

Co Authors: Sharon Perrella, Ching Tat Lai, Donna Geddes (University of Western Australia School of Molecular Sciences)

**Background:** Nipple shields (NS) are used to improve breastfeeding comfort but may inhibit milk removal. Assessment of the effect of NS use on milk removal can be confounded by the infant's sucking characteristics. We designed a mechanistic study to determine the effect of NS use on milk removal during use of an electric breast pump, enabling the control and replication of vacuum strength, pattern and duration across multiple study sessions.

**Objective:** To determine whether NS use and size impact milk removal during pumping.

**Methods:** Control Group (CG) mothers without feeding difficulties; Pain Group (PG) mothers using a NS for pain. 3 randomized visits: pumping without a NS; pumping with 2 different NS sizes. Mothers expressed for 15 min. 24hr milk production, milk samples, expressed milk volumes and PAMRs were measured.

**Results:** 24hr milk production volumes were similar between CG (n=19): 770–190mL (584 to 1122mL) and PG (n=7): 768–279mL (244 to 1147mL, p=0.84). Fitted and small NS were associated with reductions in volume of 35mL and 43mL, and PAMR 29% and 30% respectively for CG only (p=0.01 and p=0.004; p=0.002 and p=0.003 respectively).

**Conclusions:** NS use in mothers without pain may reduce milk removal. Accurate NS sizing is imperative.

**Funding:** Medela AG and Science Without Borders Program.

#### P-71. RHEOLOGICAL BEHAVIOR OF HUMAN MILK

Presenting Author: Diana Alatalo, The University of Texas at Dallas Department of Mechanical Engineering

Co Authors: Fatemeh Hassanipour

**Background:** This study investigates the flow properties of human milk from an engineering point of view. Recent studies of human milk flow within the breast ductal system assumed Newtonian behavior meaning the viscosity (response to shear stress) of milk is constant under environmental conditions. However, milk experiences large variations of shear rates ( $7\ 90,000 + s^{-1}$ ) in the breast ductal system.

**Objective/Hypothesis:** Milk is derived from blood, and therefore it should exhibit the same flow behavior as blood which is shear-thinning with a yield and flow point. This study aims to determine the flow behavior (rheological properties) of raw human milk.

**Methods:** Fifteen milk samples from 8 lactating women were tested for viscosity at 37°C using rotational shear sweep ( $0.01\ 100\ s^{-1}$ ). Six samples were tested for complex shear modulus using oscillatory shear strain logarithmic ramp from  $0.01\ 1000\%$  at constant angular frequency  $5\ s^{-1}$ .

**Results:** Viscosity is inversely related to shear rate which confirms milk, like blood, is shear-thinning. The complex shear modulus defines milk as a viscoelastic solid with both yield and flow points similar to blood.

**Conclusions:** Raising the shear rate in breast ducts, as occurs during suckling, positively impacts flow by decreasing viscosity. Further study is planned.

**Funding:** National Science Foundation Graduate Research Fellowship Program under Grant No. 1746053, National Science Foundation under Grant No. 1454334 and 1707063, and Eugene McDermott Graduate Fellowship.

#### P-72. EX-VIVO PLACENTAL TRANSFER OF 2-FUCOSYLLACTOSE

Presenting Author: Evelyn Jantscher-Krenn, Medical University Graz Department of Obstetrics and Gynecology

Co Authors: Birgit Hirschmugl, Christian Wadsack (Medical University Graz Department of Obstetrics and Gynecology)

**Background:** Recently, we found that Human Milk Oligosaccharides (HMOs) are not only present in maternal serum during pregnancy, but also in cord blood. Maternal concentrations of Secretor status dependent HMOs, such as 2'Fucosyllactose (2'FL) increase during pregnancy and are correlated with concentrations in cord blood, suggesting maternal origin and transfer of HMOs across the placental barrier.

**Objective/Hypothesis:** This study aimed to investigate maternal to fetal 2'FL transport across the human placenta using an ex-vivo placental perfusion method.

**Methods:** As a pilot study, placentas were obtained from C-sections of uncomplicated term pregnancies (n=2). After a washout phase (1h), isolated cotyledons were perfused with 2'FL (51g/ml) in the maternal reservoir in a double closed setting for 180 mins. Samples were taken from the maternal and fetal circulation at 15 mins, 30 min, followed by 30 min steps. 2'FL concentrations were determined in maternal and fetal samples by HPLC with fluorescence detection.

**Results:** Time dependent 2'FL transfer from maternal to fetal circulation was observed. 2'FL was already detectable in fetal vein within 15 min of perfusion, and mean concentration increased from 0.37 1g/ml to 1.1 1g/ml (7 % and 22 % of the offered 2'FL concentration, respectively) without reaching equilibrium after 180 min. 2'FL was not detectable in samples taken after the initial washout phase as well as from the fetal reservoir at the start of perfusion.

**Conclusions:** Our results suggest that the placenta transfers 2'FL from the maternal to the fetal circuit. Future studies will investigate potential differences in the transfer of individual HMOs and whether this transport might be altered in pregnancy disorders implicating placental or fetal development.

**Funding:** This project was supported by OeNB (#16927) and BioTechMed-Graz, Graz, Austria.

#### P-73. HUMAN MILK OLIGOSACCHARIDE ISOMERS DIFFERENTIALLY INFLUENCE BIFIDOBACTERIAL PHYSIOLOGY WITHIN A MODELED INFANT GUT MICROBIOME

Presenting Author: Ezgi Özcan, University of Massachusetts Amherst Department of Food Science

Co Author: David A. Sela, University of Massachusetts Amherst Department of Food Science, Department of Microbiology, University of Massachusetts Medical School Department of Microbiology & Physiological Systems.