www.jpnim.com Open Access eISSN: 2281-0692
Journal of Pediatric and Neonatal Individualized Medicine 2017;6(2):e060238
doi: 10.7363/060238
Published online: 2017 Oct 31

Abstracts

Selected Abstracts of the 2nd Congress of joint European Neonatal Societies (jENS 2017) · Session "Neonatal Fetal Nutrition and Metabolism"

VENICE (ITALY) · OCTOBER 31ST-NOVEMBER 4TH 2017

58th ESPR Annual Meeting, 7th International Congress of UENPS, 3rd International Congress of EFCNI

ORGANIZING INSTITUTIONS

European Society for Paediatric Research (ESPR), European Society for Neonatology (ESN), Union of European Neonatal & Perinatal Societies (UENPS), European Foundation for the Care of Newborn Infants (EFCNI)

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Organizing secretariat

HOW TO CITE

[Abstract's authors]. [Abstract's title]. In: Selected Abstracts of the 2nd Congress of joint European Neonatal Societies (jENS 2017); Venice (Italy); October 31-November 4, 2017; Session "Neonatal Fetal Nutrition and Metabolism". J Pediatr Neonat Individual Med. 2017;6(2):e060238. doi: 10.7363/060238.

ABS 1

PREVALENCE OF BREASTFEEDING AT 6 MONTHS IN SICK NEONATES

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INTRODUCTION

Breast milk is the best medicine for sick neonates. The use of breast milk for sick neonates especially for preterm infants has decreased rates of infection, length of hospital stays, increased gut motility and improved neurodevelopmental outcomes. Mothers of sick neonates face many problems in breastfeeding e.g. physical separation, emotional stress, immaturity of infants. Currently, there are not many studies focusing on prevalence and factors associated with the continuation of breastfeeding in this population.

METHODS

This is a cross sectional study. Enrolled mothers and their sick neonates, hospitalized in the sick newborn unit at Thammasat University Hospital, between August 2015 and July 2016. Baseline characteristics were recorded. Mothers' knowledge and perceptions were assessed by validated questionnaire. Telephone interview was performed at the 2nd, 4th and 6th month focusing on breastfeeding practices and reasons for discontinuation of breastfeeding. Data were presented in mean and SD. Clinical factors affecting breastfeeding practices were analysed using odds ratio, exact probability test and Wilcoxon rank sum test.

RESULTS

There were 100 mothers enrolled in this study. Telephone interviews were completed in 87 mothers. The percentage of infants who still received breast milk feeding was 57%, 34% were exclusively breastfed (**Fig. 1**). Factors affecting breastfeeding practices at 6 months are mother as primary caregiver (OR 3.43, 95% CI 1.26-9.63), high family income (OR 3.1, 95% CI 1.05-9.88), and perceptions of knowledge and barriers

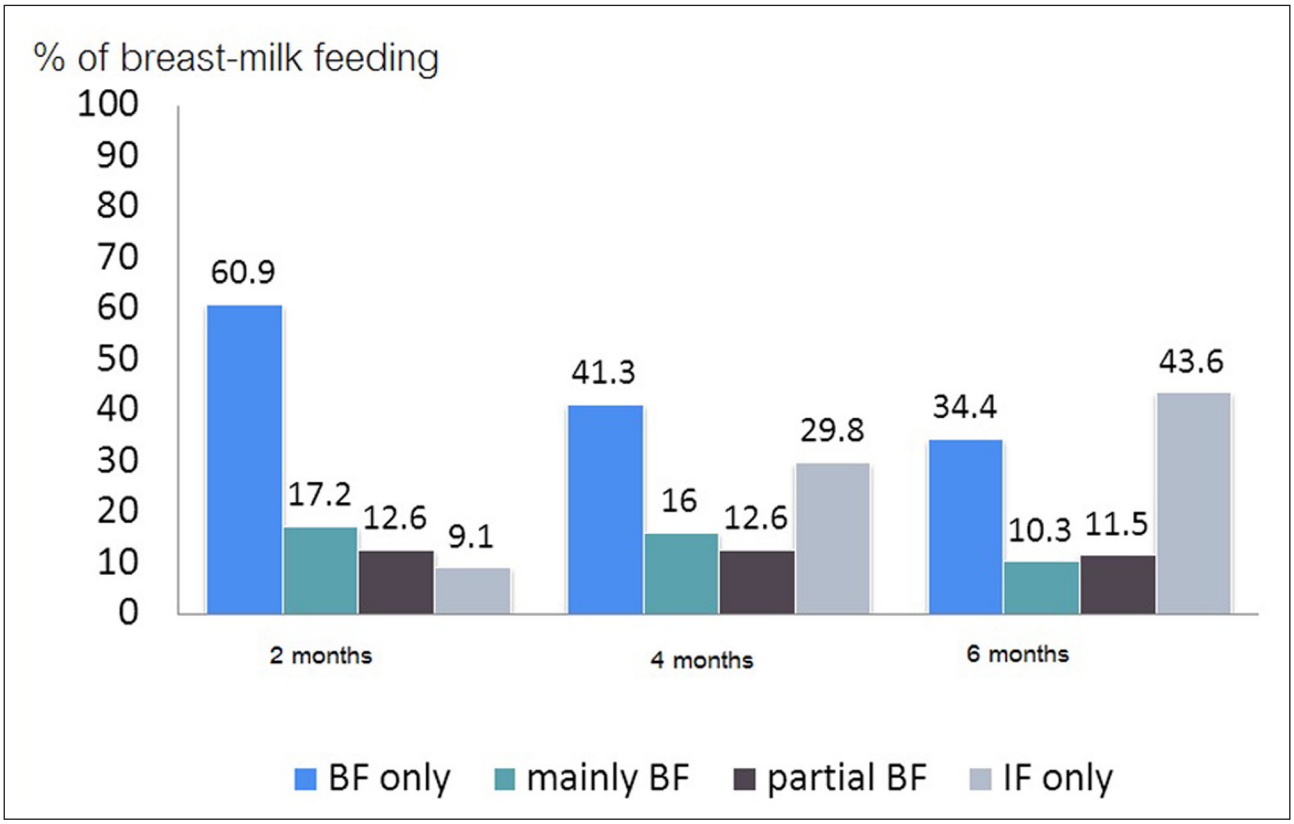

Figure 1 (ABS 1). Breastfeeding practices in the 2nd, 4th and 6th month of life.

regarding breast milk feeding ($p < 0.05$). Mode of delivery (cesarean section), maternal age, maternal education, gestational age, intention to continue breastfeeding and mainly breastfeeding more than 50% before discharge were not statistically different.

CONCLUSIONS

Mother as primary caregiver, high family income and perception of the mother were the significant factors associated with continuation of breastfeeding until 6 months of age. Therefore, targeted interventions to improve maternal perceptions during hospital stay may improve breastfeeding practices in sick neonates and support the continuation of breastfeeding in to the 6th month.

ABS 2

ROLE OF BREAST MILK AND FECAL MICROBIAL CONTENT IN DEVELOPMENT OF BREAST MILK JAUNDICE

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INTRODUCTION

Breast milk jaundice (BMJ) is the most common cause of prolonged jaundice and is seen in 2-15% of all newborns. Many theories regarding its etiology have been formed but the exact mechanisms have not been elucidated. Being a condition, which currently does not have any specific treatment, BMJ continues to be a source of anxiety for parents and pediatricians. Recent studies have suggested that breast milk microbial content and subsequent neonatal intestinal flora may play a role in development of jaundice. Aim of this study is to investigate the role of breast milk and fecal microbial content in development of BMJ.

METHODS

This study was designed randomised and prospectively enrolling term and near term babies who applied to our neonatal outpatient clinic with prolonged jaundice and eventually diagnosed as BMJ. A total of 112 babies (consisting of 77 BMJ patients and 35 healthy babies) were enrolled. Maternal and neonatal demographics, mode of feeding and delivery were recorded. Thirty-seven of BMJ patients received probiotic supplementation for a week. Quantitative DNA of *L. rhamnosus*, *L. gasseri*, *L. plantarum*, *B. longum*, *B. bifidum* and *B. adolescentis* species was measured by real-time PCR in breast milk and fecal samples of all cases. Breast milk and fecal microbial content and their relations to bilirubin levels were compared between groups.

RESULTS

Fecal *B. longum* and *B. Bifidum* content of vaginally delivered babies were significantly higher than babies delivered by caesarian section (p 0.05). BMJ patients had significantly lower amounts *L. rhamnosus*, *L. gasseri*, *L. plantarum*, *B. longum* and *B. bifidum* in breast milk and significantly lower amounts of *L. gasseri*, *L. plantarum* and *B. bifidum* in fecal samples compared to controls ($p < 0.05$).

CONCLUSIONS

Evidence suggesting that breast milk and fecal probiotic bacteria content has a role in development of BMJ is increasing. The facts that BMJ patients has lower breast milk and fecal bacteria and probiotic supplementation has a reducing effect on bilirubin levels and duration of jaundice suggest that probiotics might be a treatment option for BMJ.

ABS 3

VARIABILITY IN THE PROTEIN AND FAT CONTENT OF THE DONOR HUMAN MILK SUPPLY REVEALED BY MID-INFRARED SPECTROMETER ANALYSIS: A FIRST STEP TOWARDS PREVENTING DISRUPTION OF "PERINATAL PROGRAMMING"

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INTRODUCTION

The premature babies, to improve their development, need fortified human milk (HM) (owns mother milk or donor milk). Standardized enrichment does not always reach the values recommended because of the high variability of the nutritional composition of every HM. The use of an analyzer of HM allows an enrichment à la carte, but all recognize that the important cost of the device and the investment in time and in staff do not allow the generalization of this practice. Objective: in our study we looked for a correlation between the volume of milk pumped by the mothers by day and the protein, lipids and sodium content of their milk which would allow an à la carte accessible adjustment to all. A correlation was also looked for different variable and produced volume

of milk (maternal age, term, weight of the baby, the notion of previous breast-feeding, smoking).

METHODS

We analyzed 103 samples of milk (resulting from 40 mothers), which were collected in the Regional Milk bank of Paris from January till May 2014. The dosage of proteins and lipids was made by means of the analyzer MIRIS AB the principle of the analysis of which is the spectroscopy infrared way. The sodium analyses were mad by spectrophotometry.

RESULTS

More the volume of HM is important more the content in protein is low with a maximum of significance beyond the eighth day. More the volume of milk produced is important more the content in lipid decrease and same result was obtain for sodium. We did not find relation with maternal age, mode of childbirth, parity, notion of the previous feeding, age of lactation or smoking.

CONCLUSIONS

We were able to notice the extreme variability HM supply daily even in same optimal conditions of collection. The extreme variability of the nutritional quality of the milk prevailing on lipids then proteins recently described by other team is confirmed by our work. Our results show a significant tendency to the decrease of the protein, lipids and sodium content of HM when the volume of milk produced increases, but our sampling does not allow determining a conversion factor volume product/content in proteins nor lipids.

ABS 4

BOVINE COLOSTRUM FOR PRETERM INFANTS IN THE FIRST DAYS OF LIFE: A RANDOMIZED CONTROLLED PILOT TRIAL

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INTRODUCTION

Maternal milk (MM) is the best nutrition for newborn preterm infants, but is often limited in supply just after birth. Human donor milk (DM) and especially preterm infant formula (IF) are less optimal. Bovine colostrum (BC) is a rich source of protein and bioactive components and has beneficial effects in preterm piglets compared to DM and IF. However, BC has never been used as the first feeding for preterm infants. The aim of this study was to investigate feasibility, initial safety and potential benefits of using BC as a supplement to MM instead of DM or IF in preterm infants during the first days of life.

METHODS

In an open-label, randomized, parallel, controlled pilot, safety trial in three neonatal intensive care units, we included infants before 24 h of age with gestational ages (GA) of 27^{+0}-32^{+6} weeks (Copenhagen, Denmark) or birth weight of 1,000-1,800 g (Foshan and Shenzen, China) after parental consent. Exclusion criteria were major congenital anomalies or infections, perinatal asphyxia, extremely small for GA, and invasive mechanical ventilation or cardiovascular support before inclusion. Forty infants were to be randomly allocated in a 1:1 ratio to BC or DM in Denmark, and to BC or IF in China. If MM was limited or lacking, BC, DM or IF was given instead according to local feeding guidelines during the first 14 days of life, and the infants were followed until 37 weeks GA or discharge.

RESULTS

In Denmark, nine infants were allocated to BC and eleven to DM (GA 30.3 ± 0.6 and 29.5 ± 0.6 weeks, respectively). In China, 10 infants were allocated to BC and 10 to IF (GA 31.2 ± 0.4 and 30.9 ± 0.3 weeks, respectively). Infants fed BC showed no signs of increased feeding intolerance or gastric residual volumes and did not suffer from any clinical adverse events (defined in the protocol as surgical necrotizing enterocolitis and death). The infants supplemented with BC received more enteral protein ($p < 0.05$) than infants receiving DM or IF (**Fig. 1**). In China, the infants fed BC tended to reach full enteral feeding at 150 ml/kg/d earlier than infants fed IF (median 19 d versus 27 d, $p = 0.04$, per protocol analysis without correction for multiple outcomes). Eight infants in the BC group showed a temporary elevation in plasma

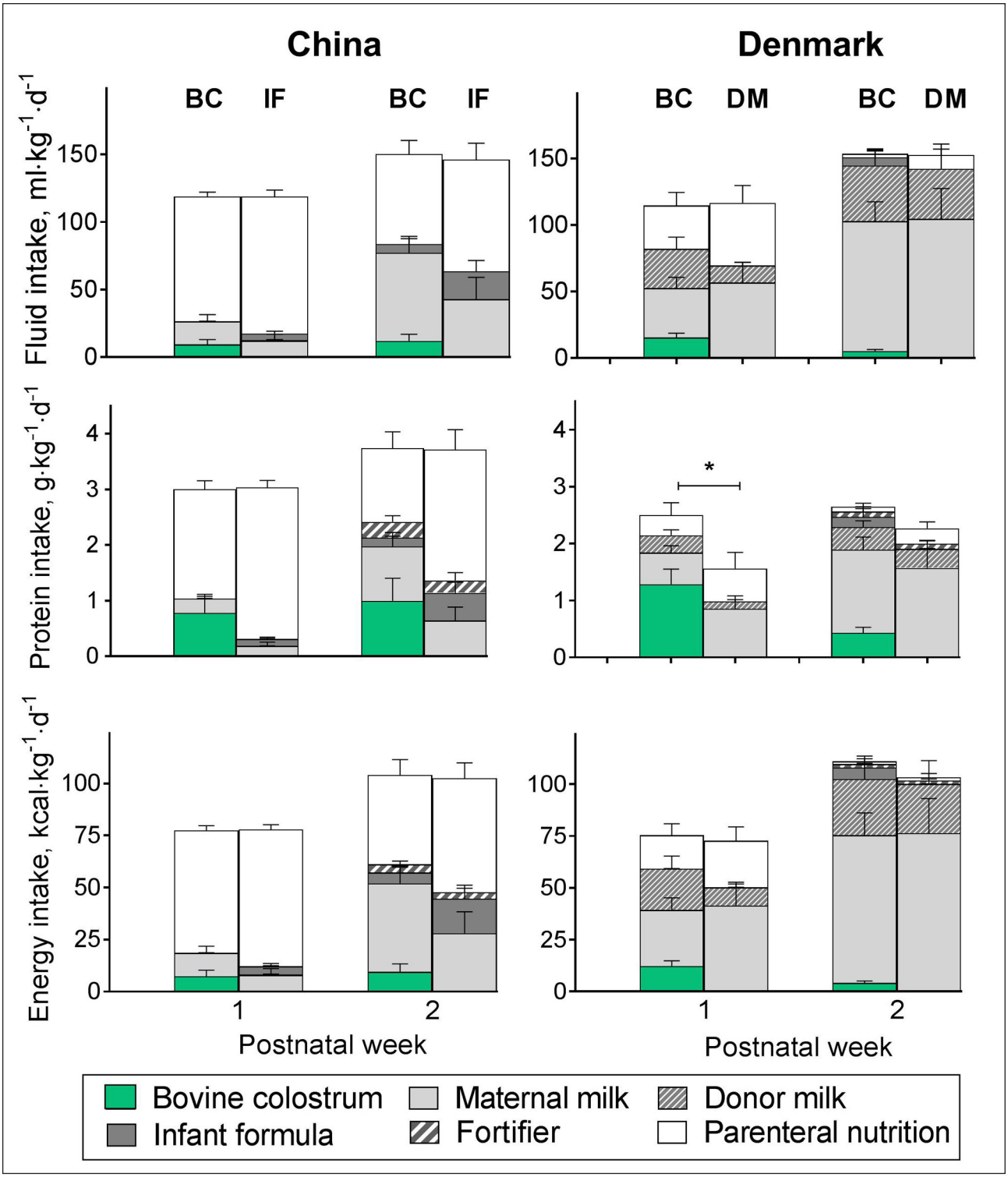

Figure 1 (ABS 4). Energy intake, protein intake, and fluid intake with different types of nutrition.

tyrosine on day seven, versus two infants in the DM/IF groups.

CONCLUSIONS

The results of this pilot study indicated that it was feasible and safe to use BC as a supplement to MM during the first days of life in very preterm infants. Plasma tyrosine levels may be a marker for excessive protein intake. A larger randomized controlled trial is now planned in China (ClinicalTrials.gov Identifier: NCT03085277) to further investigate whether supplementation with BC versus IF will reduce the time to full enteral feeds in very preterm infants.

DECLARATION OF INTEREST

BC was donated by Biofiber Damino, Gesten, Denmark. The University of Copenhagen holds a patent on the use of bovine colostrum for pediatric

patients. Per Sangild is listed as sole inventor but has declined any share of potential revenue arising from commercial exploitation of such a patent. All other authors have no conflicts of interest.

ABS 5

PROTEIN AND CALORIC DEFICIT DURING THE NEONATAL PERIOD IN INFANTS WITH BIRTH WEIGHT LESS THAN 1,500 G AND ITS ASSOCIATION WITH BLOOD PRESSURE IN THE ADOLESCENCE

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INTRODUCTION

Infants with birth weight less than 1,500 g (VLBW) frequently present postnatal malnutrition at hospital discharge. This phenomenon is associated with short- and long-term adverse outcome. Its association with high arterial tension levels in the adolescence has not been reported. Objective: to evaluate the association between higher than 75% percentile systolic (SBP) and diastolic blood pressure (DBP) in adolescents with VLBW at birth and their nutritional deficits during the first 28 days of life.

METHODS

Prospective cohort. VLBW patients enrolled in a follow-up program that in the neonatal period received an intensive early nutritional support and in whom the nutritional deficits were prospectively recorded.

RESULTS

137 patients were followed-up. Pc 75th was 113 mmHg for SBP and 63 mmHg for DBP. **Tab. 1** shows the characteristics of subjects with or without SBP and DBP above 75th percentile respectively. In a multivariate analysis protein deficit and BMI persisted significant for high SBP. Neonatal caloric deficit was associated with higher DBP. For each gram of neonatal protein deficit the probability that SBP were above the 75th percentile at the adolescence increased 5% (95% CI 0.5-8). For each point of BMI increase at adolescence, the probability of SBP above the 75th percentile increased by 37% (95% CI: 15-64). For each 100 Kcal deficit during the neonatal period there was a 3% increase in the risk of presenting DBP above 75th percentile (95% CI: 1-5), also for each point of higher BMI the probability of DBP above 75th percentile increased by 17% (95% CI: 2-34).

CONCLUSIONS

Systolic blood pressure higher than 75th percentile was associated in our population with increased protein deficit during the neonatal period and higher BMI after the second year of life.

Higher diastolic blood pressure in the adolescence was associated with caloric deficit in the neonatal period and BMI after the third year of life. In this population there was not an association between blood pressure levels above 75th percentile and low birth weight for gestational age, birth weight or Z-score for body weight at time of discharge from hospital.

ABS 6

EFFECTS OF EXCLUSIVE DONOR HUMAN MILK FEEDING IN A SHORT PERIOD AFTER BIRTH ON MORBIDITY AND GROWTH OF PRETERM INFANTS DURING HOSPITALIZATION

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Table 1 (ABS 5). Characteristics of subjects with or without SBP and DBP above 75th percentile, respectively.

	SBP > 75th Pc n = 36	SBP < 75th Pc n = 101	p	DBP > 75th Pc n = 39	DBP < 75th Pc n = 98	p
BW, g (r)	1,310 (780-1,700)	1,240 (620-1,790)	ns	1,260 (620-1,500)	1,260 (750-1,490)	ns
GA, weeks (r)	30 (27-34)	30 (24-36)	ns	30 (26-35)	30 (24-36)	ns
Male gender, n (%)	20 (55)	46 (46)	ns	21 (53)	45 (46)	ns
BW Z-score, median (r)	-0.25 (-2.2/1.6)	-0.68 (-3.5/2.2)	ns	-1 (-3.48/2)	- 0.6 (-3.6/2.2)	ns
Caloric deficit Kcal, median (r)	-530 (-1,248/6.6)	-344 (-1,200/1,039)	ns	-613 (-1,248/-102)	-338 (-1,200/1,039)	0.003
Protein deficit, g, median (r)	-21 (-43/3.66)	-13 (-52/46)	0.044	-20.7 (-44/3.7)	-13.7 (- 52/43)	ns
Age at evaluation, years	12 (10-14)	11 (9-14)	0.01	12 (10-14)	11 (9-14)	ns
Z-score at evaluation, median (r)	1.4 (-2.17/5.1)	0.42 (-2.5/3.9)	0.001	0,95 (-2.5/4.6)	0.5 (-2.2/5.1)	ns
BMI, median (r)	22 (15 - 34)	18 (13-26)	0.001	21 (12-34)	18.7 (14 -29)	0.02

INTRODUCTION

Although donor human milk (DHM) is considered the first alternative when a mother's own milk is not sufficiently available, concerns have been raised about its adequacy in providing the necessary nutritional and immunological components of breast milk. It has been demonstrated that DHM may retain some of the non-nutritional benefits of the breast milk, even after pasteurization. However, the risks and benefits of feeding preterm formula (PF) versus DHM in preterm infants are uncertain. The aim of this study was to determine and compare the outcome of short-term morbidity and growth between premature infants fed exclusively DHM and infants fed with a PF mix after birth.

METHODS

The data of 112 infants with low birth weight of < 1,500 g and gestational ages < 32 weeks, who were admitted to the neonatal intensive care unit (NICU) of the Kyung-Hee University Hospital at Gangdong, between January 2011 and December 2015, were retrospectively reviewed. Eighty-two infants were analyzed, of which 78 were discharged alive. However, in the course of the study 1 infant was transferred to another hospital and remaining 3 died in the NICU. The infants were placed in categories, based on the type of feed administered. The DHM group was made up of infants who were fed exclusively with DHM, whilst the PF group consisted infants who were fed with a combination of PF and either DHM or HM, until a volume of 130 mL/kg/d of enteral feeding was achieved. Once feeding in the DHM group progressed to volumes greater than 130 ml/kg/d, infants were fed fortified DHM and PF alternately.

RESULTS

We evaluated 82 infants, categorized into two groups: DHM (n = 28) and PF (n = 54). The DHM group was more likely to have short duration of ventilator care and central venous catheter, as well as a lower incidence of bronchopulmonary dysplasia, late onset sepsis (LOS), LOS/necrotizing enterocolitis, and shorter length of stay in hospital, than the PF group. The DHM group was also more likely to shorter duration of age, at which a daily intake of 50 to 130 mL/kg/d was achieved. Although the DHM group demonstrated a comparatively lower rate of weight gain (8.8 ± 8.4 vs. 16.3 ± 4.9 g/kg per day, p < 0.001), head circumference increment (0.2 ± 0.4 vs. 0.6 ± 0.5 cm/kg per week, p = 0.001), and length increment (0.4 ± 0.5 vs. 1.0 ± 0.3 cm/kg per week, p < 0.001) from birth to the age at which an enteral feeding volume of was achieved 130 mL/kg/d, there were no significant differences in these values at 36 weeks' postmenstrual age (PMA) between both groups.

CONCLUSIONS

Exclusive DHM feeding for a short period after birth grants protection from several morbidities in very low birth weight infants, and successful catch-up growth at 36 weeks' PMA, following high-calorie nutritional support.

ABS 7

IMPROVED NUTRITION FOR EXTREMELY PRETERM INFANTS – A POPULATION BASED OBSERVATIONAL STUDY

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INTRODUCTION

Extremely preterm (EPT) infants are at high risk for malnutrition due to immaturity and medical complications. They often accumulate nutritional deficits and experience growth faltering during treatment at the neonatal intensive care unit (NICU). Enhanced intake of energy and protein during the first weeks of life promotes weight gain and head circumference growth. However, the optimal nutritional strategy for these infants' health and long-term development remains unclear. The aim of this study was to evaluate changes in nutritional intake over time during the first 56 postnatal days in EPT (< 27 gestational weeks) infants, who were treated in NICUs during 2004-2011 in Stockholm, Sweden.

METHODS

Several different nutritional interventions were implemented over an 8-year period. Detailed nutritional data for all years were obtained retrospectively from hospital records. Intake of all nutritional parenteral and enteral fluids including

protein, fat, carbohydrates, and supplements of micronutrients as well as analysed mothers' own milk (MOM) and donor human milk (DHM), and type of human milk fortifiers were used to calculate daily nutritional intakes, during the first 28 postnatal days and thereafter once a week until postnatal day 56. Target fortification based on analysed MOM, and DHM was used throughout the study period. Infants who survived > 24 hours after birth, born before 27 weeks of gestational age (n = 329) were included in this population-based study.

RESULTS

The intakes of energy and protein during postnatal days 0-6 increased significantly over the eight years studied and protein intake increased during all 56 postnatal days. Median energy intake increased from 77 kcal/kg/d during the 2004-2005 period to 98 kcal/kg/d during the 2010-2011 period on days 4-6. Median protein intake increased from 2.4 g/kg/d during 2004-2005 to 3.6 g/kg/d during 2010-2011. Median fat intake increased over every 2-year period during days 0-3, and during days 4-6 over the first 4 years. During 2004-2011, there was no consistent time trend, regarding advancement of enteral feeds. Full enteral feeds were reached earlier and the proportion of enteral feeds during the first week was higher during 2008-2009 compared to all other years. A significant improvement in growth was primarily noted by comparing the 2004-2005 periods to subsequent years.

CONCLUSIONS

There has been a significant improvement in neonatal nutrition and growth in Stockholm during the study period, coinciding with an introduction of a nutritional bundle of care. Above all, parenteral nutrition was initiated more promptly during the first week and was provided at higher quantities. However, many of the EPT infants born during the later years still did not reach the recommended macronutrient intake levels.

ABS 8

POSITIVE RELATIONSHIP BETWEEN TRANSTHYRETIN AND INSULIN-LIKE GROWTH FACTOR 1 DURING THE ANABOLIC PERIOD IN VERY PRETERM INFANTS

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INTRODUCTION

Transthyretin (TTR) and Insulin-like growth factor 1 (IGF-1) are proteins mainly synthesized by the liver and both proteins are considered to be reliable nutritional markers. We have previously shown that levels of IGF-1 are persistently low during the first postnatal weeks in very preterm infants but start to increase significantly at approximately 30-31 weeks postmenstrual age (PMA), which coincides with better utilization of nutrients and less catabolic state. The aim of the study was to investigate the influence of nutritional intake on levels of TTR and evaluate the relationship between TTR and IGF-1 from birth until term age.

METHODS

Observational study of 64 very preterm infants with mean (SD) gestational age 26.1 (1.9) weeks and birth weight 852 (276) g. TTR and IGF-1 were analysed from serum samples day 7 and then weekly until discharge at 35-36 weeks PMA and again at 40 weeks PMA. Enteral and parenteral energy and protein intake was prospectively calculated daily from birth until 35 weeks PMA. Relationships between TTR and IGF-1 and between TTR and protein/energy intake were analysed separately each week from birth until term age. Non-parametric tests were used.

RESULTS

Absolute levels of TTR did not correlate with total protein (g/kg/d) or energy intake (kcal/kg/d) during the preceding week at any PMA from birth until term age. Increase in TTR correlated positively with mean protein intake (g/kg/d) during 31-35 weeks PMA, $r = 0.35$ $p = 0.02$, whereas no correlation was seen with energy intake. A positive correlation between concentrations of TTR and IGF-1 was present from a PMA of 31 weeks and onwards. The degree of correlation increased from 33 weeks PMA and a strong correlation persisted up until term age ($r = 0.31$-0.65, $p = 0.04$-< 0.001). Mean level of TTR during 31-35 weeks PMA correlated with that of mean IGF-1 during the corresponding time period $r = 0.4$, $p = 0.004$ (**Fig. 1**). The correlation remained significant after adjustment for SDS weight at birth and mean protein and energy intake during the corresponding weeks PMA.

CONCLUSIONS

Increased protein intake was positively associated with increase in TTR during 31-35 weeks PMA in very preterm infants. A positive association between circulating levels of the hepatic derived proteins TTR and IGF-1 occurred from a PMA of 31 weeks and persisted until term age. This association may

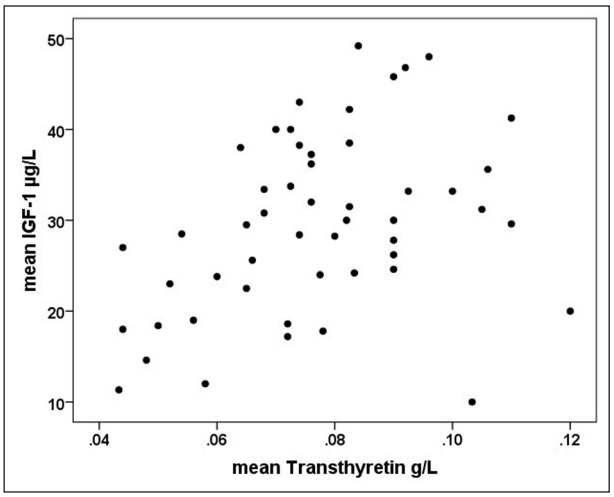

Figure 1 (ABS 8). Correlation of mean levels of transthyretin (TTR) with mean levels of insulin-like growth factor 1 (IGF-1), during 31-35 weeks postmenstrual age (PMA).

indicate onset of a maturational process resulting in improved hepatic protein synthesis with increase in both IGF-1 and TTR.

ABS 9

MEASURING POSTNATAL GROWTH: A COMPARISON OF NEONATAL GROWTH USING INTERNATIONAL INTERGROWTH-21ST STANDARDS AND ESTABLISHED UK CHARTS

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INTRODUCTION

Current practice in the UK is to measure postnatal growth using the UK-90 growth charts (UKGC), which have several limitations. Firstly, they are based on cross-sectional data from birth measurements, implying extrauterine and intrauterine growth mimic each other. Secondly, they are reference charts, which describe typical, but not necessarily the healthy growth of infants. Thirdly, they are built on data from 1990s. The INTERGROWTH-21st (IG21) Project has produced international standards for assessing size-at-birth and postnatal growth of preterm infants, which have been adopted by WHO and CDC. Study aim: to compare centile measurements between the new IG21 standards and the current UKGC.

METHODS

A retrospective sample of neonates born at a level three neonatal centre in Oxford were selected. Infant weight (WT) and head circumference (HC) measurements were prospectively documented at birth, mid-admission and at discharge. All measurements were collected from a national electronic database (BadgerNet® Neonatal) and plotted on UKGC centiles using a publicly available online tool. For comparison, online software made available by IG21 was used for size-at-birth centiles. Mid-admission and discharge measurements were plotted on growth charts obtained from the IG21 website. Centiles were compared by subtracting one from the other. Data was analysed by student t-test analysis, a p-value < 0.05 was considered statistically significant.

RESULTS

Weight and head-circumference plotted on IG21 centiles resulted in significantly, up to 30 centile points, greater centile measurements than that on corresponding UK chart centiles. This difference was apparent for all gestational ages and at all three time points (birth, mid-admission and discharge from the neonatal unit).

CONCLUSIONS

This study showed that UKGC significantly underestimated centiles for WT and HC compared to IG21. This has several potential implications, e.g. whether underestimating infant weight results in overfeeding, which has been associated with an increased incidence of metabolic syndrome. This poses the question whether IG21 centiles, constructed using a similar methodology to the WHO Child Growth Standards, should become an accepted standard worldwide.

ABS 10

EVALUATION OF MILK AND BLOOD IRISIN LEVELS IN PRETERM NEWBORNS DIAGNOSED WITH EITHER SMALL OR APPROPRIATE WEIGHT FOR GESTATIONAL AGE COMPARED TO FULL TERM NEWBORNS

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INTRODUCTION

Irisin is a newly discovered myokine with anti-obesity properties. Irisin regulates body energy expenditure by turning white adipose tissue (WAT) into brown-like adipose tissue (BAT). It is regarded as a potential biomarker of metabolic syndrome and obesity. Premature infants represent one of the groups with increased risk for metabolic syndrome. Until now, there have been only multiple studies on irisin role in adult population. Our study is the first one to evaluate irisin levels both in blood of the preterm and full term newborns, as well as in the breast milk of their mothers.

METHODS

A total of 72 newborns was enrolled in the study: a study group of 53 very low birth weight preterm infants subdivided in the 2 groups – 6 newborns in a small for gestational age group (SGA group) and 47 newborns appropriate for gestational age (AGA group). The control group included 19 term infants. Irisin levels were assessed in the maternal milk, as well as in the infants' serum. Measurements were made twice; first analysis was done during the 1st week of life, followed by the other one after 4 weeks of life. We used a commercial enzyme-linked immunosorbent assay at our hospital laboratory. The study protocol was approved by the Jagiellonian University Medical College Ethical Committee (issue No KBET/58/B/2013 from 4.04.2013). The study was sponsored by RG1/2013 grant obtained from NUTRICIA Foundation.

RESULTS

Plasma irisin levels were positively correlated with birth weight during the 1st week of life ($r = 0.234$; $p < 0.048$), weight at 4 weeks of age ($r = 0.264$, $p < 0.035$) and head circumference at 4 weeks age ($r = 0.253$, $p < 0.043$). SGA infants had significantly lower serum irisin levels (0.73 [SD 0.23] ug/ml) compared to the AGA group (1.74 [SD 1.16] ug/ml) and control term infants (2.21 [SD 1.22] ug/ml, $p < 0.001$) during the 1st week of life. There were no statistically significant differences between SGA and AGA groups in regard to the demographic features, such as gender, mode of delivery, type of feeding ($p < 0.05$). Serum irisin levels during the 1st week of life were positively correlated with serum irisin levels after 4 weeks of life (p 0.05) (**Tab. 1**).

CONCLUSIONS

Our results support a notion that irisin may play a physiologic role in the preterm neonates. We hypothesize that impaired skeletal muscle metabolism in SGA newborns might cause their irisin deficiency, which further leads to altered fetal programming process. Such changes early in life may contribute to development of catch up growth and eventually lead to a higher risk for metabolic syndrome in later years.

ABS 11

ASSAY OF IRISIN CONCENTRATION IN INFANT FORMULAS AND BREAST MILK

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Table 1 (ABS 10). Correlation between irisin serum and maternal milk levels and chosen anthropometric parameters.

		Irisin Blood sample 1st week	Irisin Blood sample 4 weeks of life	Irisin Milk sample 1st week	Irisin Milk sample 4 weeks of life
Birth weight	r-value	0.234	0.228	-0.018	0.108
	p-value	0.048	0.074	0.901	0.545
Birth length	r-value	0.214	0.161	-0.054	0.078
	p-value	0.071	0.211	0.712	0.660
Head circumference at birth	r-value	0.212	0.177	-0.040	0.113
	p-value	0.074	0.169	0.783	0.524
Weight at 4 weeks of life	r-value	0.264	0.201	0.033	0.097
	p-value	0.035	0.118	0.836	0.584
Length at 4 weeks of life	r-value	0.203	0.143	0.043	0.125
	p-value	0.107	0.267	0.789	0.480
Head circumference at 4 weeks of life	r-value	0.253	0.153	0.018	0.137
	p-value	0.043	0.236	0.909	0.439

INTRODUCTION
Early life nutrition plays an important role in long-term appetite control and is involved in the programming of feeding regulatory mechanisms in central nervous system and those mediated by factors from peripheral tissues. Irisin is a newly discovered myokine with anti-obesity properties. Irisin regulates body energy expenditure by turning white adipose tissue into brown-like adipose tissue. It is regarded as a potential biomarker of metabolic syndrome and obesity. Our study is the first one to evaluate irisin levels in breast milk of the preterm and full term newborns, as well as in the different infant formulas. The aim of the study was to test if irisin is presented in infant formulas.
METHODS
A total of 49 newborns was enrolled in the study: a study group of 31 very low birth weight preterm infants. The control group included 18 term infants. Samples of 14 infant formulas were collected: 6 starting formulas, 4 preterm infant formulas and 4 special formulas (hydrolyzed casein protein formulas). Milk samples were collected twice – during the 1st week of life, followed by the other one after 4 weeks of life. We used a commercial enzyme-linked immunosorbent assay at our hospital laboratory. The study protocol was approved by the Jagiellonian University Medical College Ethical Committee (issue No KBET/58/B/2013 from 4.04.2013). The study was sponsored by RG1/2013 grant obtained from NUTRICIA Foundation.
RESULTS
Irisin concentrations were significantly lower in artificial milk than both in human preterm and full term milk during the 1st week of life (1.68 [1.19] ug/ml vs 3.16 [0.57] ug/ml; $p < 0.05$; 1.68 [1.19] ug/ml vs 3.11 [0.81] ug/ml; $p < 0.05$) and after 4 weeks of life (1.68 [1.19] ug/ml vs 3.39 [0.99] ug/ml; $p < 0.05$; 1.68 [1.19] ug/ml vs 3.27 [0.64] ug/ml; $p < 0.05$), respectively. Human milk irisin levels during the 1st week of life were positively correlated with human milk irisin levels after 4 weeks of life ($r = 0.52$, p 0.05). There were also no differences in irisin concentration between colostrum and mature milk in both tested groups ($p > 0.05$).
CONCLUSIONS
This study provides evidence that irisin is present in infant formulas. Formula feeding has been observed to be associated with higher weight gain and length gain than breastfeeding during infancy. Such changes early in life may eventually lead to a higher risk for metabolic syndrome in later years. Identification and characterization of additional regulatory proteins in human milk may lead to changes in the in the composition of infant formulas.

ABS 12

CURRENT PRACTICE AND BELIEFS: SURVEY OF BREAST MILK HANDLING ROUTINES IN GERMAN, SWISS AND AUSTRIAN NEONATAL UNITS REVEALS LARGE CENTRE SPECIFIC DIFFERENCES

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INTRODUCTION
Breast milk (BM) is handled on a daily basis in neonatal units throughout. Screening and treatment for bacterial colonization and viral load, pasteurization or freezing of BM, storage and distribution as well as providing human donor milk (DM) require complex procedures. However, evidence for mothers own breast milk (BM) handling is limited. Only scarce data about actual breast milk handling routines within neonatal units are available to assess the impact of existing evidence and recommendations on BM handling. Therefore we surveyed German, Swiss and Austrian neonatal units to assess existing BM handling routines to and to determine areas for future research.
METHODS
Web-based survey among German, Swiss and Austrian neonatal intensive care units from June 2016 until May 2017. Different aspects of BM handling were analysed: threshold values and methods for Cytomegalovirus (CMV) inactivation and bacterial count reduction and indications for those interventions depending on gestational age and birth weight were assessed. Organizational structures for BM handling, assigned workforce and responsibilities for those tasks were asked. We analysed use and demand of DM as well as objections for its use. Furthermore, nutrient analysis, fortification, availability of lactation consultants and BM administration errors were among the covered topics. We performed a literature research for evidence or recommendations concerning aforementioned aspects of BM handling.

Table 1 (ABS 12). Indications per neonatal unit for bacterial count reduction in mothers own breast milk for premature infants less than 32 weeks gestational age or birth weight less than 1,500 g.

	Not tested	Not relevant	Any positive culture	≥ 10^2 CFU/mL	≥ 10^3 CFU/mL	≥ 10^4 CFU/mL	≥ 10^5 CFU/mL
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Skin commensals	0 (0)	11 (46)	0 (0)	0 (0)	0 (0)	5 (21)	8 (33)
Staphylococcus aureus	1 (4)	3 (12.5)	6 (25)	1 (4)	6 (25)	4 (17)	3 (12.5)
Gram-negative bacteria	0 (0)	4 (18)	11 (50)	0 (0)	5 (23)	1 (4.6)	1 (4.6)
Bacillus cereus	2 (9.5)	6 (29)	8 (28.6)	0 (0)	4 (19)	2 (9.5)	1 (5)

CFU: colony forming units.

RESULTS

German (n = 254), Swiss (n = 14) and Austrian (n = 34) units were contacted, 163 (54%) participated in the survey. 105 (66%) units provided level III and 41 (26%) level II of neonatal care. 75% performed maternal CMV screening. 59% of those units inactivated CMV by Holder-Pasteurization, 12% by short-time pasteurization, 29% by freeze-thawing of BM. Bacterial load was assessed by 43%, and pasteurized (any method) by 42% or discarded by 58% after certain cut-off values were exceeded (**Tab. 1**). DM is regularly used in 15% of units. In contrast, DM is never provided in 68%, but 76% of those neonatologists would feed DM if available. Milk banks are mostly headed by a nurse (70%), in 17% no one was in charge. Nutrient analysis and fortification were performed by 12% and 59%, respectively. All but one units offered lactation consultations. 72% of units report about milk administration errors.

CONCLUSIONS

Wide variations concerning all covered aspects of BM handling routines within the participating neonatal centres were found. There was a high incidence of milk administration errors throughout most units. Evidence and recommendations for most handling routines are either scarce or not existent. However, available evidence or recommendations did not seem to have a perceptible impact on BM handling routines in participating neonatal centres.

ABS 13

ENTERAL FEEDING STRATEGIES FOR VERY LOW BIRTH WEIGHT INFANTS: A NATIONWIDE SURVEY IN JAPAN

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INTRODUCTION

Enteral feeding is critical for the postnatal growth and development of very low birth weight infants (VLBWI; < 1,500 g); however, optimal feeding intervals for VLBWI have not been established. In Japan, 2-hourly or 3-hourly feeding regimens are generally used, but there is no strong evidence to support either approach. Furthermore, there are no nationwide data regarding enteral feeding strategies for preterm infants in Japan. We undertook a nationwide survey of enteral feeding strategies used in VLBWI in neonatal intensive care units (NICUs) in Japan.

METHODS

After obtaining the approval of the ethics committee of Kobe University Graduate School of Medicine, we sent a questionnaire to the 382 NICUs that comprise the Neonatal Research Network in Japan. We sought information on the size of NICU, the enteral feeding interval for VLBWI, and the use of donated milk.

RESULTS

We received responses from 217 NICUs (response rate 56.8%), including 76 tertiary centers (35.0% of respondents) and 140 regional centers (64.5% of respondents). Most NICUs (66.4%) adopted a 3-hourly feeding strategy. Only 8.3% used a 2-hourly strategy for all patients, with the remainder using this strategy only in VLBWI below a certain weight (e.g. < 1,000 g) (**Fig. 1**). Most NICUs (79.7%) never used donated breast milk, which is not routinely pasteurized due to the

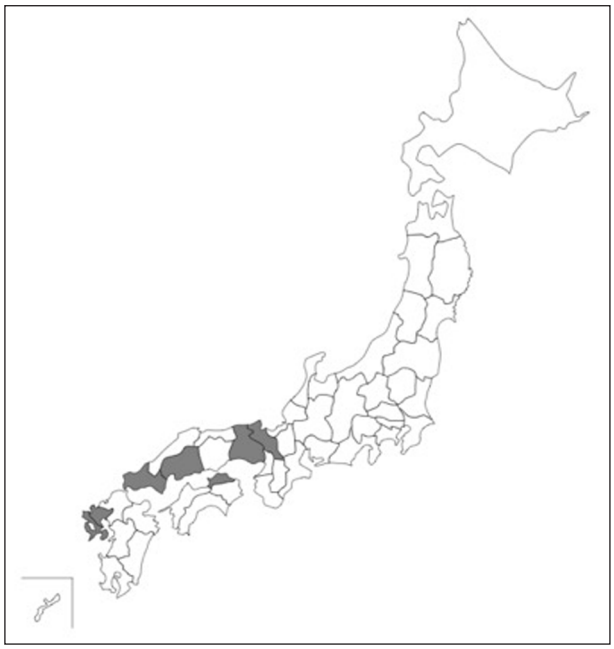

Figure 1 (ABS 13). Localization of NICUs that used a 2-hourly feeding strategy for VLBWI in Japan.
Grey regions: the prefectures where NICUs with 2-hourly feeding strategy are located.

lack of a nationwide breast milk bank in Japan. Donated milk was used with or without limitation, such as birth weight < 1,000 g or gestational age < 28 weeks, in 41 NICUs (18.9%). All NICUs that used a 2-hourly feeding strategy for VLBWI were in the west of Japan, suggesting historical localization. The NICUs in which donated milk was used were distributed evenly across the country.

CONCLUSIONS

Our nationwide survey found that most NICUs in Japan use 3 hourly-feeding intervals for VLBWI, but 2 hourly-feeding intervals are predominant in the west of Japan. The use of donated milk for VLBWI is uncommon in Japan.

ABS 14

DONOR HUMAN MILK MACRONUTRIENT CONTENT: THE EFFECT OF HOLDER PASTEURIZATION

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INTRODUCTION

Human milk (HM) is the gold standard for preterm infants' nutrition. When mother's milk is unavailable, donor human milk (DHM) is recommended. Pasteurization is required to guarantee DHM microbiological safety but it does affect its composition. As a result, nutritional needs of preterm infants may not be met. There is no consensus on the effect of heat treatment on DHM components. The lack of agreement may be due to the heterogeneity of the performed test protocols including the low number of analyzed pools or fresh expressed samples. Aim of this study was to investigate the effect of the Holder pasteurization on the DHM macronutrients content, analyzing a large number of pools.

METHODS

We analyzed macronutrients content of 104 DHM pools. Each pool (mean volume: 1,824 ± 342 ml) was obtained by mixing mature thawed HM from 1 to 5 donors enrolled at the authors' institution Human Milk Bank. Analyses were conducted using a sample of 10 ml of each pool both before and after Holder pasteurization (62.5°C for 30 minutes). These samples were divided into three 3.3 ml aliquots which were analyzed using a HM analyser (Miris AB®). The contents of proteins, lactose, lipids (g/100 ml) and energy (kcal/100 ml) before and after treatment were measured and the mean of the results obtained by the analyses of the three aliquots was considered. The mean macronutrient contents were compared at each step by paired t test and their decrease was then calculated.

RESULTS

The mean macronutrient contents decreased significantly after pasteurization. In **Tab. 1** are shown the mean content before and after pasteurization. The decrease in term of proteins, lactose and lipids, expressed as percentage, were -3.02 ± 14.53, -1.46 ± 7.00 and -6.11 ± 11.46, respectively.

Table 1 (ABS 14). Mean macronutrient contents of the 104 DHM pools before and after Holder pasteurization.

	Before pasteurization	After pasteurization	p
Proteins (g/100 ml)	0.86 ± 0.18	0.82 ± 0.17	< 0.0001
Lactose (g/100 ml)	6.83 ± 0.31	6.72 ± 0.47	0.001
Lipids (g/100 ml)	3.44 ± 0.58	3.21 ± 0.59	< 0.0001
Energy (kcal/100 ml)	65.00 ± 5.31	62.57 ± 5.53	< 0.0001

CONCLUSIONS
The present study showed that Holder pasteurization reduces macronutrients content of DHM with lipids and proteins being the most affected components. Hence, in order to meet the preterm infants' nutritional requirements, an adequate macronutrients supplementation, with particular regard to lipids and proteins, is mandatory.

ABS 15

NEW PARENTERAL NUTRITION AND ACIDOSIS IN PRETERM INFANTS

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INTRODUCTION
Enhanced nutritional supply with an early and high intake of protein and calories is useful for VLBW infants, as it promotes growth and a good neurological development. To date, several biological complications have been described in association to enhanced parenteral nutrition (PN), but any study has evaluated the impact of this nutritional strategy on acid-basic homeostasis. The aim of the present investigation is to evaluate the effect of nutrient supply on acid-base homeostasis in a large population of preterm infants.
METHODS
Observational study describing the acid-base profile of very preterm infant (≤ 29 WG) in relation to nutrition during the first week of life. Three different groups of infants receiving different nutritional intakes were considered. Nutrition data were recorded daily and correlated to acid-base data (pH, base excess, and lactate). The outcome measure to assess non-lactic metabolic acidosis was the base excess (BE).
RESULTS
161 infants were included, 1,127 daily nutritional records and 795 blood gas data were analyzed. Results for the three groups were different according to PN intakes (**Tab. 1**). Metabolic acidosis (BE) was more important in the group with the highest intake of amino acids and lipids. At the multivariate analysis the significant risk factors for metabolic acidosis were: gestational age, initial BE, amino-acid and lipid intravenous intakes.
CONCLUSIONS
Nutritional intakes had an influence on acid-base balance. Intravenous amino-acid and lipid intakes independently increased the risk of metabolic acidosis. This phenomenon was particularly evident in infants with the smaller gestational age (24-26 WG).

ABS 16

IMPACT ON BREASTFEEDING RATES OF PRETERM INFANTS WITH LESS THAN 29 WEEKS WITH RESTRICTION OF RAW HUMAN MILK IN THE FIRST EIGHT WEEKS OF LIFE DUE TO THE RISK OF PERINATAL CYTOMEGALOVIRUS INFECTION

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INTRODUCTION
Wide variability of clinical manifestations has been described in preterm newborns with post-natal CMV infection, such as diarrhea, necrotizing

Table 1 (ABS 15). Results for the three groups according to parenteral nutrition intakes.

	Group 1	Group 2	Group 3	Kruskal-Wallis p
Gestational Age, weeks	27.8 ± 1.2	27.8 ± 1.6	27.5 ± 1.6	0.39
pH at day 2-7	7.28 ± 0.08	7.30 ± 0.10	7.24 ± 0.13	< 0.001
Base excess at day 2-7	-5.1 ± 3.0	-6.4 ± 3.4	-8.7 ± 3.4	< 0.001
Mean daily intakes (1st week)				
Amino acids, g/kg/d	2.1 ± 0.8	3.1 ± 0.7	3.3 ± 0.8	< 0.001
Lipids, g/kg/d	1.6 ± 1.2	1.8 ± 1.2	2.8 ± 1.4	< 0.001
Carbohydrates, g/kg/d	10.2 ± 2.8	10.4 ± 2.4	11.6 ± 3.0	< 0.001

enterocolitis, pneumonia, meningitis, sepsis-like and association with advanced stages of retinopathy of prematurity, which motivated discussions about the recommendations of the use of unprocessed breast milk in preterm newborn of mothers who are seropositive for this virus. This study aimed to analyze the impact of the introduction of the protocol for the raw maternal milk supply for preterm infants in the rates of maternal breastfeeding of preterm infants with gestational age of less than 29 weeks. Objectives: To verify the impact on the rates of breastfeeding in newborns with gestational age at birth less than 29 weeks after the introduction of a protocol for the supply of unprocessed breast milk in the neonatal units.

METHODS

It is a cohort and retrospective study that analyzed newborns included in the Brazilian Neonatal Network with gestational age at birth of less than 29 weeks, born between 2006 and 2016, in a university hospital. By August 2015 all clinically stable preterm infants were fed preferentially with unprocessed breast milk. From September 2015 the protocol for the supply of raw human milk for preterm infants was introduced in the service. This study was approved by the Ethics Research Committee (process number 1.018.827). All the newborns who died, those transferred to other institutions, and those whose forms were incomplete were excluded. For the analysis of exclusive breastfeeding rates in hospital discharge, time series charts were constructed considering the annual breastfeeding rates in the study period. Description of variables: 1) Protocol for the supply of raw human milk for preterm newborns: this protocol, based on the study by Martins-Celini et al. [1] due to the risks of CMV perinatal transmission for preterm newborns of mothers of one Population with high maternal nutrition, recommends, for newborns with gestational age 29 weeks and 30 weeks or children of mothers who are seronegative for this virus: preferentially offer raw breast milk.

RESULTS

A total of 1,481 newborns were included in the study. From which 616 were excluded: 369 due to death, 4 due to transfers and 243 by incomplete forms. The study was completed with 865 newborns. It is noted that the rates of breastfeeding at the time of hospital discharge in the study period are between 10 and 15%. In this study, it was observed that the rates of breastfeeding at the time of hospital discharge remained practically unchanged after the beginning of the protocol for the supply of unprocessed human milk for premature infants (**Fig. 1**).

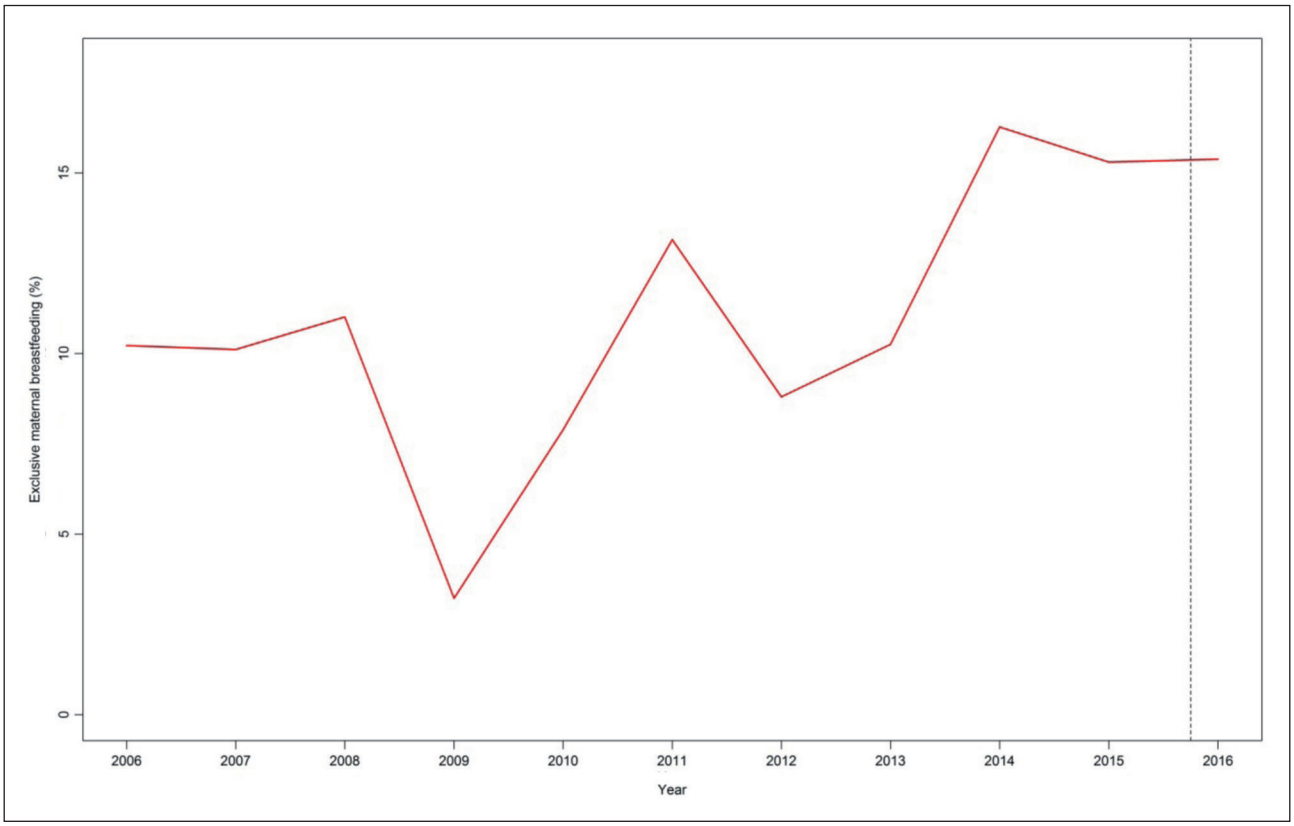

Figure 1 (ABS 16). Rates of exclusive maternal breastfeeding of preterm infants less than 29 weeks.

CONCLUSIONS

In this study it was observed that there is no impact on the rates of maternal breastfeeding in preterm infants with gestational age less than 29 weeks after the introduction of the protocol that restricts the supply of raw human milk in the first 8 weeks of life. This demonstrates that with guiding measures to the mothers, along with support from the care team, it is possible to establish breastfeeding even after prolonged periods of suspension of unprocessed breast milk. New studies for longer periods are needed to confirm these data.

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ABS 17

EFFECT OF A NATIONWIDE PROGRAM FOR PROMOTING BREASTFEEDING IN-HOSPITAL IN CHINA

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INTRODUCTION

Breastfeeding (BF) is internationally recognized as the optimal method of infant feeding. Support from health care professionals has been demonstrated to be positively associated with the initiation and continuation of BF. In China, the institutional delivery was about 99.6% in 2014, and exclusive BF in 6 month was about 27.6% in 2008. To promote the initiation and continuation of BF in China, "Breastfeeding Counseling Program" was launched in 31 provinces since 2009 to help pregnant women and new mothers build BF confidence, improve BF technical ability and resolve BF problems. This paper shows the effect of this program on BF in hospital.

METHODS

The strategies of this program were: Developed "Implemented Suggestions for Breastfeeding Coun-

Table 1 (ABS 17). Status of breastfeeding (BF) and BF Health Education in hospital.

			2012		2014		χ^2	P
			N	%	N	%		
BF in-hospital	Exclusive BF		895	57.8%	1,127	75.3%	107.02	< 0.001
	Mixed feeding		582	37.5%	317	21.2%		
	Artificial feeding		73	4.7%	53	3.5%		
BF within 1 hr of birth	Yes		1,034	70.2%	1,102	73.0%	2.84	0.10
	No		439	29.8%	408	27.0%		
	Duration of 1st BF	1-10 min	265	27.9%	264	27.7%	42.51	< 0.001
		11-20 min	220	23.1%	165	17.3%		
		21-30 min	433	45.5%	422	44.3%		
		> 30 min	33	3.5%	101	10.6%		
BF in the 1st day	Yes		1,160	78.9%	1,316	87.3%	37.53	< 0.001
	No		311	21.1%	192	12.7%		
	BF times	1-4	480	46.7%	294	28.5%	94.51	< 0.001
		5-7	309	30.1%	317	30.7%		
		≥ 8	239	23.2%	420	40.7%		
BF health education in-hospital	Times	≥ 4 times	418	40.5%	766	52.4%	57.13	< 0.001
		3 times	153	14.8%	246	16.8%		
		2 times	185	17.9%	201	13.8%		
		1 times	147	14.3%	153	10.5%		
		None	128	12.4%	95	6.5%		

BF: breastfeeding.

seling in Hospital" to direct the implement in hospital. Supplied health education facilities and materials for building "Breastfeeding Counseling Room" and doing counseling in daily. Organized training for clinic staffs twice each year and held workshops every year to promote communication on national level. To evaluable the effect of this program, retrospective surveys were done every 3 years. Questionnaires were finished by delivery women would discharge from hospital. The data of 38 Maternal and Children Health Care Hospitals was used in this study, including 1,480 data in 2012 and 1,581 data of 2014. No significant demographic differences were found among the target populations of 2012 and 2014.

RESULTS

The rate of exclusive BF in hospital increased significantly from 57.8% (2012) to 75.3% (2014) ($p < 0.001$). The percentage of BF initiation within a half-hour of birth was 70.2% (2012) and 73.0% (2014), respectively ($p = 0.10$). However, there was statistical significance in the percentage of duration for first BF between 2012 and 2014. The percentage of newborn babies who got BF in first day was 87.3% in 2014, which was higher than that in 2012 group (78.9%). The rate of BF times was increased with statistical significance ($p < 0.001$); the proportion of babies who got BF more than 8 times in 1st day was 23.2% (2012) and 40.7% (2014) respectively. The percentage of mothers who got BF education in hospital rose from 40.5% in 2012 to 52.4% in 2014 ($p < 0.001$). Awareness rate of mother who know BF counseling room also increased from 71.4% (2012) to 75.5% (2014) ($p = 0.01$).

CONCLUSIONS

The Breastfeeding Counseling Program was effective for promoting BF health education in hospital, and associated with increasing the BF initiation and exclusive BF rate before discharge from the hospital.

ABS 18

VITAMIN D STATUS AMONG PRETERM INFANTS AS A HIGH RISK MORBIDITY MARKER

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INTRODUCTION

Vitamin D is a prohormone that plays an important role, not only for bone health but also in the immune system and had a pleiotropic effect. Prevalence of vitamin D deficiency is still common in pregnant women and infants and it is associated with pregnancy-induced hypertension, gestational diabetes, intrauterine growth restriction and premature birth. On the other hand, very preterm infants had risks of developing vitamin D deficiency compared to with full term infants.

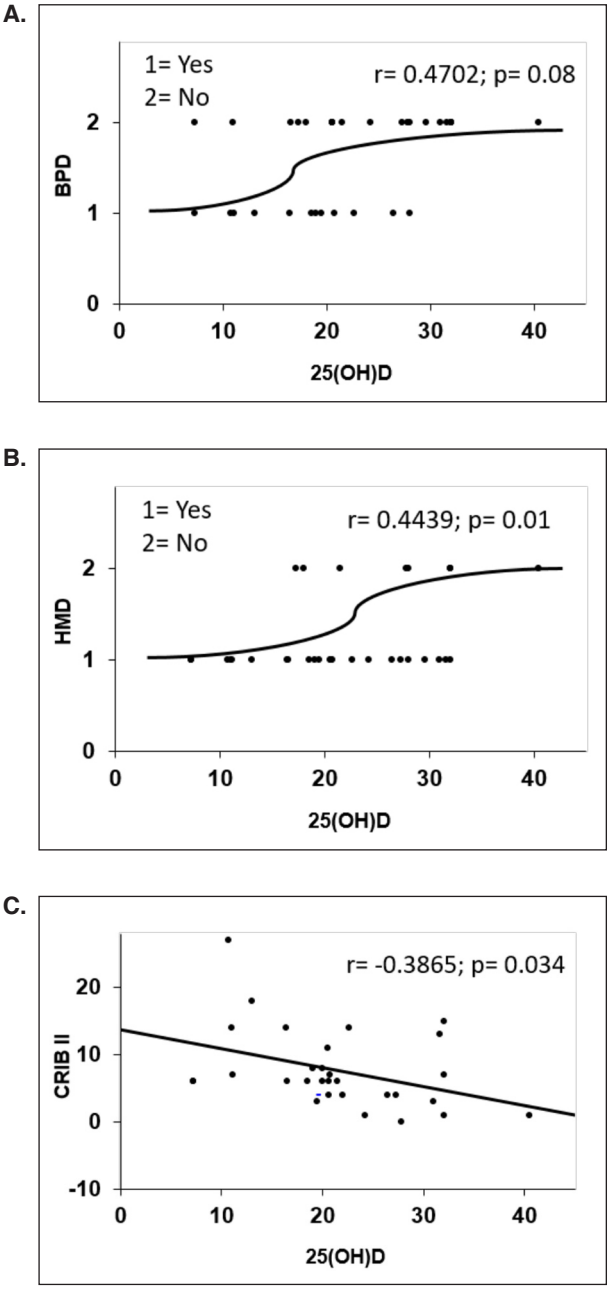

Figure 1 (ABS 18). Correlation of 25(OH)D and bronchopulmonary dysplasia (BPD), hyaline membrane disease (HMD) and CRIB II.

METHODS
We performed a prospective clinical observational study. The aim of this study was to investigate the prevalence of vitamin D deficiency among premature infants ≤ 32 weeks of gestation and/or ≤ 1,500 g birth weight in neonatal intensive third level care unit from June 2016 to January 2017. Vitamin D status was defined as vitamin D sufficient (25 OH vitamin D) ≥ 20 ng/ml. CRIB II index score was performed. SPSS® v.22 was used for statistical analysis.
RESULTS
36 newborn was enrolled (16 male and 20 female). 25 OH vitamin D levels were: 23.8 ng/ml. Medium gestational age: 29 weeks. Medium birth weight 1,207.8 g. 25 OH vitamin D levels are negative related to CRIB II (r = -3.8). Results are shown in **Fig. 1**.
CONCLUSIONS
Vitamin D deficit for general cellular health is surprisingly high among preterm infants. More studies concerning vitamin D requirements among pregnant women and premature babies are needed. 25 OH vitamin D levels on admittance could be used as a prognostic tool in neonatal intensive care unit.

ABS 19

INDIVIDUALIZED GROWTH TRAJECTORIES FOR PRETERM INFANTS USING A GROWTH TRAJECTORY CALCULATOR TOOL

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INTRODUCTION
Current growth charts provide no target for how a preterm infant should grow. They ignore the physiological postnatal adaptation to extrauterine life with the well known weight loss in preterm and term infants. This weight loss is due to one-time, irreversible, contraction of extracellular spaces. Recently we have studied the weight loss and downshifts of the postnatal growth trajectories during the first 21 days of life in healthy preterm infants. This adjustment to a new postnatal growth trajectory can be described precisely by a prediction model. However, the individual growth trajectory between day of life 21 and term, when preterm infants should achieve a weight and body composition similar to their term-equivalent, remains unclear. The aim of the study is to compare approaches to create individualized postnatal trajectories between birth and $42^{+0/7}$ weeks PMA, that consider the physiologic weight loss and matches best with term-equivalent weight.
METHODS
Three approaches to achieve growth similar to healthy term infants at $42^{+0/7}$ weeks PMA on WHO growth standards (target weight) were tested for infants born at 24-34 weeks PMA and for birth weights at 7 major percentiles. The three approaches include: 1) following the birth percentile (Birth-Weight-Percentile Approach), 2) following the new percentile achieved at DOL 21 after postnatal weight loss (Postnatal-Percentile Approach); 3) using day-specific fetal median growth velocities starting at DOL 21 (Growth-Velocity Approach [GVA]). Primary outcome was the difference between achieved and target weight at $42^{+0/7}$ weeks. Secondary outcome was the deviation from target weights vs. % fat in a cohort of 20 disease-free VLBW infants.
RESULTS
The weights following the Birth-Weight-Percentile and Postnatal-Percentile approaches deviated significantly from target weights. Weights using the Growth-Velocity approach merged with the target weights after introducing a single correction factor. % fat and deviation from target weight correlated best with term equivalent % fat using the Growth-Velocity approach. **Fig. 1** demonstrates an individualized growth trajectory using the Growth-Velocity approach for a male preterm, born at $31^{+0/7}$ weeks, with a birth weight of 1,980 g.
CONCLUSIONS
The Growth-Velocity approach provides individualized growth trajectories for preterm infants. The Growth-Velocity approach is based on physiological data incorporating that phenomenon that healthy preterm infants adjust their postnatal trajectory below their birth percentile. After postnatal adjustment, the Growth-Velocity Approach applies the median fetal growth velocity. The Growth-Velocity approach matches consistently with term-equivalent weights at $42^{+0/7}$ weeks. The Growth-Velocity approach has been

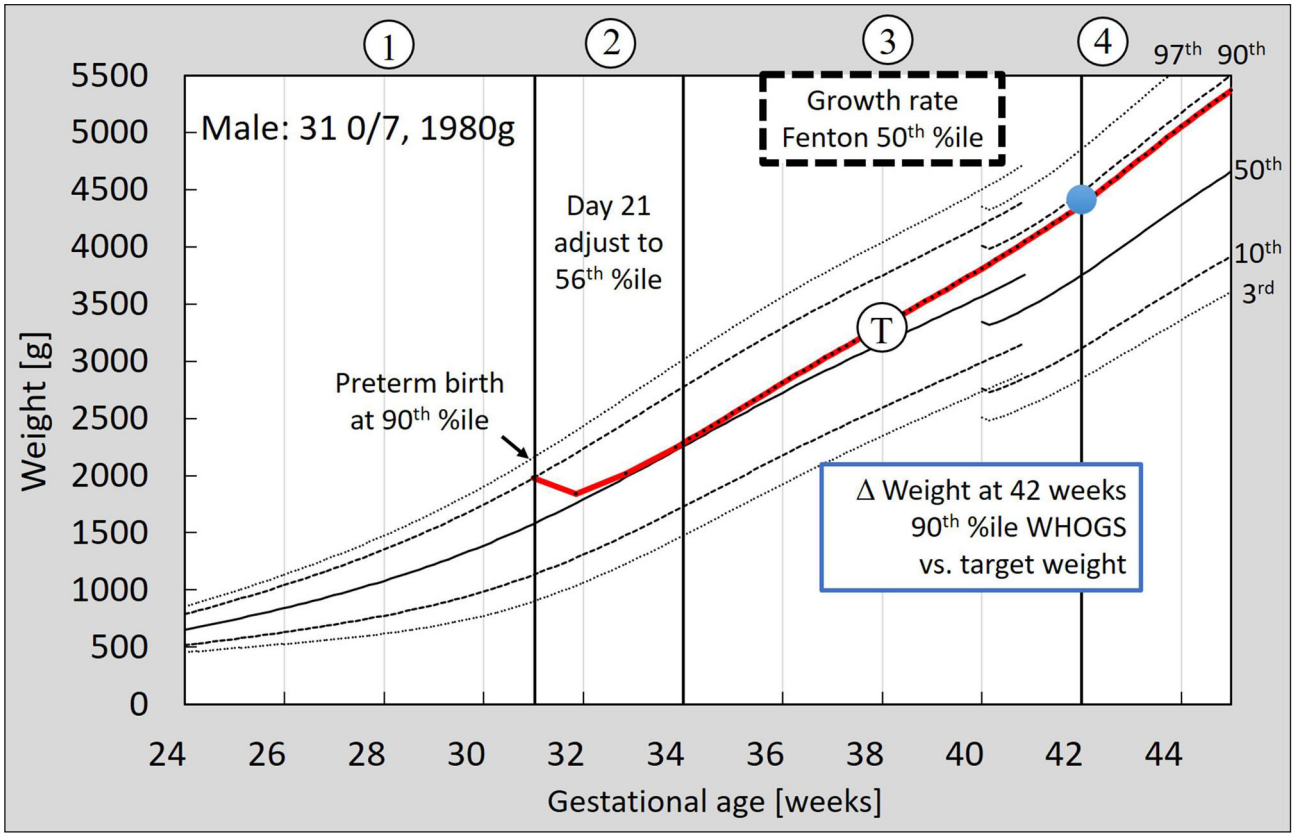

Figure 1 (ABS 19). An individualized growth trajectory using the Growth-Velocity approach for a male preterm, born at $31^{+0/7}$ weeks, with a birth weight of 1,980 g.
(**1**) fetal growth, (**2**) postnatal adaptation and weight loss, (**3**) period of stable growth, (**T**) target trajectory using Growth-Velocity approach, (Blue dot) outcome – weight difference at 42 weeks, (**4**) term-equivalent growth – WHO growth standards.

integrated into a bedside tool that can be used to aid clinicians in monitoring growth, guiding nutrition and minimizing chronic adult disease risks (DOHaD) as a consequence of unguided, inappropriate growth.

ABS 20

PROACTIVE USE OF BREAST MILK FORTIFIER AND BREAST MILK AT DISCHARGE: IS THERE A LINK? A NATIONAL SURVEY OF PRACTICE

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INTRODUCTION

The use of breast milk in preterm infants is a well established gold standard of care. Despite this, the number of babies being discharged in the UK receiving any mother's milk is reportedly only 58% [1]. Ericson et al. [2] postulated that the reduction in breastfeeding at discharge for preterm infants in Sweden observed over a 10 year period might be linked to the use of breast milk fortifier (BMF) and post discharge formulas. We hypothesised that acknowledgment of the increased nutritional requirements of preterm infants, and hence use of BMF, might lead to a reduced confidence on the part of clinicians with respect to promoting and supporting breastfeeding for preterm infants.

METHODS

In order to test this theory, we conducted an electronic survey of UK neonatal units, disseminated via network leads to a wide range of units from tertiary intensive care to special care. Questions were asked in relation to both current practice with BMF and to explore beliefs regarding its usefulness and potential side effects. In addition we queried availability of breastfeeding support. The results were compiled and compared against the National Neonatal Audit Programme (NNAP) Report 2015 for rates of breast milk at discharge, in order to establish whether a link exists between the feeding practice and published breastfeeding rates. This was further analysed looking at trends between types of units depending on level of care provided.

RESULTS

In total there were 107 respondents from across the UK and a variety of settings. Respondents ranged from neonatal consultants to network nursing leads and neonatal nutrition experts. The average (any) breast milk at discharge rate was 60% in our group, similar to 58% quoted by NNAP. 90% of respondents have an established feeding guideline and 50% routinely prescribe BMF as standard care once enteral feeding has been established. 92% believe BMF is useful to support preterm growth – whilst 40% believe it can be implicated in the pathogenesis of necrotising enterocolitis (NEC). Importantly, the use of BMF appears to have neither a negative nor positive influence on breast milk rates at discharge, with equivalent numbers in both groups (60.8% vs 60.3%, p = 0.91). There was no statistically significant difference depending on the level of care provided by the setting (**Fig. 1**).

CONCLUSIONS

The results show that there remains great heterogeneity of practice across the UK: where some units routinely prescribe fortifier to all preterm infants, while others wait for growth failure to occur. With growing knowledge as to the importance of good postnatal nutrition from birth, these data illustrate that BMF can be proactively used for preterm infants without fear of reducing breastfeeding at discharge.

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ABS 21

INFLUENCE OF HUMAN MILK AND PARENTERAL LIPID SOLUTIONS ON SERUM FATTY ACID PROFILES IN EXTREMELY PRETERM INFANTS

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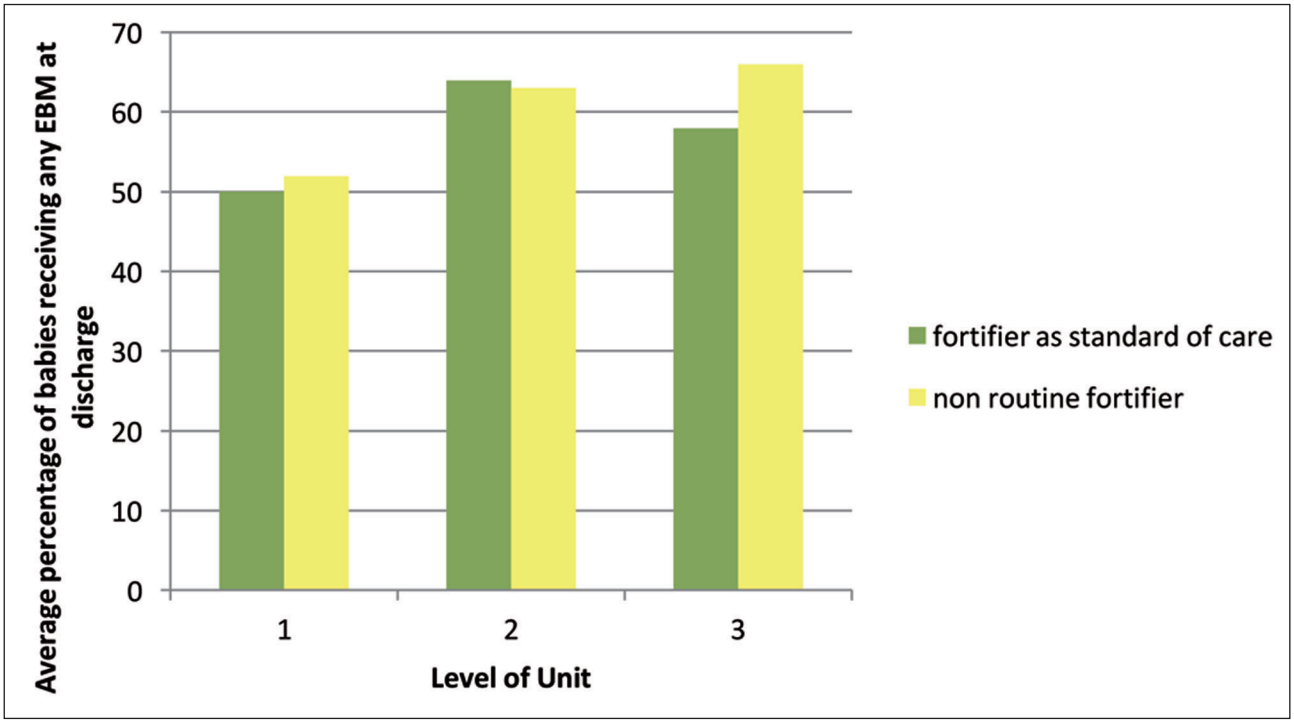

Figure 1 (ABS 20). Use of fortifier and National Neonatal Audit Programme (NNAP) data.

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INTRODUCTION

Long chain polyunsaturated fatty acids (LC-PUFA) are essential for proper neural development and function. LC-PUFAs such as arachidonic acid (AA) and docosahexaenoic acid (DHA) are selectively transferred across the placenta to the growing fetus, especially during the third trimester. Fetal *de novo* synthesis of LC-PUFAs from precursor molecules is regarded to be insufficient. Infants born extremely preterm therefore rely on dietary and/or parenterally administered LC-PUFA during the first period of life. We have investigated how omega-3 LC-PUFAs provided enterally via breast milk or parenterally via lipid emulsions affect fatty acid levels in infant serum.

METHODS

Seventy-eight infants born at a gestational age < 28 weeks were randomized to receive parenteral lipid emulsion with or without the omega-3 LC-PUFAs EPA and DHA. Volumes of enterally given mothers' milk or donor breast milk were recorded from birth to two weeks of age. Venous blood samples were obtained from infants at chronological ages 1, 7, 14 and 28 days and at postmenstrual age (PMA) 32, 36 and 40 weeks. Milk samples from mothers were collected at one week post-conception and at PMA 32 and 40 weeks. Fatty acids from serum phospholipids and milk total lipids were analyzed by gas GC-MS. Enteral and parenteral intake of LC-PUFAs during the first two weeks of life were calculated and correlated against infant serum levels.

RESULTS

AA and DHA mean levels in breast milk were 0.34 (min.-max., 0.16-0.62) and 0.31 (0.11-0.71) mol%, respectively, and significantly declined during the lactation period. Infants´ total mean milk intake was 1,309 (146-3,250) ml during the first two weeks of life. Infants receiving parenteral omega-3 LC-PUFAs had an average of 4.4 times higher DHA intake during the period. This group showed a modest but significant increase in serum DHA, but no correlation to amount DHA provided enterally or parenterally was found within group. Infants not receiving parenteral DHA showed a significant correlation between enteral supply and serum levels at 14 days. AA levels could not be predicted by enteral and/or parenteral supply in any of the groups.

CONCLUSIONS

We found a linear relationship between dietary intake of DHA and infant serum DHA levels when this fatty acid was not administered parenterally. DHA incorporation into serum phospholipids appears to be much more efficient when provided enterally via breast milk than when parenterally administered. It remains to be investigated if excess parenteral DHA is accreted into tissue or metabolized via other routes in extreme preterm infants.

ABS 22

GROWTH AND BODY COMPOSITION UP TO 4 MONTHS OF AGE IN PRETERM INFANTS AND TERM CONTROLS (PEAPOD STUDY)

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INTRODUCTION

It has been previously reported that premature infants at the time of achieving term-equivalent age differ from term peers both when it comes to anthropometry (they are lighter and shorter), and body composition (they have greater percentage of total body and lower fat free mass). It is not clear whether the differences in body composition persist.

METHODS

Premature infants (< 32 weeks of gestational age or birth weight < 2,000 g) and full-term healthy controls (37-41 weeks, 2,500-4,500 g) were recruited in a prospective longitudinal study in a tertiary care hospital in Umeå, Northern Sweden. All infants were followed until 4 months of age. Body composition was assessed by air displacement pletysmography (PeaPod Infant Body Composition System, Concord, California, USA) at four occasions (clinical stability, discharge, term-equivalent age, 4 months) in preterm infants, and at two occasions in controls (term and 4 months of age). Weight, length and head circumference were measured on each occasion.

RESULTS

Thirty-three preterm infants (mean gestational age 27.5 weeks) and sixty-nine term controls were included. Preterms were significantly lighter and shorter compared to term infants at achieving term-equivalent age and at 4 months. At term equivalent age preterms had a greater percentage of fat mass (mean [SD]: 20.17 [3.36] vs 11.67 [3.98]; $p < 0.0001$), higher fat mass (mean difference [MD] 0.26 kg; $p < 0.001$), and lower fat free mass (MD -0.46 kg; $p < 0.001$) compared to controls. Fat free mass

remained lower in preterm infants at 4 months (MD -0.47 kg; $p < 0.001$). In preterm infants, weight-for-length z-score change between achieving clinical stability and obtaining term equivalent age was strongly correlated to percentage of fat mass and fat mass at term equivalent age ($r = 0.75$, $p < 0.0001$; $r = 0.6$, $p < 0.0001$. respectively). At 4 months of age, all body composition parameters were positively correlated with weight-for-length z-score change between discharge and age 4 months (percentage of total body fat: $r = 0.42$, $p = 0.03$; fat mass: $r = 0.5$, $p = 0.01$; fat free mass: $r = 0.42$, $p < 0.03$). In addition, a strong positive correlation was seen for fat free mass at 4 months and at term equivalent age ($r = 0.71$, $p < 0.001$).

CONCLUSIONS

Until 4 months of age preterm infants remained lighter and shorter compared to their term peers. Their body composition at term equivalent age indicated more adiposity and deficit of fat free mass remained until 4 months. More rapid weight-for-length gain until term equivalent age was correlated to acquisition of fat mass. Our next step will be to study associations with early nutrition, in particular energy and protein intake.

ABS 23

SODIUM SUPPLY BUT NOT HYPERNATREMIA IS ASSOCIATED WITH SEVERE INTRAVENTRICULAR HEMORRHAGE IN EXTREMELY PRETERM INFANTS

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INTRODUCTION

Intraventricular hemorrhage (IVH) is a neonatal morbidity among extremely preterm (EPT) infants that leads to adverse neurodevelopmental consequences. The etiology of IVH in preterm infants is multifactorial. A possible association of IVH with hypernatremia, fluctuation of serum sodium and/or sodium supply has previously been suggested. In the present study, we aimed to explore the associations between sodium supply, plasma sodium concentration and/or hypernatremia and severe IVH in EPT infants during early postnatal life.

METHODS

We investigated a population-based cohort of Swedish EPT infants (< 27 gestational weeks). Detailed data of sodium supply, biochemical levels of sodium and weight measurements were retrospectively obtained from hospital records for the first postnatal week. Severe IVH was defined as grade 3-4 according to the Papile classification. Infants who died within the first 24 postnatal hours and infants with multiple congenital and/or chromosomal anomalies were excluded from all analyses.

RESULTS

Of 592 included EPT infants, 83 (14%) developed severe IVH. Sodium supply but not hypernatremia and/or the highest plasma sodium concentration during the first postnatal week were associated with IVH. The association between sodium supply and IVH remained after adjusting for gestational age. We did not find any association between fluid volume without blood products or weight change until nadir, and severe IVH (**Tab. 1**).

CONCLUSIONS

Sodium supply but not hypernatremia was associated with severe IVH in EPT infants during early postnatal life. A possible explanation is that

Table 1 (ABS 23). Factors associated with severe intraventricular hemorrhage (IVH) in extremely preterm infants (EPT).

	Severe IVH[a]
	p-value
Hypernatremia[b]	0.259
Moderate-severe hypernatremia[c]	0.389
Severe hypernatremia[d]	0.937
Highest plasma sodium (mmol/l)[e]	0.410
Sodium supply (mmol/kg/day)[f,i]	
During the first 3 postnatal days	< 0.001
During the first postnatal week	0.001
Fluid volume (ml/kg/day)[g]	
During the first 3 postnatal days	0.161
During the first postnatal week	0.153
Weight change until nadir[h]	0.237

[a]Intraventricular hemorrhage grade 3-4; [b]plasma sodium > 145 mmol/l occurring during the first postnatal week; [c]plasma sodium > 150 mmol/l occurring during the first postnatal week; [d] plasma sodium > 155 mmol/l occurring during the first postnatal week; [e]during the first postnatal week; [f]average daily sodium supply from enteral and parenteral fluids; [g] average daily fluid volume other than transfusions from enteral and parenteral fluids; [h] percent weight change until postnatal day 4.

Logistic regression analysis. [i]adjusted for gestational age. The number of infants included in the analyses varies between 347 and 556.

additional sodium might have been given to infants with low blood pressure, which in itself is a risk factor for IVH. However, the causal relationship of sodium supply and severe IVH cannot be verified by retrospective studies, including ours.

ABS 24

COMPARISON OF THE POSTNATAL CATCH UP GROWTH ACCORDING TO THE DEFINITION OF SMALL FOR GESTATIONAL AGE INFANTS

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INTRODUCTION

The definition of small for gestational age (SGA) infants is confusedly used by birth weight (BW) below 3rd percentile or 10th percentile. The aim of the study was to evaluate the difference of the postnatal catch up growth between the small for gestational age (SGA) groups with different definitions. Additionally, the etiology of SGA in both group for catch up growth were evaluated.

METHODS

This is a retrospective study of 160 infants who was born with BW below 10th percentile and admitted to Korea University Anam Hospital and Ansan Hospital from January 2011 to December 2015. Growth parameters were analyzed by height and weight at 3, 6, 12, 18, and 24 months in the outpatient clinic and the results were compared between group A (BW < 3rd percentile) and group B (BW 3rd~10th percentile). Corrected age was used for preterm infants. The catch up growth was defined as growth parameter over 10th percentile of normal Korean infant's growth curve.

RESULTS

77 infants were in group A, and 83 infants were in group B. In regard of weight, at 3 months (n = 157), 31.6% in group A and 51.9% in group B showed catch up growth (p = 0.010). At 6 months (n = 138), 63.2% in group A and 70.0% in group B showed catch up growth (p = 0.399). At 12 months (n = 122), 58.6% in group A and 73.4% in group B showed catch up growth (p = 0.084). In regard of height, at 3 months (n = 79), 31.0% in group A and 48.6% in group B showed catch up growth (p = 0.108). At 6 months (n = 83), 56.4% in group A and 77.3% in group B showed catch up growth (p = 0.043). At 12 months (n = 88), 55.0% in group A and 60.4% in group B showed catch up growth (p = 0.608). Up to 24 months, catch up growth of weight/height were shown in 69.6%/85.7% of group A and 63.6%/80.0% of group B, respectively. The predisposing factors for SGA including twin, pregnancy induced hypertension, congenital infection and chromosome anomaly showed no statistically significant difference between the two groups.

CONCLUSIONS

The postnatal catch up growth showed no statistically significant difference between the two SGA groups. About 20% of SGA infants born with BW 3rd~10th percentile did not show catch up of growth until 2 years. Wider definition would be helpful for early diagnosis of failure to catch up in SGA infants and early referral to pediatric endocrinologist is necessary when needed.

ABS 25

RELATION OF CORD SERUM LEVELS OF INSULIN-LIKE GROWTH FACTOR-I, INSULIN-LIKE GROWTH FACTOR-BINDING PROTEIN-3, GLUCAGON AND LEPTIN ON BIRTH INDICES BETWEEN KOREAN PRETERM AND TERM INFANTS

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INTRODUCTION

Insulin-like growth factor-I (IGF-I), IGF binding proteins (IFGBPs), and leptin are associated with fetal growth. Fetal growth is accelerated in third trimester of gestation. We investigate the relation of cord blood levels of IGF-I, IGFBP-3, and leptin with intrauterine growth in preterm and term infants.

METHODS

The serum IGF-I, IGFBP-3, and leptin levels of umbilical cord blood were prospectively measured using magnetic bead based multiplex immunoassay in 151 infants born at Keimyung University Dongsan Medical Center from October 2014 to March 2015, who were classified as small (SGA, n = 40) or appropriate for gestational age (AGA, n = 111)

according to their anthropometry and calculated ponderal index at birth. One hundred-eleven AGA infants were classified into three groups according to gestational age (GA): 28-32 weeks, early preterm (EP, n = 35); 33-36 weeks, late preterm (LP, n = 38); 37-40 weeks, full term (FT, n = 38).

RESULTS

Birth weight (BW), Height, head circumference (HC), ponderal index, and cord serum levels of IGF-I and leptin were significantly different between AGA and SGA infants ($p < 0.05$). Cord serum levels of IGF-I and leptin were shown significant differences between three groups according to GA ($p < 0.05$), but cord serum IGF-BP3 level was not. Cord serum levels of IFG-I and leptin were significantly positively correlated with BW, height, HC, and ponderal index ($p < 0.05$), but cord serum IGF-BP3 level was not. Mean values and standard error of the mean (SEM) on birth indices and hormones according to gestational ages are presented in **Tab. 1**.

CONCLUSIONS

Fetal growth is associated with cord serum levels of IGF-I and leptin, but not with IGF-BP3.

ABS 26

USE OF DONOR BREAST MILK IN A TERTIARY NEONATAL UNIT – COMPLIANCE WITH A GUIDELINE

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Table 1 (ABS 25). A. Mean values and standard error of the mean (SEM) on birth indices and hormones according to gestational ages. **B.** Correlation coefficients between birth indices and cord blood hormones. **C.** Multivariate regression coefficient adjusted for gender and gestational age (IGF-I and leptin values were logarithmically transformed to normalize the respective distributions).

A.

	28-33 Weeks (n = 47)	34-36 Weeks (n = 46)	37-40 Weeks (n = 58)	p-value
Prepregnancy BMI (kg/m²)	22.9 ± 0.5	22.5 ± 0.6	22.2 ± 0.5	0.64
Pregnancy BMI (kg/m²)	26.9 ± 0.5	27.7 ± 0.6	27.6 ± 0.5	0.63
Maternal age (years)	34.7 ± 0.7	22.2 ± 0.5	22.6 ± 0.6	0.217
Birth weight (g)	1,604 ± 62	2,356 ± 64	2,937 ± 60	0
Birth height (cm)	41.2 ± 0.5	46.8 ± 0.4	48.9 ± 0.3	0
Birth head circumference (cm)	29.2 ± 0.4	32.1 ± 0.2	33.8 ± 0.2	0
Ponderal index (g/cm³ * 100)	2.25 ± 0.38	2.28 ± 0.35	2.50 ± 0.32	0
IGF-I (pg/mL)	9,539 ± 606	13,055 ± 1,049	15,938 ± 1,183	0
IGF-BP3 (ng/mL)	982 ± 55	892 ± 39	932 ± 44	0.422
Leptin (pg/mL)	2,440 ± 568	4,709 ± 935	7,123 ± 815	0

B.

	IGF-1		IGF-BP3		Leptin	
	r	p-value	r	p-value	r	p-value
Prepregnancy BMI (kg/m²)	0.029	0.720	0.720	0.381	0.130	0.112
Pregnancy BMI (kg/m²)	0.062	0.449	0.011	0.893	0.172	0.035
Maternal age (years)	-0.055	0.499	-0.073	0.373	0.069	0.397
Gestational age (weeks)	0.315	0.000	-0.042	0.607	0.408	0.000
Birth weight (g)	0.544	0.000	-0.038	0.645	0.546	0.000
Height (cm)	0.467	0.000	-0.047	0.566	0.460	0.000
Head circumference (cm)	0.372	0.000	-0.104	0.203	0.379	0.000
Ponderal index (g/cm³ * 100)	0.323	0.000	0.010	0.901	0.331	0.000

C.

	IGF-1			Leptin		
	β ± SE	Partial R^2	p-value	β ± SE	Partial R^2	p-value
Birth weight (g)	917.568 ± 120.090	0.287	0.000	354.966 ± 67.973	0.158	0.000
Birth height (cm)	4.940 ± 0.882	0.179	0.000	1.527 ± 0.487	0.064	0.002
Birth head circumference (cm)	2.445 ± 0.635	0.093	0.000	0.571 ± 0.351	0.018	0.106
Ponderal index (g/cm³ * 100)	0.226 ± 0.095	0.037	0.019	0.127 ± 0.056	0.034	0.024

INTRODUCTION

Donor Expressed Breast Milk (DEBM) is an alternative source of enteral nutrition for preterm babies when maternal breast milk is not available. DEBM has been associated with enhanced gut maturation and a lower incidence of necrotising enterocolitis compared to formula milk. DEBM contains many of the immunological factors present in breast milk however nutritional content of is of concern for preterm babies particularly protein. Leeds Neonatal Service believe the benefits of DEBM outweigh the disadvantages and have implemented a guideline with clear direction on which babies should receive DEBM and when and how the transition to formula milk should occur.

METHODS

The objective is to determine compliance with the guideline within the Leeds Neonatal Service. Premature infants (< 30 weeks of gestation) who were born during a two-year period (01/08/14-31/07/16) were included. Type of feed (MEBM, DEBM, TPN or formula) on days 3, 7, 14 and 21 of life were recorded. A group of surgical infants (included within the DEBM guideline) were also reviewed.

RESULTS

158 medical infants met the criteria (median gestation 27 weeks, mean birth weight of 903 g). Of these, 78.4% (124 infants) followed the DEBM guideline. The guideline was more strictly adhered to on day 7 and 14 compared to day 3 and 21. Of the 11 surgical babies (median gestation 31 weeks, mean birth weight 1,093 g) 9 infants followed the DEBM guideline (72.7%). In this group, the guideline was followed more closely on day 14 and 21 post surgery compared to day 1 and 7.

The guideline was followed more closely with the premature infants than the surgical infants.

CONCLUSIONS

There is good compliance to the guideline, demonstrating a good local appreciation of the benefits of DEBM use. A lack of adherence to the guideline is related more to practical issues than parental refusal. This study shows a sensible DEBM guideline can be followed and is acceptable to parents. Further focus should be made on surgical infants in order to ensure the benefits of DEBM in this vulnerable group are not missed.

ABS 27

COPPER AND ZINC CONTENT OF BREAST MILK FROM WOMEN SUFFERING FROM WILSON'S DISEASE

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INTRODUCTION

Copper (Cu) is an essential trace element. In newborns, Cu deficiency can cause, e.g., anemia, mental retardation and muscular hypotonia. A mouse model of Wilson's disease (Toxic Milk Mouse) is without Cu excretion into breast milk, and breastfed pups die of Cu deficiency. Zinc (Zn) is used to treat Wilson's disease as Zn limits the intestinal uptake of Cu. There are no studies determining the Cu or Zn content of human breast milk in Wilson's disease. Mothers with Wilson's disease often abstain from breastfeeding, since the danger of Cu deficiency in newborns cannot be excluded. The purpose of this study was to determine the concentration of Cu and Zn in breast milk of Wilson patients.

METHODS

We measured both trace elements in 11 breast milk samples of women suffering from Wilson's disease (n = 2). The 2 women were both treated with Zn. Women were asked to collect all breast milk they produced over 24 hours. 10% of every milk sample was collected for analysis, the rest was fed to the infant. To assure sufficient Cu supply, infants were partially fed with standard formula. The samples were each analyzed for Cu and Zn to obtain a profile of excretion over time. Additionally, we measured Cu and Zn in pooled 24 h-samples. We obtained three complete 24 h-milk-samples from two women. Samples from woman #1 were from 6 and 11 weeks postpartum, the sample from woman #2 from 6 weeks postpartum. Cu and Zn content was measured using mass-spectrometry.

RESULTS

The Cu content in all three pooled 24 h-samples was within the reported range of Cu in term milk from healthy women (0.2-0.4 mg/l), being 0.21 mg/l, 0.21 mg/l in woman #1's milk and 0.27 mg/l in woman #2's milk. There was only a small difference in Cu excretion over 24 h, with Cu content in single sample portions ranging between 0.20 mg/dl and 0.28 mg/dl. Interestingly, in woman #1, the amount of Cu in mother's milk did not decrease with the duration of lactation, as is seen in healthy women. Zn excretion in 24 h-samples was 2.2 mg/l, 1.1 mg/l and 1.5 mg/l and thus even below the Zn content of

formula (usually 5 mg/l). Zn excretion did not show peaks correlating with the time of administration of Zn-medication.

CONCLUSIONS

Although our data suggest a breast milk Cu excretion in Wilson's disease that is comparable to that of healthy mothers, and an even lower Zn content of mother's milk than standard formula, the small sample size forbids definitive conclusions as to whether it is safe for children of mothers with Wilson's disease to be exclusively breastfed. We aim to include in our study more mothers suffering from that rare disease to get more reliable data.

ABS 28

EARLY ENERGY AND PROTEIN INTAKE AFFECTS GROWTH AND MORBIDITY IN EXTREMELY PRETERM INFANTS

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INTRODUCTION

The importance of early energy and protein intake for growth in extremely preterm (EPT) infants has been recognized in previous studies. Low energy intake the first month was associated with increased risk of severe retinopathy of prematurity (ROP) in a previous study, but associations between early nutritional intakes and later respiratory morbidity have not been clearly demonstrated. We aimed to evaluate the effect of higher intakes of energy and protein the first week and month on weight development, and possible association with bronchopulmonary dysplasia (BPD) and ROP in a population based cohort of EPT infants.

METHODS

This study included all infants born before 27 weeks of gestational age (GA) during the years 2004 to 2011 in Stockholm, Sweden without severe malformations, hydrocephalus or abdominal surgery. Mean intakes were calculated from daily registrations of all given parenteral and enteral fluids. We examined associations between intakes of energy, protein and protein to energy ratio (PE ratio) day 4-6 and day 7-27 and a) growth (change in weight standard deviation score [WSDS] from birth), b) BPD (need for supplemental oxygen at 36 weeks postmenstrual age), and c) grade of ROP. Adjustment for GA, BWSDS, sex, antenatal corticosteroids, days of mechanical ventilation (MV), transfusions and

Table 1 (ABS 28). Difference in weight standard deviation score (ΔWSDS) from birth to 7 and 28 days.

A.

ΔWSDS from birth to day 7 (n = 271)	ΔWSDS	95% CI	p-value
Energy day 4-6 (10 kcal/kg/day)	0.09	0.06-0.12	< 0.001
Protein to energy ratio day 4-6 (g/100 kcal)	0.14	0.09-0.19	< 0.001
Energy < 90 kcal: PE ratio day 4-6 (n = 130)	0.10	0.03-0.16	0.004
Energy ≥ 90 kcal: PE ratio day 4-6 (n = 141)	0.19	0.12-0.27	< 0.001

B.

ΔWSDS from birth to day 28 (n = 249)	ΔWSDS	95% CI	p-value
Energy day 4-6 (10 kcal/kg/day)	0.09	0.06-0.12	< 0.001
Energy day 7-27 (10 kcal/kg/day)	0.06	0.02-0.10	0.002
Protein to energy ratio day 7-27 (g/100 kcal)	0.31	0.21-0.41	< 0.001
Energy < 110 kcal: Energy day 4-6 (n = 129)	0.10	0.05-0.15	<0.001
Energy < 110 kcal: PE ratio day 7-27 (n = 129)	0.26	0.14-0.38	< 0.001
Energy ≥ 110 kcal: Energy day 4-6 (n = 120)	0.06	0.02-0.10	0.007
Energy ≥ 110 kcal: PE ratio day 7-27 (n = 120)	0.44	0.27-0.60	< 0.001

A. Linear regression model of weight development from birth to day 7. Adjusted for exact gestational age (GA), birth weight standard deviation score (BWSDS), sex, transfusions of erythrocytes and plasma, days on mechanical ventilation (MV) and fluid intake the first week. **B.** Linear regression model of weight development from birth to day 28. Adjusted for GA, BWSDS, sex, transfusions of erythrocytes and plasma, days on MV day 0-28 and fluid intake the first week.

fluid intake were considered in linear and Poisson regression models.

RESULTS

The study cohort consisted of 280 EPT infants. Higher intake of energy day 4-6 was significantly associated with reduced weight loss the first week irrespective of fluid intake, and positively associated with change in WSDS at 28 days. Higher PE ratio was associated with weight gain dependent on energy intake (**Tab. 1**). Energy or protein intake day 4-6 was not associated with risk of BPD. There was a 5% risk reduction in degree of ROP (95% CI 1-10; p = 0.029) for every 10 kcal/kg/d increase in energy intake day 4-6. Every 10 kcal/kg/d higher energy intake day 7-27 reduced the risk of BPD with 10% (95% CI 2-17; p = 0.015), and ROP with 5% (95% CI 0-9; p = 0.038). In infants that received MV day 7-27 higher protein intake was associated with a statistically significant lower risk of BPD, provided that the energy intake was sufficient.

CONCLUSIONS

Early intake of energy and protein are of importance for reduced initial weight loss and later growth. Higher energy intake the first month is associated with a lower risk of developing BPD and ROP, and higher protein intake to infants receiving MV the first month is associated with a reduced risk of BPD, if energy intake is sufficient.

ABS 29

USE OF PROBIOTICS IN PRETERM NEWBORNS. DOES FEEDING TOLERANCE IMPROVE?

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INTRODUCTION

The use of probiotics is increasingly popular as they may enhance intestinal function in premature infants thus preventing necrotizing enterocolitis and sepsis. However questions remain about the efficacy of probiotics in improving growth and feeding tolerance. The objective is to assess nutritional outcomes in preterm infants with very low birth weight after the implementation of probiotics.

METHODS

Retrospective chart review of infants with birth weight less than 1,500 grams and/or 32 weeks of gestational age admitted to our Neonatal Intensive Care Unit. Data were collected over two periods, period 1 (before probiotics) and period 2 (after probiotics) and included demographic data, feeding strategies and comorbidities affecting feedings and weight gain (weight at 28 days of life, weight at 36 weeks corrected age, weight at discharge. Multispecies probiotic mixture consisted of 1×10^9 CFU, *L. acidophilus* and *L. bifidobacterium* per day until 35 weeks of gestation or discharge. Primary outcomes were incidence of necrotizing enterocolitis (NEC) and sepsis.

RESULTS

A total of 84 infants (period 1) were compared with 124 infants (period 2). There were no significant differences in the incidence of NEC, sepsis or weight

Table 1 (ABS 29). Results over 2 periods, before and after administration of probiotics.

	Before	After	p
NEC	0.9%	0.7%	0.849
Staphylococcal sepsis	36.8%	47%	0.099
Gram negative sepsis	7.9%	9.4%	0.669
DBP			
O_2 at 28 days	23.9%	24.3%	0.936
O_2 at 36 weeks	9.7%	14.5%	0.25
Feeding			
Time to reach full	11.67 (5.37)	15.39 (11.22)	0.005
Isolated shot	5.86 (12.23)	11.18 (18.20)	0.021
Vomit	0.64 (2.37)	1.03 (1.61)	0.166
Weight gain			
Weight at 28 days of life	1,466.49 (514.44)	1,361.54 (564.51)	0.284
Weight at 36 weeks corrected age	1,549.78 (2,290.76)	1,314.76 (346.16)	0.317
Difference Z score between weight at hospital discharge and birth weight	-2.01 (1.13)	-4.79 (28.51)	0.375
Hospital stay	25.5%	25.12%	0.861

gain. There were no differences either between the two groups in the hospital stay. The bivariate analysis noted an increase in the numbers of days to reach full feeds in period 2 (11.67 vs 15.39 p = 0.005) and also in numbers of feeding intolerance episodes (5.86 vs 11.18 p = 0.021). Multivariate logistic regression finally showed no relation with probiotic administration. Results are presented in **Tab. 1**.

CONCLUSIONS

In our study probiotics supplementation did not affect growth outcomes or the improvement of incidence of any signs of feeding intolerance. Larger studies focusing on short and long-term outcomes are needed in the future.

ABS 30

VALID AND RELIABLE EARLY IDENTIFICATION OF NEONATAL DYSPHAGIA

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INTRODUCTION

Developing countries are faced with multiple health care challenges, including support for optimal infant growth and nutrition. The early identification of feeding difficulties in the neonatal period may contribute to early nutritional and feeding skill management leading to improved infant health outcomes.

METHODS

The Neonatal Feeding Assessment Scale (NFAS) was validated and developed to address the need for a user-friendly clinical tool to identify oropharyngeal feeding and swallowing difficulties in neonates born prematurely and with low birth weight. The sensitivity, specificity, accuracy, inter-rater reliability and predictive value of the NFAS were investigated to determine validity and reliability. A comparative within-subject design was implemented. A group of 48 neonates with a mean gestational age of 35.5 weeks were sampled. The NFAS consists of six subsections, including physiological stability, infant state, stress cues, screening of muscle tone and control, oral peripheral examination and feeding/swallowing assessment.

RESULTS

High sensitivity (78.6%) and specificity (88.2%) scores were obtained. The positive predictive value was 78.6%. Subsequently the accuracy of the NFAS to identify the presence of feeding and swallowing difficulties correctly was 85.4% in comparison to the objective gold standard outcomes. Inter-rater reliability was determined using 35% of the sample. The agreement on overall NFAS outcome between two raters was considered substantial beyond chance (Cohen's Kappa: 0.598; Asymptotic standard error: 0.211).

CONCLUSIONS

The NFAS may be used as a clinical assessment tool to identify oral-pharyngeal dysphagia in premature neonates. The NFAS may also be of use to clinicians working without access to instrumental assessment equipment and to reach under served neonates to ensure early intervention to support optimal nutrition and growth and facilitation of developmentally supportive oral feeding skills.

ABS 31

EFFECT OF INFANT FORMULA WITH PROTEIN CONTENT OF 1.6 G/100 KCAL FED BETWEEN 3-12 MONTHS ON BODY COMPOSITION AND ADIPOSITY AT AGE 5 YEARS

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INTRODUCTION

Breastfed infants have a lower risk for later obesity compared to formula-fed infants, possibly due in part to the lower protein content of breast milk vs. standard term formulas. We have previously shown that children fed lower-protein formula during infancy had normal growth at 3 and 5 years of age; significantly higher body mass index (BMI) at age 5 years among children fed higher-protein (but not lower-protein) formula vs. breast milk suggested a possible programming effect. Additional anthropometry, body composition, and blood pressure data from this follow-up study are presented here, in order to assess potential differences in fat mass, lean mass, and markers of cardiovascular health.

Table 1 (ABS 31). Treatment differences in body composition assessed by DEXA (n = 160 at 3 y; n = 151 at 5 y).

	Study interval	Body fat (%)		Fat mass (g)		Fat-free mass g)	
		Difference [95% CI]	P	Difference [95% CI]	p	Difference [95% CI]	p
EXPL vs. CTRL	6 mo to 3 y	-3.31 [-6.21, -0.41]	**0.026**	-339 [-795, 118]	0.144	-140 [-576, 295]	0.524
	6 mo to 5 y	-2.89 [-5.71, -0.08]	**0.044**	-130 [-867, 607]	0.727	131 [-630, 892]	0.733
CTRL vs. BF	6 mo to 3 y	5.33 [2.75, 7.90]	**0.001**	530 [124, 936]	**0.011**	-277 [-664, 111]	0.160
	6 mo to 5 y	5.27 [2.85, 7.69]	**< 0.001**	853 [219, 1,487]	**0.009**	152 [-502, 807]	0.646
EXPL vs. BF	6 mo to 3 y	2.02 [-0.68, 4.71]	0.141	191 [-233, 616]	0.373	-417 [-823, -12]	**0.044**
	6 mo to 5 y	2.37 [-0.18, 4.93]	0.068	723 [54, 1,392]	**0.034**	283 [-407, 974]	0.418

DEXA, dual-energy x-ray absorptiometry; CI, confidence interval.

METHODS

Children randomized as healthy infants to receive experimental (EXPL; 1.61 g protein/100 kcal, 67.2 kcal/dL) or control (CTRL; 2.15 g protein/100 kcal, 64.6 kcal/dL) formula from age 3-12 mo (n = 97/group), or enrolled as a non-randomized breastfed group (BF; n = 112), were contacted for follow-up visits at 3 y and 5 y. Follow-up measures included anthropometry (waist and mid-arm circumferences; triceps, subscapular, abdominal, and thigh skinfold thickness), body composition (DEXA), and blood pressure (BP). Group differences (n = 192 at 3 y; n = 173 at 5 y) were estimated by ANCOVA and odds ratio (OR) of incidence of BMI-for-age Z-score > 85th percentile was estimated by logistic regression, both corrected for baseline (3 mo value or 3 mo weight if value was unavailable), sex, and maternal pre-pregnancy BMI.

RESULTS

Changes in percentage body fat from 6 mo to 3 and 5 y were significantly greater in CTRL vs. BF and CTRL vs. EXPL, with no significant difference between EXPL vs. BF (**Tab. 1**). Triceps skinfold thickness was significantly greater in CTRL vs. BF at 3 y (group difference [Δ] = 1.02 mm; p = 0.024) and 5 y (Δ = 1.32 mm; p = 0.014), with no significant differences between EXPL and BF or EXPL and CTRL. Mid-arm circumference at 5 y was higher in both EXPL and CTRL vs. BF (Δ = 0.81, 0.67 cm, respectively; both p < 0.014). There were no differences in other anthropometric or skinfold parameters. Both EXPL and CTRL had higher systolic BP vs. BF at 5 y (Δ = 4.17, 4.20 mmHg, respectively; both p 85th percentile at 5 y was significantly higher in both EXPL and CTRL vs. BF (Δ = 4.82, 5.90, respectively; both p < 0.024).

CONCLUSIONS

Children fed formula with 1.61 g protein/100 kcal during infancy have adequate growth based on anthropometric assessments at age 3 and 5 years. Among children fed higher-protein formula vs. breast milk during infancy, greater changes in percentage body fat over time, higher triceps skinfold thickness, and previously reported higher BMI values and Z-scores support a possible programming effect of higher protein intakes during infancy.

DECLARATION OF INTEREST

This study was sponsored by Nestlé Nutrition. DG, MC, and NPH are employees of the research organization of Nestec Ltd. EEZ, DAF, and SEN received research funding from Nestlé Nutrition. FH is a board member of the Nestlé Nutrition Institute and receives consulting fees from Nestec Ltd.

ABS 32

EARLY-LIFE PROTEIN INTAKE IN INFANTS BORN EXTREMELY PRETERM IS ASSOCIATED WITH HIGHER BLOOD PRESSURE AT SCHOOL-AGE

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INTRODUCTION

Survival among extremely preterm infants (born < 27 weeks of gestation) has greatly increased in

recent years. It has been suggested that preterm birth is associated with worse cardiovascular outcomes later in life, including death due to cardiovascular causes. More specifically, blood pressure has been shown to be elevated among both adults and school-age children born preterm. It has also been long debated whether early-life nutrition and catch-up growth affect cardiovascular morbidity later in life. This study aimed at investigating the association between early-life nutrition and catch-up growth and blood pressure measurements at 6.5 years of age in children born extremely preterm.

METHODS

We included children from the Extremely Preterm Infants in Sweden Study (EXPRESS) – a cohort study including all infants born in Sweden before 27 weeks of gestation during 2004-2007. A population-based group of 262 surviving children was invited to a comprehensive cardiovascular assessment at 6.5 years of age ± 3 months in 3 of the 7 participating regions. Children were excluded if they had congenital or ongoing cardiovascular or pulmonary disease or if no blood pressure measurement could be performed. Three consecutive blood pressure and heart rate measurements were performed after 15 minutes rest and mean values were calculated. Height and weight were also measured. Nutritional intake data was extracted from the patients´ files. A linear regression model was used in the analysis.

RESULTS

The analysis included 171 children. An association was found between mean protein intake during the periods 0-10 and 5-10 weeks of life and mean diastolic blood pressure (DBP) at age 6.5 years – a 4-5 mmHg increase in DBP with every 1 g/kg/day increase in protein intake ($p < 0.01$). This association was strongest among small for gestational age (SGA) infants ($n = 22$, DBP increase of 9-11 mmHg; $p = 0.001$). The association remained significant when adjusted for gestational age at birth and height at follow-up. No such association was found in non-SGA infants or for systolic blood pressure (SBP). Lower SBP was found among SGA infants who had larger increase in length during the periods 0-8 and 0-10 weeks of life – a 5 mmHg decrease in SBP for every 1 standard deviation gained in length ($p < 0.05$). No such association was shown for non-SGA infants, for the entire cohort, for DBP or for heart rate.

CONCLUSIONS

DBP at school age was clearly associated to early-life protein intake among children born extremely preterm. Most of this association was confined to extremely preterm children born SGA.

However, catch-up growth during the first postnatal months was not associated with later blood pressure in children born extremely preterm except for those born SGA, in which early-life length catch-up was associated with lower SBP at school-age.

ABS 33

EXTRAUTERINE GROWTH RESTRICTION ASSOCIATED FACTORS IN SMALL AND APPROPRIATE FOR GESTATIONAL AGE INFANTS: A COHORT STUDY

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INTRODUCTION

Extrauterine growth restriction (EUGR) remains frequent in very-low-birth-weight infants (VLBW), despite the dissemination of more aggressive nutritional practices, and is associated with impairment in neurodevelopmental and growth. This study aims to estimate the rate of EUGR and describe the associated factors in appropriate (AGA) and small for gestational age (SGA) infants.

METHODS

Prospective cohort study in which 285 VLBW infants were followed. The Z-score of weight to gestational age at birth and at discharge have been calculated using the Fenton dataset. The fall in weight Z-score between birth and discharge > 1.0 has been used as the definition of EUGR. Both groups of SGA and AGA infants were divided into those with and without EUGR and these groups were compared. The categorical variables were compared using the Chi-square test and the continuous variables were compared with the T-test or non-parametric test. The multiple logistic regression was used to demonstrate the independent effect of selected variables in EUGR on each group (AGA and SGA).

RESULTS

A rate of 40.7% EUGR among VLBW infants was found and the mean change in weight Z-score between birth and discharge was -0.92. EUGR was more frequent amongst AGA (45.4% vs 22.8%, $p = 0.006$). EUGR was associated with the majority of

neonatal morbidities. For AGA, the probability of EUGR at discharge increases by 12 times if NEC occurs and by 6.35 times if the infant takes longer than 11 days to regain the birth weight; for SGA, need for resuscitation in delivery room and birth weight below 1 kg increases that chance by 5.7 and 3.2 times, respectively.

CONCLUSIONS

EUGR was more frequent amongst AGA and was associated with the occurrence and severity of neonatal morbidities. Amongst SGA, EUGR was linked to the need of resuscitation and lowest weights at birth.

ABS 34

IS THERE ANY ASSOCIATION BETWEEN LAMELLAR BODY COUNTS AND CORD BLOOD VITAMIN D LEVELS OF TERM AND LATE PRETERM INFANTS?

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INTRODUCTION

There is a growing knowledge that vitamin D deficiency could be related with various neonatal morbidities such as early sepsis, respiratory distress syndrome etc. However, the exact mechanism of how vitamin D deficiency leads to respiratory morbidities is not clearly elucidated. The aim of this study was to investigate the relationship between cord blood vitamin D levels and lamellar body counts.

METHODS

Umbilical cord blood samples and gastric aspirates to examine lamellar body counts were collected in delivery room from the infants with gestational age ≥ 34 weeks and whose parents gave consent. All infants were monitored and assessed every 30 minutes with Silverman score. Infants who had a score ≥ 4 were admitted to NICU. Cord blood vitamin D levels and lamellar body counts were compared between infants who required admission and not. None of the mothers received vitamin D support during their pregnancy.

RESULTS

Twenty-three infants required NICU admission and they compared with 27 control subjects. Mean gestational ages (36.3 ± 1.4 and 37.9 ± 1.3 weeks) and mean birth weights (2,789 ± 530 g and 3,135 ± 416 g) were significantly lower in admitted infants ($p < 0.01$). Lamellar body counts (197 × 103 ± 135 × 103 and 167 × 103 ± 144 × 103/μl) and vitamin D levels (10.3 ± 5.1 and 10 ± 4 ng/ml) did not differed between groups. No significant correlation observed between lamellar body count and vitamin d levels ($r = -0.16$, $p = 0.24$).

CONCLUSIONS

These results did not reveal any relationship between lamellar body counts and vitamin D levels. In this cohort only one patient had normal vitamin D level (> 25 ng/ml) so this could be the reason that we could not support our hypothesis. Recruitment to the study is ongoing and further analysis will be performed.

ABS 35

NEONATAL BODY COMPOSITION OF INFANTS BORN TO MOTHERS WITH GESTATIONAL DIABETES MELLITUS

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INTRODUCTION

Gestational diabetes complicates approximately 5% of pregnancies. While some studies have demonstrated a strong correlation between gestational diabetes and fetal macrosomia with increased neonatal adiposity, others have demonstrated the converse. Air-displacement plethysmography is a non-invasive, safe and validated method of determining the neonatal body composition. The aim of this study was to measure the body composition of term infants born to mothers with diabetes complicated pregnancy.

METHODS

The study was a prospective observational study. Women attending the Antenatal Diabetic Clinic were identified and approached for consent after delivery. All infants were well, term (> 37 weeks gestation) neonates. Infants who were admitted to the neonatal unit for > 48 hours

Table 1 (ABS 35). Birth weight and body fat percentage between male and female infants.

	Gender	N	Mean	Std. Deviation	p-value
Birth weight (kg)	Male	42	3.5533	0.3653	0.216
	Female	45	3.4351	0.5037	
Body fat (%)	Male	41	11.482	3.7697	0.815
	Female	43	11.686	4.1806	

were excluded. Birth weight and gestation was recorded, as well as infant anthropometry. Body composition was measured using air-displacement plethysmography.

RESULTS

Of 87 infants recruited, 42 (48.2%) were male and 45 (57.8%) were female, with a mean gestational age of 38.8 weeks (SD 0.80). The mean birth weight was 3.49 kg (SD 0.44) and the mean body fat percentage was 11.58% (SD 3.96). The mean maternal BMI was 30.7 (SD 7.46). There was no significant difference in birth weight and body fat percentage between male and female infants (**Tab. 1**). Maternal BMI, fasting and 2-hour postprandial glucose and gender were not predictors for birth weight. We also found no significant correlation between infant body fat percentage and gestational age (p 0.99), gender (p 0.78), maternal BMI (p 0.69), fasting glucose (p 0.49) and 2-hour postprandial glucose (p 0.12).

CONCLUSIONS

In a pregnancy uncomplicated by gestational diabetes, female gender and increased gestation result in an increase in neonatal body fat percentage. In this study it was found not to be the case for infants of gestational diabetic mothers. It could be that gestational diabetes has more of an adverse effect on the male infant. Despite maternal BMI being in the obese range, mean birth weight of the infants was within the population norm.

ABS 36

EFFECT OF ENTERAL IRON SUPPLEMENTATION ON HEALTH OUTCOMES IN PRETERM AND LOW BIRTH WEIGHT INFANTS: A SYSTEMATIC REVIEW

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INTRODUCTION

Achieving iron balance by avoiding deficiency as well as iron overload is critical to optimal growth and development during infancy and beyond. Enteral iron supplementation from 2-6 weeks of age is recommended to achieve this balance in preterm infants, however the impact of this supplementation on health outcomes is unclear. Our objective was to perform a systematic review of the literature to examine the effect of enteral iron supplementation on iron status indices, growth, neurodevelopment and adverse clinical outcomes (e.g. retinopathy of prematurity, morbidity) in preterm and low birth weight infants.

METHODS

A systematic literature search of PubMed and the *Cochrane* Library was performed from inception up until April 2017. Studies were eligible for inclusion if participants were infants born either premature (< 37 weeks' gestation) or with a low birth weight (< 2,500 g) and received enteral iron supplementation, i.e. formula, fortified human milk, medicinal iron. All types of intervention studies were eligible, but specific information on the dose of iron supplementation was an essential requirement for inclusion.

RESULTS

From a total of 630 records retrieved, 27 were eligible for inclusion. The heterogeneity across studies was extensive, particularly in the duration of treatment and follow-up (ranging 1 week-5 years). The risk of bias was high in 14 studies, mainly due to inadequate allocation concealment and incomplete outcome data. 24/27 studies reported on iron status indices. Supplementation for ≥ 8 weeks resulted in increased haemoglobin and ferritin concentrations and a reduction in iron deficiency in nine placebo-controlled trials. No study reported on the incidence of iron overload. Out of 12 studies that included growth-related parameters, no effect of supplementation was reported. Six studies reported on neurodevelopment; a positive effect on behaviour at 3.5 years was observed in one study. Ten studies reported on adverse clinical

outcomes; no adverse effect of supplementation was observed.

CONCLUSIONS

Enteral iron supplementation for ≥ 8 weeks appears to result in improvements in iron status indices and a reduction in iron deficiency in preterm/low birth weight infants. There is a paucity of high quality evidence regarding the effect of supplementation on other health outcomes, in particular with respect to long-term neurodevelopmental outcomes. The issue of iron overload has largely been ignored. High quality randomised controlled trials with long-term follow-up are required.

ABS 37

NEONATAL INTESTINAL FAILURE IN THE UK – WHO CARES?

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INTRODUCTION

Neonatal intestinal failure (IF) is a challenging condition with uncertain long-term outcome. With improving survival rates the number of neonates (particularly preterms) dependent on long-term parenteral nutrition is increasing. In the UK children with IF are cared for by multi-disciplinary teams led by gastroenterologists in order to provide a cohesive approach to decision-making and management. However, no clear framework exists for the management of neonates. It is recognised that knowledge, beliefs and practice vary between different paediatric sub-specialists. Therefore variation in the provision of care is likely to lead to variation in parental counselling and clinical management. The objective of this survey was to determine the clinical care arrangements for preterm and term neonates with short bowel syndrome in the UK.

METHODS

A questionnaire consisting of 10 questions relating to place of care, multi-professional and paediatric gastroenterology involvement was distributed to clinicians at NHS hospital trusts providing neonatal surgery within the UK using an online survey tool. The questions specifically related to the care of a preterm and a term neonate with extreme short gut. The survey was initially sent to paediatric surgeons and subsequently to neonatologists and/or paediatric gastroenterologists if no response had been obtained from a hospital after two requests.

RESULTS

We received responses from 22/25 (88%) centres. The majority of babies (88% and 71% of preterm and term

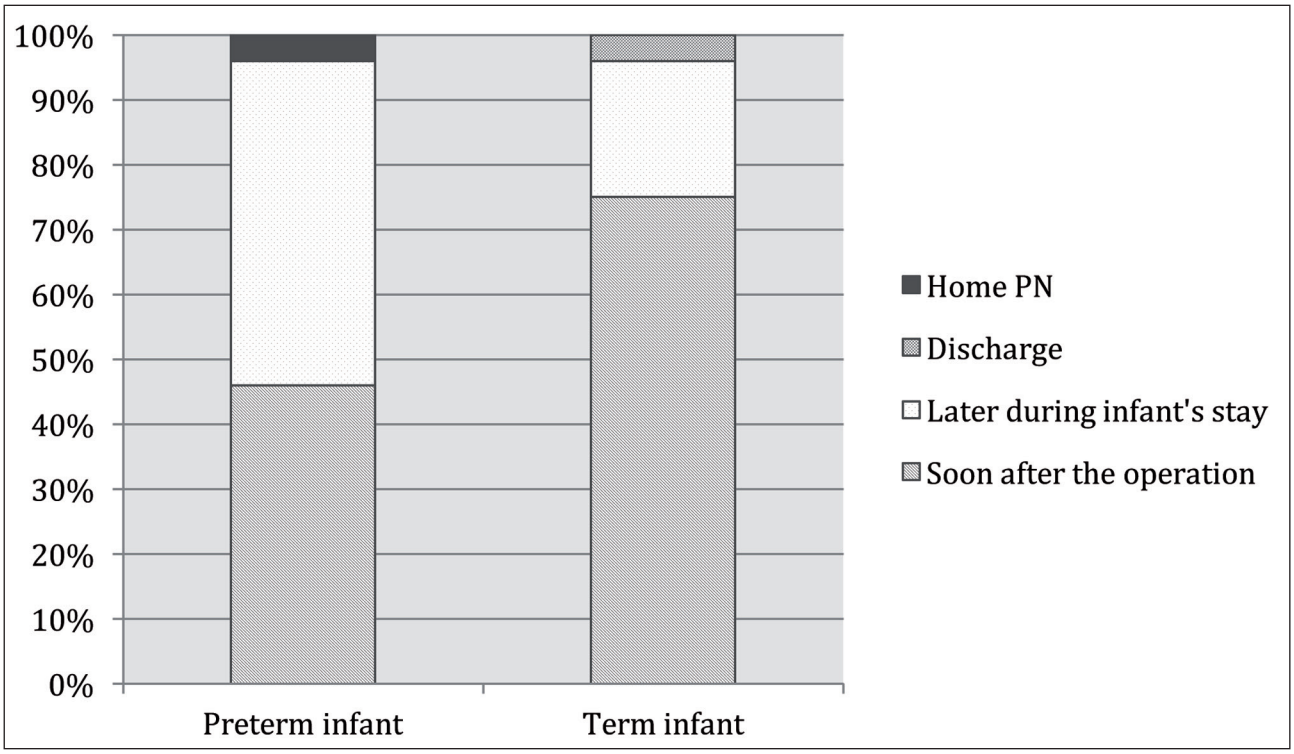

Figure 1 (ABS 37). Care of preterm and term infants with extreme short guts (for the explanation see the text).

infants respectively) are cared for on a neonatal intensive care unit (NICU) in the immediate postoperative period. 25% of term babies then transfer to a paediatric surgery and 25% to a paediatric gastroenterology ward. However, the majority of preterms (83%) remain in a NICU under the care of neonatologists. The criteria for transfer of a preterm baby from neonatal care to other paediatric subspecialties are highly variable. 75% and 83.3% of centres have formal multi-professional teams for preterm and term infants respectively with short bowel syndrome. While 75% of term babies have gastroenterology involvement from early after the initial surgery, only 46% of preterms have early involvement. Results are presented in **Fig. 1**.

CONCLUSIONS

In the UK arrangements for the care of babies with IF is inconsistent, particularly for preterms who are often most challenging. Regardless of place of care, all infants with IF should be managed by a team of appropriately skilled professionals, including paediatric gastroenterologists.

ABS 38

PREVALENCE OF PREDIABETES AND TYPE 2 DIABETES IN YOUNG ADULTS BORN WITH VERY LOW BIRTH WEIGHT

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INTRODUCTION

Some evidence suggests that those born with very low birth weight (VLBW) have increased risk for insulin resistance. Two studies of VLBW young adults born 1978-1985 reported 7-9% of the VLBW group had abnormal glucose with oral glucose tolerance testing (OGTT). One found hyperglycemia was influenced by sex and birth weight < 10th percentile, the other found no association with adiposity status. As the prevalence of adiposity has increased, our objective was to describe the overall and sex-specific prevalence of type 2 diabetes (T2DM) and prediabetes and the associations between birth weight < 10th percentile and obesity in a contemporary cohort of young adults born with VLBW.

METHODS

In a cohort of VLBW infants born 1992-1996 we measured height and weight, calculated body mass index (BMI) and performed an OGTT. Participants were classified as having T2DM (fasting glucose ≥ 7 mmol/L or 2 hour glucose ≥ 11.1 mmo/L) or prediabetes based on impaired fasting glucose (5.6-6.9 mmol/L) or impaired glucose tolerance (2 hour glucose 7.8-11.0 mmol/L) using American Diabetes Association guidelines. Using crude and adjusted (adjusted for race) generalized linear models (logit link, binomial distribution) we estimated the

Table 1 (ABS 38). Characteristics of participants.

	Prediabetes/T2DM n = 31		Normal glucose n = 139	
	Male n = 11	Female n = 20	Male n = 63	Female n = 76
Perinatal				
Gestational age, weeks	28 ± 1.8	27 ± 2.8	28 ± 3.0	28 ± 2.7
Birth weight, g	1,041 ± 240.4	956 ± 279.2	1,104 ± 267.9	1,050 ± 276.4
Birth weight z score	-0.36 ± 0.756	-0.21 ± 0.798	-0.46 ± 0.938	-0.24 ± 0.774
Birth weight < 10th percentile	1 (9.1)	3 (15.0)	11 (17.5)	5 (6.6)
Black	4 (36.4)	9 (45.0)	30 (47.6)	32 (42.1)
Young adult				
Age, years	19.5 ± 1.13	19.8 ± .88	19.6 ± .74	19.7 ± .83
Height, cm	174.8 ± 8.29	157.6 ± 6.11	171.3 ± 8.03	159.3 ± 6.91
Weight, kg	79.4 ± 29.19	75.3 ± 22.63	77.4 ± 21.19	63.3 ± 16.96
BMI, kg/m^2	25.7 ± 8.33	30.2 ± 8.36	26.3 ± 6.57	25.0 ± 6.72
Obese (BMI > 30 kg/m^2)	3 (27.3)	12 (60.0)	17 (27.0)	17 (22.4)

Data are expressed as mean ± SD or N and percentage.
T2DM: Type 2 Diabetes Mellitus: BMI: Body Mass Index.

association between birth weight percentile (< 10th vs ≥ 10th) and obesity (BMI ≥ 30 vs < 30 kg/m^2) with prediabetes/T2DM stratified by sex.

RESULTS

Valid results were obtained for 170 (74 male, 75 black) participants at 18-22 years of age. Characteristics of participants are shown in the **Tab. 1**. Birth weight < 10th percentile was present in 20 (12%) and obesity in 38 (29%). Thirty-one (18%) had abnormal glucose values with 26 (15%) having prediabetes (11 male) and 5 (3%) having T2DM (0 male). A positive association was observed between obesity and prediabetes/T2DM (aOR = 3.0; 95% CI: 1.3, 6.9) relative to non-obesity adjusted for race. The association was sex-dependent (aOR = 5.8; 95% CI: 1.9, 17.7 for females and aOR = 1.0; 95% CI: 0.2, 4.3 for males). Birth weight < 10th was not associated with prediabetes/T2DM nor influenced by sex (main effect aOR: 1.1; 95% CI: 0.3, 3.6 and p for interaction with sex = 0.25).

CONCLUSIONS

Our cohort of VLBW young adults exhibited higher rates of prediabetes and T2DM than reported in earlier cohorts. Among females but not males, adiposity was associated with increased risk of prediabetes or T2DM. This finding may be attributed in part to exposure to a more obesogenic environment, but other factors such as early life exposures and lifestyle differences such as physical activity should be explored.

ABS 39

THE MATERNAL-FETAL GRADIENT OF FREE AND ESTERIFIED PHYTOSTEROLS AT THE TIME OF DELIVERY IN HUMANS

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INTRODUCTION

During pregnancy, dietary phytosterols (PHY) are able to cross the human placenta. High intakes of PHY, such as those consumed by vegan and vegetarian women, are not recommended for pregnant women (PW) due to potential adverse effects on pregnancy and neonates. Previously known evidences suggest that preterm neonates receiving PHY-rich lipid emulsions may be at higher risk to develop life threatening illness, such as cholestasis. In our opinion, understanding of fetal PHY exposure *in utero* may be important to improve the nutritional management of PW and preterm neonates. For this purpose, we characterized the maternal-fetal gradient of free and esterified PHY at the time of delivery in humans.

METHODS

PW who delivered at term (37 full gestational weeks) at the Obstetrics and Gynaecology Unit of the University Hospital of Padua (Padua, Italy), between November 2016 and March 2017, participated in the study. Left over blood samples after routine biochemistry (scavenged blood) were collected from PW (cubital vein), and umbilical cord (umbilical vein) at the time of delivery for fatty acids (FA), cholesterol, (CHO), CHO metabolites (7-dehydrocholesterol, 7-DHCHO; lathosterol, LATHO; 7α-hydroxycholesterol, 7α-HCHO), and PHY (campesterol, CAMP; stigmasterol, STIGM; sitosterol, SITO) measurements. Venous blood of non-pregnant adult volunteers (Ctrl-NA), consuming a normal diet, served as controls. Gas chromatography-mass spectrometry was used for measurements.

RESULTS

Thirty-four term PW and 12 Ctrl-NA signed informed consent and were studied. Plasma total PHY concentrations in cord blood (CB) were up to 20-folds lower than in PW ($p < 0.05$). Positive and significant correlations were found between total PHY of PW-CB pairs ($p < 0.01$), and between total FA and CAMP of PW ($p < 0.05$). Interestingly, free CHO to CHO ester ratio of CB did not differ from that of PW, and free PHY to PHY ester ratios were higher in CB than in PW ($p < 0.001$; **Fig. 1**). No differences were found between PHY concentrations of PW and Ctrl-NA. However, free CHO to CHO ester ratio, and free PHY to PHY ester ratios were found higher in PW than in Ctrl-NA ($p < 0.05$). CHO synthesis, as indicated by 7-DHCHO to 7α-HCHO, LATHO to 7α-HCHO, and LATHO to SITO ratios, was greatest in CB, and lowest in Ctrl-NA ($p < 0.01$).

CONCLUSIONS

To the best of our knowledge, this is the first study on the maternal-fetal gradient of free and esterified PHY at the time of delivery in humans. Our data suggested that: (a) the placenta tends to limit the

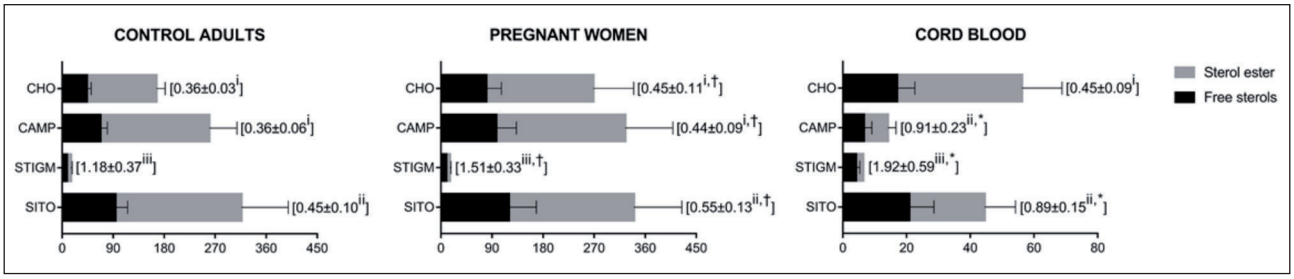

Figure 1 (ABS 39). Free and esterified sterol concentrations, and free sterol to sterol ester ratios of PW, CB and Ctrl-NA. Values are presented as Mean ± SD. Values are in mg/dl for CHO, and in μg/dl for CAMP, STIGM, and SITO. Free sterol to sterol ester ratios are in parentheses.
*$p < 0.05$ compared with PW; paired t-test between PW and CB. †$p < 0.05$ compared with Ctrl-NA; independent t-test between PW and Ctrl-NA.
i$p < 0.05$ compared with other sterol ratios; repeated measures-ANOVA and Bonferroni post-test within each group.

PHY availability to the fetus, (b) free PHY cross the placenta more easily than PHY ester, and (c) STIGM crosses the placenta more easily than the other PHY, when they were compared to CHO. Further studies will be needed to clarify the impact of these findings on the neonatal outcomes.

ABS 40

TRANSIENT POSTNATAL OVERFEEDING IN MICE LEADS TO METABOLIC AND HEPATIC DISORDERS AT ADULTHOOD

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INTRODUCTION

Increased rates of childhood obesity, leading to increased occurrence of metabolic syndrome are observed worldwide. An altered nutritional environment during critical periods of development can lead to metabolic disorders later in life. The liver, involved in lipid/glucose homeostasis, is particularly vulnerable to nutritional programming during the perinatal period. Oxidative stress (OS) associated with stress-induced premature senescence (SIPS) has been involved in metabolic and liver dysfunctions. In this study, we investigated in a murine model whether transient postnatal overfeeding (OF) can lead later in life to metabolic and hepatic disorders.

METHODS

C57BL/6 male pups were maintained, during the lactation period, in litters adjusted to 9 pups for normal feeding (NF) or reduced to 3 pups to induce transient postnatal OF. After weaning at postnatal day (PND) 24, all mice had free access to a standard diet. At 6 months of age, glucose and insulin tolerance tests were performed. The following parameters were studied at PND 24 and 7 months of life: i) body weight (BW); ii) markers of OS (reactive oxygen species, antioxidant defenses); iii) markers of SIPS (factors involved in cell cycle arrest (p21, p53, Acp53 and p16, pRb/Rb), SIRT-1); iv) liver structure/function (histological analysis, insulin signaling pathways and glucose transporters expression).

RESULTS

At PND 24, BW of OF pups was 63% higher than NF pups, but no difference in hepatic structure and function were observed between both groups. At 6 months of life, OF vs. NF mice displayed increased area under curve of blood glucose concentration after glucose challenge as well as a higher blood glucose concentration after insulin injection ($p < 0.05$). At 7 months, BW of OF group mice was 11.7% higher compared to NF animals. Moreover, in the liver from 7-month-old OF vs. NF mice, we observed: i) higher levels of superoxide anion, and decreased catalase and superoxide dismutase expression ($p < 0.01$); ii) increased expression of p21, p53, Acp53 and p16, but decreased pRb/Rb and SIRT-1 expression ($p < 0.01$); iii) microvesicular steatosis and hepatic fibrosis; iv) decreased IRS-1/2, pIRS-1/2, PI3K, pAkt/Akt expression ($p < 0.01$), decreased GLUT-2, but increased GLUT-4 expression ($p < 0.05$).

CONCLUSIONS

A transient postnatal OF during the lactation period leads to increased BW, glucose intolerance, insulin resistance and impaired hepatic structure and function at adulthood. These changes are associated with liver OS and SIPS, probably due to decreased

SIRT-1 expression. Modulating SIRT-1 expression may represent an interesting therapeutic strategy to prevent metabolic and hepatic dysfunctions induced by early postnatal OF.

ABS 41

HYPOARGININAEMIA AND SEPSIS IN VERY PRETERM INFANTS RECEIVING PARENTERAL NUTRITION

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INTRODUCTION

We have previously shown that very preterm infants (VPI) have low plasma arginine levels when receiving current parenteral nutrition (PN) amino acid (AA) formulations. Arginine is involved in several metabolic and inflammatory pathways including those affecting T-cell function. Hypoargininaemia is associated with necrotising enterocolitis (NEC). Arginine and glutamine share metabolic pathways. Glutamine also has a role in immune function and gut integrity. Aim: to compare plasma arginine levels in VPI stratified according to whether positive (PS) or negative for sepsis (NS).

METHODS

The RCT: Standardised Concentrated Additional Macronutrient Parenteral (SCAMP) nutrition study [1] stratified infants into to gestational bands and randomised to receive a standard or high protein/energy PN regimen. Our secondary analysis re-stratified VPI into PS or NS based on blood culture in the first 28 days of life using previously published sepsis criteria and outcomes [2]. This process was repeated for a positive/negative diagnosis of confirmed NEC and the composite outcome of NEC or sepsis. Plasma arginine, glutamine and glutamate levels were measured in the second week of life using ion exchange chromatography.

RESULTS

Of the 150 VPI (< 29 weeks) randomised in the original study, AA data were available for 47/57 in the PS group and 77/93 in the NS group. Mean (sd) plasma arginine levels were lower in the PS group (**Tab. 1**) and lowest in the 24-26 weeks gestation stratum. They were also lower in the substratum of all PS infants (n = 21) with more than 1 episode of sepsis: 30 (15) μmol/l (p = 0.02). Analysis was unchanged by excluding the 2 infants with early onset sepsis (day 1-3). There was no difference in plasma AA comparing NEC (n = 19) and no NEC (n = 105) groups. The composite outcome: NEC or sepsis is shown in **Tab. 1**.

CONCLUSIONS

Sepsis in the first 28 days of life is associated with low plasma arginine levels in VPI receiving PN.

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ABS 42

ASSOCIATION BETWEEN MATERNAL KNOWLEDGE ON BREASTFEEDING AND THE ASSESSMENT OF THE NEWBORN'S LATCH IN A MATERNITY CENTER IN THE UNIVERSITY HOSPITAL OF THE SOUTH REGION OF BRAZIL

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Table 1 (ABS 41). Mean (sd) plasma AA levels (μmol/l).

Group (n)	Birthweight	PN age (d)	Arginine	Glutamine	Glutamate
PS: all infants (47)	856 (148)	9 (3)	37 (18)	442 (114)	96 (32)
NS: all infants (77)	915 (180)	10 (3)	48 (30)	491 (161)	112 (65)
p	0.06	0.35	0.03	0.07	0.12
PS: 24-26 wks (27)	807 (114)	9 (2)	30 (11)	439 (120)	95 (29)
NS: 24-26 wks (32)	798 (162)	10 (3)	46 (36)	470 (167)	121 (82)
p	0.74	0.41	0.03	0.35	0.19
PS or NEC (59)	845 (157)	9 (3)	36 (19)	447 (131)	107 (46)
NS and no NEC (65)	932 (173)	10 (3)	50 (31)	493 (158)	105 (63)
p	< 0.01	0.25	< 0.01	0.08	0.88

PS: positive for sepsis; NS: negative for sepsis; NEC; necrotising enterocolitis.

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INTRODUCTION

Breastfeeding (BF) constitutes a re-enforcing strategy of attachment, protection and nutrition between newborns and mothers. Although breastfeeding rates have remained low worldwide, the topic is rarely addressed where health care providers fail on promoting it. Multiple factors having described as determinants to the success of BF, studies suggest a positive relation between maternal knowledge on BF and the maintenance of exclusive breastfeeding. This study aims to evaluate the association between maternal knowledge on BF and the assessment of the newborn's latch in a maternity center of the University Hospital ULBRA/GAMP.

METHODS

A cross-sectional, observational, descriptive and associative approach. This study involved 86 pairs of mother-neonate participants within a general postnatal ward of a University hospital in the months of February through April 2017. Contributors have been evaluated through a structured survey questionnaire on the functional and technical aspects of breastfeeding. They have also been assessed getting baby latched to the breast and maternal behavior during BF.

RESULTS

Only 30.2% were referred for breastfeeding in prenatal care. We have found a negative correlation between the percentage of knowledge and the number of unfavorable behaviors for the responsiveness ($p = 0.035$) and attachment ($p = 0.010$) factors of the BF evaluation. Maternal knowledge on breastfeeding (73.7%) is positively associated with age ($p = 0.019$), education level ($p = 0.011$), number of children ($p = 0.018$) and guidance in prenatal care ($p = 0.044$).

CONCLUSIONS

The present study suggests that the higher the maternal knowledge on BF, the more affectionate the mother is towards her baby, whose behavior is also more responsive during BF.

ABS 43

HUMAN MILK AND HUMAN MILK DERIVED PRODUCTS: HOW BIOACTIVE COMPONENT ANALYSIS MAY INFORM CLINICAL OUTCOMES IN THE NICU

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INTRODUCTION

Hospital acquired infections (HAI) like necrotizing enterocolitis (NEC) and sepsis results in significant morbidity and mortality in very low birth weight infants (VLBW). We have previously shown that infants fed an exclusive human milk diet (EHMD) exhibit a greater-than-expected reduction in NEC, sepsis and other organ-specific HAI when compared to infants fed a cow-milk based diet. Breast milk contains many bioactive substances including human milk oligosaccharides (HMO). HMO may reduce HAI by supporting gut colonization by commensal bacteria thereby reducing colonization by pathogenic bacteria that underlie HAI in VLBW infants. We determined the impact of industrial processing on the concentration and spectrum of HMO present in human milk and human milk-derived fortifier.

METHODS

We used high-performance anion exchange chromatography (HPAE) and pulsed amperometric detection (PAD) with known HMO standards to determine the spectrum and concentration of HMO present in industrially processed and standardized human milk and human milk-derived protein fortifier. The resolution of HPAE and the sensitivity of PAD allowed detection of a full spectrum of HMO across a wide range of concentrations. A simplified HMO extraction method was developed to avoid the use of chemical reagents and solid phase extraction thereby reducing the artificial loss of HMO inherent in other methods.

RESULTS

We identified a full spectrum of fucosylated, non-fucosylated and sialylated HMO in pasteurized human milk and human milk-derived protein fortifier using HPAE/PAD. The wide range and abundance of HMO were reflective of the maternal postpartum lactation stage and secretor status of a diverse breast milk donor pool. The abundance and pattern of HMO also support that HPAE/PAD minimized the artificial loss of HMO inherent in other methods. Moreover, our results indicate that industrial processing of human milk and human milk-derived protein fortifier retains HMO.

CONCLUSIONS

We have developed a method for detecting and quantifying diverse and naturally occurring HMO in

industrially processed human milk, and human-milk derived fortifier. These data support that industrially processed donor human milk is a robust source of a complete HMO spectrum that may underlie the extended health benefits observed in VLBW infants fed an EHMD.

DECLARATION OF INTEREST

All authors are employed by Prolacta Bioscience Inc.

ABS 44

EVALUATION OF SUPPORTING FISH-OIL CONTENTS FROM BIRTH: CAN IT CHANGE OUTCOMES IN PRETERM INFANTS?

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INTRODUCTION

Because it is not possible to feed enterally preterm infants from birth, it is often necessary to use parenteral nutrition solutions in order to meet their daily energy, protein requirements. Lipid is an important part of parenteral nutrition. In this study, we aimed to compare the effects and short-term outcomes of preterm infants using lipid solutions by adding fish oil to the standard lipid solutions with receiving standard parenteral lipid solution.

METHODS

Preterm infants who were admitted to İzmir Dr. Behçet Uz Children's Hospital NICU between January 2016 and January 2017 < 32 weeks of gestation and/or < 1,500 grams were included into the trial. Newborns with perinatal asphyxia, major congenital anomaly, early-onset neonatal sepsis, congenital metabolic disease, and those who initially had liver pathology and/or high bilirubin levels were excluded. Parenteral feeding was initiated at the latest 24 hours in all infants. Lipid was started on the 2nd postnatal day. Infants were randomized into two groups; Group 1: 1 g/kg/day Omegaven + 2 g/kg/day Clinoleic; Group 2 had only Clinoleic 3 g/kg/day. Protein and electrolyte replacement were the same in both groups and enteral feeding was started at least at 48 hours. Preterm formula was given if breast milk could not be brought. Laboratory levels (AST, ALT, GGT, bilirubin levels), weight at discharge and short-term outcomes (surfactant requirement, RDS severity, IVH, ROP, BPD, NEC, sepsis) were compared.

RESULTS

A total of 55 infants, 25 of which were in Group 1, were included into the trial. There were no difference between the groups in terms of gender, gestational age, birth weight, type of delivery, breast milk intake rate, duration of lipid administration and duration of hospital stay ($p > 0.05$). Direct bilirubin level was significantly lower in Group 1 ($p < 0.05$). Surfactant requirement was statistically higher in Group 1 but BPD, PDA, IVH, mortality, stage ≥ 2 ROP, stage ≥ 2 NEC, sepsis and duration of hospital stay were similar in both groups. Weight at discharge was significantly high in Omegaven Group.

CONCLUSIONS

This was the first study in the literature, which compared fish-oil support from birth to standard solutions in preterm infants. We showed that supporting preterm infants with Omegaven had positive effects on weight at discharge and laboratory parameters. Infants who are exposed to very intense oxidative stress early may be expected to use the antioxidant system as a supporting parenteral product. We conclude that supplementing parenteral nutritional solutions with fish-oil from the first days of life is be associated with positive outcomes in large case control series.

ABS 45

LEVELS OF GLUCOSE IN CORD BLOOD SAMPLES (LOGICS)

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INTRODUCTION

Neonatal hypoglycaemia is a common cause of medical review and admission to the neonatal unit, and a known risk factor for neonatal brain injury. Currently the proposed lower limit for serum glucose level, to diagnose hypoglycaemia after the first hour of life, is 2.6 mmol/l. Maternal and foetal glycaemic controls are believed to be closely related, however levels of glucose and fructosamine

in umbilical cord blood have rarely been studied. We hypothesise that a proportion of infants may have been hypoglycaemic at delivery. The aim of this study is to determine the incidence of infants born with glucose < 2.6 mmol/l, and establish the corresponding fructosamine levels.

METHODS

This is a prospective observational study. The inclusion criteria were gestational age ≥ 37 weeks, irrespective of maternal history. Infants with known congenital or chromosomal anomalies were excluded from participation. Umbilical arterial blood was collected at delivery for cord glucose and lactate, as well as fructosamine, which was corrected for total protein. Medical team was notified of glucose levels < 2.6 mmol/l and these infants were reviewed at one hour of life and glucose levels were repeated. Our primary outcome was the incidence of hypoglycaemia (defined as glucose < 2.6 mmol/l) in cord blood, and the corresponding fructosamine levels. The secondary outcome was to identify a correlation between umbilical cord blood glucose levels and admission to neonatal unit.

RESULTS

We enrolled 50 patients following maternal consent. Mean gestational age (± SD) was 38.5 weeks of gestation (± 0.8) and mean birth weight was 3.5 kg (± 0.45). 38% (19) were girls, 8% (4) were small for gestational age (91st centile). All infants were born by caesarean section. Mean cord glucose level was 2.9 mmol/l (± 0.5). Ten infants (20%) had glucose level < 2.6 mmol/l (group 1). Sixty percent (6) of those involved required admission to the neonatal unit compared to 15% (6) in the group with normal cord glucose level (group 2) (p = 0.008). Mean fructosamine level was 201 µmol/l (± 20.7) for the entire cohort. Fructosamine levels ranged from low to lower limit of normal based on the adult fructosamine reference range. There was no statistically significant difference in the fructosamine levels between the group 1 and 2 (p = 0.63).

CONCLUSIONS

Umbilical arterial glucose levels were below the neonatal recommended range for normoglycaemia in a significant proportion of our study population. Infants with low cord glucose were significantly more likely to be admitted to the neonatal unit. Corresponding fructosamine levels indicate the possibility of hypoglycaemia *in utero*, however current reference ranges in practice for corrected fructosamine are adult based.

ABS 46

SANJAD SAKATI SYNDROME: ABOUT NEW TUNISIAN CASES

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INTRODUCTION

Sanjad-Sakati syndrome (SSS) (OMIM 241410), also known as hypoparathyroidism-retardation-dysmorphism (HRD) syndrome, is a rare autosomal recessive syndrome reported almost exclusively in people of Arabian origin. Children affected with this condition are born IUGR and present with hypocalcaemic tetany or seizures due to hypoparatyroidism at an early stage in their lives. They have typical faces with deep-set eyes, depressed nasal bridge with beaked nose, and micrognathia. SSS molecular pathology has been shown to be due to mutations in the TBCE gene on chromosome 1q42-q43. All affected patients of Arab origin are homozygous for a 12-bp (155-166del) deletion in exon 3 of this gene

CASE REPORTS

Two Tunisian patients suspected of SSS have been investigated using sanger sequencing of the exon 3 of TBCE gene. Here, we report two Tunisian children with a confirmed SSS. The first patient was a 32-week preterm boy (birth weight, 1,820 g), from a consanguineous family. The child had typical facial dysmorphism namely; microcephaly, frontal-temporal pattern of hair loss, preeminent forehead, triangular face with deep-set eyes. He had convulsions at the age of one-month and Investigations revealed severe hypocalcemia (1.64 mmol/L), hyperphosphatemia (3.2 mmol/L) and hypoparathyroidism. The second patient was a two-month-old boy who had recurrent admissions to hospital with convulsions. On examination, he showed severe growth retardation, his weight was 2,100 kg, height 42 cm, dysmorphic facies: (microcephaly, deep-set eyes, peaked nose, large

ears and small hands and feet) and discharging ears. Biochemical Investigations showed: very low calcium (1.1 mmol/L), high phosphate and low PTH 7 mg/l. The convulsions were controlled with intravenous calcium infusions. Mutation analysis by direct sequencing of the TBCE gene (exon3) in both patients and their parents revealed the presence of the 12-bp (155-166 del) deletion. The affected individuals were homozygous for this mutation and their parents were heterozygous. The consanguinity of the parents gave evidence of autosomal recessive inheritance pattern. The TBCE gene encodes a chaperone E required for the folding of alpha-tubulin and its heterodimerization with beta-tubulin and plays a critical role in the formation of the parathyroid. The 155-166 del seems to destabilize the chaperone and thus the assembly of the tubulin associated with hypoparathyroidism, hypocalcemia, and growth retardation.

CONCLUSIONS

SSS is a rare autosomal recessive disorder and was originally described in 12 infants of consanguineous parents from Saudi Arabia. Several other reports followed, and SSS was reported in Oman, Palestine, Qatar, Kuwait, Jordan and Tunisia. Our patients with confirmed SSR provide additional support the founder effect of the common mutation, 155-166 del of the TBCE gene, in Arab patients.

ABS 47

CORRELATION BETWEEN MATERNAL AND CORD SERUM LIPID PROFILES AND RESPIRATORY PROBLEMS OF PRETERM NEONATES

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INTRODUCTION

Respiratory problems in preterm infant (PI) are related to difficulty in extrauterine adaptation due to immaturity. Lipid metabolism has an important role in increasing amniotic fluid lecithin levels with maturation of pulmonary function. Fetal alveolar type II epithelial cells utilize lipid substrates to synthesize Dipalmitoylphosphatidylcholine, the major surfactant lipid that lowers surface tension at the alveolar air-fluid interface. The aims of this study are to correlate the levels of lipid profiles in maternal and cord blood of PI with respiratory disorders, and also to investigate the levels of lipid profiles in maternal and cord blood as early predictors of respiratory disorders of PI.

METHODS

This study is longitudinal prospective study. It was conducted on 50 women who delivered premature and their PI. Exclusion criteria were small for gestational age, hypoxic ischemic encephalopathy, clinically diagnosed major congenital anomalies and mothers with complicated pregnancy (as hypertension, drug intake that affect lipid metabolism as steroid...). Blood samples were obtained from the mothers at time of labor and from cord blood of their PI for estimation of serum total cholesterol (TC), high density lipoprotein (HDL), low density lipoprotein (LDL) and triglyceride (TG). The determinations were performed on automated clinical chemistry analyzer. Follow-up of PI was done daily for early detection of any respiratory problems and for short outcome of these problems until discharge from NICU or death.

RESULTS

PI divided into 3 groups (Gr); no respiratory problems (noRP) (18%), TTN (36%) and RDS (46%). There was a statistically significant (SS) decrease in maternal serum LDL ($p = 0.000$), TC ($p = 0.002$) and TG ($p = 0.02$) in RDS Gr; however HDL was SS decrease ($p = 0.03$) in TTN Gr. In cord serum (CS) there was a SS decrease in HDL ($p = 0.000$), LDL ($p = 0.02$) and TC ($p = 0.01$) in RDS Gr. There was a SS positive correlation between maternal serum and CS HDL, LDL and TC ($p = 0.000$). For prediction of respiratory problems in PI, the best cut off point of maternal HDL is ≤ 29 mg/dl with sensitivity of

Table 1 (ABS 47). Multivariate logistic regression analysis for maternal lipid profile as predictors of respiratory problems in their preterm infants. This table shows that maternal low density lipoprotein (LDL) and high density lipoprotein (HDL) can be used as predictors for respiratory problems in their preterm neonates.

	B	S.E.	Wald	Sig.
HDL (mg/dl)	-0.201	0.085	5.537	0.019
LDL (mg/dl)	-0.126	0.061	4.197	0.04
Chol (mg/dl)	-0.026	0.038	0.477	0.49
Triglyci (mg/dl)	0.002	0.023	0.011	0.917

HDL: high density lipoprotein; LDL: low density lipoprotein.

43.9% and specificity of 100%; and of maternal LDL is < 121 mg/dl with sensitivity of 82.93% and specificity of 88.8%. For the same aim, the best cut off point of CS HDL is ≤ 29 mg/dl with sensitivity of 53.6% and specificity of 100% and of CS LDL is < 113 mg/dl with sensitivity of 70.7% and specificity of 77.7%. Results are presented in **Tab. 1**.

CONCLUSIONS

Respiratory problems (RP) are accompanied with lipid alteration in PI and their mothers. Low plasma lipid concentration during gestation appears to have negative effects on the fetal lung development. Lipid metabolism in maternal and CS had SS correlations with each other. Lower levels of HDL and LDL either in maternal or CS of PI could predict the occurrence of RDS. No SS difference between maternal and CS HDL and LDL as a predictor of RP in PI.

ABS 48

TRACKING CHILDHOOD HEIGHT OF SMALL FOR GESTATIONAL AGE INFANTS IN IRELAND

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INTRODUCTION

Small for gestational age (SGA) defines infants whose birth weight or crown-heel length is 2 standard deviations (SDs) below the mean for their appropriate gestational age (AGA). Approximately 3-5% of neonates are born SGA. This cohort is estimated to account for 1 in 5 children (and adults) who are short in stature. SGA is associated with poor outcomes in terms of growth and metabolism. Understanding population distributions of growth outcomes will aid consideration of treatments such as growth hormone in a paediatric population. Data from the 'Growing Up in Ireland' (GUI) longitudinal study is explored.

METHODS

Birth height was standardised according to gestational age and sex. Childhood growth measures were standardised for sex. Distributions of outcome variables were examined using robust graphical methods. Univariate poisson regression was employed to examine the relative risk of SGA on quintiles of growth outcomes at 9 months, 3 and 5 years of age. A sex-adjusted height below two standard deviations was identified as a significant cut-score from the literature. Univariate logistic regression was employed to examine the likelihood

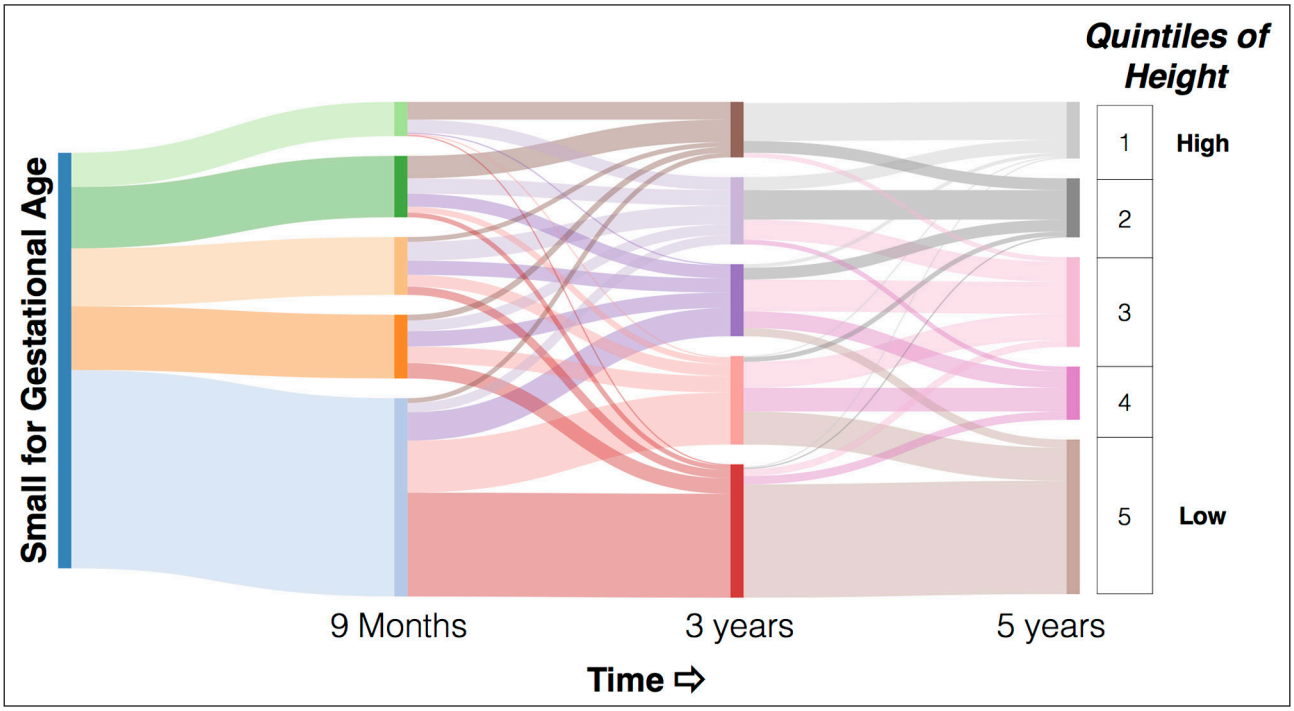

Figure 1 (ABS 48). Sankey diagram used to track the distribution of participants with SGA across quintiles of height through 9 months, 3 years and 5 years of age.

of this outcome in the SGA group. R statistical programming was used for analysis.

RESULTS

The GUI cohort consisted of 12,121 children in Ireland, 56% of whom were female. Those born SGA were 29%, 16% and 12% more likely to fall in a height decile below that of their average for gestational age peers at 9 months, 3 and 5 years respectively (significant at an alpha level of 0.95). At 5 years of age the SGA group demonstrated a likelihood of falling 2 SD below the sex-adjusted mean, five-fold over their peers (OR: 5.40, 95% CI: 2.86, 10.20). Quantile analysis was undertaken and graphical visualisations were plotted to aid interpretation of growth outcomes for the SGA group in this dataset. A sankey diagram (**Fig. 1**) is used to track the distribution of participants with SGA across quintiles of height through 9 months, 3 years and 5 years of age.

CONCLUSIONS

Small for Gestational Age neonates represent between 3 to 5% of a given population. In Ireland, data from the GUI study demonstrated a 3.5% prevalence. This analysis suggests that subgroups of SGA infants may exhibit worse growth outcomes than their population matched peers. Future analysis may employ machine learning techniques at a population level to identify those who may benefit from growth hormone therapy.

ABS 49

THE EFFECT OF DRESSING AFTER TUB BATHING ON MOISTURE LOSS IN PRETERM INFANTS

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INTRODUCTION

Maintaining fluid and electrolyte balance in the first days after birth is difficult particularly in preterm infants and those with very low birth weights. Hidden fluid losses occur as a result of mucous membranes and the evaporation of water from the skin. The characteristics of the skin, the largest organ of the body of preterm infants, cause more fluid loss than term infants. So preventing hidden fluid losses is much more effective than replacing losses. This was designed as a randomized controlled experimental study, in order to determine the effect of dressing after tub bathing on loss of skin moisture in healthy preterm infants.

METHODS

The population of the study consisted of newborns aged between 33.0-36.6 gestational week at Neonatal Intensive Care Units between November 2013 and December 2015, who met inclusion criteria and were determined by using randomized controlled method. While control group (n = 20) of the study consisted of newborns dressed immediately after being dried following bathing, experimental group (n = 20) consisted of newborns who were dried immediately after bathing, worn a hat, covered with double blanket after the diaper was exchanged and dressed 10 minutes later. Skin moisture (forehead, abdomen, back, arm, leg) and body temperature measurements of the infants before bathing, immediately after bathing, and 10, 20, 30, and 60 minutes after bathing were assessed.

RESULTS

As the groups were compared at the end of the study, no statistically significant difference was found in terms of means of local (forehead, abdomen, back, arm, leg) and whole body moisture measurements 10 minutes after bathing ($p > 0.05$). However, concerning difference of change observed in average whole body moisture at 10^{th} minute, it was determined that moisture was kept and increased in experimental group and moisture loss occurred in control group. Infants in both groups were found to lost heat after bathing. While experimental group almost reached pre-bathing body temperature in 60 minutes after bathing application, control group did not reach yet.

CONCLUSIONS

In accordance with these all data, it was determined that even though there was not statistically significant difference, intervention administered to the experimental group positively affected skin moisture and body temperature.

ABS 50

PERSONALISED PREDICTION OF WEIGHT CHANGES IN THE FIRST WEEK OF LIFE

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INTRODUCTION
As part of normal physiology newborns lose weight during the first days of life before they begin to gain weight. An excessive loss should be avoided as it increases morbidity whereas too early intervention complicates breastfeeding. The aims of this work were to (i) characterise physiological weight changes and effects of supplemental feeding in neonates during the first week of life; (ii) identify and quantify multiple neonatal and maternal factors influencing weight loss and weight gain; (iii) provide an educational online tool allowing caregivers to forecast individual weight changes and supplemental feeding effects up to 1 week of life.
METHODS
Retrospective study on prospectively recorded clinical data from all healthy infants born with more than 34 weeks gestational age (GA) at the University Hospital Basel in 2009 and 2010 (n = 4,196). Exclusion criteria: only one recorded weight (n = 141), transfer to a neonatal ward (n = 269), multiples (n = 148). Two thirds (n = 2,425) were randomly selected to develop a semi-mechanistic model characterising weight changes as a function of the balance between time-dependent rates of weight gain and weight loss and to characterise linear dose-effects of formula and pumped breast milk. Population analysis was implemented using NONMEM7.3. Model selection and evaluation were based on statistical criteria, goodness-of-fit plots and simulations. Advanced evaluation was done on the remaining third (n = 1,213).
RESULTS
Key characteristics of investigated newborns (median, range) were as follows: GA 39.9 weeks (34.4-42.4), birth weight 3,394 g (1,980-5,230), mother's age 32 years (15-51), delivery by caesarean section 26%, girls 51%. Model evaluation demonstrated a good predictive performance (bias = 0.01%, precision = 0.56%). The following characteristics were identified as key predictors of individual weight changes during the first week of life in our population: birth weight, GA, gender, delivery mode, type of feeding, mother´s age and parity. The model was able to accurately forecast individual weight changes and dose dependent effects of supplemental feeding up to 1 week after birth, based on weight measurements during the first 3 days of life (bias = 0.15%, precision = 1.43%).
CONCLUSIONS
We present the first pharmacometric model that describes physiological weight changes and effects of supplemental feeding during the first week of life in term and late preterm neonates. We developed a user-friendly online tool to support caregivers to forecast individual weight changes and assist decision making regarding formula milk supplementation, timing of discharge home, with the goal to further personalise clinical care of neonates.

ABS 51

THE IMPACT OF EARLY VERSUS LATE NUTRITIONAL SUPPORT ON GROWTH AND NEURODEVELOPMENTAL OUTCOME IN VERY LOW BIRTH WEIGHT INFANTS

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INTRODUCTION
Adequate nutritional support has been regarded as crucial in the management of preterm infants in terms of growth and developmental benefit. Little is known about the differential role of early and late nutritional support in the long-term growth and neurodevelopmental outcomes in very low birth weight (VLBW) infants. The objective of the present study was to determine the impact of early versus late nutritional support on the long-term growth and neurodevelopmental outcomes in VLBW infants.
METHODS
We retrospectively reviewed the medical records of inborn VLBW infants with gestational age < 33^{+0} weeks who survived until 18 to 24 months' corrected age. Daily nutritive profiles including non-protein calorie (NPC) intake and protein intake were obtained both in the early (from d 1 to d 14 after birth) and the late (d 29 after birth to postmenstrual age 36^{+0} weeks or at discharge) period of hospitalization in the NICU. Growth parameters (body weight, height and head circumference [HC]) and neurodevelopmental outcomes determined by the mental developmental index (MDI) and psychomotor developmental index (PDI) of Bayley Scales of Infant Development (BSID) II were obtained at corrected age of 18-24 months.

RESULTS

The mean early NPC and late NPC intake was 53.1 ± 13.1 kcal/kg and 90.0 ± 12.0 kcal/kg, respectively. The mean early protein and late protein intake was 2.7 ± 0.5 g/kg and 3.3 ± 0.3 g/kg, respectively. Neither early nor late nutritional intake was associated with neurodevelopmental outcomes. Early NPC intake positively correlated with the HC z-score ($p < 0.01$) but not with weight and height. Early NPC intake < 53 kcal/kg/d was an independent risk factor HC z-score below -2. Meanwhile, the protein intakes and late NPC intake were not associated with growth parameters.

CONCLUSIONS

Although the NPC intake during the initial 2 weeks after birth was associated with head growth at corrected age of 18-24 months, the impact of the NICU's nutritional strategy on the long-term neurodevelopmental outcomes remains uncertain in VLBW infants.

ABS 52

NUTRIENT INTAKE IN THE FIRST TWO WEEKS OF LIFE PREDICTS BRAIN MACRO- AND MICROSTRUCTURAL GROWTH IN PRETERM NEONATES

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INTRODUCTION

Optimizing early nutritional intake in preterm neonates might promote brain health and neurodevelopmental outcomes through enhanced brain maturation. The relationships of nutritional intake with brain growth during neonatal intensive care need to be determined. The primary objective was to determine the association of energy and nutrient intake in the first 2 weeks of life with brain growth, and white matter (WM) maturation assessed by serial magnetic resonance imaging in very preterm (VPT) neonates. Secondary objectives were to examine (i) how critical illness modifies this association, and (ii) the relationship with neurodevelopmental outcomes.

METHODS

49 VPT (21 males, median [IQR] gestational age (GA): 27.6 [2.3] weeks, 2 were small for gestational age) were scanned serially at median postmenstrual weeks (PMA): 29.4, 31.7 and 41. Basal nuclei, cerebellum and total brain were semi-automatically segmented in the T1-weighted images. As a measure of WM maturation, fractional anisotropy (FA) was extracted from diffusion-tensor imaging data. Nutritional intake from days of life 1 to 14, and clinical factors over the NICU course were collected. Neurodevelopmental outcome at 18-months corrected age were assessed using the Bayley Scales of Infant Development, second edition. Generalized estimating equations and multivariate linear regression were used to assess the association between nutrient intake and volumes, and FA values in separate models.

RESULTS

Greater energy (kcal/kg/day) and lipid (g/kg/day) intake predicted increased total brain ($\beta = 839.8$, $p = 0.021$; $\beta = 13{,}425.5$, $p = 0.019$, respectively) and basal nuclei ($\beta = 37.6$, $p = 0.019$; $\beta = 616.8$, $p = 0.017$, respectively) volumes (mm^3) over the course of neonatal intensive care to term-equivalent age, adjusting for PMA at MRI. Examining volumes at each scan, the associations of energy and lipid intake with basal nuclei, cerebellum and total brain volumes strengthened over time. Similarly, energy and lipid intake were significantly associated with FA values in the posterior corona radiata, posterior thalamic radiation, and superior longitudinal fasciculus (all $p < 0.05$). Importantly, the association of duration of ventilation with small brain volumes was attenuated by higher energy intake. Regional and total brain growth predicted motor development at 18-months corrected age. Results are presented in **Fig. 1**.

CONCLUSIONS

In VPT neonates, greater energy and lipid intake during the first two weeks of life predicted more robust brain growth particularly in subcortical structures and cerebellum, and accelerated white matter maturation. The long-lasting effect of early nutrition on neurodevelopment might be mediated

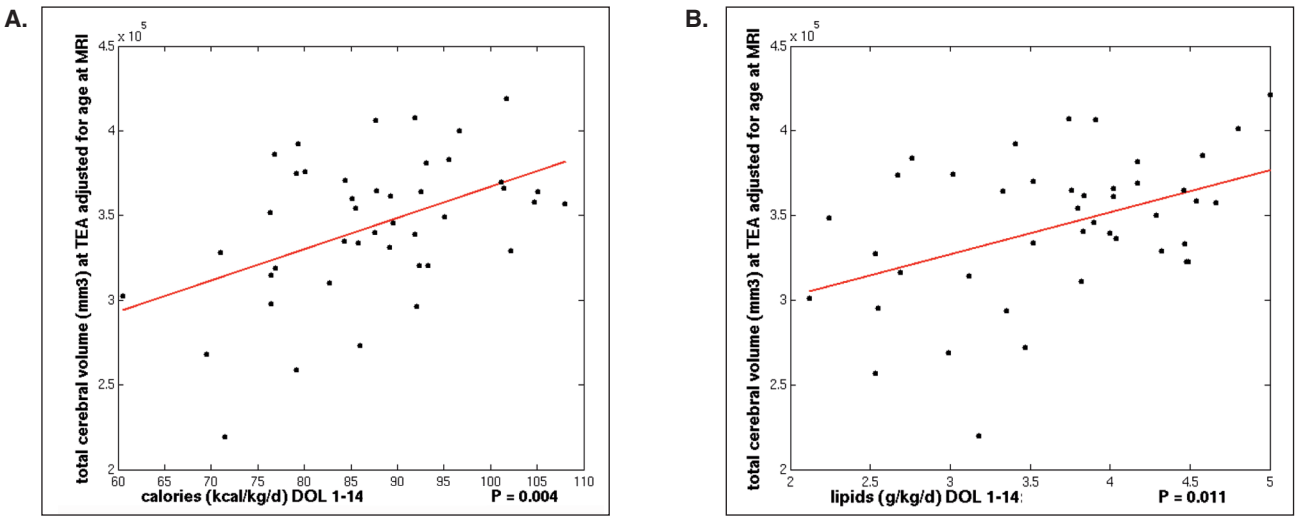

Figure 1 (ABS 52). The figure illustrates the relationships between total cerebral volumes (in mm^3) at term-equivalent age (TEA) adjusted for PMA at MRI on the x-axis and **A**) early energy (kcal/kg/day) and **B**) lipid (g/kg/day) intake from days of life 1 to 14 on the y-axis. P-values result from the multivariate linear regression models examining total brain volumes on the TEA scan and adjusting for PMA at MRI.

by enhanced brain growth. Optimizing nutrition in VPT neonates might be a potential avenue to mitigate the adverse brain consequence of critical illness.

FUNDING

Swiss National Science Foundation, SICPA Foundation, Société Académique Vaudoise, Canadian Institutes of Health Research, NeuroDevNet

ABS 53

INSULIN INFUSION FOR HYPERGLYCEMIA IN EXTREMELY PRETERM – A PILOT STUDY

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INTRODUCTION

Transient hyperglycemia is a frequently observed problem affecting extremely preterm infants (gestational age at birth < 28 weeks) during the first weeks of life. The knowledge of early perinatal glucose and insulin regulation and the effect of premature birth on the mechanisms involved are today poorly understood. The use of insulin in treatment for hyperglycemia in the neonatal intensive care units lacks solid evidence-base results and the effects of continuous insulin infusion for hyperglycemia during the first postnatal weeks have not been fully investigated and thus remains controversial. Aims: To observe and investigate the effects of exogenous administered insulin infusion on serum C-peptide and insulin levels during hyperglycemia in extremely preterm infants. Secondary aim was to illustrate the possible effects of exogenous insulin on plasma-glucose levels.

METHODS

A prospective descriptive observatory pilot study of nine extremely preterm infants with insulin-treated hyperglycemia admitted to the neonatal intensive care unit at the Neonatology Units at the Dep. of Pediatrics, The Queen Silvia Children's Hospital, Gothenburg and the Dep. of Pediatrics, Lund's University Hospital, Lund. Serum levels of C-peptide and insulin were analyzed in blood samples collected prior to start of insulin infusion and after 12, 24 hours and then every 24th hour during ongoing insulin infusion. Subsequently, blood samples were collected 12, 24 and 72 hours after end of insulin infusion. All data at postnatally day 1-28 regarding plasma-glucose levels, insulin infusions and total daily amount of all intravenously administrated glucose were collected and registered on a timeline (hours: minutes). The immediate effect of exogenously administrated insulin was calculated the first 12 hours of infusion.

RESULTS

The median gestational age at birth was 24^{+5} weeks (min 22^{+3} maximum 26^{+5}). The median (range) time of insulin infusion was 5.90 days (1.27-18.95).

Serum C-peptide levels decreased at 12, 24, 48 and 72 hours after start of insulin infusion compared to baseline levels before start of infusion (p = 0.017, p = 0.05 p = 0.036, p = 0.025). The mean serum C-peptide levels after end of infusion were not significantly different compared to start levels (p = 0.26) (**Fig. 1**). Plasma-glucose levels decreased at 12 (p = 0.012), 24 (p = 0.012) and 72 hours (p = 0.012) after start of insulin infusion compared to start. After end of infusion mean p-glucose continued to decrease, but not in a significant way. The individual proxy for insulin sensitivity; plasma-glucose/insulin ratio at start correlated with the change in C-peptide the first 12 hours (p = 0.007). Correlation Spearman 0.857.

On an individual level, the infants with acute etiology of hyperglycemia e.g. sepsis (n = 3) and IVH grade 3-4 (n = 1), had either decreased levels (3/4) or the most moderate rise (1/4) in levels of serum insulin after 12 hours of insulin infusion compared to before start (0.71 ± 0.31, range, 0.41 to 1.16) and also had the four highest baseline levels of insulin before start of infusion out of all individuals. These individuals with sepsis or IVH also had a significantly larger decrease in serum C-peptide levels after 12 hours compared to the other individuals (p = 0.03). Correspondingly, the individuals with no clear etiology of hyperglycemia (n = 5) all more than doubled their serum insulin-levels after 12 hours of insulin infusion (mean 4.94 ± 3.22, range, 2.01 to 10.71) and had a less prominent decrease in serum C-peptide levels. On a group level, the dose of insulin infusion did not correspond with the change in the matched glucose level in a significant way.

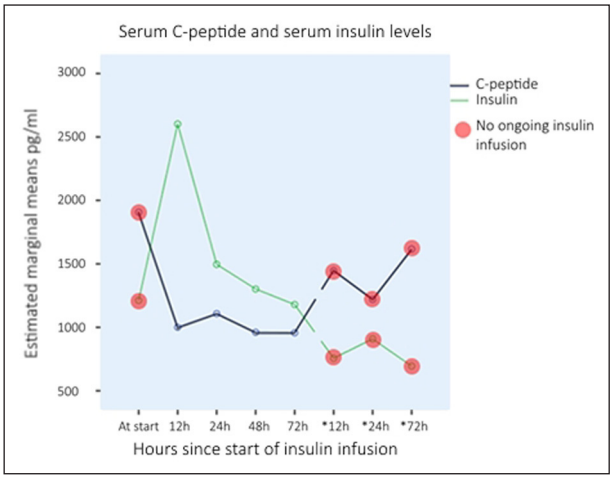

Figure 1 (ABS 53). Mean levels of serum C-peptide and serum insulin at start of insulin infusion, at 12, 24, 48 and 72 hours during insulin infusion, respectively, and at 12, 24 and 72 hours after end of insulin infusion.
*Hour passed after end of insulin infusion.

CONCLUSIONS

In this pilot-study including nine hyperglycemic extremely preterm infants, we were able to observe a suppression of serum C-peptide levels during insulin infusion with findings suggesting different responses to insulin infusion based on the etiology of hyperglycemia in preterm infants born before 28 weeks of gestation, something that has not been previously described. The short and long term effects of possible suppression of β-cell function during the early postnatal period which is critical for pancreatic development have not been fully evaluated.

ABS 54

USE OF PASTEURISED HUMAN DONOR MILK IN ENGLAND

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INTRODUCTION

The use of pasteurised human donor milk (pHDM) for preterm infants is supported by the European Society of Paediatric Gastroenterology and Nutrition, American Academy of Paediatrics and World Health Organisation although robust evidence of benefit, particularly when used as a supplement to Own Mothers' Milk (OMM), is lacking. Earlier small surveys in the UK suggest wide variation in use of pHDM. The aim of this study was to describe the use of pHDM systematically across neonatal networks in England and investigate whether proximity to a pHDM bank is an influencing factor.

METHODS

We obtained daily feeding data from the National Neonatal Research Database (NNRD), on infants born below 32 weeks gestational age (GA) admitted to neonatal units in England over the complete two-year period 2012-2013, recorded prospectively as part of a population study. 8 We evaluated the proportion (95% CI) of infants fed and type of milk exposure (pHDM, OMM, formula) in the first two postnatal days, and postnatal age (median, IQR) at first feed by network. We also evaluated the use

of pHDM during the first 30 postnatal days using two measures i) the proportion (95% CI) of infants receiving any pHDM and ii) the proportion of total care-days pHDM was received. We fitted a logistic regression of the exposure to pHDM on at least one of the first 30 postnatal days on variables considered relevant (birth-weight, birth-weight Z score (< -0.5, -0.5 to +0.5, > 0.5), presence of a pHDM bank in the network, and an indicator variable for each network). Significance was assessed by the chi-squared test.

RESULTS

At the time of this study, there were 163 neonatal units in England organised into 23 networks, and 13 pHDM banks, 12 co-located with neonatal units. We achieved complete national coverage, including data from 13,463 infants born below 32 w GA and admitted to neonatal units in England. Of these 50.5% (49.6%, 51.5%) received their first milk feed within the first two postnatal days, some receiving a combination of milks (any pHDM 7.3% (6.8%, 7.8%); any OMM 33.6% (32.7%, 34.5%); any formula 14.6% [14.0%, 15.3%]). Postnatal age at first feed by network ranged from 1.0 (1.0, 2.0) to 3.0 (2.0, 5.0) days. During the first 30 days the proportion of infants receiving any pHDM ranged from 1.96% (0.96%, 2.96%) to 61.0% (57.4%, 64.6%) across networks. The proportion of total care-days pHDM was received ranged from 0.08% (0.04%, 0.1%) to 21.9% (19.9%, 24.0%). Patient characteristics across networks were similar. The presence of a pHDM bank in the network was associated with higher rate of exposure (Odds Ratio 2.4 [95% CI 2.1, 2.6]). Variation between networks remained highly significant ($p < 0.001$) following adjustment for all covariates including presence of a pHDM bank.

CONCLUSIONS

The introduction of enteral feeds is delayed beyond 24 h in about half of all very preterm babies in England. The use of pHDM is low and there is wide variation that is not explained by differences in patient characteristics or proximity to a pHDM bank. These observations indicate uncertainty around optimal clinical care and provide justification to evaluate enteral feeding practices, including the benefits of pHDM, in efficient, rigorous randomised controlled trials.

ABS 55

PONDERAL INDEX IN SGA NEONATES: IS IT RELIABLE INDEX?

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INTRODUCTION

The designations of appropriate for gestational age, small-for-gestational age (SGA), intrauterine growth restriction, and large-for-gestational age are systematic categorizations used to assess and monitor growth throughout pregnancy and delivery. Each abnormal growth descriptor aids in anticipating neonatal needs after birth because each has the potential for complications related to feeding, glucose utilization, short- and long-term growth, and development. SGA is defined as infants with a birth weight below the 10th percentile for gestational age. However, this definition does not differentiate SGA infants who are constitutionally small from those who are growth-restricted and have higher risk of mortality and morbidity. Ponderal index (PI) is a useful tool to detect fetal growth restriction. Therefore, we aimed to evaluate the reliability of PI of SGA infants born in our hospital to predict the disproportionality and morbidity.

METHODS

Medical records of 11,600 newborns born at American Hospital, Istanbul, Turkey between January 2007 and December 2016 were reviewed. Infants whose birth weight was below the 10th percentile according to Fenton's growth chart was considered as SGA infants and included in the study. PI of SGA infants were calculated according to the formula; [weight in g x 100] ÷ [length in cm]^3. PI of SGA infants were plotted on the PI-gestational age curve and neonates were classified as the ones with disproportionate growth retardation if the PI was less than 10 percentile for gestational age (group 1) and as the ones with proportionate growth retardation if PI was between the 10th and the 90th percentile for gestational age (group 2). Their blood glucose, bilirubin levels, complete blood counts, duration of hospitalization, respiratory problems, NICU admission were recorded. Statistical analyses were performed by SPSS® 17.0.

RESULTS

There were 321 (2.76%) SGA infants. 203 (63.2%) of them were female, and 118 (36.8%) of them were male. There was a significant positive correlation between PI and gestational age (spearman; $r = 0.26$, $p < 0.001$). PI was in normal ranges (between 10

and 90 p) in 84.1% of neonates (n = 270, group 2). In 12 neonates (3.7%) PI was above 90 p. Group 1 consisted of 39 neonates (12.1%) whose PI was below 10 p. Length of 194 infants (60.4%) was also below 10 p. In group 1, 14 neonates (35.9%) also had length and head circumference below 10 p. There was no difference between the groups according to morbidity. None of them had severe morbidity or died.

CONCLUSIONS

As the gestational age of the infants increases, PI increases. Nearly one third of the infants with a PI less than 10 p, that is thought to have disproportionately growth restriction, has symmetrical SGA as birth weight, length and head circumference are all below 10 p. Furthermore, there is no difference in the morbidity of neonates when we group them according to their PI. Therefore, the reliability of PI is questionable.

ABS 56

TARGETING GLUCOSE CONTROL WITH REAL TIME CONTINUOUS GLUCOSE MONITORING

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INTRODUCTION

Hyperglycaemia is common in the very preterm infant and has been associated with adverse outcomes. Preventing hyperglycaemia without increasing the risk of hypoglycaemia has proved challenging. The development of real time continuous glucose monitors (CGM) to inform treatment decisions provides an opportunity to reduce this risk. We aimed to assess the feasibility of real time CGM combined with a specifically designed paper based guideline to target glucose control in the preterm infant to inform a larger randomised controlled trial.

METHODS

Single centre study of preterm infants who were < 48 hours of age, < 1,200 g, and with informed parental consent (n = 23). Babies were randomized using MINIM program to either real time CGM (Paradigm®Veo, Medtronic, Watford) or standard care (with blinded CGM data collection using Ipro2, Medtronic, Watford). A CGM sensor was inserted within 48 hours of birth, allowing monitoring for 6 days. Percent times in pre-specified targets of glucose control were compared between study arms. Staff acceptability was assessed with a questionnaire. The study was funded by the Evelyn Trust, Cambridge and equipment was provided by Medtronic (Watford UK).

RESULTS

Data was available from the 20 babies with median (range) length of data collection 142.5 (90.3, 148.2) and 140.5 (89.3, 143.8) hours in control and intervention respectively. Infants randomized to real time CGM had a median time in target (2.6-10 mmol/l) of 77% compared to 59% in controls (p = 0.3). Percent time > 10 mmol/l was lower in the intervention arm 40% compared to 24% in controls (p = 0.3). One baby in the intervention arm had a single episode of hypoglycaemia (SG < 2.6 mmol/l) lasting 205 minutes, compared to 3 episodes of hypoglycaemia (25, 325 and 410 minutes) in the control study arm, one of which was not detected clinically. There were no differences in nutritional delivery or insulin infusion rates between study arms. There were no serious adverse events associated with sensor use and the nurses felt the use of real time CGM improved care.

CONCLUSIONS

Real Time continuous glucose monitoring has the potential to support the targeting of glucose control in the preterm infant, without increasing the risk of hypoglycaemia, but larger studies are required to validate these findings.

ABS 57

POSTNATAL GROWTH VELOCITY CALCULATION: ACCURACY OF DIFFERENT METHODS

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INTRODUCTION

Postnatal growth in premature infants is an indirect measure of health status, nutritional adequacy, and long-term health outcome. Growth is usually assessed as an increase in weight over time. However, an absolute weight gain has different clinical implications depending on the size of the infant. Hence, growth velocity (GV) that is

normalized for body weight expressed as g/kg/day is an important parameter of growth assessment, for clinical management and research. Currently, there is no agreement for the calculation of GV. The objective of this study was to compare different methods of growth velocity calculation in a real infant dataset.

METHODS

Real weight data of 220 infants (< 35 weeks gestational age at birth) was used with six different methods of GV calculation: 1) 2-point linear 2) 2-point exponential 3) daily average method 4) linear regression 5) exponential regression 6) generalized reduced algorithm. The first two are 2-point methods whereas the first and last weights are used for GV calculation. The third is a modification of a 2-point method where daily GV is calculated using two points, and averaged over a period. The next three are regression methods where all available weight data are incorporated into the calculation. We calculated GV using six methods for 21 days periods, and calculated mean absolute error from the observed values.

RESULTS

GV calculated with the generalized reduced algorithm method and exponential regression had the lowest mean absolute error (17.5 ± 7.3 g and 17.6 ± 7.3 g, respectively). The mean absolute error for the remaining methods was as follows: linear regression (19.9 ± 7.9 g), daily average method (25.4 ± 25.2 g), 2-point exponential (25.4 ± 25.2 g) and 2-point linear (32.7 ± 29.8 g).

CONCLUSIONS

Regression methods have the lowest mean absolute error. 2-point methods may overestimate low-growth and underestimate high-growth rate. This has significant implications for clinical trials, which are often powered to detect difference of 2-3 g/kg/day; this may be masked by type of calculation used. Incorporating all data appears to be better than using only 2-points. GV calculation needs standardization to allow comparison across nutritional studies.

ABS 58

ELEVATED ESSENTIAL AMINO ACID LEVELS IN VERY PRETERM INFANTS ON TOTAL PARENTERAL NUTRITION

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INTRODUCTION

We have previously shown that there is overprovision of essential amino acids (EAA) in current neonatal parenteral nutrition (PN) formulations, with many EAA levels in the second week of life being above the normal range. Our unit delivers standardised, concentrated, added macronutrient PN by a regimen of incrementally increasing protein, fat and energy intake over the first 7 days of life and routinely measures plasma AA levels on day 10 of life when the infants are fully established on PN. Aim: To assess day 3 levels of AAs prior to maximal protein intake and compare with day 10 levels.

METHODS

Infants born < 29 weeks' gestation were eligible for PN. Plasma AA levels were measured on day 3 and day 10 of life using ion exchange chromatography. Daily nutritional intake data (both parenteral and enteral) was collected for the first 10 days of life.

RESULTS

20 babies had AA levels assessed at both time points. They had a mean gestation of 26^{+6} weeks' and mean

Table 1 (ABS 58). Mean (sd) plasma EAA levels (μmol/l).

EAA	Phenylalanine	Valine	Leucine	Isoleucine	Lysine
Ref range	25-80	65-290	44-169	20-91	70-266
Day 3	97 (20)	199 (48)	150 (48)	58 (21)	244 (74)
Day 10	74 (17)	148 (40)	115 (36)	48 (15)	265 (179)
p	0.0002	0.0005	0.009	0.051	0.321

EAA	Methionine	Threonine	Histidine	Tryptophan
Ref range	11-49	39-175	43-111	10-19
Day 3	33 (12)	267 (82)	103 (21)	28 (7)
Day 10	20 (10)	446 (172)	88 (25)	20 (8)
p	0.168	< 0.0001	0.024	0.001

birth weight of 885 g. The mean protein intake over the 72 hours before the plasma AA level was 2.25 g/kg/day for the day 3 sample and 3.74 g/kg/day for the day 10 sample. The results for the EAA are shown in (**Tab. 1**). Many of the day 3 EAA levels were higher than the day 10 levels, despite lower protein intakes. The babies with the highest EAA levels were those with the highest absolute protein intakes, i.e. the largest babies in the cohort.

CONCLUSIONS

Even a PN regimen with an incremental increase in protein results in high day 3 levels of some EAAs, with some being paradoxically higher than on day 10 when the protein intake is greater. Day 10 profiles may underestimate the degree of plasma AA derangement even in incremental increasing PN regimens.

ABS 59

NEONATAL HYPOGLYCEMIA DETECTED BY A GLUCOSE METER: IS IT RELIABLE?

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INTRODUCTION

Neonatal hypoglycemia is the most common metabolic problem in newborns. Infants in the first or second day of life may be asymptomatic but it can lead to major long-term sequelae include neurologic damage resulting in mental retardation, recurrent seizure activity, developmental delay, and personality disorders. The reference diagnosis method is the blood glucose measurement in the laboratory but results are not immediately available. Glucose meter is usually used because of the minimal blood sampling and immediate results. The aim of our work was to study the frequency of a real hypoglycemia detected by a Glucose meter.

METHODS

This was a prospective study conducted over a period of two-month. Capillary blood glucose was measured by the device (ACCU-CHEK® Active), compared to concomitant venous blood glucose measured by enzymatic technique (Hexokinase) in the laboratory. We included neonates with capillary blood glucose < 0.5 g/L.

RESULTS

During the study period, 58 newborns were collected. The sex ratio was 1.4. The average term was 38 WG [29-42 WG]. The preterm birth rate was 18% (11 cases). The mean weight was 3,285 g [880-4,750 g], 34 newborns were eutrophic, 15 macrosome and 9 hypotrophic. Mean age at the time of sampling was 35 hours [1-504 h]. Glucose meter mean blood glucose was 0.39 g/L [0.17-0.49]; Laboratory mean blood glucose was 0.40 g/L [0.2-0.7]. Only 10 newborns (17%) had real hypoglycemia confirmed in laboratory by gold standard method.

CONCLUSIONS

The Glucose meter is not a reliable device for the detection of hypoglycemia. In our study it tends to underestimate glycemia compared to reference method.

ABS 60

EARLY PARENTERAL USE OF A LIPID EMULSION CONTAINING FISH OIL RESULTS IN IMPROVED LONGITUDINAL GROWTH IN EXTREMELY PRETERM INFANTS – A RANDOMIZED CONTROLLED TRIAL

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INTRODUCTION

Long chain polyunsaturated fatty acids (LCPUFAs) are essential for normal development of the fetus. Preterm infants do not receive the third trimester transfer of LCPUFAs from the mother and rely on parenteral nutrition during their first weeks of life. We have previously shown that preterm infants receiving parenteral nutrition with SMOFlipid© (15% fish oil) have longitudinal changes in serum fatty acid profiles with increased levels of omega-3 fatty acids DHA and EPA compared with infants receiving conventional olive oil-based Clinoleic©. The aim of this study was to compare the effects of early parenteral nutrition with SMOFlipid© or Clinoleic© on longitudinal growth.

METHODS

90 infants born with gestational age < 28 weeks and with a mean (SD) gestational age at birth of 25.2

(1.4) weeks and mean (SD) birth weight of 882 (220) g were randomized to treatment with either SMOFlipid© or Clinoleic©. 78/90 infants survived the study period (SMOFlipid© n = 41, Clinoleic© n = 37). Weekly calculations of nutritional intake were performed and standardized measurements of weight, length and head circumference (HC) were obtained within the first 24 hours after birth and then weekly at the same weekday until 36 w postmenstrual age. Weight SDS (SDS = standard deviation score), length SDS and HC SDS at birth and longitudinal weight SDS, length SDS, and HC SDS were computed from a sex-specific growth reference in a Swedish population. Using all samples at each time point growth parameters were analysed and compared between groups with GLM (general linear model) using the variables parenteral nutrition and time, and the interaction parenteral nutrition * time.

RESULTS

The majority of the infants received parenteral nutrition for up to 14 days. Infants on SMOFlipid© received a median (min-max) of 92 (9-1,384) mL parenteral fats given for 12 (2-72) days while infants on Clinoleic© received 72 (15-1,558) mL fat given for f 12 (2-92) days, with no significant difference between groups. Total nutritional intake (energy kcal/kg/d, carbohydrates g/kg/d, protein g/kg/d and fat g/kg/d divided by enteral and parenteral intake) during the first two weeks of life, in which the majority received parenteral nutrition, did not differ between groups. There were significant differences in longitudinal weight SDS, length SDS, and HC SDS with both time and parenteral nutrition but not with the interaction time*nutrition. Infants receiving SMOFlipid© had significantly improved growth for weight SDS ($p = 0.042$), length SDS ($p = 0.018$), and HC SDS ($p < 0.001$) when compared to infants receiving Clinoleic©.

CONCLUSIONS

Improved longitudinal general and head growth was seen in extremely preterm infants receiving early parenteral nutrition enriched with long-chain polyunsaturated fatty acids. The findings were not related to total nutritional intake during the first two weeks of life when the majority of infants received parental nutrition.

ABS 61

INDIVIDUALIZED FORTIFICATION OF HUMAN MILK IMPROVES NUTRITIONAL SUPPLIES AND GROWTH IN PRETERM INFANTS

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INTRODUCTION

Human milk's macronutrient content is insufficient to cover high nutritional needs, postnatal growth and development of VLBW infants. Expressed human milk is highly variable especially for protein and fat suggesting the need of individual fortification. Mid-infrared analyzer, analysis has been suggested as a rapid and simple method to analyze human milk optimizing individual fortification in clinical routine [1, 2]. The aim of the present study is to evaluate an individualized human milk fortification procedure on nutritional intakes and growth in exclusively HM fed VLBW infants compared with standard fortification.

METHODS

Growth and nutritional intakes were evaluated in preterm infants (< 32 weeks) fed individualized HM fortification. Macronutrient's composition of own mother milk collected and provided daily to our NICU or donor milk was determined using a mid-infrared analyzer (Milkoscan minor®, Foss). Individualized HM fortification was performed in two steps: Adjustment of fat content up to 4 g of fat/dL using Liquigen® Danone, followed by the addition of a human milk fortifier to provide 4.3 g of protein/kg/day according to the daily volume order. Growth rates were compared with those of a standardized HM fortification. Growth rate of infants exclusively fed with donor milk were compared with those fed mostly own mother's milk.

RESULTS

In 103 preterm infants (BW 967 ± 254 g for a GA of 27.7 ± 1.9 weeks) daily individualized fortification was initiated at 19.6 ± 8 days of life during 25 ± 8 days. The mean volume intake was 167 ± 3 ml/kg/day with a protein intake of 4.2 ± 0.1 g/kg/day and an energy intake of 142 ± 8 kcal. During the individualized fortification period, mean weight gain was 19.1 ± 2.0 g/kg/day whereas length and head circumference gain accounted respectively to 1.1 ± 0.4 cm and 1.1 ± 0.3 cm/week. Weight gain was higher than that we recently reported in a multi-centric RCT evaluating two standard human milk fortifications in similar groups of preterm infants (16.8 ± 3.7 g/kg/d, n = 76, $p < 0.001$ and 18.3 ± 3.7 g/kg/d, n = 77, $p = 0.064$) [3]. Preterm infants fed individualized fortified donor milk grow

significantly slower than those consuming own mother's milk (18.3 ± 2.2 g/kg/d, n = 30 vs 19.4 ± 1.8 g/kg/d, n = 73; p = 0.01).

CONCLUSIONS

Individualized fortification according to daily human milk analysis allows to provide protein and energy intakes in the range of nutritional recommendations and improve growth in preterm infants but requests equipments and extra workload. With similar nutritional intakes, growth rate of VLBW infants fed donor milk remains lower than those fed own mother's milk. Further randomized controlled studies are necessary to confirm our results.

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ABS 62

CLINICAL EFFECTS OF OROPHARYNGEAL COLOSTRUM ADMINISTRATION IN VERY LOW BIRTH WEIGHT INFANTS IN THE FIRST MONTH OF LIFE

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INTRODUCTION

Very low birth weight (VLBW) infants have an immature immune system and also disrupted defense natural barriers. Human colostrum provides higher concentrations of secretory IgA, growth factors, lactoferrin, anti-inflammatory cytokines and other protective components compared with mature human milk. Oropharyngeal colostrum administration stimulates the immune system, developing the protective immune barrier. Aim: To evaluate the clinical effects of oropharyngeal colostrum administration to VLBW infants in their first two weeks of life, by assessing feeding, neurology, respiratory and infection outcomes to one month of life.

METHODS

We conducted an interventional, non randomized, controlled trial recruiting newborns ≤ 32^{+6} gestational weeks and/or birth weight < 1,500 g. 86 newborns were enrolled. Subjects received 0.2 ml of their own mother colostrum every 4 hours, starting in the first 24 hours of life, and for a 15 days period. Number of total parenteral nutrition (TPN) days, rate of noninvasive ventilation (NIV) and mechanical ventilation (MV) support, necrotizing enterocolitis (NEC), sepsis, abnormalities in ultrasound brain scan and retinopathy of prematurity (ROP) were measured at 15 and 30 days of life. Perinatal data for the first month of life were registered.

RESULTS

From April 2014 to July 2016, 86 newborns were enrolled: 40 in the colostrum group, 46 in the control group; median gestational age 29.97 weeks vs 29.47 (p = 0.33), birth weight 1,230.12 g vs 1,267.61 g (p = 0.60), respectively. A reduction in the number of TPN days in the colostrum group (7.28 vs 9.07 days, p = 0.045) was observed. However, no significant decreases in the rate of NEC, sepsis, ROP, brain injuries or need of respiratory support were demonstrated during the intervention and at 30 days of life (**Tab. 1**).

Table 1 (ABS 62). Clinical effects of oropharyngeal colostrum administration.

	Colostrum group (n = 40)	Control group (n = 46)	p
TPN days	7.28	9.07	0.04
NEC at 15 days	1	0	0.46
NEC at 30 days	2	2	1
Sepsis at 15 days	7	5	0.37
Sepsis at 30 days	3	2	0.66
NIV during the 1st month of life	35	39	0.87
MV during the 1st month of life	9	13	0.72
ROP at 1st month of life	2	4	0.42
Abnormalities in ultrasound brain scan at 1° month of life	15	9	0.11

TPN: total parenteral nutrition; NEC: necrotizing enterocolitis; NIV: noninvasive ventilation; MV: mechanical ventilation; ROP: retinopathy of prematurity.

CONCLUSIONS

Our data suggest that oropharyngeal colostrum administration might improve feeding outcomes in VLBW by reducing the number of TPN days. A shorter period of TPN would reduce the risk of hepatic disease or infections. Other clinical benefits have not been demonstrated. Further large studies in VLBW babies are needed to confirm improving clinical outcomes of oropharyngeal colostrum administration.

ABS 63

BIRTH WEIGHT PERCENTILES BASED ON MATERNAL HEIGHT ARE UNIVERSALLY APPLICABLE AND VALID FOR DIFFERENT ETHNIC GROUPS

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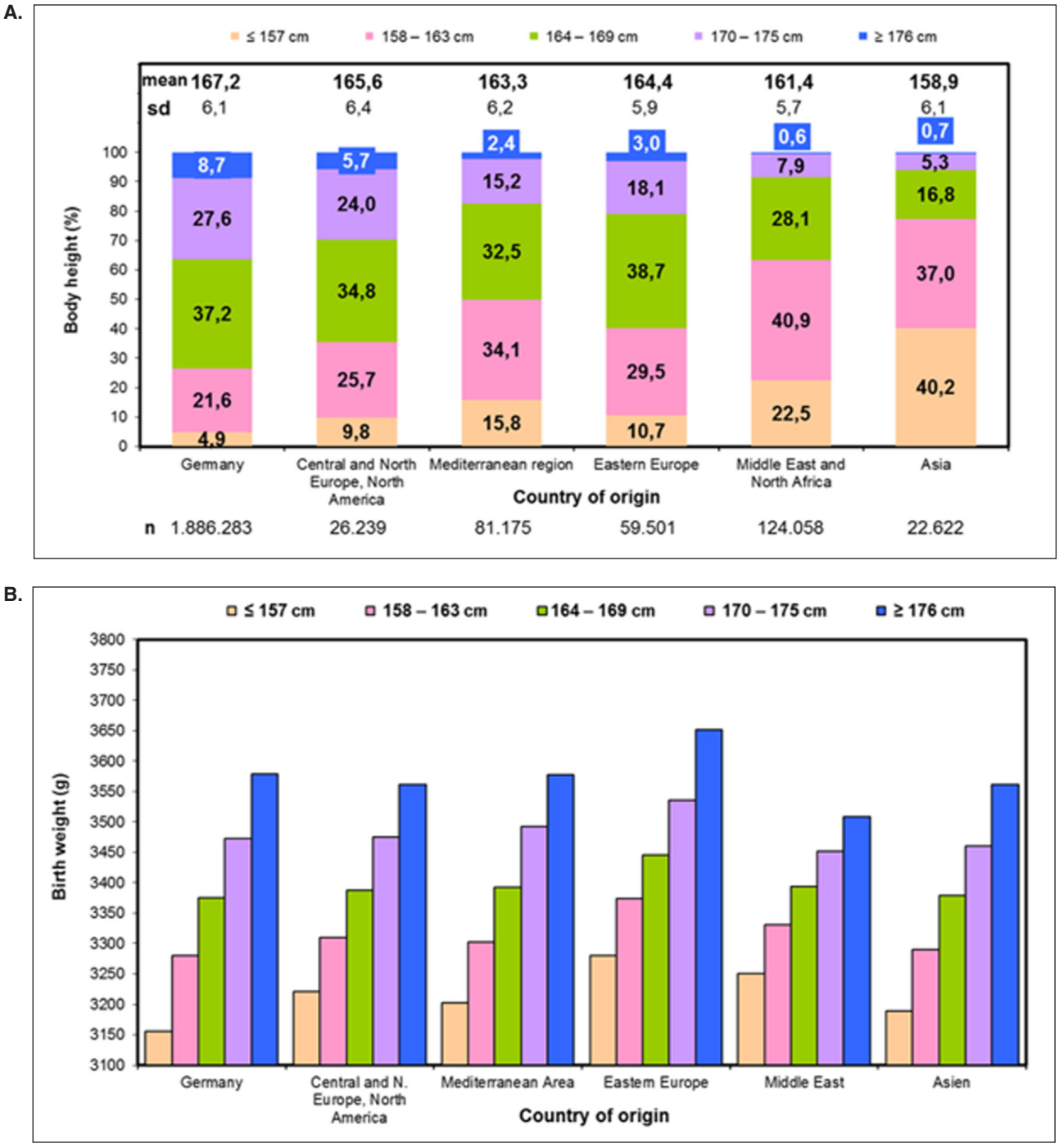

Figure 1 (ABS 63). A. Maternal body height by country of origin. **B.** Birth weight stratified by maternal height and ethnic group.

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INTRODUCTION

Birth weights are known to be different between ethnic groups. As a result, birth weight percentiles have been developed for specific populations. However, due to globalization there are immigration and interethnic families. It is unclear which percentiles should be used. However, there is a linear relation between the maternal height and their child's birth weight. For each cm increase in maternal height, birth weight increases by 16.7 g. The average maternal height has also been found to be different between ethnic groups. It could be hypothesized that birth weight percentiles adjusted for maternal height account for the ethnic effects on the weight at birth. The objective of this study is to test whether the birth weight is different between ethnic groups when maternal body height remains similar.

METHODS

Data (birth weight, gestational age, sex, maternal height, ethnicity) from the German Perinatal Survey of 1995-2000 with n = 2.3 Million. Singleton neonates, gestational age ranging from 21 to 43 weeks, were analyzed. Data were stratified for maternal height (≤ 157, 158-163, 164-169, 170-175, ≥ 176 cm) and ethnic origin (Germany; Central and Northern Europe, North America; Mediterranean region; Eastern Europe; Middle East and North Africa; Asia excluding Middle East). Percentiles and average birth weight were calculated and compared.

RESULTS

The average birth weight and maternal height between the ethnic groups are significantly different (**Fig. 1A** and **Fig. 1B**). Classification of birth weight by common growth charts showed a low rate of SGA and high rate of LGA infants in tall mothers (≥ 176 cm), and a high rate of SGA and low rate of LGA in neonates from shorter mothers (≤ 157 cm). When reference birth weight charts are stratified by maternal height then average birth weight, SGA and LGA rates are similar between ethnic groups.

CONCLUSIONS

Birth weight percentile charts for maternal height seem to reflect genetic fetal growth potential in small and tall mothers and might be universally applicable for different ethnic groups.

ABS 64

DECREASING EXTRAUTERINE GROWTH RESTRICTION IN VERY LOW BIRTH WEIGHT (VLBW) INFANTS AFTER IMPLEMENTATION OF A NUTRITIONAL PROTOCOL

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INTRODUCTION

The occurrence of extrauterine growth restriction (EUGR) is common in VLBW infants and has been associated with significant neurodevelopmental impairment. Several studies demonstrate the strong influences of nutritional practices on growth, especially on weight gain. However, more comprehensive nutritional practices aimed at reducing EUGR, improving neurodevelopmental outcomes, and decreasing an infant's risk for adult-onset metabolic diseases, must also support brain and linear growth. The purpose of our study was to evaluate whether our new nutrition protocol, which focuses on higher protein and energy intake, improves overall postnatal growth in VLBW infants.

METHODS

In 2015, we implemented new evidence-based nutritional guidelines for VLBW infants, focusing on improving protein intake. We prospectively collected demographic, nutritional, and growth data for infants born 12 months before and after the changes in practice who survived to discharge. Anthropometric data were converted to gender and age-specific Z-scores using the 2013 Fenton dataset. A fall in Z-score between birth and discharge > 2 was defined as severe EUGR. The effect of the intervention on change in weight (Wt), length (L), and head circumference (HC) Z-score between birth and discharge, and in the incidence of severe Wt, L, or HC EUGR were examined by linear and logistic modeling respectively, correcting for gender, ethnicity, birth Z-score, gestational age, and length of stay.

RESULTS

We included 143 VLBW infants: 80 infants before (PRE) and 63 after (POST) the new guidelines were

implemented. Babies studied before the intervention tended to be smaller at birth (BW Z-score -0.38 vs -0.08, p = 0.055; HC Z-score -0.19 vs +0.12, p = 0.08, L Z-score -0.26 vs +0.03, p = 0.02). There was no difference in GA, gender, or ethnicity between the periods. Discharge L Z-score was significantly higher after the intervention (1.64 vs -2.76; p < 0.0001) even adjusting for differences in birth HC Z-score. There was no effect on discharge Wt Z-score (-1.26 vs -1.46; p = 0.17), or discharge HC Z-score (-0.54 vs -0.77; p = 0.21). The odds of severe EUGR in length was significantly less after the intervention (OR 0.11, 95% CI 0.03-0.33; p < 0.0001). There was no significant change in the odds of severe EUGR in Wt (OR 0.7, 95% CI 0.16-2.79; p = 0.2), or in HC (OR 0.52, 95% CI 0.06-3.56; p = 0.5).

CONCLUSIONS

A nutritional intervention focusing on increasing protein intakes significantly improved the growth of VLBW infants in our institution. Significant improvements were seen in linear growth, without any significant change in weight or HC. These results demonstrate that improvements in linear growth are not necessarily accompanied by increases in weight gain in VLBW preterm infants.

ABS 65

Z-SCORE DIFFERENCES BASED ON CROSS-SECTIONAL GROWTH CHARTS DO NOT REFLECT WEIGHT GAIN IN PRETERM INFANTS: AN ADJUSTED Z-SCORE FOR LONGITUDINAL ASSESSMENT OF GROWTH

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INTRODUCTION

Growth of preterm infants is often assessed by z-score differences between birth and discharge. Z-score differences represent the deviation from the percentile of the weight at birth and discharge as well as the reference weight gain. Current z-scores are calculated using references based on birth weights of pregnancies with known gestational age (GA). A significant proportion of pathological pregnancies skews the distribution of percentiles and affects the z-score calculation. Larger distances are seen between percentiles and standard deviations from 24 to ~30 weeks followed by a decrease until term age (**Fig. 1**A). A physiological explanation for the resulting fluctuation of weight gain suggested when following the 3rd and 10th percentile curves is lacking (**Fig. 1**B). It is hypothesized that the current z-score differences approach has a systematic error indicating growth restriction in infants even they grow with desired rates. The objective of the study is to test the hypothesis that the assessment of growth by z-score differences in preterm infants is affected by GA and birth weight percentile reference data.

METHODS

This observational study included 6,832 (male = 3,429) VLBW infants from German Neonatal Network (2009 to 2015). For each infant, z-score differences and weight gain from birth to discharge was calculated. Weight gain expressed as ratio of weight gain/reference growth rate (50th percentile [1]) for the corresponding observation period. Primary outcome is the homogeneity of z-score differences versus weight gain.

RESULTS

In male infants the correlation between z-score differences and weight gain is weak $R^2 = 0.56$, the inter-individual variation is high, up to a factor of 5 with a median (IQR) deviation from line of identity of 0.36 (0.17;0.58). Z-score differences are affected by birth weight percentile and GA. A significant proportion n = 761 (22%) of infants with negative z-score differences had higher weight gain than *in-utero* (**Fig. 1**C). An adjusted z-score differences that reduces the confounding effect of GA decreased the deviation to 0.05 (0.02;0.08) from line of identity ($R^2 = 0.99$). Analysis for females showed similar results.

CONCLUSIONS

This study supports the hypothesis that z-score differences, which is used to assess growth, is confounded by skewed reference data. This is primarily due to the fact that cross-sectional data of interrupted pregnancies with pathologies have been used to create birth weight charts. New z-score references optimized for GA showed a high correlation with weight gain and should be used when growth of infants born at different GA is compared.

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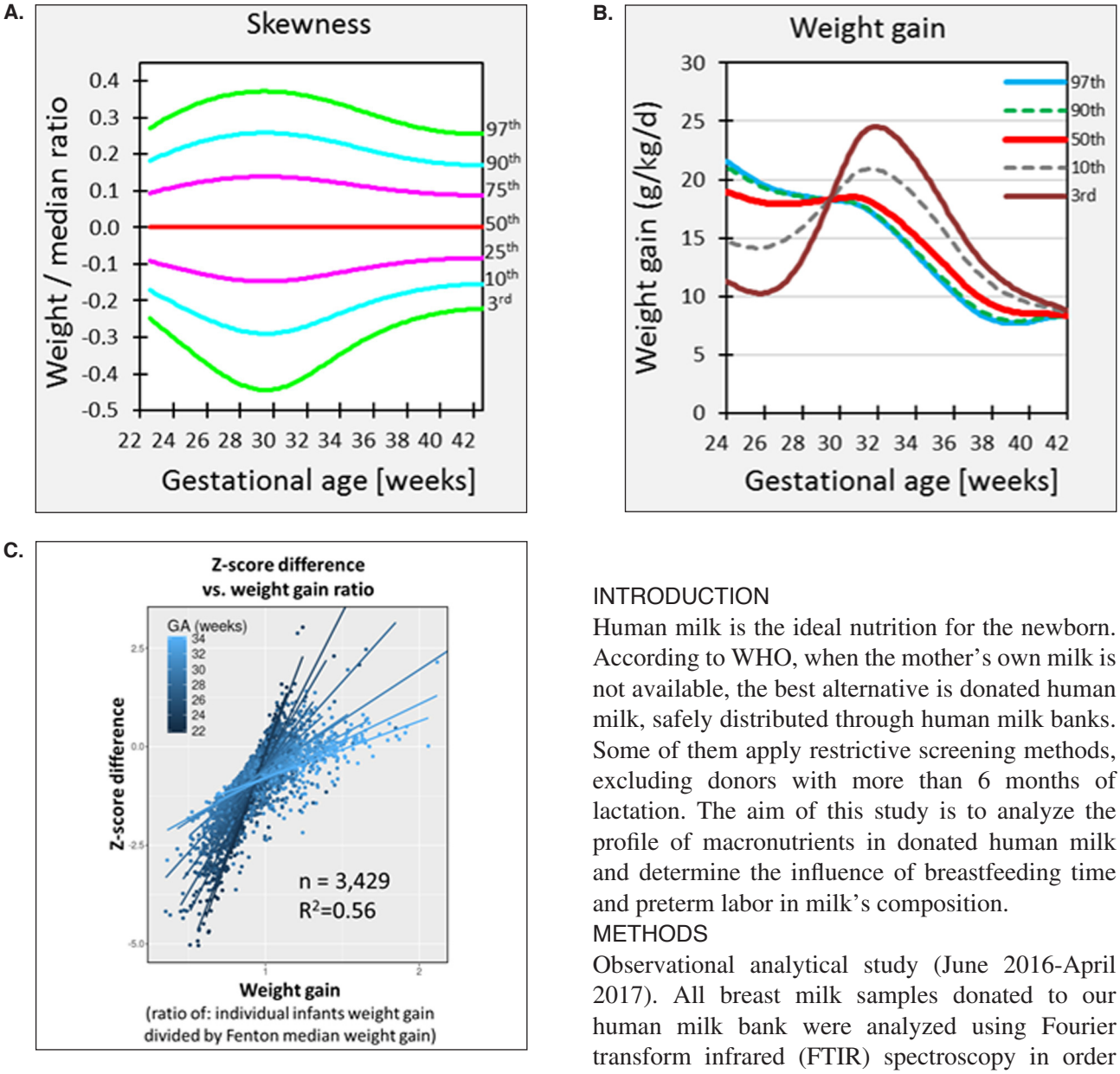

Figure 1 (ABS 65). Characteristic of *in-utero* growth charts. **A.** Skewness of percentile distribution. **B.** *In-utero* weight gain during pregnancy for selected percentiles. **C.** Relation of z-score changes versus deviation from median growth rates. Scatter plots show individual values as well as regression lines stratified by gestational age.

ABS 66

MACRONUTRIENT PROFILE OF DONATED BREAST MILK: DOES LONG TIME BREAST-FEEDING MODIFY IT?

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INTRODUCTION

Human milk is the ideal nutrition for the newborn. According to WHO, when the mother's own milk is not available, the best alternative is donated human milk, safely distributed through human milk banks. Some of them apply restrictive screening methods, excluding donors with more than 6 months of lactation. The aim of this study is to analyze the profile of macronutrients in donated human milk and determine the influence of breastfeeding time and preterm labor in milk's composition.

METHODS

Observational analytical study (June 2016-April 2017). All breast milk samples donated to our human milk bank were analyzed using Fourier transform infrared (FTIR) spectroscopy in order to determine their nutritional profile. According to donor's characteristics, samples were classified as: human milk from women who have delivered at term and have been breastfeeding more than 6 months (group 1), milk from women who have delivered at term but have been breastfeeding for less than 6 months (group 2) and milk from mothers who have delivered preterm children and were breastfeeding for less than 6 months (group 3). Statistical analysis (SPSS® v.22) was performed to determine the influence of breastfeeding time and preterm delivery in human milk's nutritional profile.

RESULTS

122 samples, belonging to 54 women donors were analyzed. Mean protein content in groups 1, 2 and 3 was 1.05, 1.11 and 1.31 grams/dl respectively. Fat content was 2.64, 2.57 and 3.01 grams/dl and lactose content was 7.30, 7.23 and 7.29 grams/dl

in all 3 groups respectively. Mean energy supply was 57.23, 56.5 and 61.47 Kcal/dl respectively. We found a higher protein content ($p < 0.05$) in samples from mothers with a breastfeeding time of less than 6 months (group 2 + 3) compared to samples of mothers with a prolonged breastfeeding (group 1), but no other differences in macronutrients or energy supply were found. Those differences were still present when excluding mothers with a preterm delivery. When comparing group 2 and 3 separately, we have observed a higher protein, fat and energy content in samples of mothers with a preterm delivery ($p < 0.05$).

CONCLUSIONS

Sustaining breastfeeding for longer than 6 months should not be a matter of concern to be eligible as a milk donor mother. Protein content, although slightly lower than shorter time breastfeeding milk, is on average above 1 gr/dl, enough to fulfill nutritional demands of preterm recipients after adjusted fortification. No other differences in macro nutrient profile or energy were found. Milk donated by mothers who delivered preterm infants showed a better nutritional quality, higher protein, fat and energy content during the first months after delivery. We should take this into account in order to optimize the distribution of milk to neonatal recipients according to their nutritional needs.

ABS 67

TYPE OF FEEDING IN BABIES FROM THE NEONATAL INTENSIVE THERAPY UNIT OF A BABY FRIENDLY HOSPITAL AT THE TIME OF HOSPITAL DISCHARGE

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INTRODUCTION

Prematurity and low birth weight are important isolated or associated causes of mortality. Breastfeeding (BF) alone is responsible for reducing infant mortality. In 1990, the Baby-Friendly Hospital (BFHI) was created to promote and protect breastfeeding. Breastfeeding is highlighted in prematurity so a version of the BFHI for neonatal units was created. The mean of the present study was to describe the type of feeding in preterm infants from the neonatal intensive care unit (NICU) of a BFHI in the Federal District of Brazil at the hospital discharge.

METHODS

Longitudinal, retrospective, descriptive and quantitative study. Sixty-three premature newborns born from January 2016 to January 2017 were selected for this study. The following data were collected: gestational age (GA) at birth; birth weight (BW); sex; corrected GA, weight and corrected GA at the time of initiation of oral transition; corrected GA and weight at the time of establishment of full oral feeding; type of oral feeding at the time of hospital discharge. Babies with contraindications to BF, with facial or brain malformations, with syndromic malformations or infants with social risk were excluded from the study. Descriptive statistics were used to present the data. For the presentation of the data were used median, minimum and maximum.

RESULTS

The sample consisted of 35 male and 28 female newborns. The median, minimum and maximum GA at birth and BW were 31 weeks, 25 weeks and 36 weeks and 4 days; 1,362.5 g, 490 g and 3,265 g, respectively. The median, minimum and maximum corrected GA and weight at the time of oral transition were 33 weeks, 31 weeks and 3 days and 1 month and 12 days; 1,495 g, 1,030 g and 3,025 g, respectively. The median, minimum and maximum corrected GA and weight at the time of full oral feeding were 34 weeks and 6 days, 32 weeks and 4 days and 2 months and 7 days; 1,670 g, 1,450 g and 3,025 g, respectively. Forty-four (69.8%) patients were hospital discharged with exclusive BF, 7 (15.9%) with translactation (TL) of the mother's own milk. Eleven (17.5%) were discharged with infant formula offered in bottle-feeding. Eight (12.7%) patients were discharged with BF and infant formula, 2 (25%) with a bottle-feeding and 6 (75%) with TL.

CONCLUSIONS

The type of oral feeding at hospital discharge was predominantly exclusive BF. Early introduction of oral suction decreases the time of transition from the tube to the full oral feeding, the mean time to establish a full oral feeding was 1 week and 6 days. The full oral feeding was established at around 34 weeks coinciding with the time by which the fetus presents coordination of the functions of suction, swallowing and breathing.

ABS 68

DONOR HUMAN MILK IMPACT ON NUTRITIONAL STATUS OF VERY PRETERM INFANTS

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INTRODUCTION

Benefits of human milk (HM) in very preterm infants (VPI) have been widely demonstrated. Short term growth in VPI seems to be hampered in those fed with HM, specially if milk is not correctly fortified, although this is not related to worse long term nutritional results. Some studies have showed a higher prevalence of HM feeding at discharge after the introduction of donor milk (DM).

METHODS

This is an observational, retrospective cohort study that compares nutritional outcomes in VPI (≤ 32 weeks) in two periods, before and after the introduction of DM in our unit: period 1 (2009-2010) and period 2 (2012-2013). To describe changes in nutrition and growth in VPI exclusively HM-fed compared to a group of VPI that received formula when HM was not available.

RESULTS

A sample of 227 VPI was analyzed, 99 in period 1 and 128 in period 2. Enteral feeding was started earlier in period 2 (2.55 ± 1.1 vs. 2.09 ± 1 days, p = 0.001). No differences were found in duration of parenteral nutrition or days to reach full enteral feeds. Growth velocity at 14 and 28 days of life was higher in period 2 and loss z-score from birth to 28 day of life was smaller in period 2. Discharge weight was higher in period 1 (2,290 ± 447 g vs. 2,168 ± 365 g, p = 0.03), but not referred to z-score at discharge (-1.41 ± 0.98 vs. -1.57 ± 0.97, p = 0.2). Breastfeeding rate at discharge remained stable between periods.

CONCLUSIONS

Enteral nutrition is started earlier since the introduction of DM. This has not affected the days of parenteral nutrition or the days to reach full enteral feeds. We have not found a slower growth during admission using DM. Breastfeeding rates have not been modified by the availability of DM. Our findings suggest that exclusively HM nutrition is safe and does not worsen nutritional status compared to those receiving HM and formula.

ABS 69

INFLUENCE OF THE USE OF DONOR HUMAN MILK IN THE CLINICAL COURSE OF TWO COHORTS OF VERY PRETERM INFANTS

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INTRODUCTION

Own mother's milk (OMM) is the feeding choice for very preterm infants (VPI). When it is not available, human donor milk (HDM) is advised, since it has been proven its protective effect against necrotizing enterocolitis (NEC) and late onset sepsis (LOS).

METHODS

This is an observational, retrospective cohort study that compares clinical outcomes in VPI (≤ 32 weeks) in two periods, before and after the introduction of HDM in our unit: period 1 (2009-2010) and period 2 (2012-2013).

RESULTS

A sample of 227 VPI was analyzed. Baseline characteristics are shown in **Tab. 1**. There were no significant differences regarding days of ventilator support, incidence of patent ductus arteriosus, bronchopulmonary dysplasia, retinopathy of prematurity or intraventricular hemorrhage. Prevalence of late onset sepsis was not different between periods. The duration of parenteral nutrition, central line or antibiotic was similar between periods. A trend in lower incidence of NEC in period 2 was found (9.1% vs 3.4%, p 0.055). This difference was statistically significant in the subgroup of patients > 28 wg (5.4% vs 0%, p 0.044). Mortality rate was similar between periods, but in the subgroup of patients > 28 wg, we found

Table 1 (ABS 69). Baseline characteristics of very preterm infants VPI (≤ 32 weeks) in two periods, before and after the introduction of HDM in the unit: period 1 (2009-2010) and period 2 (2012-2013).

	Period 1 (n = 99)	Period 2 (n = 128)	p-value
Male	56/99 (56.6%)	69/128 (53.9%)	0.690
Gestational age (weeks)	29.49 ± 2.28	29.12 ± 2.33	0.227
Birth weight (g)	1,282.81 ± 392.85	1,197.50 ± 370.04	0.095
IUGR	18/99 (18.2%)	15/128 (11.7%)	0.171
Multiple pregnancy	39/99 (39.4%)	48/128 (37.5%)	0.771
Cesarean section	55/99 (55.6%)	86/128 (67.2%)	0.073
Full antenatal steroid course	69/99 (69.7%)	79/128 (61.7%)	0.211
CRIB score	2.22 ± 3.00	2.76 ± 3.05	0.188

a trend in mortality due to NEC (75% vs 14.3%, p 0.088).

CONCLUSIONS

A trend in the reduction of NEC has appeared in our unit after the introduction of HDM, especially in those born after 28 wg probably because this population receives more formula than before 28 wg. In patients < 28 wg there are probably no significant differences due to the high rate of breastfeeding in this population in both periods.

ABS 70

COMPARATIVE CLINICAL EFFECTIVENESS OF TWO METHODS OF HYPERGLYCEMIA CORRECTION IN VERY LOW BIRTH WEIGHT PRETERM INFANTS

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INTRODUCTION

Hyperglycemia (HG) is a common problem in preterm newborns undergoing intensive care, especially in very low birth weight (VLBW) preterm infants, which affects their morbidity and mortality. Management of neonatal hyperglycemia remains controversial. The aim of this study was to compare clinical effectiveness of reduction of glucose infusion rate and insulin therapy in management of early hyperglycemia in VLBW infants with respiratory distress.

METHODS

Sixty VLBW newborns (gestational age < 32 weeks) with HG and respiratory distress were enrolled into the study on the first day of life and were followed until discharge or death. Criteria of HG were blood glucose concentration (BGC) > 8.3 mmol/L with glycosuria (GU) or BGC ≥ 10 mmol/L regardless of GU. The neonates were randomly divided into two groups. Newborns in the insulin group (n = 30) were treated with insulin (0.1 U/kg) and control babies (n = 30) were managed with reduction of glucose infusion rate by 25%. Normal saline was infused for 1 hour if above mentioned measures were ineffective and HG persisted with BGC > 10 mmol/l. Standard protocols of enteral and parenteral feeding were used in the both groups.

RESULTS

The groups were not different in terms of gestational age and birth weight (28.07 ± 2.38 weeks and 1,016.33 ± 245.25 g in the insulin group vs. 28.23 ± 2.31 weeks and 1,058.33 ± 258.95 g in the control group; p > 0.05). The median age at the first episode of HG and median time to normalization of glycaemia were the same in the both groups – 1.0 day and 1 hour respectively. Maximum number of recurrent HG episodes and maximum duration of HG episode were higher in the insulin group but the differences were not statistically significant (13 and 30 hours vs. 5 and 4 hours respectively). Mortality rates (26% in the both groups) and incidences of severe intraventricular haemorrhages (23% in the insulin group vs. 24% in the control group), bronchopulmonary dysplasia (26% and 28% respectively), and retinopathy of prematurity (27% in the both groups) were not affected by the method of HG management (p > 0.05).

CONCLUSIONS

Insulin treatment as compared to the standard measures does not confer any clinical benefit in management of early hyperglycemia in VLBW preterm infants.

ABS 71

GROWTH AND BODY COMPOSITION ASSESSMENT AT FOLLOW-UP OF VERY PRETERM INFANTS

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INTRODUCTION

Very preterm infants (VPI) often present growth restriction during their admission in the neonatal unit. Neonatologists and pediatricians should ensure an adequate catch-up growth during childhood in order to avoid nutritional and metabolic problems. However, the nutritional status is often poorly evaluated using only anthropometric tests. The study of body composition and adiposity adds valuable information about the metabolic health of these infants. The aim of our study was to evaluate growth and to determine the correlation between different measures of body composition at 2 years of corrected age in a cohort of VPI.

METHODS

We conducted a longitudinal follow up study of VPI (< 32 weeks of gestation). Newborns

with major congenital malformations (n = 5), chromosomopathies (n = 2) or predictable early death were excluded; 2 patients refused follow up. We included 209 patients of whom 133 had reached 2 years of postmenstrual age by March 2017. We measured weight, length and head circumference, triceps and subscapular skinfolds and body circumferences (abdominal, thoracic and middle upper arm). The variables were transformed into z-scores by age according to WHO curves for the available parameters.

RESULTS

90 patients were evaluated at a mean corrected age of 26 months (SD 2.2). Their mean z-score measures were: weight -0.44 (SD 0.96), length -0.54 (SD 1.2), head circumference 0.38 (SD 1.1) and body mass index (BMI) -0.27 (SD 0.95). At 2 years postmenstrual age, 22 patients (11%) had not reached the 10th centile in terms of weight. This subgroup of infants was born smaller (absolute value and Z-score) and half of them (43.8%) were SGA at birth (birth weight p < 10). At 28 day of life and at discharge, Z-score were also lower. At discharge, all these patients had a weight below the 10th centile. They had more prenatal diagnosis of IUGR (37.5% vs 9.6%, p 0.011). We did not find any differences in growth velocity during the first 28 days of life according to the weight centile achieved at 2 years. We found a good correlation between the majority of adiposity measures (body circumferences, BMI and skinfolds) either with absolute values or z-scores.

CONCLUSIONS

According to our data, patients below the 10th centile at 2 years were also discharged in p < 10 independently of gestational age or growth velocity during hospitalization. We found a good correlation between the different measures we used to assess body composition at 2 years.

ABS 72

GROWTH OF VERY PRETERM INFANTS (< 32 WEEKS) WITHIN 3 YEARS AFTER BIRTH

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INTRODUCTION

To assess postnatal growth of preterm infants, SD scores of body weight, body length and head circumference, and their changes from birth until 3 years were studied.

METHODS

Very preterm infants born before 32 weeks of gestation and cared in the Perinatal Center of Tokai University Hospital in 2012 were studied. Data of body weight, body length and head circumference were collected at birth, 2 months, 6 months, 12 months and 3 years after birth. Correlation between SD scores of the above growth indices at birth and those at 3 years, as well as change from birth to 3 years was analyzed using Pearson's correlation test.

RESULTS

Growth data were collected from 24 infants (10 males, 14 females). Their gestational age ranged 23.1-31.4 (median 28.3) weeks with birth weight of 524-1,736 (median 1,124) grams, birth length of 29.2-42.5 (median 37.0) cm, and head circumference at birth of 21.0-28.6 (median 25.2) cm. At 3 years, medians of body weight, body length and head circumference were 12.2 kg, 92.0 cm and 48.3 cm, respectively. Values of head circumference tended to catch up earlier compared to those of body weight and body length. Correlation between SD scores at birth and at 3 years showed tendency of positive correlation in body weight (p = 0.08), but not in body length or head circumference. There was a significant inverse correlation between SD scores at birth and changes in SD scores from birth to 3 years in body weight (p = 0.0001), body length (p = 0.005) and head circumference (p = 0.004).

CONCLUSIONS

The catch-up growth was almost complete by 3 years. Growth was already impaired in some infants, which tended to persist even after 3 years. There was a significant influence of postnatal factors on growth, especially in extremely preterm infants.

ABS 73

THE ASSOCIATION BETWEEN 25 OH-D VITAMIN LEVELS AND AORTIC, CAROTID INTIMA MEDIA THICKNESS IN HEALTHY NEWBORN INFANTS

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INTRODUCTION

Vitamin D deficiency is a worldwide major public health problem, affecting people of all ages, from infants to the elderly. There is a growing interest in

the link between vitamin D status and development of cardiovascular diseases. The objective of this study is to determine whether aortic intima-media thickness (aIMT) and carotid artery intima-media thickness (cIMT) are related with 25-hydroxyvitamin D (25-OH-D) concentrations in term healthy newborns.

METHODS

Eighty six healthy term infants were enrolled to the study. The infants divided into three groups according to serum 25-OH-D levels. (Group 1 20 ng/ml). Cord blood samples were obtained from neonates immediately at birth. After centrifugation at 5,000 rpm, serum samples were stored at -40 C before analysis. Serum 25-OH-D levels were measured with Architect immunoassay method (Abbott, Illinois, USA). Demographic details were recorded for all infants. All ultrasonographic parameters were measured by using a Toshiba linear ultrasound probe PLT-704SBT 7.5MHz.

RESULTS

A total of 86 infants enrolled to the study. The infants had a median gestational age of 39.14 ± 0.9 weeks and median birth weight of 3,324.76 ± 516 g. Mean umbilical cord 25-OH-D levels were 9.50 ± 4.2 ng/ml. Maximum and median aIMT and cIMT values of newborns were 0.488 ± 0.94 mm and 0.43 ± 0.09 mm and 0.43 ± 0.08 and 0.38 ± 0.08 mm, respectively. There was no statistically difference between abdominal and carotid IMT values among group 1 and group 2 ($p \geq 0.05$). All of the 25-OH-D levels were < 20 ng/ml therefore we could not be able to compare the impact of the higher levels of 25-OH-D vitamin abdominal and carotid IMT values. No correlation was found between abdominal and carotid IMT values and 25-OH-D levels.

CONCLUSIONS

We already know that exposure to vitamin D deficiency during early life has the potential to program for long-term cardiovascular disease and measurement of aortic intima-media thickness (aIMT) has been proposed as an alternative measure of early markers of atherosclerosis. Most experts agree on the association between vitamin D deficiency and increased risk for cardiovascular disease, although in our study we did not find any association between two entity.

ABS 74

TARGET FORTIFICATION OF BREAST MILK WITH PROTEIN, CARBOHYDRATE AND FAT FOR PRETERM INFANTS IMPROVES GROWTH OUTCOMES: A DOUBLE-BLIND RANDOMIZED CONTROLLED TRIAL

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INTRODUCTION

The natural variation of breast milk (BM) composition makes it difficult to provide recommended macronutrient (MN) intakes for preterm infants with standard fortification (SF). There is evidence that this increases the risk for poor postnatal growth. Target Fortification (TFO) is a novel approach that individually adjusts MN content using bedside milk analysis and was shown to be feasible in a pilot trial. This study aim to investigate the impact of TFO on growth outcomes of preterm infants in a double-blind randomized controlled trial (RCT).

METHODS

Single center RCT, infants born < 30 gestational weeks on BM or donor milk; intervention (INTVN) group received SF+TFO, control (CTL) group only SF. SF was provided using Enfamil HMF. For TFO modular fortifier products (Beneprotein, Microlipids, Polycal) were added after BM content was measured 3x/week using a validated near-IR spectrometer (Spectrastar) to achieve ESPGHAN recommended intakes [g/kg/d] of 4.5, 13.2 and 6.6 for protein, CHO and fat, respectively. For final MN analysis all native BM samples (n = 2,810) were reanalyzed: near-IR for protein and fat and UPLC-MS/MS for CHO (lactose). SF intakes were defined as deficient when they fell below the lower limit of ESPGHAN guidelines. Nutritional efficiency (NE) was defined as weight gain per fluid intake [g/dL]. Body composition was measured by Air Displacement Plethysmography (PeaPod). The primary outcome was weight at 36 weeks.

RESULTS

For analysis, 103 infants were included with mean time in the study at 27 and 28 days for INTVN (52 infants) and CTL (51 infants), respectively. Baseline characteristics and total fluid intake were similar between groups. After applying SF, n = 55 (53%) and n = 91 (88%) of all infants were deficient in protein or CHO, respectively. In INTVN, infants had higher intakes of MN (**Fig. 1**). The INTVN group had higher weight at 36 weeks, higher growth

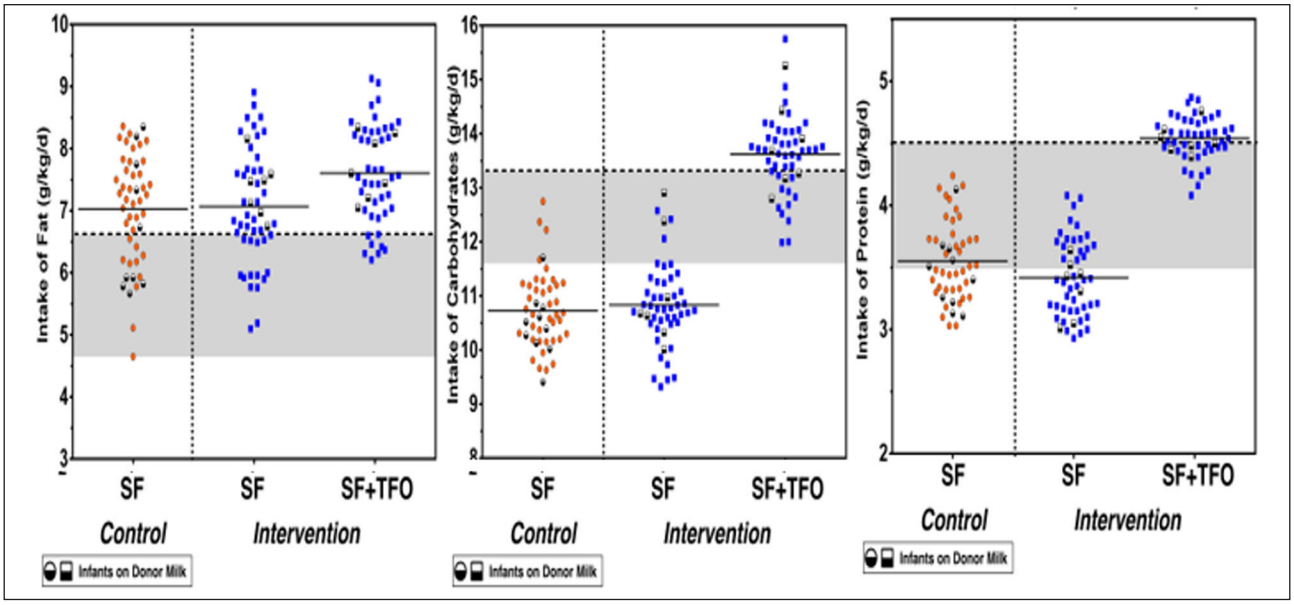

Figure 1 (ABS 74). Distribution of macronutrient intake during intervention.
Grey shaded region represents ESPGHAN recommended intake range. Horizontal dashed line represents the target for TFO.

Table 1 (ABS 74). A. Growth outcomes and clinical outcome for intervention period. **B.** Growth outcomes for low-protein sub-group.

A.

	Control n = 51	Intervention n = 52
Birth weight (g)	980 ± 270	980 ± 210
Age at birth (weeks)	27.2 ± 1.7	27.2 ± 1.2
Age at start of INTVN (weeks)	30.3 ± 1.4	30.0 ± 1.1
DOL at start (day)	22 ± 7	20 ± 6
Total fluid intake (mL/kg/d)	154 ± 5	153 ± 5
Weight at 36 weeks (g)	2,290 ± 300	2,510 ± 290**
Growth rate (g/kg/d)	19.3 ± 2.4	21.2 ± 2.5***
Nutritional efficiency (g/dL)	12.5 ± 1.7	13.9 ± 1.8***

Values presented as mean ± sd, *p < 0.05, **p < 0.01, ***p < 0.001.

B.

	Control	Intervention
Weight at term (g)	3,230 ± 635 (23)	3,560 ± 520* (31)
Fat free mass at term (g)	2,480 ± 554 (13)	2,610 ± 441 (11)
Δ length (z)	-1.40 ± 1.08 (14)	-0.60 ± 1.02* (17)

Values presented as mean ± sd (number of subjects), *p < 0.05, **p < 0.01, ***p < 0.001.

rate and higher NE (**Tab. 1A**). Sub-group analysis, stratified for protein intake below the median (< 3.5 g/kg/d after SF), showed that INTVN infants had higher change in length z-scores compared to the CTL group. Fat-free mass at term age was also higher for the INTVN group (not statistically significant) (**Tab. 1B**). No NEC occurred in INTVN group. NICU morbidities were not different between groups as well as metabolic parameter.

CONCLUSIONS

This RCT shows that TFO leads to improved growth outcomes in a group of extremely preterm infants. In addition to TFO enhancing the quality of nutrition, these results provide further evidence of the positive effect of nutritional intake on growth. Neurodevelopmental follow-up is in progress.

ABS 75

HORMONE PROFILE AND ANTHROPOMETRIC ASSESSMENT OF VERY PRETERM NEWBORNS AT FOLLOW-UP

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INTRODUCTION

Very preterm infants seem to be at higher risk of metabolic disorders and metabolic syndrome when they grow up. Data regarding the influence of postnatal catch up growth in the development of this disease is inconsistent. We aimed to study the hormone profile of very preterm infants at 2 years of postmenstrual age and its relation to their anthropometric characteristics.

METHODS

Patients were assessed in the clinic for anthropometric measures (weight, height, head circumference, abdominal and mid upper arm circumference and tricipital [TSK] and subscapular [SSK] skinfolds). Body mass index was calculated and all measurements were transformed into Standard Deviation Scores (SDS) with data from the WHO normative curves. A blood sample was drawn after overnight fast for basic metabolic tests and insulin measurement (Chemiluminescence Immuno Assay). Plasma was frozen and later analysed for Adiponectin, CRP, Ghrelin, leptin and TNF-α by Enzime-Linked ImmunoSorbent Assay (ELISA). Assays were run in duplicate and samples with a coefficient of variation higher than 15% were excluded. Results under detection threshold were computed as 0.

RESULTS

78 patients had blood samples drawn for hormonal analysis. As expected, levels of leptin correlated positively with current weight and SDS for all anthropometric measurements at 2 years except for TSK. There was also a positive correlation with levels of triacylglycerides (r = 0.419, p 0.002) and a negative correlation with prealbumin (r = -0.359, p 0.007). Adiponectin was correlated negatively with weight and with height SDS, but had no relation with weight SDS or with SDS of other anthropometric measurements. Children with a weight SDS under -1.28 (approximately 10th centile) at 2 years had higher levels of ghrelin and a tendency to higher levels of TNF-α than those appropriately grown, while the contrary was true for levels of leptin. There were no differences in basal insulin levels.

CONCLUSIONS

According to our data, children with different anthropometric measurements at 2 years corrected age have different hormone profile. In a similar way, children who have not reached the 10th centile at 2 years of corrected age show a different hormonal pattern that those who have grown up appropriately. Neonatologists and pediatricians should be aware that a poor catch-up growth may have consequences on the hormone profile of VPI during childhood.

ABS 76

REDUCING VARIABILITY IN MACRONUTRIENT INTAKES IMPROVES GROWTH IN PRETERM INFANTS: TARGET FORTIFICATION OF BREAST MILK – A DOUBLE-BLIND RANDOMIZED CONTROLLED TRIAL

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INTRODUCTION

Our recent RCT investigated the effects of optimizing the macronutrient (MN) intakes with individualized Target Fortification (TFO) of breast milk (BM) on growth outcomes. In this study, all native BM samples used for were analyzed for their MN content to determine true daily nutritional intake. This provides a unique opportunity to explore the effect of day-to-day variability in MN intake on growth. From adult data, it could be speculated that a larger variation of the MN intakes could influence metabolism and growth. This study aims to examine the impact of MN intakes, and their variability, on growth rates of preterm infants.

METHODS

In this singlecenter, doubleblind RCT, 103 infants < 30 gestational weeks fed BM or donor milk receiving either standard fortification (SF) in control or SF+TFO in intervention. All native BM samples (n = 2,810) used to make feeds were analyzed; fat and protein with nearIR spectrometer (SpectraStar) and CHO (lactose) with UPLC-MS/MS. Daily MN intakes and average growth rates were calculated for a 21-day observation period. The variability of MN intakes was calculated as the average of day-to-day changes (absolute value) divided by the average MN intake. Correlation and regression analysis was used to assess the impact of MN intakes and their variability on growth rates.

RESULTS

Protein and CHO intakes are positively correlated with growth velocity (**Fig. 1**). However when combined in a multiple linear regression model (r^2 = 0.102, p = 0.013), these intakes are not significant predictors of infant's growth rate. The variability of the average MN intake indicates that larger day-to-day changes in CHO and fat intakes were negatively correlated with growth velocity. The variability of the CHO intake is also a negative predictor (p = 0.008) of growth rate in a multiple regression model including MN intakes and variability (r^2 = 0.207, p = 0.001). The data show that growth rates decrease by 0.23 g/kg/d for each percentage increase in average CHO variability. The trend of increasing CHO intake variability related to decreasing growth rates is independent

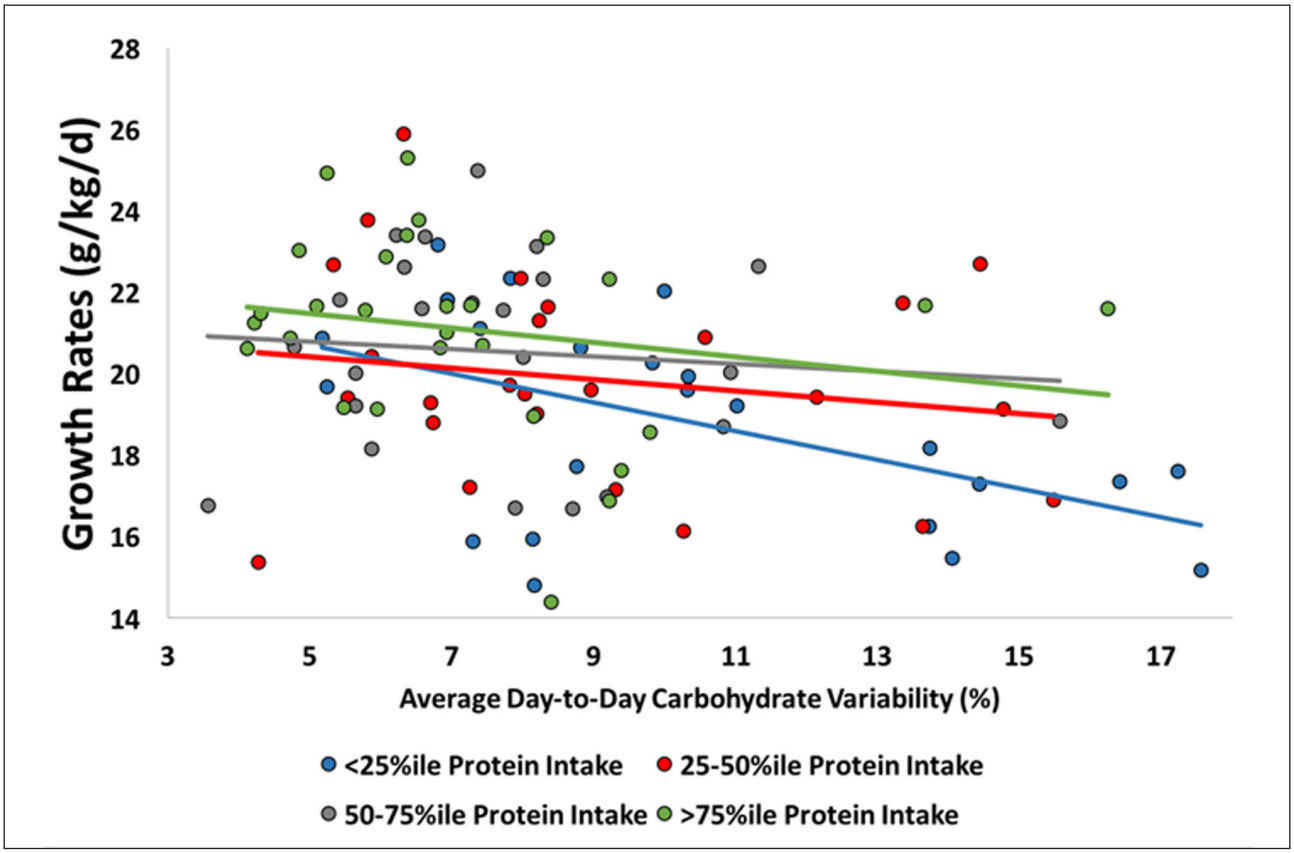

Figure 1 (ABS 76). Protein and CHO intakes are positively correlated with growth velocity.

Table 1 (ABS 76). Correlation coefficients (r) for macronutrients intake, variability and growth rate.

	Growth rate (g/kg/d)
Macronutrients intake (g/kg/d)	
Fat	0.138
Carbohydrates	0.316**
Protein	0.285**
Macronutrient variability (%)	
Fat	-0.237*
Carbohydrates	-0.363***
Protein	-0.153

*p < 0.05, **p < 0.01, *** p < 0.001.

of an infant's mean protein intake during the study period (**Fig. 1**). The results are also presented in **Tab. 1**.

CONCLUSIONS

This study provides evidence that the variability of MN intakes has a significant impact on weight gain in extremely preterm infants. These findings are supported by the intrauterine physiology where a constant flux of nutrients is provided by the placenta to allow high fetal growth rates.

ABS 77

NEWBORN BONE HEALTH IS AFFECTED BY MATERNAL BARIATRIC SURGERY

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INTRODUCTION

Bariatric surgery is known to affect subsequent pregnancies, by reducing fetal growth and lowering

Table 1 (ABS 77). Baseline characteristics of the 2 groups.

	Bariatric surgery mothers n = 25	Control group n = 311	p-value
Maternal characteristics			
Maternal age (years)[a]	30.3 (4.1)	31.2 (4.6)	N.S
Pre-pregnancy BMI (kg/m[b]) [a]	28.8 (4.8)	30.9 (6.0)	N.S
Gestational weight gain (kg) [a]	13.2 (8.3)	11.4 (6.1)	N.S
Primipara (%)[b]	52	60	N.S
Maternal smoking (%)[b]	5.2	9.6	N.S
Placental weight (g)[a]	645 (91)	665 (151)	N.S
Pre-surgery BMI (kg/m[b]) [a]	44.0 (5.4)		
Weight loss after surgery (kg) [a]	40.8 (12.9)		
Time from surgery to birth (months) [a]	29.7 (11.6)		
Newborn characteristics			
Birth weight (g) [a]	3,284 (327)	3,619 (523)	< 0.001
Birth length (cm) [a]	51.0 (1.5)	52.2 (2.3)	0.01
Fat-free mass (g)	3,062 (308)	3,330 (398)	< 0.001
Fat (%)	7.7 (3.6)	10.5 (4.3)	< 0.001
Head circumference (cm) [a]	34.2 (1.6)	35.1 (1.6)	0.007
Abdominal circumference (cm) [a]	32.0 (2.2)	33.4 (2.2)	0.002
Sex [b]			
Male (%)	52	52	N.S
Female (%)	48	48	
Gestational age at birth (days) [a]	277 (9)	280 (9)	N.S
Birth weight Z-score [a,c]	-0.45 (1.0)	0.12 (1.10)	0.01

[a]Mean (+SD), Student's t-test; [b]proportion, chi-square test; [c]normalised birth weight adjusted for gestational age at birth and sex, according to Marsal et al. SGA (small for gestational age), AGA (appropriate for gestational age) and LGA (large for gestational age).

infant birth weight. The study aim was to examine how newborn infant bone health is affected by bariatric surgery.

METHODS

We consecutively recruited mother-newborn dyads, where the mothers had undergone Roux-en-Y gastric bypass bariatric surgery. Newborn bone health was assessed using dual-energy X-ray absorptiometry scanning (DXA). We compared offspring born after maternal bariatric surgery to controls. The control group consisted of a mix of pre-pregnancy normal weight and obese women with matching body mass index (BMI). Setting: A University Hospital. Patients: We included 25 mother-newborn dyads born after maternal bariatric surgery and they were compared to a control group of 311 mother-newborn dyads (**Tab. 1**). Main outcome measure: newborn bone health.

RESULTS

Offspring born after bariatric surgery had lower bone mineral content (BMC), 63.5 g versus 74.8 g ($p < 0.001$) and bone mineral density (BMD) 0.21 versus 0.23 g/cm^2 ($p < 0.001$) when compared to the control group. Multiple regressions revealed that BMC was 4.2 g ($p = 0.001$) and BMD was 0.006 g/cm^2 ($p = 0.065$) lower in offspring born after bariatric surgery. These analyses were adjusted for pre-pregnancy BMI, gestational weight gain, parity, maternal smoking, birth weight, gestational age at birth and newborn sex.

CONCLUSIONS

Offspring born at term, after maternal bariatric surgery, have lower BMC and BMD. Further studies are needed to examine if there are long-term implications of these findings.

ABS 78

LONG TERM GROWTH AND NEURO-DEVELOPMENTAL OUTCOME IN PRETERM INFANTS BORN SMALL FOR GESTATIONAL AGE (SGA) AND INFANTS WITH INTRAUTERINE GROWTH RESTRICTION (IUGR)

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INTRODUCTION
The terms small for gestational (SGA) and intrauterine growth restriction (IUGR) are often used synonymously in preterm infants. IUGR infants are newborns who failed to reach their potential growth due to a placental insufficiency, while SGA represents a constitutionally small infant. So far we do not consider the underlying pathogenesis in our treatment concepts, which might cause long-term consequences. Furthermore, the ESPGHAN recommends to feed enhanced nutrients up to 52nd week of gestation in all growth restricted preterm infants, regardless if they are SGA or IUGR. The aim of this study was to evaluate the effect of SGA and IUGR on growth and neurodevelopment in preterm infants.
METHODS
In a retrospective observational study all preterm infants born below < 10 percentile, < 32 weeks of gestation and < 1,500 grams between the years 1999 and 2012 were included. The group assignment (SGA and IUGR) was based on prenatal pathological ultrasound measurements according to the Society for Maternal-fetal Medicine (SMFM). Preterm infants with genetic disorders affecting growth or neurodevelopment were excluded from the analysis. Anthropometric parameters were evaluated from birth until the age of 5½ years. Neurodevelopmental outcome was assessed by Bayley Scales of Infant Development at the corrected gestational age of 2 years and Kaufman Assessment Battery for Children (KABC) at the age of 5½ years.
RESULTS
We included 158 preterm infants in this study, 31 SGA (19.6%) and 127 IUGR (80.4%). Median (interquartile range) birth weight was 600 g (361-1,240) in the SGA- and 688 g (300-1,215) in the IUGR-group (p = 0.13), respectively. Median weight at term was lower in the IUGR- (2,530 g) than in the SGA-group (3,050 g) (p = 0.07), respectively. After term until the age of 5½ years, weight was lower in the IUGR- than in the SGA-group but did not reached significance. Weight catch-up growth (crossing 10th percentile) occurred earlier in the SGA- (6 months) than in the IUGR-group (4½ years). Length was significantly lower in the IUGR- than in the SGA-group at term (p = 0.02) and at the age of 12 month (p = 0.03). Length catch-up growth occurred earlier in the SGA- (6 month) than in the IUGR-group (2 years). No significant differences in the neurodevelopmental outcome were observed between groups.
CONCLUSIONS
Infants with different pattern of growth restriction (SGA and IUGR) showed different types of catch-up growth during the first years of life. These data indicate, that the differentiation between SGA and IUGR is of major importance and IUGR preterm infants may have individual nutritional requirements to avoid growth restriction and poor metabolic programming. Post discharged feeding recommendations for preterm infants should be adapted according to type of growth restriction.

ABS 79

HUMAN MILK COMPOSITION IN RELATION TO GROWTH AND BODY COMPOSITION IN PRETERM INFANTS AT TERM AGE

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INTRODUCTION
Preterm infants are prone to develop risk factors for the metabolic syndrome. Human milk consumption, however, has been shown to improve metabolic outcomes in these infants, for example through association with a more favourable body composition. Nevertheless, we do not fully understand how human milk composition, i.e. macronutrient and energy content as well as ratio, contribute to infant growth and body composition.
METHODS
Forty-four preterm infants born between 24 and 32 weeks of gestation were subjected to anthropometric and body composition measurements during hospitalization and at term age. Weight, length, head and waist circumference as well as skinfold measurements were conducted weekly during hospitalization and at term age. At term age body composition was assessed using air displacement plethysmography (PEA POD®, COSMED srl, Rome, Italy) and DEXA (Dual Energy X-ray Absorptiometry; Hologic4500 A, Hologic Inc, Bedford, MA, USA). At 32 weeks postmenstrual age (PMA), human milk samples were assessed

for their protein, carbohydrate, fat and energy content. Associations were examined by multiple linear regression. Maternal smoking, maternal pre-pregnancy BMI, ethnicity, being born small for gestational age and total nutrient intake were taken into account as potential confounders.

RESULTS

A positive association was found between human milk energy content and weight, length, head circumference z-scores as well as body composition at 32 weeks PMA and at term age. Protein content was positively related to weight z-score at 32 weeks PMA and to weight z-score, waist circumference and lean mass percentage at term age, whereas human milk fat content was negatively related to these outcomes. Human milk carbohydrate content was positively associated with length and head circumference z-scores at 32 weeks PMA, however, no relations were found at term age. Lastly, protein/energy ratio was positively related to weight and length z-scores at 32 weeks PMA and to lean mass percentage at term age.

CONCLUSIONS

Human milk composition impacts growth and body composition in preterm infants. Remarkably, there might be an inverse association between human milk fat content and growth and adiposity. Moreover, this study highlighted the importance of the protein/energy ratio in human milk. Therefore, it is key to take human milk composition into account when promoting human milk consumption and considering human milk fortification.

ABS 80

GROWTH PARAMETERS AT BIRTH IN INFANTS WITH CONGENITAL ZIKA VIRUS SYNDROME AND MICROCEPHALY

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INTRODUCTION

The International Fetal and Newborn Growth Consortium for the 21st Century, or INTERGROWTH-21st, is a global, multidisciplinary network dedicated to improving perinatal health globally and to reducing preventable newborn deaths that occur as a result of preterm birth or poor intrauterine growth. After the Zika virus infection spread, the INTERGROWTH-21st standards for weight, length and head circumference evaluation at birth have been an important tool to assess growth of infants exposed to Zika *in utero*. The objective of our study is to determine growth parameters in infants with congenital Zika virus syndrome and microcephaly.

METHODS

Medical records of infants with microcephaly associated to maternal Zika virus infection during pregnancy, who were admitted to the Puerto Rico University Pediatric Hospital (UPH) Neonatal Intensive Care Unit or referred for follow-up to the UPH High Risk Clinics were reviewed. Data was extracted for gestational age, birth weight, birth length, and head circumference. Percentiles and Z-scores were calculated using the INTERGROWTH-21st standards.

RESULTS

Twelve newborns with congenital Zika syndrome and microcephaly were included from April 2016 to April 2017. Sex distribution was 64% males, 36% females. All infants were born at term (range 38 to 41 weeks). Median birth weight (BW) was 2,600 grams (range 2,065 to 3,825); median BW percentile 8.74 (range 0.51 to 91.22); median BW Z-score -1.090 (range -2.5696 to 0.1262). All infants presented severe microcephaly with head circumference (HC) below the 1st percentile. Median HC percentile was 0.02 (range 0 to 0.78); median HC Z-score was -3.5520 (range -6.09 to -2.4177). Median length percentile was 15.18 (range 0.03 to 94.24); median length Z-score was -0.6472 (range -3.4026 to 1.5851).

CONCLUSIONS

Although microcephaly has been emphasized as the most devastating anomaly affecting infants with congenital Zika syndrome, these infants showed overall growth restriction affecting also birth weight and length. The INTERGROWTH-21st standards as well as the World Health Organization and the Centers for Disease Control growth calculators are useful tools for the follow-up of growth in infants exposed to Zika during pregnancy. These tools are available as applications for mobile phones making them easy to use for the medical providers.

ABS 81

THE EFFECT OF FISH OIL EMULSIONS ON LUNG FUNCTION IN PRETERM INFANTS RECEIVING PARENTERAL NUTRITION

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INTRODUCTION

Parenteral lipid emulsions (IVLE) containing fish oil (FO) are currently used for preterm infants, but their safety and efficacy are not known [1]. A FO-containing lipid emulsion (≈60 mg/kg/d DHA) has been shown to reduce lipogenesis in preterm infants on routine parenteral nutrition by our group [2]. Oral FO supplementation to preterm infants (≈60 mg/kg/d DHA) was associated with increased bronchopulmonary dysplasia (BPD) rate in a recent large RCT [3]. We studied the $SatO_2/FIO_2$ ratio (SFR) at 36 weeks' PMA in a large cohort of infants who received routine parenteral nutrition (PN) with "conventional" lipid emulsions and with lipid emulsions containing FO.

METHODS

Retrospective study including consecutively admitted infants born < 1,250 g between Sep 2008-Jun 2016. Individual patients received one of the 5 lipid emulsions: 1 = FMS (10% FO, 40:50 MCT: soybean oil), 2 = MOSF (15% FO, 30: 30: 25 MCT: soybean oil: olive oil), 3 = S (100% soybean oil), 4 = MS (50%MCT and 50% soybean oil) and 5 = OS (80% olive oil and 20% soybean oil). The SFR of the infants receiving FO (1&2) were compared to those who received conventional IVLE (3&4&5). Prenatal and neonatal risk factors and neonatal outcomes were also compared (chi^2, Mann-Whitney, Kruskal Wallis tests as appropriate). SFR was calculated using the median FIO_2 and median $SatO_2$ at 36 weeks' PMA. We report the SFR distribution by lipid emulsion and performed a multiple regression analysis to find predictors of SFR.

RESULTS

461 infants were born in the study period: 394 were analyzed (47 died, 20 had unavailable data).

FO was administered to 212 (53.8%) infants. Patients receiving FO compared to those who did not had similar mortality (9.9 vs 10.4%, p = 0.878) and BPD (23.6 vs 18.9%, p = 0.252); there were no significant differences regarding BW, GA, other prenatal (antenatal steroids, preeclampsia etc.) and neonatal conditions and (PDA, sepsis etc.), human milk feeding (data not shown). SFR was lower in infants receiving FO vs those who did not (455 vs 464, p = 0.000), and differed according to the lipid emulsion (1 = 463, 2 = 455, 3 = 458, 4 = 467, 5 = 465, p = 0.000) (**Fig. 1**). Multiple regression analysis (r^2 = 0.344) showed that FO (B = -21.9, p

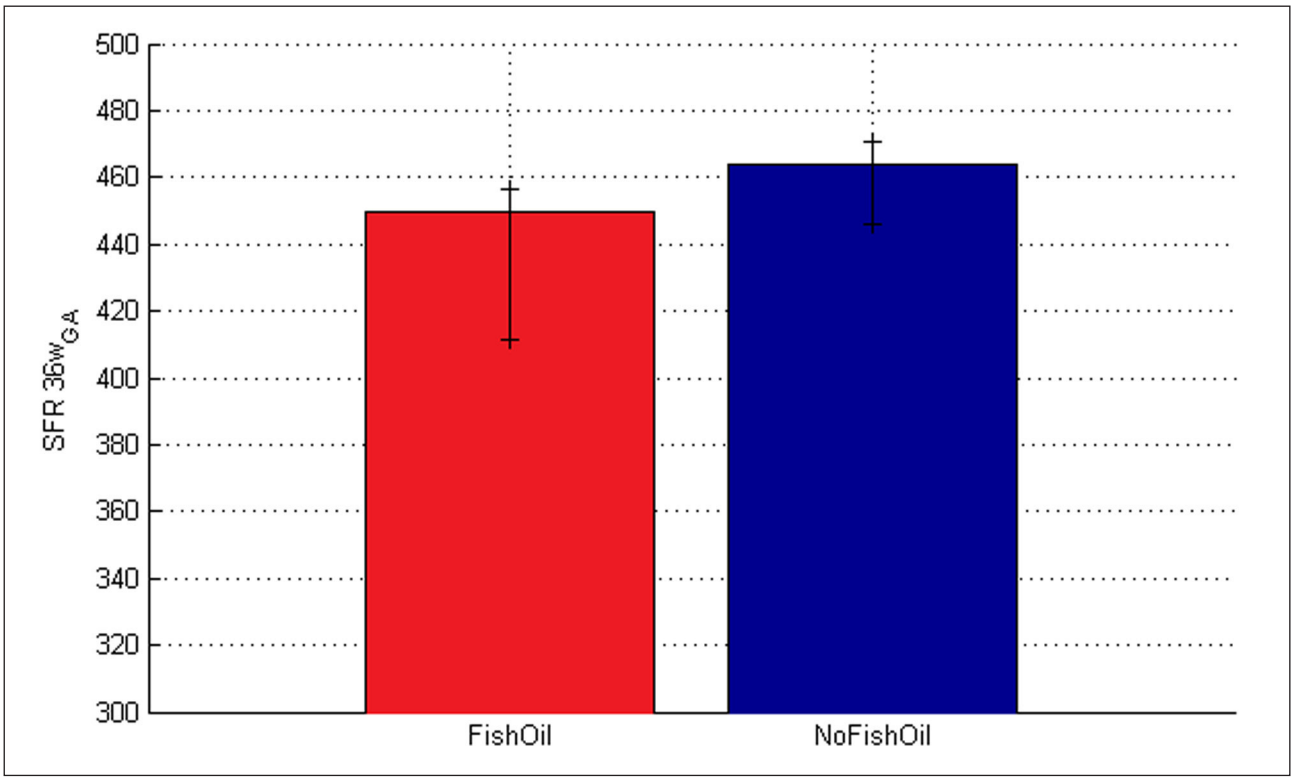

Figure 1 (ABS 81). The $SatO_2/FIO_2$ ratio (SFR) at 36 weeks' PMA: the SFR was lower in infants receiving fish oil vs those who did not.

= 0.006), sex (M, B = -23.8, p = 0.004), sepsis (B = -17.6, p = 0.041), surfactant administration (B = -21.1, p = 0.024), PDA (B = -21.8, p = 0.024) and birth weight (B = 0.127, p = 0.000) predicted SFR.

CONCLUSIONS

In this study, infants who received routine PN with a fish oil IVLE compared with those who received "conventional" IVLE had similar mortality, morbidity and BPD. However, infants who received FO had a significantly lower (worst) SFR at 36 weeks' PMA. Predictors of SFR were lipid emulsions, sex, birth weight, sepsis, surfactant administration, PDA. Larger prospective RCT are needed to confirm the potential detrimental role of FO on lung function.

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ABS 82

MICROBIOTA AND SCFA OF TERM INFANTS

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INTRODUCTION

Intestinal microbiota plays important role in child physical development, immune system modulation and resistance to certain diseases from the very first minutes of life or even from conception. Mode of delivery has been shown to have crucial effect on gut bacterial portfolio. It is not known how long these changes persist and whether gut colonization can be modified soon after birth. The goal of the study was to assess the changes in microbiota and short-chain fatty acids (SCFA) profile after 6 weeks from being discharged home.

METHODS

There were 32 full term newborns, 15 vaginally and 17 CS-delivered and none had antibiotics administered. Quantitative real-time polymerase chain reaction (qPCR) for determination of *Bifidobacterium*, *Bacteroides*, *Faecalibacterium prausnitzii*, *Akkermansia muciniphila* and total bacterial count (TBC) was used. Microbiological culture for determination of *E. coli*, *Enterococcus*, *Proteus*, *Pseudomonas*, *Enterobacteriaceae*, *Clostridium*, *Lactobacillus* and *Yeasts* was used. SCFA levels were established based on gas chromatography. All analyses were performed in meconium and in stool 6 weeks after discharge home. Statistical analyses were performed using Mann Whitney U Test and Wilcoxon signed ranks test.

RESULTS

The mean birth weight (SD) and gestational age (SD) was 3,602.6 g (± 531.1) and 39.1 weeks (± 1.4), respectively. Intestinal colonization of newborns born by CS was delayed. We found significant differences in types of bacteria in meconium in the group delivered vaginally versus CS. There were more *E. coli* and *Enterococcus* in vaginally-delivered group compare to CS-delivered group ($p = 0.002$; $p < 0.001$ respectively). Six weeks after discharge from hospital there were higher levels of *Bacteroides* and lower levels of *Enterobacteriaceae* and *Clostridium* in the vaginal group. There was no difference in the amount of SCFA at 6 weeks of age among newborns delivered via C-section except elevated amount of butyrate.

CONCLUSIONS

The colonization of term newborns born by CS is altered on the first day of life. Higher amount of *Clostridium spp.* after 6 weeks being home can lead to higher level of butyrate.