

*Short Communication*

## Characteristics of Human Breast Milk Based on Infant's Gender

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**Abstract:** Human milk is a complex fluid, which contains a number of constituents such as fats, proteins and vitamins, in addition to other compounds. These nutrients are needed for infant protection against infections and diseases. This study was undertaken to evaluate some physicochemical properties and biochemical constituents content of human milk samples (based on the gender of the breast feeding infant). This includes acidity, density and viscosity, as well as lactose, protein, calcium and magnesium contents. Results showed that the highest value of viscosity as well as the highest percentages of protein and acidity were recorded for human breast milk for a boy (2.212 cP, 1.237% and 0.02% respectively) while close values for density and other biochemical contents were recorded for both types of samples. However, only the change in viscosity was found to be significant ( $p < 0.05$ ). Variations in some properties of human milk depending on the infant's sex could be of benefit for developing infant formula taking infant's gender into consideration.

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### INTRODUCTION

Milk is needed for its basic nutrients by all mammals including human beings. It is a fluid that looks homogenous, while it is, in fact, a complex combination of vitamins, fats, carbohydrates and other compounds. Human breast milk is also an important source of a number of constituents, which may vary between individual mothers and different populations (Prentice and Paul, 2000). It is composed of micronutrients, macronutrients and immunological components, which are needed for the infant health and growth (Goldman and Goldblum, 1995; Friel et al, 2002; WHO, 2003).

A significant amount of research has been done on human milk in general. However, and up to the knowledge of the authors, reports on human breast milk based on infant's gender are still rare in literature. The objective of this work, therefore, is to determine if there are any differences in the biochemical constituents and physicochemical properties of the human breast milk according to the gender of the breast feeding infant.

### MATERIALS AND METHODS

This study was conducted in the city of Sabratha, north-western region of Libya. For the purpose of this study, human milk was collected from healthy breastfeeding volunteer mothers, aged between 28 and 40 years, after two months of delivery. All samples were collected in the morning hours before

the babies were fed. The human milk was collected to study its physiochemical properties based on whether the mother's baby is a boy or girl. All samples were collected between December 2017 and February 2018 and were kept in a refrigerator for analysis.

Density was determined using a Pycnometer while viscosity was recorded using Ostwald viscometer. Acidity was measured by the titration method and expressed as percentage lactic acid. Total nitrogen was determined using the Kjeldahl procedure. The percentage of protein in milk samples was determined using spectrophotometer (DR 1900\_HACH) Lange system. Lactose content was determined by titration with Fehling's solutions (A and B) method. Calcium and magnesium contents were determined by the complexometric titration method (EDTA-2Na).

**Statistical analysis:** Data analysis was performed using statistical package for social sciences (SPSS, version 14.0; Chicago, IL). All values are expressed as mean  $\pm$  SD.

### RESULTS AND DISCUSSION

Table 1 shows various physicochemical parameters and biochemical constituents content of the human breast milk samples. Higher value of viscosity and higher percentage of acidity were recorded for human breast milk for a male (2.212 cP and 0.02%

respectively) while close values of density were shown by both types of samples. Also, higher percentage of protein was found in human breast milk for a boy (1.237%). Other biochemical constituents showed close contents for both breast milk samples. However, only change in viscosity was found to be significant ( $p < 0.05$ ).

It has been demonstrated that human mothers make different milk depending upon whether the mother's baby is a boy or girl. For example, it was reported that mothers with sons provided milk with more energy (Powe et al, 2010) and fats (Thakkar et al, 2013) than those with daughters. In our previous study (Musallam et al, 2017), we reported that mothers with boys produced breast milk with higher value of viscosity and higher contents of protein and lactose than mothers with daughters. Also, Dafaallah et al (2018) reported that male infants received significantly higher lipids and calcium contents compared with female infants, but failed to find any significant differences in amino acids content relative to infant sex. However, in another study conducted by Quinn (2013), no evidence was found related to infant sex with respect to fat, protein, and total energy contents

## CONCLUSION

This study has shown that some physicochemical properties and biochemical contents of human breast milk vary depending on the gender sex. Higher value of viscosity and higher percentages of protein and acidity were recorded for human breast milk for a boy while close values for density and other biochemical contents were observed for both types of milk samples. However, only the change in viscosity was found to be significant ( $p < 0.05$ ). Observations presented in this study are a good indication that human breast milk could vary depending on baby's gender. The authors suggest the conduction of further intensive studies with large samples to investigate the variations in the human breast milk constituents as well as its physical and chemical properties based on infant's sex. If such variations are proved, this could help in developing baby formula according to baby's sex.

## Conflict of interest

The authors declare that there is no conflict of interests relevant to this paper.

**Table1. Physicochemical properties and biochemical contents of human breast milk of males and females.**

Physicochemical properties and biochemical contents	Male infants (mean value± SD)	Female infants (mean value± SD)	p- value
Density (g/cm <sup>3</sup> )	1.024±0.003	1.026±0.004	0.220674
Viscosity (cP)	2.212±0.467	1.574±0.212	0.018246*
Acidity (%)	0.02±0.05	0.01±0.04	0.197373
Lactose % (g/100 ml)	5.279±1.016	5.315±0.687	0.474745
Protein % (g/100 ml)	1.237±0.806	1.050±0.636	0.270683
Calcium (%)	0.031±0.017	0.024±0.005	0.232881
Magnesium (%)	0.005±0.001	0.003±0.002	0.120991

\* Significant

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