectrophotometric measurements of lactose and D-galactose content.

Lactose and D-galactose content were determined according to Megazyme, Ireland (K-LACGAR), performed according to the guidelines supplied by the producer. Products of the reactions were monitored using spectrophotometer (Shimadzu UV-1280) at 340 nm. The results are presented as mean  $\pm$  standard error. Results were tested by one-way analysis of variance. Differences were considered statistically significant at  $p < 0.05$ .

## RESULTS AND DISCUSSION

Results for lactose and D-galactose content of mother's milk and infant formulas are presented in Table 1. Lactose content of PMM samples was significantly lower than of MM samples ( $p < 0.05$ ). These results are in accordance with compositional differences between preterm and term mother's milk [4].

Lactose and D-galactose content of infant formulas IF 1 and IF 2 are comparative with mature mother's milk in first 12 month of age, while IF 3 is significantly different ( $p < 0.05$ ) in accordance with nutritional recommendations for young children. Infant formula IF PRE has lactose and D-galactose contents comparative to PMM ( $p > 0.05$ ) which is in accordance with physiological and nutritional requirements for preterm infants. This formula can only be used under neonatologist recommendation, and usage depends on maturity and weight of newborn.

**Table 1.** Lactose and D-galactose content in infant formulas and mother's milk.

Sample	Lactose (g/100 ml)	D-galactose (g/100 ml)
MM	6.99±0.23	0.0028±0.0002
PMM	6.11±0.45	0.0014±0.0001
IF 1	6.96±0.05	0.0046±0.0002
IF 2	6.71±0.07	0.0031±0.0001
IF 3	6.47±0.06	0.0034±0.0002
IF PRE	6.33±0.08	0.0070±0.0002
IF FL	0.01±0.01	0.9370±0.0003

IF FL has lower lactose content and higher D-galactose content compared with other tested infant formulas and mother's milk samples. These results are expected since it is a special milk formula for nutrition of infants and young children suffering from lactose intolerance and diarrhea.

Our results for MM are similar to data obtained from another recent research done in Latvia [7]. Broka et al. determined lactose content in milk samples collected from day 11<sup>th</sup> to 28<sup>th</sup> of lactation, including transitional milk (7 to 21 days post partum). Our research only included samples of mature mother's milk (at least 21 days postpartum). Our results for lactose content of MM are also similar to data obtained from other countries (from 6.14 to 7.75%) [8].



## CONCLUSION

The aim of our work was to determine lactose and D-galactose content of infant formula and mother's milk. Results showed that determined lactose and D-galactose contents in human milk are in accordance to data obtained from other studies. Besides that, obtained results showed that infant formulas produced in Serbia are in accordance to declared values, and can be used to fulfill adequate nutrition for infants and children.

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