www.jpnim.com Open Access eISSN: 2281-0692
Journal of Pediatric and Neonatal Individualized Medicine 2015;4(2):e040210
doi: 10.7363/040210
Published online: 2015 Sept 08

Abstracts

Selected Abstracts of the 1st Congress of joint European Neonatal Societies (jENS 2015) · Session "Nutrition and gastroenterology"

BUDAPEST (HUNGARY) · SEPTEMBER 16TH-20TH 2015

PROGRAMME COMMITTEE

Artúr Beke (Hungarian Society), Morten Breindahl (ESN), Giuseppe Buonocore (UENPS), Pierre Gressens (ESPR), Silke Mader (EFCNI), Manuel Sánchez Luna (UENPS), Miklós Szabó (Hungarian Society of Perinatology), Luc Zimmermann (ESPR)

European Society for Neonatology

European Society for Paediatric Research

UENPS
Union of European Neonatal & Perinatal Societies

EFCNI
european foundation for the care of newborn infants

HUNGARIAN SOCIETY OF PERINATOLOGY AND OBSTETRIC ANESTHESIOLOGY

MPT
MAGYAR PERINATOLÓGIAI TÁRSASÁG · HUNGARIAN SOCIETY OF PERINATOLOGY

Supported by

COINN
Council of International Neonatal Nurses

Organizing secretariat

MCA
scientific events

HOW TO CITE

[Abstract's authors]. [Abstract's title]. In: Selected Abstracts of the 1st Congress of joint European Neonatal Societies (jENS 2015); Budapest (Hungary); September 16-20, 2015; Session "Nutrition and gastroenterology". J Pediatr Neonat Individual Med. 2015;4(2):e040210. doi: 10.7363/040210.

POSTER PRESENTATIONS

ABS 1

NEONATAL ANTIBIOTICS IN PRETERM INFANTS AND RISK OF ALLERGIC DISEASES LATER IN LIFE

E. Westerbeek[1], A. van Zwol[2], L. Carstens[1], R. van Elburg[3,4]

[1]Department of Pediatrics, VU University Medical Center, Amsterdam, the Netherlands

[2]Erasmus MC-Sophia Children's Hospital, Department of Pediatrics, Rotterdam, the Netherlands

[3]Department of Pediatrics, Emma Children's Hospital, Academic Medical Center, Amsterdam, the Netherlands

[4]Nutricia Research Centre for Specialized Nutrition, Utrecht, the Netherlands

INTRODUCTION

Antibiotic use is associated with increased risk of developing allergic diseases, possibly through modulation of the intestinal microbiota and subsequently the immune system. Preterm infants frequently require antibiotics during the neonatal period, therefore we hypothesized that preterm infants are at increased risk of developing allergic diseases later in life. Aim of this study was to determine the effect of antibiotics on the risk of developing allergic diseases later in life in preterm infants.

PATIENTS AND METHODS

Preterm infants (gestational age [GA] < 32 weeks and/or birth weight [BW] < 1,500 grams) who participated in two large nutritional intervention studies were eligible. At six years of age, the prevalence of allergic diseases was assessed by a validated questionnaire. Antibiotic use was defined as the number of days of antibiotic use during neonatal period (the first 30 days of life). Allergic diseases included atopic dermatitis, hay fever, recurrent wheeze and asthma. To adjust for potential confounders (socioeconomic status, parental history of atopy, smoking at home, pets, glutamine-enriched enteral feeding and non-human neutral and acidic oligosaccharides), data were analyzed by multivariable logistic regression.

RESULTS

In total, 142/183 (78%) children participated. Mean (SD) GA and BW were 29.4 (± 1.9) weeks and 1,259 (± 349) grams, respectively. Prevalence of atopic dermatitis was 26/142 (18%), hay fever 12/142 (8%), recurrent wheeze 24/142 (17%) and asthma 18/142 (13%). Antibiotic use during ≥ 8 days in the neonatal period was significantly associated with atopic dermatitis at six years of age (adjusted odds ratio 3.74; 95% confidence interval 1.15-12.22; p = 0.03). No association was found between antibiotic use and other allergic diseases.

CONCLUSIONS

Antibiotic use during the neonatal period in preterm infants was associated with the development of atopic dermatitis up to six years of age. This indicates that neonatal antibiotic use may have long term adverse consequences in preterm infants.

Breastfeeding

ABS 2

FRENOTOMY FOR TONGUE-TIE IN NEWBORN INFANTS: A SYSTEMATIC REVIEW

J.E. O'Shea[1,2], J.P. Foster[3,4], S.E. Jacobs[1,5,6], C.P.F. O'Donnell[7], D.A. Todd[8], P.G. Davis[1,5,6]

[1]Neonatal Services, Royal Women's Hospital, Melbourne, VIC, Australia

[2]Department of Neonatal Medicine, Southern General Hospital, Glasgow, Scotland

[3]School of Nursing & Midwifery, University of Western Sydney, Sydney, NSW, Australia

[4]Sydney Nursing & Medical Schools, University of Sydney, Sydney, NSW, Australia

[5]Department of Obstetrics and Gynaecology, University of Melbourne, Melbourne, VIC, Australia

[6]Critical Care and Neurosciences Group, Murdoch Childrens Research Institute, Melbourne, VIC, Australia

[7]Department of Neonatology, The National Maternity Hospital, Dublin, Ireland

[8]Department of Neonatology, The Canberra Hospital, Canberra, ACT, Australia

INTRODUCTION

Tongue-tie (ankyloglossia) is a congenital anomaly where a short lingual frenulum connects the underside of the tongue to the floor of the mouth and

may decrease tongue mobility. Prevalence is 4-11% in newborns, in whom it has been cited as a cause of poor breastfeeding and maternal nipple pain. Tongue-tie is commonly treated with frenotomy. We sought to determine whether frenotomy resolved breastfeeding problems in infants with tongue-tie.

PATIENTS AND METHODS

We performed a systematic review using the methodology of the Neonatal Review Group of the Cochrane Collaboration.

RESULTS

Five randomised trials met our inclusion criteria (n = 302). Three studies objectively measured infant breastfeeding. Pooled analysis of 2 studies (n = 213) showed no objective change following frenotomy, mean difference (MD) -0.1 (95% CI -0.6, 0.5) units of 10 point feeding scale. A third study (n = 58), showed an objective improvement, MD 3.5 (95% CI 3.1, 4.0) units of 12 point feeding scale. Maternal pain was objectively assessed in 4 studies. Pooled analysis of 3 studies (n = 104) showed a reduction in maternal pain scores following frenotomy, MD -0.9 (95% CI -1.4, -0.3) units of 10 point pain scale. A fourth study (n = 58), also showed a reduction in pain scores MD -8.6 (95% CI -9.4, -7.8) units of 50 point pain scale. All studies reported no adverse effects following frenotomy. The studies had methodological shortcomings. Only 2 blinded both mothers and assessors and one was not blinded.

CONCLUSIONS

Frenotomy reduced breastfeeding mothers' nipple pain. A positive objective effect on infant breastfeeding was not consistently found. No serious complications were found but the total number of infants studied was small. The small number of trials and the methodological issues limits the certainty of these findings. Further randomised controlled trials of high methodological quality are necessary to clarify the effect of frenotomy.

ABS 3

EARLY FORMULA MAY HELP SUPPORT LONG-TERM BREASTFEEDING

Z. Stranak, J. Kolarova, M. Cerna

Neonatal Department, Institute for the Care of Mother and Child, 3rd Medical Faculty, Prague, Czech Republic

INTRODUCTION

Breastfeeding is the first and best, cost-effective intervention for newborns. It improves a child's physical and mental potential by supporting the rapid growth and critical brain development that occurs from birth to two years of age. The World Health Organization and other authorities recommend breastfeeding for at least 1 year and exclusive breastfeeding for at least 6 months. However, the maintenance of breastfeeding remains low through the first year of child's life world wide. The aim of our study was to investigate the role of formula usage on the breastfeeding discontinuation.

PATIENTS AND METHODS

We randomly assigned 100 healthy term infants, 24 to 48 hours old, who had lost ≥ 5% birth weight to controlled limited formula (CLF group) intervention (10 ml formula by syringe after each breastfeeding and discontinued when appropriate breastfeeding began) or control group (standard breastfeeding approach, SBA). Infants were excluded if they had any serious complication or had mothers who were undergoing therapy that might affect breastfeeding, who wanted early formula introduction or had refused to participate. Informed consent was obtained from all mothers by a study doctor or nurse. The study was approved by local Ethical commitee.

RESULTS

Overall, 50 (50%) infants were assigned to CLF group and 50 (50%) to SBA group (Control group). There was a significant difference in the quantity of given formula top-up feeds in the groups (CLF 78.2 ml, SBA 64.4 ml, p = 0.0003). The weight loss was lower in CLF group (7.13% vs. 8.44%, p = 0.001). At 3 months, 42 (84%) of 50 infants assigned to CLF during hospitalization were breastfed exclusively, compared with 34 (68%) of 50 controls (p = 0.06). At 6 months, mothers were breastfeeding in 32 (64%) in CLF group and 26 (52%) in control group respectively (p = 0.22). There was no statistically significant difference in breastfeeding between the groups according to the mode of delivery and skin-to-skin contact in the delivery room.

CONCLUSIONS

Newborns receiving small amounts of formula feeds were more likely to be breastfeeding and to be breastfed without formula at 3 months and 6 months of age respectively compared to controls with standard approach. Our results suggest that early supplementation of limited volumes of formula before mature production may help support long-term breastfeeding for infants with early weight loss.

ACKNOWLEDGEMENT

Supported by Research Project PRVOUK32.

Metabolism

ABS 4

COMPARISON OF DRY BLOOD SPOT AMINO ACID PROFILES BETWEEN PRETERM INFANTS AT TERM POSTMENSTRUAL AGE AND HEALTHY TERM NEWBORNS

C. Balcells[1], M. Izquierdo-Renau[1], M. Molero[2], C. Sierra[2], R. Artuch[2], I. Iglesias-Platas[1]

[1]Neonatology Service, Sant Joan de Déu, BCNatal – Centre for Maternal-Fetal and Neonatal Medicine, Hospital Sant Joan de Déu-Hospital Clínic, Barcelona University, Barcelona, Spain

[2]Clinical Biochemistry Department, University Hospital Sant Joan de Déu, and Centre for Biomedical Research on Rare Diseases (CIBER-ER), Instituto de Salud Carlos III, Barcelona, Spain

INTRODUCTION

Due to immaturity of their gastrointestinal tract and of enzymatic pathways together with a frequent insufficient supply during postnatal life, very preterm infants (VPI, born at or before 32 weeks of gestation) are at risk of protein deficits. Dried blood spot measurement of amino acids could be an advantageous method in this population, allowing for sampling of small volumes of blood obtained by heel prick. We aimed to compare levels of amino-acid in dry blood spots obtained from term-postmenstrual age (PMA) VPIs with a reference group (cord blood from healthy term babies) in order to determine if we could detect deficits or excess values that may associate adverse outcomes.

PATIENTS AND METHODS

Blood dry spots were obtained from 44 term-PMA very preterm infants and cord blood from 15 healthy term newborns. Levels of amino acids (taurine, aspartic acid, threonine, serine, glutamic acid, glutamine, proline, glycine, alanine, citruline, valine, tyrosine, phenylalanine, ornithine and lysine) were analyzed by ion exchange chromatography with ninhydryn derivatization and spectrophotometric detection (Biochrom 30®, Chromsystems). Mean levels were compared between groups (Student's t) using SPSS® Statistical Package v. 17.0.

RESULTS

Levels of most amino acids were similar between preterm infants and cord blood from term babies (taurine, aspartic acid, threonine, serine, glutamic acid, proline, glycine, alpha-aminobutyric acid, valine and phenylalanine). Preterms showed significantly higher levels of glutamine (190 µmol/L vs. 75 µmol/L), citrulline (24 µmol/L vs. 12 µmol/L), tyrosine (75 µmol/L vs. 53 µmol/L) and ornithine (76 µmol/L vs. 50 µmol/L) and lower levels of alanine (222 µmol/L vs. 465 µmol/L) and lysine (85 µmol/L vs. 140 µmol/L). Concentrations of amino acids in both groups were in keeping with published data, but comparisons are difficult due to different techniques and reference populations.

CONCLUSIONS

Amino acid profiles in VPI at term PMA seem to indicate that their metabolic pathways are mature enough to maintain appropriate levels of most amino acids. Further analysis according to type of diet and growth trajectories and comparison with healthy term newborns are underway.

ABS 5

VARIABILITY IN BONE MARKERS PROFILE OF NEWBORNS AND THEIR MOTHERS AFTER DHA SUPPLEMENTATION IN PREGNANCY

L. Serrano López[1], M. Peña Caballero[1], E. Martín Álvarez[1], J. Diaz Castro[2], N. Najarabille[2], J.J. Ochoa[2], J.A. Hurtado Suazo[1]

[1]Neonatologist Department, University Hospital Virgen de las Nieves, Granada, Spain

[2]Institute of Nutrition and Food Technology "Jose Mataix", Universidad de Granada, Granada, Spain

INTRODUCTION

Most studies of DHA supplementation during pregnancy and infant development are focused on visual and neural development. However, recent studies emphasize the influence of DHA supplementation on other areas like bone metabolism.

AIM

Evaluate the effect of DHA supplemented dairy drink consumption during pregnancy and breastfeeding on variables of bone metabolism by expression of bone markers (osteocalcin and osteopontin) in mothers (pregnancy, delivery and breastfeeding) and their newborns (birth and 2.5 months of age).

PATIENTS AND METHODS

Methods: clinical trial, randomized, double blind.

60 women were randomly assigned to two intervention groups: A) control group (n = 30:

Table 1 (ABS 5). Osteocalcin plasma levels.

Osteocalcin pg/ml	Control group Mean	Supplemented group Mean
SM0	2,636	2,694
SM1	6,951	9,149
SM2	11,767	12,893
SHOV	19,006	19,338
SHOA	20,927	20,037
SH1	17,439	20,985

Table 2 (ABS 5). Osteopontin plasma levels.

Osteopontin pg/ml	Control group Mean	Supplemented group Mean
SM0	3,441	3,428
SM1	5,469	7,590
SM2	9,095	8,501
SHOV	124,854	122,470
SHOA	124,301	120,927
SH1	147,732	140,361

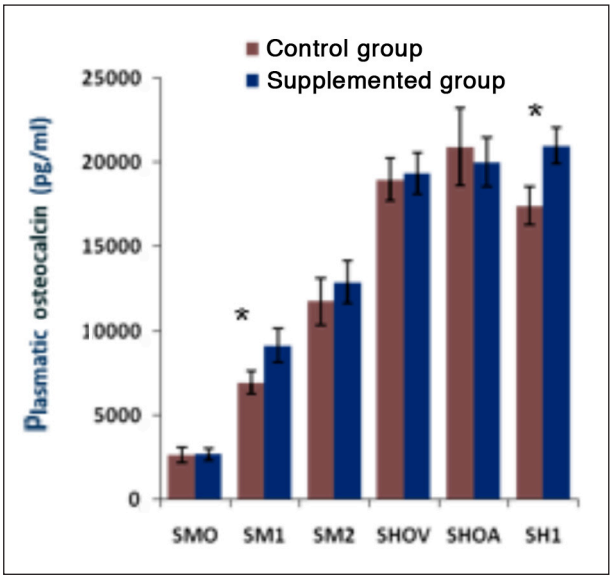


Figure 1 (ABS 5). Histograms of plasmatic osteocalcin in the two groups.

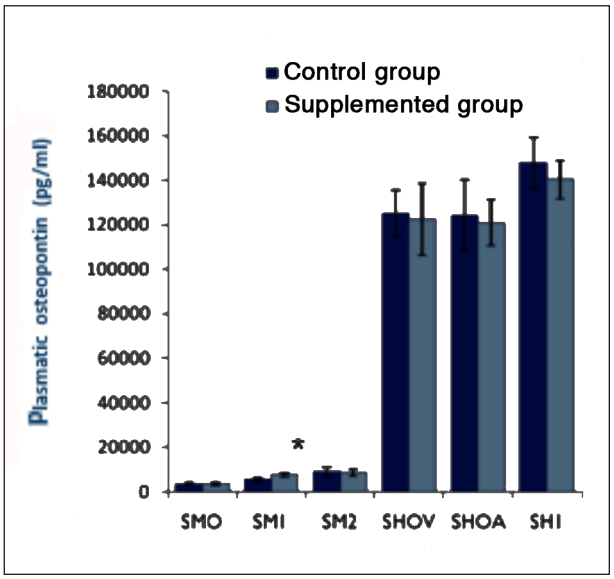


Figure 2 (ABS 5). Histograms of plasmatic osteopontin in the two groups.

they took 2 glasses/day of the control dairy drink); B) supplemented group (n = 30, the women took 2 glasses/day of the supplemented drink [320 mg DHA/day]). Dietary intervention began in week 28th of pregnancy and concluded when breastfeeding stopped.

Samples of blood were obtained from the mothers at the beginning (28 weeks gestational age) (SM0), at delivery (SM1) and at 2.5 breastfeeding month (SM2). Also blood were obtained from the umbilical vein (SHOV) and artery (SHOA) and the newborn at 2.5 months postpartum (SH1).

Osteocalcin and osteopontin plasma levels were determined using a panel from Luminex® xMAP® technology.

RESULTS

Osteocalcin was significantly higher ($p < 0.05$) in the DHA supplemented group both: in mother's blood during delivery (SM1) and newborn at 2.5 months old (SH1). Osteopontin was significantly higher in the intervention group in maternal plasma at delivery (SM1) (**Tables 1** and **2**, and **Figures 1** and **2**).

CONCLUSIONS

The most noteworthy result in bone markers is that the effect of DHA supplementation is found in mother plasma at delivery.

DHA supplementation has no overall effect on all samples from the newborn and the mother. However, the effect on the newborn is beneficial from the point of view of bone remodeling by increasing bone formation process.

ABS 6

A SYNBIOTIC MIXTURE OF scGOS/lcFOS AND *BIFIDOBACTERIUM BREVE* M-16V IS ABLE TO RESTORE THE DELAYED COLONIZATION OF *BIFIDOBACTERIA SPP.* IN C-SECTION DELIVERED INFANTS

M.C. Chua[1], C. Chew[2], A. Goh[1], W.C. Chiang[1], R. Rao[1], C. Lay[2], K. Ben-Amor[3], S. Chaithongwongwatthana[4], N. Khemapech[4], K. Knol[3], V. Chongsrisawat[4]

[1]*KK Women and Children Hospital, Neonatology Department, Singapore*

[2]*Danone Nutricia Research, Singapore*

[3]*Danone Nutricia Research, Utrecht, the Netherlands*

[4]*Chulalongkorn Memorial Hospital, Department of Obstetrics and Gynecology, Bangkok, Thailand*

INTRODUCTION

Infants born by C-section (CS) miss the early exposure to the maternal vaginal microbiota and this lack of microbial exposure has been associated with a delayed colonization. This compromised microbial inoculation may impact the healthy development of the newborn. Epidemiological data show a link between CS births, immune and metabolic disorders such as asthma, diabetes and obesity. The objective of this study was to determine the effect of a mixture of 90% short-chain galacto- and 10% long-chain fructo-oligosaccharides (scGOS/lcFOS) and the probiotics strain *B. breve* M-16V in restoring the delayed colonization by *Bifidobacteria spp.* observed in healthy, term CS delivered infants.

PATIENTS AND METHODS

In a multi-country, double-blind, randomised controlled study, 153 infants born by elective CS were randomly allocated to receive (1) an infant formula supplemented with 0.8 g / 100 ml scGOS/lcFOS and 7.5×10^8 CFU / 100 ml of *B. breve* M-16V (Synbiotic), or (2) a formula supplemented with 0.8 g / 100 ml scGOS/lcFOS (Prebiotic), or (3) a control formula (Control) from birth until age 4 months. Stool samples were collected at day 3/5, week 4, week 8, week 12, week 16, and week 22 (6 weeks post-intervention). The proportion of *Bifidobacteria spp.*, and the probiotic strain *B. breve* M-16V were assessed by molecular tools. Faecal pH and short chain fatty acids (SCFA) were also measured. Safety and tolerance parameters were recorded on a weekly basis. Adverse events (AE) were documented for the whole study population.

RESULTS

In the synbiotic group, proportion of *Bifidobacteria spp.* was higher at D3/5 ($p = 0.006$) and at 1 month of age ($p = 0.029$) compared to the control. This effect was observed at 1 month of age in the prebiotic ($p = 0.048$) compared to the control group. At week 22, *B. breve* M-16V was detected in 37% of the infants of the symbiotic group revealing the persistence of the probiotic. A lower pH was observed at D3/5 ($p = 0.02$) and 1 month of age ($p = 0.03$) in the synbiotic as compared to the control, while this effect was only observed at D3/5 in the prebiotic group ($p = 0.032$). Acetate was the main SCFA detected, and it was higher in the synbiotic at D3/5 ($p < 0.001$) compared to the control group. All formulas were well tolerated and all groups showed comparable safety profile based on the number and severity of AE. A lower number of eczema cases was observed in the synbiotic ($n = 2$) compared to the control group ($n = 8$)

CONCLUSIONS

An infant formula supplemented with a specific mixture of scGOS/lcFOS (ratio, 9:1) and *B. breve* M-16V is able to restore the delayed colonization of *Bifidobacteria spp.* in CS delivered infants from the first days of life. This bifidogenic effect is associated with a positive modulation of the gut ecosystem which in turn may offer potential short- and long-term health benefits.

ABS 7

COMPARISON BETWEEN RENAL PHOSPHATE HANDLING OF PREMATURE INFANTS OF 23-26 AND 27-32 WEEKS OF GESTATIONAL AGE

Z.P. Halaba[1], J. Stępień[2], P. Adamczyk[3], H. Sławska[3], G. Ziomek[3]

[1]*Wrocław Medical University, Wrocław, Poland*

[2]*Provincial Specialist Hospital nr 2, Jastrzębie Zdrój, Poland*

[3]*Medical University of Silesia, Katowice, Poland*

INTRODUCTION

The objective of this study is to compare TP/GFR (tubular phosphate reabsorption under basal conditions without phosphate load/GFR) levels in infants of 23-26 weeks GA to those in infants of 27-32 weeks GA.

PATIENTS AND METHODS

We retrospectively evaluated case notes of 48 infants, 8 infants of 23-26 weeks GA and compared them to 41 infants of 27-32 weeks GA. TP/GFR in newborns is identical to TmP/GFR (tubular maximum phosphate reabsorption/GFR). TP/GFR was calculated from simultaneous measurements of urinary phosphate, urinary creatinine, serum phosphate, and serum creatinine – infants who had phosphaturia < 1 mmol/l were not included in the statistical analysis because their values represent lower limits of TP/GFR.

RESULTS

TP/GFR values at 3 and 5 weeks postnatally were lower in infants of 23-26 weeks GA (1.22 ± 0.05, 1.48 ± 0.37 mmol/l, respectively) than in infants of 27-32 weeks GA (1.98 ± 0.77, $p < 0.001$; 1.95 ± 0.38 mmol/l, $p = 0.6$).

CONCLUSIONS

Infants of 23-26 weeks gestation have low TP/GFR values in the first 5 weeks after birth that may lead to excessive urinary phosphate excretion even in the case of low phosphate levels.

ABS 8

ADIPONECTIN CONCENTRATIONS ARE TIGHTLY ASSOCIATED WITH POSTNATAL GLUCOSE CONTROL IN VERY PRETERM INFANTS

I. Hansen-Pupp[1], C. Löfqvist[2], A.-L. Hård[2], G. Hellgren[2], L. Smith[3], A. Hellström[2]

[1]*Department of Pediatrics, Institute of Clinical Sciences Lund, Skane University Hospital and Lund University, Lund, Sweden*

[2]*Sahlgrenska Academy, Gothenburg, Sweden*

[3]*Boston Children's Hospital, Harvard Medical School, Boston, MA, USA*

INTRODUCTION

Hyperglycemia is a frequent complication following very preterm birth. Adiponectin is an insulin-sensitizing adipocyte tissue hormone which lowers hepatic glucose production, enhances fatty acid oxidation, decreases lipolysis, has anti apoptotic effects and promotes survival of pancreatic beta cells. Adult adiponectin concentrations inversely correlate with adiposity and higher concentrations are associated with lower diabetes risk. We aimed to evaluate the association between circulatory glucose and adiponectin concentrations during the early postnatal period after very preterm birth.

PATIENTS AND METHODS

A descriptive cohort study of 51 preterm infants with a mean (SD) gestational age at birth of 25.9 (1.9) weeks and mean (SD) birth weight of 882 (283) g. Serum adiponectin concentrations were measured by ELISA in cord blood and in postnatal blood, at 3, 7, 14, 21 and 28 days of

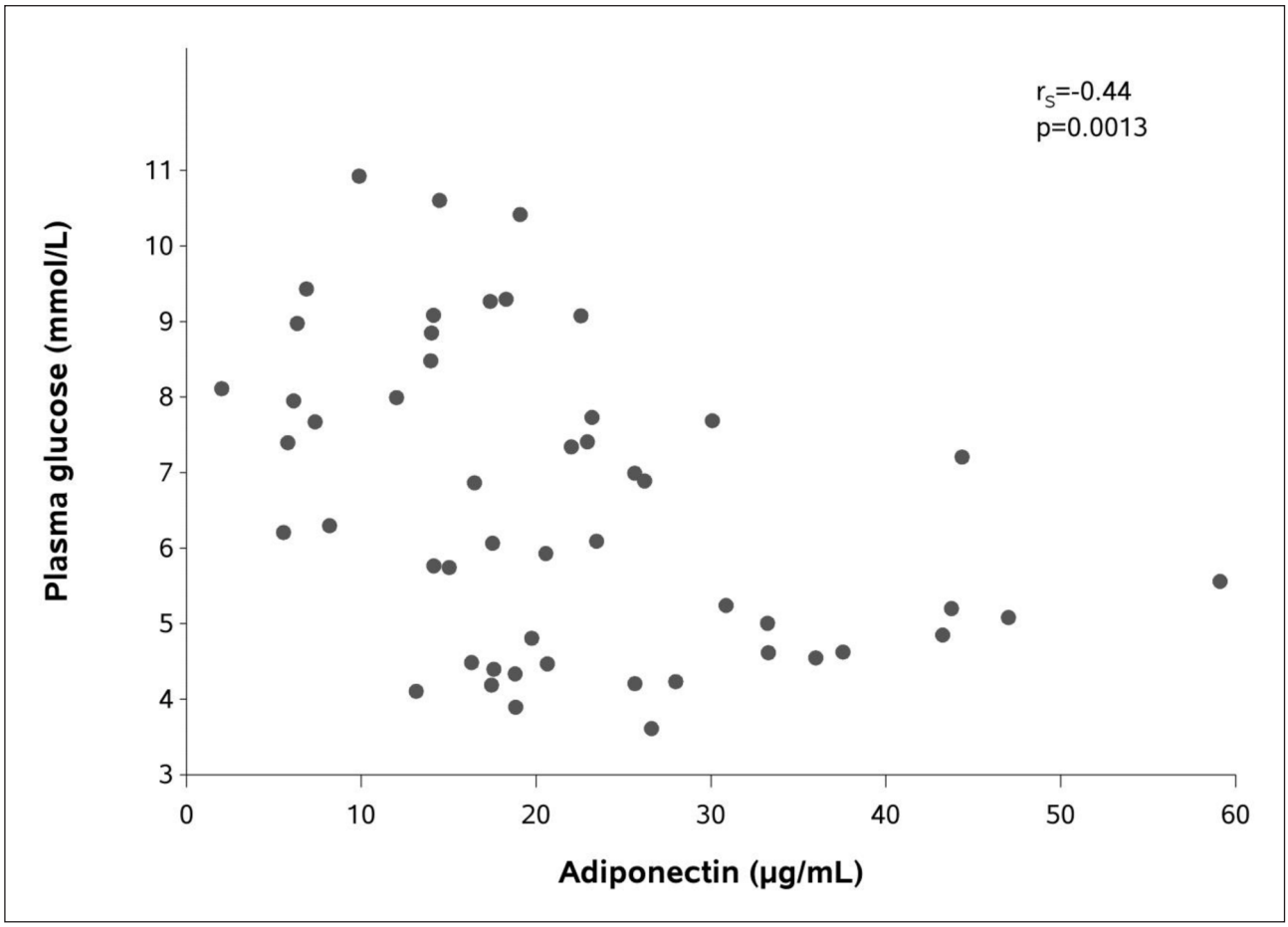


Figure 1 (ABS 8). Correlation in preterm infants (23-30 GA) between serum adiponectin and plasma glucose concentrations during postnatal days 3-28.

age. All arterial plasma glucose concentrations obtained from birth up to postnatal day 28 were recorded.

RESULTS

Mean (SD) concentrations of adiponectin increased rapidly and significantly from cord blood to 3 weeks of age, where a peak was noted, 2.8 (3.2) μg/ml and 31.8 (19.9) μg/ml, respectively. Mean (SD) adiponectin during postnatal days 3-28 was 21.4 (12) μg/ml and correlated positively with GA ($r = 0.47$, $p = 0.0005$) and with BW ($r = 0.67$, $p < 0.001$). Mean (SD) plasma glucose from birth to postnatal day 28 was 6.51 (2.02) μg/ml and correlated negatively with GA ($r = -0.76$, $p < 0.0001$). We found a significant correlation between mean adiponectin and mean plasma glucose concentrations during postnatal days 3-28 ($rs = -0.44$, $p = 0.0013$), that remained significant after adjusting for GA (**Fig. 1**).

CONCLUSIONS

An immediate significant increase in adiponectin concentrations occurs following preterm birth. A greater increase was associated with improved glucose homeostasis (lower glucose concentrations) which was independent of concomitant intravenous glucose intake. An understanding of glucose homeostasis in preterm infants is needed to improve short and long-term outcome in these infants.

Micronutrients

ABS 9

THICKENED PARTIALLY HYDROLYZED MILK FORMULA ADDED WITH *L. REUTERI* DECREASES THE NUMBER OF REGURGITATION IN INFANTS AND AMELIORATES THE GASTRIC MOTILITY

F. Indrio, A. Di Mauro, L. Trove', G. Brindisi

Department of Pediatrics, University of Bari, Bari, Italy

INTRODUCTION

Young infants are frequently affected by uncomplicated regurgitation. However, significant regurgitation may persist despite dietetic and conservative interventions increasing parental stress and causing an additional workload for health care professionals. The aim of this trial was to evaluate the efficacy of a hypoallergenic infant formula containing starch and the probiotic *L. reuteri* on regurgitation and gastric motility in infant .

PATIENTS AND METHODS

A total of 80 infants with regurgitation were enrolled and 72 completed the study. 37 received hypoallergenic formula added with starch (4 g / 100 kcal) and *L. reuteri* (2.8×10^6 CFU / g powder) (formula with 1.9 g protein / 100 kcal; 100% whey proteins) and 35 received standard infant starter formula (1.85 g protein / 100 kcal; 70% whey proteins / 30% caseins) for 30 days. The episodes of regurgitation were recorded by the parents each day. Gastric emptying time was recorded using real-time ultrasound at baseline and at the end of the study.

RESULTS

At the end of the intervention period, the fasting antral area was significantly reduced and the delta in gastric emptying rate was significantly increased in infants receiving special formula compared to standard (3.5 [2.0-4.6] cm^2 vs. 4.6 [2.4-6.0] cm^2, $p = 0.01$; and +12.3 [(-3.9)-(+22.0)]% vs. +9.1 [(-27.0) -(+25.5)]%, $p = 0.01$, respectively). Besides, the infants receiving special formula had a significant decrease in the frequency of regurgitation per day compared to placebo (1.0 [1.0 -2.0] vs. 4.0 [3.0-5.0] median episodes/day calculated over the last 7 day of treatment, $p < 0.001$).

CONCLUSIONS

The use of a starch-thickened partially hydrolyzed milk formula added with *L. reuteri* decreases the number of regurgitation in infants affected by this disease and ameliorates the gastric motility.

ABS 10

VITAMIN D AT A DOSE 400 IU/D PROTECTS TERM AND PRETERM INFANTS FROM DEFICIENCY

J. Czech-Kowalska[1], M. Jaworski[2], A. Pleskaczynska[1], D. Maksym[1], M. Gruszfeld[3], G. Wygledowska[4], B. Pawlus[5], A. Zochowska[6], M. Kornacka[7], A. Dobrzanska[1]

[1]*Department of Neonatology and Neonatal Intensive Care, The Children's Memorial Health Institute, Warsaw, Poland*

[2]*Department of Biochemistry, Radioimmunology, and Experimental Medicine, The Children's Memorial Health Institute, Warsaw, Poland*

[3]*Department of Neonatology, University Center of Woman's and Newborn's Health Care, Warsaw, Poland*

[4]*Department of Neonatology, Miedzyleski Specialist Hospital, Warsaw, Poland*

[5]*Department of Neonatology, Holy Family Hospital, Warsaw, Poland*

[6]*Department of Neonatology, Public Hospital, Otwock, Poland*

[7]*Department of Neonatology, Warsaw Medical University Hospital, Warsaw, Poland*

INTRODUCTION

Vitamin D supplementation with 400 IU/d is widely recommended for term infants, while doses for preterm infants vary from 200 IU/d to 1,000 IU/d. We aimed to assess if 400 IU/d has the same efficacy in term and preterm infants.

PATIENTS AND METHODS

A total of 141 term infants from MAVID study (birth weight 3,491 ± 411 g) and 22 preterm infants (birth weight 1,273 ± 411 g, gestational age 29 ± 2.5 weeks) were supplemented with vitamin D at a dose 400 IU/d. Serum 25(OH)D was assessed by an immunochemiluminescent method (LIAISON®, DiaSorin) in term and preterm infants at baseline (at 3 month of age) and 3 months later. Vitamin D intake from diet was also assessed. The study was approved by the Ethics Committee of The Children's Memorial Health Institute, Warsaw, Poland. Written informed consent was obtained from each participants.

RESULTS

Baseline 25(OH)D level was 33.7 ± 7.8 ng/ml in term infants and 40 ± 19 ng/ml in preterm infants ($p = 0.007$) with no significant ($p > 0.05$) increase during vitamin D3 supplementation (33 ± 8.3 ng/ml vs. 44.3 ± 25 ng/ml; $p = 0.0001$). The prevalence of 25(OH)D > 30 ng/ml was similar (64.5% vs.72.7%; $p > 0.05$) in both group, whereas the prevalence of 25(OH)D > 60 ng/ml was higher in preterms (0.7% vs. 13.6%; $p = 0.0037$) after intervention. Vitamin D3 supplemental dose based on body weight was lower in term infants (53 ± 6 IU/kg vs.74 ± 11 IU/kg; $p < 0.001$) and correlated with final 25(OH)D in both term ($R = 0.3$; $p = 0.0004$) and preterm infants ($R = 0.49$; $p = 0.024$). Vitamin D intake from diet was also lower in term infants (157 ± 171 IU/d vs. 290 ± 149 IU/d, $p < 0.05$).

CONCLUSIONS

Vitamin D supplementation at a dose 400 IU/d allows to keep stable 25(OH)D levels in term and preterm infants. Higher 25(OH)D levels observed in preterm infants are secondary to higher vitamin D dose per kg of body weight. Preterm infants are at higher risk of overdosing.

Necrotising Enterocolitis

ABS 11

AGE AT OCCURRENCE OF FOCAL INTESTINAL PERFORATION AND NECROTIZING ENTEROCOLITIS IN PRETERM INFANTS

S. Petersen, G. Greisen

Neonatal Department, Rigshospitalet – Copenhagen University Hospital, Copenhagen, Denmark

INTRODUCTION

Necrotizing enterocolitis (NEC) is a potentially fatal disease most often seen in preterm infants. It is normally classified according to the modified Bell's criteria according to severity. More recently, Gordon developed criteria to separate spontaneous/focal intestinal perforation (FIP) cases from NEC. Our hypothesis was that FIP is a focal disease and more homogenous in its presentation, compared to NEC which is the final common pathway for multiple pathological states of the gut. We conducted a retrospective observational study to investigate if FIP occurred at a different postnatal or postmenstrual age than NEC in preterm infants.

PATIENTS AND METHODS

All infants with a gestational age (GA) of 30 weeks or less, admitted to the department of neonatology at Rigshospitalet, Denmark, in the period 1 Mar 2007 to 28 Febr 2013 were included in the analysis. Infants who received metronidazole for non-prophylactic reasons were identified, and their clinical data and radiographic findings were reviewed by a paediatric radiologist, a paediatric surgeon, and a neonatologist. Cases were classified into 'no NEC', NEC grade I, II or III (Bell's modified criteria), FIP or 'other gastrointestinal disease'. FIP was defined as perforation without other signs of NEC. Cases classified as NEC grade II or III were included as NEC cases. Day of onset was defined as the first day with symptoms of FIP or NEC. Statistics were performed in IBM® SPSS® Statistics.

RESULTS

In this study, 714 infants were included (GA 27.1 [IQR 25.9-28.4] weeks), and the case records of 142 infants were reviewed. We identified 7 cases of FIP, 26 cases of NEC II and 31 cases of NEC III. The median GA at birth was 27.4 (IQR 25.3-28.1) and 26.1 (IQR 24.7-27.1) weeks for FIP cases and NEC cases, respectively ($p = 0.46$). All FIP cases occurred within the first week of life (median 4 [IQR 2-6] days), whereas NEC occurred in a range from day 0 until day 58 after birth (median 10 [IQR 5-21] days), significantly later than FIP-cases ($p = 0.007$). The median postmenstrual age at occurrence of symptoms was 28.3 (IQR 24.1-28.6) weeks for FIP and 28.0 (IQR 26.4-29.6) weeks for NEC ($p = 0.89$). The all-cause mortality was 23% in the NEC II group, 71% in the NEC III group and 41% in the FIP group.

CONCLUSIONS
We found that FIP occurred as early as the second day after birth and always within the first week of life. Surprisingly, it occurred in infants older than 28 weeks of GA. The wide interquartile ranges for postmenstrual age at onset suggested that neither FIP nor NEC occurred at a specific "vulnerable" maturational age. All in all this study supports the suggestion to separate FIP from NEC and points to a 'birth-associated' etiology of FIP.

Nutrition of the Very Preterm

ABS 12

HUMAN MILK FEEDING COMPARED TO FORMULA FEEDING POST DISCHARGE SEEMS TO BE ASSOCIATED WITH INCREASED BONE MINERAL DENSITY (BMD) AT SIX YEARS OF AGE IN VERY PRETERM BORN INFANTS

L. Toftlund, L. Agertoft, S. Halken, G. Zachariassen

Pediatric Research Unit, Hans Christian Andersen Children's Hospital, Odense, Denmark

INTRODUCTION
Infants born very preterm are at risk of developing metabolic bone disease causing rickets. Adequate nutritional intake is important to reduce the risk of severe bone disease. The aim of this study was to evaluate bone mineral content (BMC) and density (BMD) at six years of age in very preterm born infants fed different diets post discharge.
PATIENTS AND METHODS
Participants were very preterm born infants (gestational age ≤ 32^{+0} weeks) participating in a prospective, randomized, controlled multicentre trial on post discharge nutrition of very preterm infants. The infants fed human milk were randomized to be supplemented with human milk fortification or not from hospital discharge to 4 months corrected age (CA). Those not fed human milk received a preterm formula from discharge to 4 months CA. Nutrition groups consisted of: A) human milk (HM), B) fortified HM or C) preterm formula. At 6 years of age a BMD was assessed by dual-energy X-ray absorptiometry (DXA) scan (Lunar Prodigy®) measuring the mineralization of the bones using the recommended value of "total body less head" (TBLH).
RESULTS
A total number of 190 infants had a DXA scan performed at 6 (5.8-8.3) years of age. No significant difference was found comparing nutrition groups (t-test) according to height for age, bone area for age and BMC for bone area (BMD). In a multiple regression analysis breastfed infants (group A + group B) had higher BMD compared to formula fed infants (group C) ($p = 0.002$).
CONCLUSIONS
Feeding human milk compared to formula feeding post discharge was associated with increased BMD at 6 years of age among very preterm born infants.

ABS 13

NEONATAL NUTRITION AND CARDIO-VASCULAR HEALTH DETERMINANTS IN PRESCHOOL CHILDREN BORN PRETERM – PRELIMINARY DATA

I. Odri Komazec[1], A. Posod[1], E. Schermer[2], M. Schwienbacher[2], K. Kager[1], U. Pupp Peglow[1], D. Baumgartner[2], U. Kiechl-Kohlendorfer[1]

[1]Department of Pediatrics II (Neonatology), Innsbruck Medical University, Innsbruck, Austria
[2]Department of Pediatrics III (Cardiology, Pulmonology, Allergology and Cystic Fibrosis), Innsbruck Medical University, Innsbruck, Austria

INTRODUCTION
There is evidence that early exposure to parenteral lipids in preterm neonates has an unfavorable effect on cardiovascular health later in life. On the contrary, human milk feeding is thought to be protective regarding cardiovascular health. The aim of this study was to investigate the association between neonatal parenteral lipid nutrition and human milk intake at one side, and blood pressure and elastic properties of aorta in preschool children born preterm on the other side.
PATIENTS AND METHODS
We examined children born preterm at preschool age (gestational age less than 32 weeks, and/or birthweight less than 1,500 g). Neonatal nutritional data were extracted from clinical records. Blood pressure was determined oscillometrically. Elastic properties of the ascending and descending aorta were calculated using computerized wall contour analysis out of transthoracic M-mode echocardiographic tracings.
RESULTS
77 children born preterm were examined at 5 to 7 years of age. Mean duration of parenteral lipid

infusion was 9.3 days (SD 6.5 days), mean daily intake of human milk in the first 28 days of life 90.8 ml/kg/day (SD 34.9 ml/kg/day). There was no significant association between these two variables and cardiovascular health determinants at preschool age (blood pressure and elastic properties of aorta).

CONCLUSIONS

It is well known that children born preterm have increased cardiovascular risk later in life. Preliminary results of this study could not find a significant association between the duration of parenteral lipid nutrition and human milk intake in the first 28 days of life, and blood pressure and elastic properties of aorta at preschool age. Further studies are needed to investigate effect of neonatal nutrition on long-term cardiovascular health.

ABS 14

CLINICAL EFFECTIVENESS OF HYDROLYZED PROTEIN PRETERM FORMULA IN PREVENTION OF FEEDING INTOLERANCE IN VERY LOW BIRTH WEIGHT INFANTS

D. Dobryanskyy[1], O. Borysiuk[1], O. Novikova[2], Y. Dubrovna[2], Z. Salabay[2], O. Detsyk[2]

[1]Department of Paediatrics, Lviv National Medical University, Lviv, Ukraine

[2]NICU, Lviv Regional Clinical Hospital, Lviv, Ukraine

INTRODUCTION

Feeding intolerance is common in very preterm infants interfering with ability to quickly enough reach full feeding volume needed to maintain infants' optimal growth and development. It has been shown that hydrolyzed protein preterm infant formula (HPF) enabled a more rapid establishment of full enteral feeding. The aim of this open randomized study was to investigate whether HPF improves early feeding tolerance compared with standard preterm infant formula (SPF).

PATIENTS AND METHODS

All very low birth weight (VLBW) infants (n = 69) admitted to the NICU were randomly assigned to receive HPF (3.1 g of protein / 100 ml) or SPF if human milk was not available. They were fed with the predetermined formula until the full enteral volume (EV) was reached. Nine infants who died were excluded. Primary study outcome was the infant's age in which full EV (150 mL/kg birth weight/d) was achieved. Number and duration of episodes of EV reduction or withholding and postnatal growth rates were compared as well. Daily volume was advanced by 10-20 ml/kg according to the standard protocol. Preprandial gastric residuals up to 50% of the previous feed were tolerated if it was neither increase of abdominal girth > 2 cm nor vomiting; otherwise, feedings were reduced or withheld.

RESULTS

Thirty five and 25 (HPF vs. SPF) infants were enrolled into final analysis. Formula bolus feeding was started in all infants on the first day of life. There was no significant difference with regard to birth weight, gestational age, and need for resuscitation at birth. The infant's age in which full enteral volume was reached was lower with HPF feeding (12.46 [5.2] vs. 14.4 [6.76] days) but the difference was not statistically significant ($p = 0.21$). Any failure to increase daily volume was seen in 20 (57%) newborns fed with HPF and in 15 (60%) control infants ($p > 0.05$), but feeding was withheld almost 2 times more often in infants fed with SPF as compared to HPF (36% vs. 17%; $p < 0.1$). EV was reduced of withheld for the similar period of time. The patterns of postnatal physical growth were identical in the groups and there was no difference in any clinically significant outcomes.

CONCLUSIONS

HPF can improve the feeding tolerance and enable a more rapid establishment of full enteral feeding in VLBW infants compared with SPF. There is no growth concerns of VLBW infants fed with the HPF containing high concentrations of serum protein.

ABS 15

THE EFFECT OF A STANDARDIZED GASTRIC RESIDUAL REGIME ON FEEDING TOLERANCE IN PRETERM INFANTS

T.J.M. Cents, D. van Zoeren-Grobben, R.A. van Lingen, L.J. Groot Jebbink

Neonatal Intensive Care Unit, Amalia Peadiatric Department Isala, Zwolle, the Netherlands

INTRODUCTION

It is common practice to measure gastric residuals in preterm infants as an indicator of feeding tolerance. However there is no consensus on the interpretation and management of gastric residuals (e.g. frequency of measurement, color, volume), which may lead to suboptimal nutrition and delayed attainment of full enteral feeding or otherwise more necrotizing enterocolitis. The purpose of this study was to

determine whether a standardized gastric residual regime, based on the best available evidence, leads to a better tolerance of enteral feeding in preterm infants.

PATIENTS AND METHODS

A standardized gastric residual regime was developed using evidence based practice and adjusted to the local clinical setting. The algorithm was implemented on the NICU before starting the study. A historical control group was used in which the interpretation and management of gastric residuals was performed by the nurses on an individual basis. Inborn preterm infants (gestational age 26-32 weeks), whose mothers intended to provide human milk and without severe congenital malformations, were included. The primary outcome was determined as the time (in days) to achieve full enteral feeding, the secondary outcome was feeding intolerance (emesis and/or abdominal distension) and necrotizing enterocolitis.

RESULTS

No significant differences were found in the clinical characteristics of the control group (n = 77) and the study group (n = 71), except for the percentage of enteral feeding as human milk or formula milk (mean [SD] % human milk study group 88.7 [18.1], control group 77.3 [29.1], p < 0,05).

The time to achieve full enteral feeds did not differ between the groups (mean [SD] days study group 10.79 [3.40], control group 11.08 [4.81], p = 0.68).

Also in the secondary outcomes intolerance of enteral feeding measured as emesis and/or abdominal distension (study group 62.0%, control group 74.0%, n.s.) and necrotizing enterocolitis (% [n] study group 2.8 [2], control group 1.3 [1], n.s.) no differences were found.

In the study group gastric residuals were measured on standardized times, which were more frequently than the control group.

CONCLUSIONS

A standardized gastric residuals regime with an increase in the frequency of measuring gastric residuals, compared to an individual interpretation and management by the nurses does not improve feeding tolerance in preterm infant or influences feeding intolerance or the occurrence of necrotizing enterocolitis.

ABS 16

GROWTH PATTERN AND BODY COMPOSITION OF PRETERM INFANTS FROM BIRTH TO DISCHARGE: A PROSPECTIVE STUDY

Z. Khan[1,2], N. Morris[1], S. Wallner-Liebmann[2], N. Haiden[3], B. Urlesberger[1]

[1]*Division of Neonatology, Medical University of Graz, Austria*

[2]*Institute of Pathophysiology and Immunology, Medical University of Graz, Graz, Austria*

[3]*Division of Neonatology, Medical University of Vienna, Vienna, Austria*

INTRODUCTION

Optimization of nutritional management in preterm infants has gained importance due to increased survival of these vulnerable infants. Development of strategies immediately after birth has been found to produce excellent results in terms of growth without having any detrimental effect on body composition at term-corrected age. The aim of the study was to monitor nutritional support provided to very preterm infants during their stay at NICU and to further analyze growth patterns in terms of weight gain as well as body composition at discharge.

PATIENTS AND METHODS

A prospective cohort study was conducted including preterm infants born < 32 weeks entering the NICU during a 1-year-time period. Key criteria for inclusion was preterm birth (< 32 weeks) and we excluded infants born with congenital malformations/metabolic disorders or requiring abdominal surgery. Macronutrient (protein, glucose, fat) and energy supply was recorded daily during their stay at NICU. Weight of the child was recorded daily, but head circumference and length were recorded weekly. On the basis of birth weight, this cohort was divided in two groups, i.e. ELBW (< 1,000 g) and VLBW (1,000-1,500 g). To assess growth pattern, Z scores for weight were calculated by using WHO standards. Body composition was measured before discharge using the PEA POD. The study was approved by the Ethics Committee.

RESULTS

Among 61 preterm infants, 30 were ELBW and 31 were VLBW. Growth patterns were reflected by Z-scores during the first 5 weeks of stay at NICU. Mean protein, energy intake and Z-score during the first 5 weeks and at discharge are presented in **Tab. 1**.

Body composition measurements at discharge revealed that in the ELBW group body fat percentage (BF%) was increased in both girls (19.6%) and boys (17.7%) whereas in VLBW group BF% was similar to healthy term infants i.e. girls (15.5%) and boys (13%).

Table 1 (ABS 16). Mean protein intake, mean energy intake and Z-scores in the first 5 weeks and at discharge.

ELBW (< 1,000 g)	W1	W2	W3	W4	W5	discharge
Mean protein (g/kg/d)	2.37	3	3.47	3.65	3.71	3.52
Mean energy (kcal/kg/d)	67	107	123	130	136	133
Z-scores	-0.86	-1.00	-1.22	-1.09	-1.20	-1.14
VLBW (1,000-1,500 g)	**W1**	**W2**	**W3**	**W4**	**W5**	**discharge**
Mean protein (g/kg/d)	2.46	3.40	3.83	3.88	3.85	3.46
Mean energy (kcal/kg/d)	73.6	128	138	140	140	132
Z-scores	-0.94	-1.27	-1.87	-1.29	-1.22	-0.88

CONCLUSIONS

The growth pattern of ELBW and VLBW infants is variable but by discharge VLBW infants could achieve better Z-scores. Body composition analysis also revealed that at time of discharge VLBW infants had BF% comparable to normal term infants but ELBW infants had higher BF%.

ABS 17

AGGRESSIVE VITAMIN D SUPPLEMENTATION IS SAFE AND EFFECTIVE IN PRETERM NEONATES

T. Waterfield, C. Chetcuti-Ganado

Neonatal Unit, Luton & Dunstable University Hospital, Luton, UK

INTRODUCTION

Osteopenia of prematurity is common in preterm neonates (< 30 weeks) and has implications for morbidity. There is substantial evidence that low 25-hydroxycholecalciferol (25[OH]D) levels are associated with more severe osteopenia. Currently there is little evidence to determine the ideal dosing regimen for the replacement of 25(OH)D in this population. In this study we determine the safety and efficacy of high dose (1,500 IU) cholecalciferol supplementation in neonates with osteopenia of prematurity associated with sub-optimal 25(OH)D levels. To our knowledge this is the first study to determine the safety and efficacy of 1,500 Units of cholecalciferol in preterm neonates.

PATIENTS AND METHODS

25 preterm neonates with low 25(OH)D levels (< 70 IU) were recruited over a 6 month period and treated with 1,500 IU of cholecalciferol daily for 6 weeks. The initial and final 25(OH)D and ALP levels were measured using the IDS ELISA and Roche analyzer respectively. Data were analysed using SPSS®. Approval for this study was granted by the hospital audit and research department.

RESULTS

The median gestation was 26 weeks (IQR 24-29) with demographic date in keeping for the local population. The mean 25(OH)D level prior to supplementation was 52.4 IU (SD 16.9) with an associated mean ALP of 760 U/L (SD 133.2). Following supplementation there was a significant increase in 25(OH)D levels to 126.9 IU (SD 35.7) p = 0.0003 and a significant decrease in ALP to 413.4 U/L (SD 130.6) p = 0.0001. No neonates reached toxic levels of 25(OH)D (> 250 IU). Linear regression analysis demonstrated a significant negative correlation between 25(OH)D levels and ALP (R^2 = 0.4170, p = 0.0051) (**Fig. 1**).

CONCLUSIONS

Daily high dose (1,500 IU) cholecalciferol supplementation for 6 weeks is safe in preterm neonates (< 30 weeks gestation) with sub-optimal 25(OH)D levels. Increasing 25(OH) D levels correlate with a significant reduction in ALP and whilst we cannot prove a causal link we hypothesize that aggressive 25(OH)D

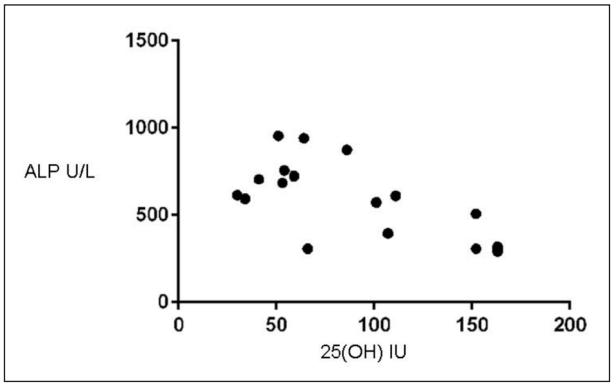


Figure 1 (ABS 17). Linear regression: correlation between 25(OH)D and ALP.

supplementation in 25(OH)D deficient neonates aids resolution of osteopenia of prematurity.

ABS 18

IMPLEMENTING AND SUSTAINING IMPROVED NUTRITIONAL CARE OF PRETERM INFANTS IN NEONATAL INTENSIVE CARE USING A PRACTICE BASED COMPLEX INTERVENTION

M. Johnson[1,2], F. Pearson[2], J. Pond[1,2], A. Emm[3], A. Leaf[1]

[1]NIHR Nutrition Biomedical Research Centre Southampton, University Hospital Southampton NHS Foundation Trust and University of Southampton, Southampton, UK

[2]Department of Neonatal Medicine, University Hospital Southampton NHS Foundation Trust, Southampton, UK

[3]Department of Nutrition and Dietetics, University Hospital Southampton NHS Foundation Trust, Southampton, UK

INTRODUCTION

Postnatal growth failure is common in preterm infants and one reason for this is that nutritional care is often variable and nutrient intakes suboptimal, despite increasing literature regarding best practice in this area, suggesting a failure to translate this evidence into practice such that it becomes part of routine care. This is important, as improving nutrition and growth has the potential to improve neurodevelopmental outcomes in this group. We aimed to develop and implement a complex intervention aimed at changing practice in our neonatal unit in order to optimise nutritional care based on current evidence, and in turn improve nutrient intakes and growth.

PATIENTS AND METHODS

We developed a complex intervention to improve the nutritional care of preterm infants (born < 30 weeks or 1,500 g) and introduced this in a phase manner. Phase 1 (Jan-Aug 2011) was the control period. During phase 2 (Aug–Dec 2011) the intervention was partially implemented, with improved parenteral and enteral nutrition solutions, multidisciplinary nutrition team and staff education. Phase 3 (Jan-Dec 2012) saw full implementation, with guidelines, screening tool and 'nutrition nurse champions' introduced. In the post implementation phase 4 (Jan-Jun 2013), data collection continued to assess the sustainability of the intervention beyond the study. Data on nutrient intakes and growth were collected during each phase and compared using generalised linear modelling with mixed methods (SAS® v.9.3).

RESULTS

Tab. 1 shows the characteristics of the infants, together with the results for nutrient intakes and growth in each phase of the study. Energy intakes improved slightly across the study (non-significant). Protein intakes increased sequentially across the study, with significant improvements in both the phases 2 and 3 compared to phase 1 ($p < 0.001$ for both). Improved protein intake was sustained beyond the intervention into phase 4, with significant improvements compared to both phase 1 and 2 ($p < 0.01$ for both). There was a significant reduction in the fall in standard deviation score (SDS) from birth for weight in periods 2 and 3 compared to period 1 ($p < 0.001$ for both), which again were sustained post implementation in phase 4 ($p < 0.001$ for phase 4 compared to both phase 1 and 2). Whilst the change in head circumference SDS from birth improved across the study, this was non-significant.

CONCLUSIONS

Both the partial and full implementation of the intervention was associated with improvements in daily protein intake and weight gain compared to the control period. Importantly, these were sustained beyond the intervention period. The findings suggest that complex multifaceted interventions using multiple elements based on best available evidence

Table 1 (ABS 18). Infant characteristics, nutrient intakes and growth in each study phase.

Phase	n	Mean (SD) birth weight	Mean (SD) gestational age	Mean daily energy intake (kcal/kg/day)	Mean daily protein intake (g/kg/day)	Mean change in weight SDS from birth	Mean change in head circ. SDS from birth
1 (control period)	52	1.08 (0.27)	29.2 (2.6)	114	2.87	-0.94	-1.06
2 (partial implementation)	36	1.03 (0.31)	29.2 (2.9)	115	3.09	-0.69	-0.91
3 (full implementation)	75	1.00 (0.27)	28.7 (3.0)	117	3.20	-0.51	-0.74
4 (post implementation)	35	0.92 (0.26)	28.1 (2.8)	120	3.34	-0.39	-0.65

SD: standard deviation; SDS: standard deviation score.

have the potential to change practice and improve patient outcomes in a sustainable fashion.

ABS 19

PROTEIN ACCRETION AND RESTING ENERGY EXPENDITURE IN VERY LOW BIRTH WEIGHT PRETERM INFANTS ACCORDING TO FEEDING REGIMEN

M.L. Giannì, L. Morlacchi, P. Roggero, E. Battiato, B. Bracco, A. Polimeni, F. Mosca

Neonatal Intensive Care Unit, Fondazione I.R.C.C.S. Ca Granda Ospedale Maggiore Policlinico, Department of Clinical Science and Community Health, University of Milan, Milan, Italy

INTRODUCTION

Very low birth weight (VLBW) infants have high nutritional requirements, with special regard to protein intakes. Human milk is the preferred feeding for VLBW infants although it has to be fortified in order to meet preterm infants' requirements. Few data are available about the energy requirements and substrates use of VLBW infants.

Aim of the present study was to investigate the nitrogen balance and the resting energy expenditure in VLBW infants according to different feeding regimens.

PATIENTS AND METHODS

An exploratory study was conducted. Inclusion criteria: gestational age less than 32 weeks. Exclusion criteria: presence of clinical conditions that could affect energy expenditure and/or growth. Infants received either preterm formula milk or fortified human milk (FHM). Macronutrient composition of human milk was determined by infrared spectroscopy (MIRIS® AB, Uppsala, Sweden) analysis.

Urine collections for determination of urinary nitrogen excretion were performed. This urine collection was used to calculate protein balance by the nitrogen balance method.

Resting energy expenditure was measured using a prototype indirect calorimetry (Quark RMR, COSMED, Italy), adapted for newborns. All measurements were performed 120 minutes after last meal and lasted 20 minutes.

RESULTS

Infants were evaluated at 36 postconceptional weeks. Out of the 15 enrolled infants, 8 received preterm formula and 7 fortified human milk. Anthropometry was similar among the groups both at birth and at time of assessment.

Protein (g/kg/day) and energy (kcal/kg/day) intakes did not differ among infants fed FHM or formula (3.59 ± 0.3 vs. 3.5 ± 0.2; 128 ± 9.8 vs. 125 ± 7 respectively). Formula fed infants received higher carbohydrates (13.6 ± 0.9 vs. 12.4 ± 0.9 g/kg/day, $p = 0.03$) but similar lipids (6.2 ± 0.4 vs. 6.9 ± 1.1 g/kg/day) intakes as compared to infants fed FHM.

Infants fed FHM had a higher nitrogen balance (mg/kg/day) but a similar resting energy expenditure (kcal/kg/day) as compared to formula fed infants (393 ± 108 vs. 258 ± 116, $p < 0.02$; 48 ± 17 vs. 56 ± 7, respectively). Energy stored (kcal/kg/day) was similar among infants fed FHM and formula fed infants (61.6 ± 21.2 vs. 56.1 ± 10.1).

CONCLUSIONS

Preterm infants fed FHM, although receiving similar protein and energy intakes, showed higher nitrogen retention compared to formula fed infants at the same postconceptional age. The present findings suggest that being fed FHM could allow for a higher protein accretion and, hence, a higher lean mass deposition.

Additional further studies are required in order to confirm these preliminary findings.

ABS 20

PRETERM SINGLE DONOR MILK FROM MOTHERS OF PRETERM INFANTS TO START ENTERAL FEEDINGS IN VERY LOW BIRTH WEIGHT INFANTS

E. Sauerzapf[1], A. Repa[1], C. Binder[1], M. Thanhaeuser[1], B. Jilma[2], A. Berger[1], N. Haiden[1]

[1]*Department of Pediatrics and Adolescent Medicine, Division of Neonatology, Pediatric Intensive Care Medicine and Neuropediatrics, Medical University of Vienna, Vienna, Austria*

[2]*Department of Clinical Pharmacology, Medical University of Vienna, Vienna, Austria*

INTRODUCTION

In premature infants human milk feedings are associated with a reduction of necrotizing enterocolitis (NEC), retinopathy of prematurity (ROP) and sepsis. During the first days of life breast milk is often not available and donor milk or preterm formula is recommended instead. Donor milk is always pooled and the nutritional properties are poor. Therefore, we implemented preterm single donor milk in our hospital and investigated the

effect on time to full enteral feedings, growth and morbidity.

PATIENTS AND METHODS

In a prospective study infants with a birthweight < 1,500 g and a gestational age < 32 weeks were fed with preterm single donor milk/breast milk until they were on full enteral feedings (PSDM group). These infants were compared with a historic control group receiving preterm formula/breast milk instead (Formula group). Preterm single donor milk was collected from mothers of preterm infants who donated for others.

RESULTS

In total, 300 infants were analysed (150/group) and stratified according to birthweight in 1,000 grams. Time to full enteral feedings was shorter in the PSDM group (27 vs. 22 days 1,000 g, p = 0.01). The incidence of ROP (21% Formula group versus 7% PSDM group) and culture proven sepsis (37% Formula group versus 13% PSDM group) was significantly lower in the PSDM group (p < 0.001 for both parameters). There was no difference in gastrointestinal tolerance, weight gain and growth.

CONCLUSIONS

Feeding PSDM shortens time to full enteral feedings and reduces the incidence of ROP and culture proven sepsis especially in infants with a birthweight < 1,001 grams. Therefore, donor milk feeding and the concept "mothers of preemies donate for other preemies" should be encouraged in all NICUs.

ABS 21

NUTRITIONAL AND CLINICAL OUTCOMES OF THE IMPLEMENTATION OF MULTI-DISCIPLINARY NUTRITION SUPPORT TEAM IN A TERTIARY NEONATAL INTENSIVE CARE UNIT

B.K. Lee[1], E.R. Jeong[2], I.G. Song[1], Y.H. Jung[1], S.H. Shin[1], E.K. Kim[1], H.S. Kim[1], J.H. Choi[1]

[1]Department of Pediatrics, Seoul National University College of Medicine, Seoul, Korea

[2]Department of Pharmacy, Seoul National University Hospital, Seoul, South Korea

INTRODUCTION

Nutritional support is crucial for preterm infants during neonatal intensive care unit (NICU) stay. Providing adequate nutrition is considered an essential part in achieving favorable clinical outcomes.

PATIENTS AND METHODS

A historical cohort study was conducted on preterm infants admitted to the NICU of Seoul National University Children's Hospital from January 2009 to August 2010 (a period prior to the establishment of the nutrition support team [NST]) and from January 2012 to August 2013 (a period subsequent to the establishment of the NST). The inclusion criteria were inborn neonates who were less than 30 weeks of gestational age or birth weight less than 1,250 g. Preterm infants with major congenital anomaly or who expired within 1 week were excluded. Medical records were reviewed to measure clinical and nutritional outcomes.

RESULTS

A total of 107 patients in the pre-NST period and 122 patients in the post-NST period were included in the study. Cumulative energy delivery during the first week of life improved during the post-NST period (p < 0.001). Cumulative protein delivery (p = 0.003) and lipid delivery (p < 0.001) also improved significantly. Time to reach full enteric feedings and the mean duration of parenteral nutrition was reduced by 5 days (p = 0.015) and 4 days (p = 0.080), respectively. Weight gain presented in z-scores showed a more positive result in the post-NST period (-1.13 ± 0.99 vs. -0.91 ± 0.74; p = 0.055). Mean length of NICU stay decreased significantly (81.7 ± 36.6 days vs. 72.2 ± 32.9 days; p = 0.040).

CONCLUSIONS

Intervention by an NST in the NICU resulted in significant improvements in the provision of nutrition for preterm infants. Nutritional practices generally improved, and this correlated to important clinical outcomes such as weight gain or length of NICU hospitalization.

ABS 22

IS MILKOSCAN™ A RAPID INFRARED ANALYZER, AFTER A SPECIFIC CALIBRATION, ACCURATE AND PRECISE ENOUGH FOR HUMAN MILK FORTIFICATION?

V. de Halleux[1], R. Buffin[2], F. Sudsinsky[1], J.C. Picaud[2], J. Rigo[1]

[1]Neonatology Department and Human Milk Bank, CHU-CHR Citadelle, University of Liège, Liège, Belgium

[2]Neonatology Department and Human Milk Bank, Hôpital de la Croix Rousse, Lyon, France

INTRODUCTION

Human milk is the feeding of choice for preterm infants. However, human milk's macronutrient content is insufficient to cover their high nutritional needs, postnatal growth and development. Expressed human milk is highly variable especially for protein and fat suggesting the need of individual fortification. Mid-infrared analyzer, originally developed for cow's milk analysis has been suggested as a rapid and simple method to analyze human milk optimizing individual fortification in clinical routine (de Halleux, 2013).

The aim of the study was to revalidate with chemical methods for protein and fat, our calibration equations in use on our human milk mid-infrared analyzer.

PATIENTS AND METHODS

70 samples of human milk provided by mother of preterm infants to our NICU were evaluated with a mid-infrared analyzer (MilkoScan™ Minor, Foss) and the results of protein and fat contents were compared to chemical method providing total nitrogen (nitrogen analyzer EP 61 and analyzer EP 428, Leco®, France) and fat ("Soxhlet") contents determined in our laboratory. Comparisons were performed using the Bland and Haltman statistical method.

RESULTS

For fat, the agreement between the calibrated MilkoScan™ and the "Soxhlet" method was high with a slope of 0.970 ± 0.016 and a correlation coefficient of (R^2 = 0.98). Mean error of estimation was -04 ± 0.15 g/dl.

Protein nitrogen equivalent (g/dl) was calculated as nitrogen in g * 6.25. Protein equivalent provided by MilkoScan™ underestimated lightly the values achieved by chemical method with a slope of 0.81 ± 0.03 and a correlation coefficient of (R^2 = 0.91). Mean error of estimation was -0.11 ± 0.15 g/dl. Precision was higher for nitrogen value ≤ 1.5 g/dl (n = 34) with an mean error of -0.02 ± 0.12 g than for higher concentration > 1.5 g/dl (n = 36) with a mean error was -0.2 ± 0.11 g. After revision of the calibration's equation according to the present data, protein nitrogen equivalent measured by the MilkoScan™ was improved with a mean error of estimation reaching 0.1 ± 0.13 g/dl.

CONCLUSIONS

Human milk calibrated MilkoScan™ provides accurate protein and fat concentrations with a higher precision for fat than for protein allowing its use in clinical practice to provide individual HM fortification. In addition, our data suggest that the accuracy and precision remain stable for several months.

ABS 23

EARLY FRESH HUMAN MILK REDUCES THE RISK OF SEPSIS IN VERY LOW BIRTH WEIGHT INFANTS

R. Nieto[1], A. Dinerstein[1], C. Solana[1], D. Ventura[1], M. Larguía[2], F. General[3]

[1]*Hospital Sardá, Buenos Aires, Argentina*

[2]*Fundación Neonatológica Dr. Miguel Larguía, Buenos Aires, Argentina*

[3]*Nutricia Bagó, Buenos Aires, Argentina*

INTRODUCTION

Late Onset Sepsis (LOS) is the most frequent and severe morbidity in Very Low Birth Weight (VLBW) infants and the main cause of death in patients admitted to NICU, predisposing to other comorbidities. Several studies have demonstrated an association between fresh human milk (FHM) feeding and a reduction in the incidence of sepsis. The critical period and volume of human milk that should be administered to exert a protective effect is not well defined. The objective of this study was to evaluate the volume of FHM that VLBW should receive during the first week after birth to reduce the risk of LOS.

PATIENTS AND METHODS

Patients were included in a randomized clinical trial designed to compare morbidity and tolerability in VLBW with gestational age less than 31 weeks and appropriate for dates, exclusively fed with fresh or pasteurized human milk during the first 28 days of life. The incidence of LOS in patients who received human milk since the first day of life and in those who began on the fourth day was compared. An univariate analysis between patients who developed or not LOS was performed and those variables that showed statistical significance were included in a multivariate model. The volume of FHM administered during the first week of life was divided into quartiles and the dose of milk that exerted a protective effect was determined.

RESULTS

96 patients included in the previous trial were analyzed. Clinical characteristics of patients with LOS (n = 24) compared to those without sepsis (n = 72) are shown in **Tab. 1**. **Tab. 2** summarizes the nutritional characteristics and **Tab. 3** the clinical outcomes. An intake of FHM greater than 40 ml/kg in the first week of life was the cutoff point associated with a significant reduction in

Table 1 (ABS 23). Clinical characteristics of patients with Late Onset Sepsis (LOS) compared to those without LOS.

	No LOS (n = 72)	LOS (n = 24)	p
Birth weight, median (range), g	1,255 (700-1,930)	1,040 (700-1,640)	0.03
Gestational age, median (range), weeks	29 (25-30)	28 (25-30)	0.04
Antenatal steroids, n (%)	61 (84.7)	21 (87.5)	0.11
Male gender, n (%)	38 (52.8)	14 (58.3)	0.22

Table 2 (ABS 23). Nutritional characteristics of patients with Late Onset Sepsis (LOS) compared to those without LOS.

	No LOS (n = 72)	LOS (n = 24)	p
Age ETF started, median (range), days	1 (1-5)	4 (1-15)	< 0.001
Total own mother's milk in the first week, median (range), ml	51 (0-244)	24 (0-146)	0.002
Total banked human milk in the first week, median (range), ml	19 (0-167)	11 (0-86)	0.2
Total own mother's milk in the first 28 days, median (range), ml	568 (0-4,382)	957 (0-5,048)	0.08
Days of TPN, median (range)	12 (6-38)	13.5 (8-28)	0.06

Table 3 (ABS 23). Clinical outcomes of patients with Late Onset Sepsis (LOS) compared to those without LOS.

	No LOS (n = 72)	LOS (n = 24)	p
Body weight at 28 days postnatal age, median (range), g	1,560 (820-2,260)	1,322 (830-1,920)	0.02
NEC ≥ II, n (%)	6 (8.3)	1 (4.2)	0.46
ROP grade II, n (%)	11 (15.28)	4 (16.7)	0.87
Death, n (%)	7 (9.72)	3 (12.5)	0.15

the occurrence of LOS adjusted by gestational age and ETF start in days by 75 % (95% CI 14-93); aOR: 0.25 (95% CI 0.07-0.86). **Fig. 1** shows the administered volumes within the first week according to the presence or absence of LOS. For each ml of FHM consumed in the first week of life, the occurrence of LOS diminishes an average of 2% with a 95% CI between 0.4 and 3.3%. For every 3.5 patients (NNT) who receive more than 40 ml/kg of FHM in the first week of life, one case of LOS is prevented.

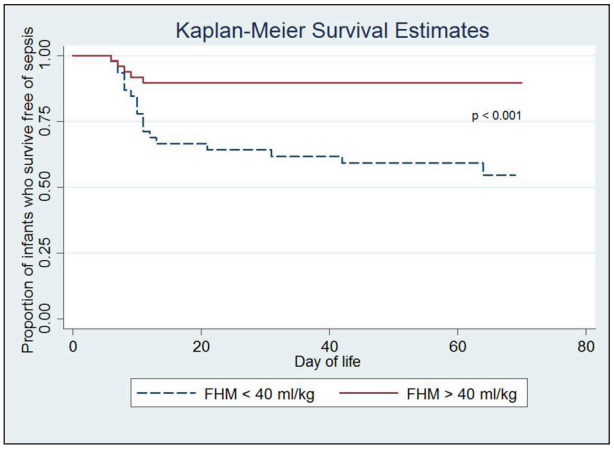


Figure 1 (ABS 23). Administered Fresh Human MIlk (FHM) in the first week of life and proportion of infants who survived free of Late Onset Sepsis (LOS).

CONCLUSIONS

A dose-response relationship was demonstrated between FHM in the first week of life and a reduction in the occurrence of LOS.

ABS 24

BREAST MILK VERSUS FORMULA FOR THE ENTERAL NUTRITION OF VERY PRETERM INFANTS – OUTCOME AT THE AGE OF ONE AND TWO YEARS

L. Kirchner, N. Klambauer, R. Fuiko, S. Brandstetter

Division of General Paediatrics and Neonatology, Department of Paediatrics and Adolescent Medicine, Medical University of Vienna, Vienna, Austria

INTRODUCTION

It is well known that breast milk is the optimal nutrition for both mature and premature infants. This retrospective study investigates whether there is a difference in motor and intellectual development and in anthropometric data between breast-fed and formula-fed preterm infants at the age of one and two years.

PATIENTS AND METHODS

Between 01/01/2000 and 12/31/2005 data of 206 preterm infants with a gestational age < 29^{+6} weeks and/or a birth weight < 1,500 g were collected. The patients were divided into two groups: 111 infants who received breast milk and 95 infants who received formula within the first six months of life. At one and two years the infants were compared with regard to their anthropometric data (body weight and head circumference) and to their motor and intellectual development by means of the MDI (mental developmental index) and PDI (psychomotor developmental index). Data were collected from the Vermont-Oxford questionnaires and from the follow-up portfolios of the patients. Patients with MDI and PDI values above 85 were considered normally developed. The statistical analysis was performed using SPSS® 22.0 for Windows®.

RESULTS

At the age of one year 72.1% of the infants in the breast milk group had an age-appropriate MDI while in the formula group only 45.3% were normally developed ($p = 0.000$). At the age of two years 66.0% of the infants in the breast milk group but only 48.4% in the formula group had age-appropriate MDI values ($p < 0.05$). The PDI at the age of one year was normal in 61.3% of the patients in the breast milk group but only in 38.3% of the formula group ($p = 0.000$). At the age of two years, 65.0% of the children in the breast milk group but only 46.2% in the formula group showed age-appropriate PDI values ($p = 0.006$). With regard to the anthropometric data there was no significant difference between the two groups.

CONCLUSIONS

Preterm infants who are fed breast milk during the first six months of life show better motor and intellectual development than formula-fed preterm infants. No significant difference in terms of anthropometric data has been detected.

ABS 25

HYPERGLYCEMIA IN EXTREMELY PRETERM INFANTS LASTS LONGER THAN PREVIOUSLY ACKNOWLEDGED – RESULTS FROM THE EXPRESS STUDY

I.M. Zamir[1], E. Stoltz Sjöström[2], F. Ahlsson[3], M. Domellöf[1]

[1]*Department of Clinical Sciences, Pediatrics, Umeå University, Umeå, Sweden*

[2]*Department of Food and Nutrition, Umeå University, Umeå, Sweden*

[3]*Department of Women's and Children's Health, Uppsala University, Uppsala, Sweden*

INTRODUCTION

Disturbances in glucose homeostasis among extremely preterm infants are common, including neonatal hyperglycemia. Most studies focus only on glucose levels in the first days of life but it has recently been suggested that these infants have abnormal glucose readings even at discharge. Also, it is unknown what plasma glucose levels should be regarded as normal and there are no clear recommendations for when to treat hyperglycemia in this population. The aim of this study was to describe the changes in blood glucose levels in extremely preterm infants during the first 4 weeks of life and assess possible correlations between blood glucose levels, growth and nutritional intakes.

PATIENTS AND METHODS

We used data from the Extremely Preterm Infants Study in Sweden (EXPRESS), a population-based cohort of all infants born in Sweden at < 27 weeks gestational age, during a 3-year period 2004-2007 (n = 602). Glucose measurements and data on nutritional intakes were retrospectively obtained from hospital records. The first, highest and lowest glucose measurements were documented daily. Infants who did not survive the first 4 weeks of life, had more than 2 missing glucose measurements during the first week of life or more than 3 missing measurements in each of weeks 2-4 were excluded. Data was analysed using linear regression.

RESULTS

Among included infants (n = 182), mean (SD) gestational age was 24.8 (1.0) weeks and mean birth weight was 698 (160) g. Hyperglycemia (> 10 mmol/L) was found in 88% of the infants for ≥ 1 day during the first month of life and in 67% for ≥ 3 days. The prevalence of hyperglycemia increased from 20% on day 7 of life to 31% on day 14 and then decreased to 26% on day 21 and 15% on day 28. The highest daily glucose level correlated with total and enteral carbohydrate intake ($r = +0.17$ and $+0.11$; $p < 0.001$) but not with parenteral intake. During days with parenteral fluid intake ≥ 75%, the highest daily glucose level correlated with parenteral carbohydrate and lipid intakes ($r = +0.11$ and -0.12; $p < 0.001$). No correlation was found between the highest daily glucose level and parenteral amino acid intake. All glucose parameters significantly correlated negatively with gestational age and current weight.

CONCLUSIONS
Hyperglycemia in extremely preterm infants has longer duration than is usually assumed. For the most part, high glucose infusion rate did not explain the variance in glucose levels. Glucose levels correlated negatively with gestational age and daily weight. No correlation was found with parenteral amino acid intake. Further studies are needed to delineate the causes of hyperglycemia in this population.

ABS 26

BLOOD UREA NITROGEN IN VERY LOW BIRTH WEIGHT INFANTS – A USEFUL MARKER FOR PROTEIN INTAKE?

M. Lindberg[1], I.M. Zamir[1], C. Späth[1], E. Stoltz Sjöström[2], M. Domellöf[1]

[1]Department of Clinical Sciences, Paediatrics, Umeå University, Umeå, Sweden

[2]Department of Food and Nutrition, Umeå University, Umeå, Sweden

INTRODUCTION
Protein requirements of very low birth weight infants (VLBW, < 1,500 g) are exceptionally high and a sufficient protein intake is essential in order to attain normal growth and development in these vulnerable infants. Blood urea nitrogen (BUN) has been suggested as a useful marker for protein status in preterm infants. However, recent studies have shown conflicting results.
This study aimed to determine the relation between protein intake and BUN during the first 28 days of life, as well as to define a reference interval for BUN levels in VLBW infants.
PATIENTS AND METHODS
We investigated a cohort of all VLBW infants born between February 2010 and February 2014 and treated at Umeå University Hospital, Sweden (n = 129). Infants were excluded if they were transferred to Umeå after the first 24 hours of life, treated in Umeå for less than 7 days, died within 28 days, had major congenital malformations, chromosomal anomalies or hydrocephalus, or developed necrotizing enterocolitis requiring surgery. Detailed data of parenteral and enteral protein intakes, biochemical markers (including BUN levels) and anthropometric measurements were retrospectively obtained from neonatal patient records. According to clinical routines at the hospital, BUN was measured once per week during the study period. Data was analysed using linear regression analysis.
RESULTS
Complete data was retrieved for 72 VLBW infants. Birth weight (mean ± SD) was 853 ± 322 g and gestational age was 26.4 ± 2.6 weeks. Mean protein intake (enteral + parenteral) was 3.5 ± 0.8 g/kg/d and median urea was 4.2 mmol/L (1.3-13.5 mmol/L; 10^{th}-90^{th} percentile). BUN did not correlate significantly with protein intake during the first four weeks of life. However, during the first two weeks, there was a significant correlation between BUN and the preceding 3 days of protein intake ($r = +0.20$, $p = 0.042$). The strongest correlation was seen during the first week of life ($r = +0.65$, $p < 0.001$), when a cut-off level could be identified using ROC analysis: BUN < 14 mmol/L significantly predicted protein intake < 3 g/kg/d with a sensitivity of 77% and a specificity of 100% ($p < 0.001$). The median (range) of protein intakes on days preceding urea levels during the first week was 2.8 (0.8-4.7) g/kg/d.
CONCLUSIONS
We were able to define a cut-off level for BUN during the first week of life, which could identify infants with insufficient protein intake. Interestingly, our results suggest that relatively high BUN levels (> 14 mmol/L) during the first week of life might indicate an adequate protein intake rather than protein excess. BUN was less useful as an indicator of protein intake after the first week of life.

ABS 27

RECRUITING AHEAD OF SCHEDULE TO A LARGE FEEDING TRIAL – LESSONS LEARNT FROM SIFT (THE SPEED OF INCREASING MILK FEEDS TRIAL)

J. Dorling, J. Abbott, J. Berrington, E. Boyle, Z. Chivers, N. Embleton, E. Juszczak, A. Leaf, L. Linsell, S. Johnson, K. McCormick, W. McGuire, T. Roberts, B. Stenson

The Speed of Increasing milk Feeds Trial (SIFT) Investigators Group

INTRODUCTION
Extremely preterm infants take time to establish enteral feeds and require parenteral nutrition whilst full milk feeds are established. The Speed of Increasing milk Feeds Trial (SIFT) started recruitment in June 2013 comparing two different rates of milk increase as feeding strategies may impact on a range of outcomes including rates of infection and necrotising enterocolitis, growth, and length of hospital stay. We expected it would

take 36 months to reach our recruitment target but current projections suggest this will be achieved 11 months ahead of schedule. Given the financial and patient benefits of trials recruiting in a timely manner we explored potential reasons for this success.

PATIENTS AND METHODS

We aimed to recruit 2,500 infants from 30 neonatal units within the UK and Ireland over 3 years commencing in early 2013, randomising babies to daily feed increments of 18 or 30 ml/kg/day. The primary outcome was the proportion of infants surviving without moderate or severe developmental disability at 24 months of age corrected for prematurity from parental report. Infection rates, NEC, time to full milk feeds, growth, duration of PN and health care use and cost will also be determined. Whilst study recruitment was still progressing, we sought anonymised feedback from local clinicians involved in the trial via face to face discussion, telephone and email. We recorded their opinions as to why they thought SIFT had recruited ahead of predicted timescales (**Fig. 1**).

RESULTS

By 11/5/15, 2,577 babies had been enrolled giving an expectation of study completion during June 2015 after 25 months of recruitment. After feedback from parents, the sample size was increased to 2,800 to adjust for loss of power associated with siblings from multiple births being allocated to the same trial arm. Potential explanations were collated and thematically grouped;

1. Importance of the clinical question; e.g. “it is an important question that needs answering”.
2. Funding of staff time; e.g. “the NIHR has helped by funding additional nurse and clinician time outside of the direct grant funding, enabling 56 units to take part”.
3. Training; “the training days were good, especially practice at discussing the study with parents and taking consent”.
4. Study/CTU processes; e.g. “the website has all the paperwork, materials and even educational podcasts that support the study”.

CONCLUSIONS

SIFT has recruited > 2,500 participants substantially ahead of schedule due to a combination of factors.

A.

	Jun 13	Jul 13	Aug 13	Sep 13	Oct 13	Nov 13	Dec 13	Jan 14	Feb 14	Mar 14	Apr 14	May 14	Jun 14	Jul 14	Aug 14	Sep 14	Oct 14	Nov 14	Dec 14	Jan 15	Feb 15	Mar 15	Apr 15	May 15	Jun 15	Jul 15	Aug 15	Sep 15	Oct 15	Nov 15
Target monthly recruitment															72	73	72	73	72	72	73	72	73	72	72	73	72	73	72	73
Actual monthly recruitment	2	15	26	41	67	95	91	123	117	94	125	134	129	148	147	117	156	167	140	156	137	164	139	0						
Projected monthly recruitment																								160	160	162	162	162	165	165
Target cumulative total															1279	1352	1424	1497	1569	1641	1714	1786	1859	1931	2003	2076	2148	2221	2293	2366
Actual cumulative total	2	17	43	84	151	246	337	460	577	671	796	930	1059	1207	1354	1471	1627	1794	1934	2090	2227	2391	2530	2530						
% target															106	109	114	120	123	127	130	134	136	131						
Proj total 95% CI lower																							2530	2683	2837	2993	3149	3305	3463	3622
Projected cumulative total																							2530	2690	2849	3011	3174	3336	3501	3666
Proj total 95% CI upper																							2530	2696	2862	3030	3199	3368	3539	3711

Month

B.

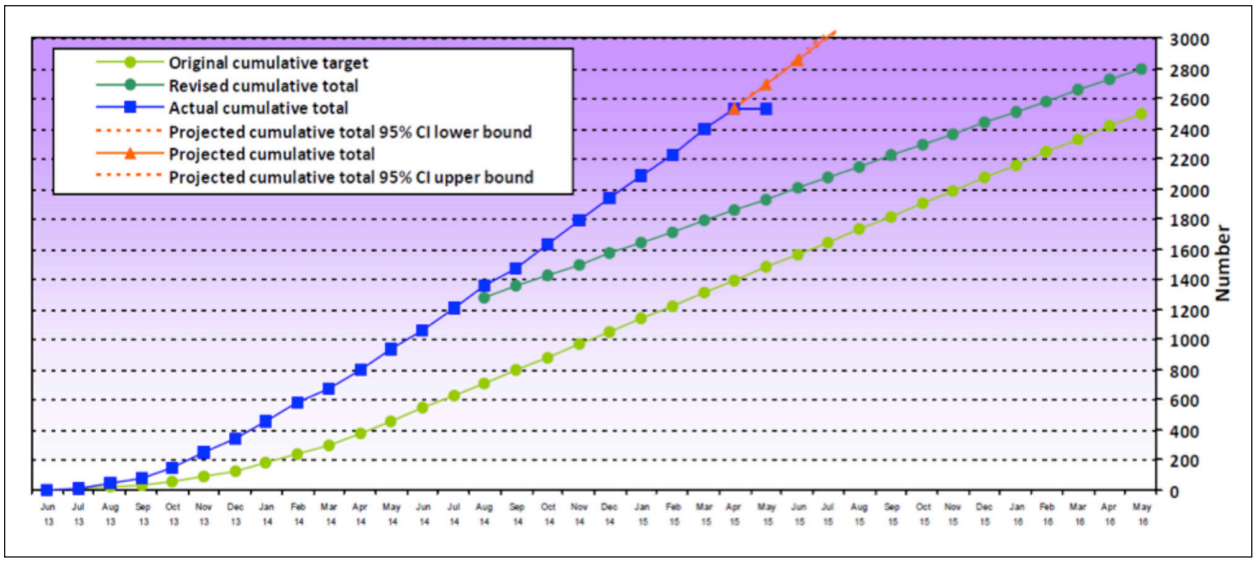


Figure 1 (ABS 27). Cumulative recruitment of infants from 30 NICUs within the UK and Ireland.

This study has built on an ongoing programme of neonatal multicentre trials the UK, allowing gradual improvements to and refinement of study management and processes. This description of the factors that clinicians in participating units felt were important will provide useful information for researchers planning studies in the UK and elsewhere.

Obesity and risk factors for cardiovascular diseas

ABS 28

PERINATAL INFLAMMATION AND CHILDHOOD ADIPOSITY – THE INFLUENCE OF GENDER

J. Donnelly[1], K. Lindsay[1], J. Walsh[1], M. Horan[1], D. O'Shea[5], E.J. Molloy[2,3], F. McAuliffe[1,4]

[1]UCD Obstetrics and Gynaecology, School of Medicine and Medical Science, University College Dublin, Dublin, Ireland

[2]Department of Paediatrics Trinity College, Dublin, Ireland

[3]Department of Neonatology Our Lady's Children's Hospital Crumlin, Dublin, Ireland

[4]National Maternity Hospital, Dublin, Ireland

[5]School of Medicine and Medical Science, St Vincent's Hospital, Elm Park, Dublin, Ireland

INTRODUCTION

To determine the association of maternal and fetal inflammatory factors with neonatal and infant adiposity independent of leptin, including analysis by gender.

PATIENTS AND METHODS

This was an analysis of 265 mother-infant pairs at birth and 280 pairs at 6 months from the ROLO study (Randomised cOntrol trial of LOw glycaemic index diet versus no dietary intervention to prevent recurrence of fetal macrosomia). Maternal TNF-alpha (TNFα), interleukin 6 (IL-6) and leptin were measured in early and late pregnancy and fetal levels were measured in

Table 1 (ABS 28). Total female neonatal/infant cohort. Multiple linear regression of the association between neonatal and infant anthropometric variables and TNF-α and IL-6, controlling for confounding factors.

Variable	B	SEB	p	R^2	R^2_{adj}	F	p
Neonatal sum of skinfolds							
IL-6 late pregnancy	-0.023	0.008	0.010	0.436	0.438	5.574	< 0.001
Leptin late pregnancy	0.000	0.000	< 0.001				
Maternal BMI	0.299	0.166	0.082				
RCT group	-0.874	1.282	0.500				
Total gestation (days)	-0.107	0.091	0.246				
Maternal educational achievement	0.871	1.365	0.528				
6-month sum of skinfolds							
IL-6 early pregnancy	0.111	0.056	0.052	0.170	0.100	2.417	0.046
RCT group	-1.233	1.476	0.407				
Weeks of age	-0.134	0.068	0.052				
Birth weight	0.002	0.002	0.152				
Maternal educational achievement	-0.392	1.477	0.791				
6-month subscapular/triceps ratio							
TNF-α early pregnancy	0.023	0.009	0.017	0.109	0.165	2.933	0.0018
RCT group	0.029	0.058	0.619				
Weeks of age	0.006	0.003	0.017				
Birth weight	0.000	0.000	0.991				
Maternal educational achievement	0.059	0.059	0.324				

Neonatal multiple regression analysis included maternal BMI, RCT group, total gestation (days) and maternal education level of achievement as forced enter variables. Anthropometric measurements were the dependant variable. Only independent variables with a significant effect ($p < 0.05$) on the dependent variable as determined via simple linear regression were included in the multiple linear regression analysis.

cord blood. Anthropometric measurements were recorded at birth and at 6 months of age.
The sum of all skinfolds and the sum of Subscapular plus Triceps skinfolds (SS + TR) were used as markers of general adiposity and the ratio of SS/TR skinfolds as a marker of central adiposity.

RESULTS

After adjusting for maternal BMI, RCT group, gender, gestation and maternal educational achievement, as a socioeconomic marker, no associations were noted between maternal and fetal inflammatory markers and adiposity in the overall or male neonatal or infant cohorts. Among female infants the following relationships were noted on multiple regression: in the neonatal cohort late pregnancy IL-6 was associated with sum of skinfolds (β -0.023, R_{adj} 43.6% (F = 5.574, $p \leq 0.001$); at 6 months female infants sum of skinfolds were associated with early pregnancy IL-6 (β 0.111, R_{adj} 10% (F = 2.417, p = 0.046) and central adiposity with early pregnancy TNF alpha (β 0.023, R_{adj} 10.9% (F = 2.933, p = 0.018) (**Tab. 1**).

CONCLUSIONS

In this cohort, maternal inflammatory cytokines were not associated with neonatal adiposity independent of leptin but a positive association of both IL-6 and TNF-α was observed in the female 6 month cohort independent of leptin in the female cohort. These results suggest that maternal inflammatory cytokines may exert an *in utero* influence on later infant adiposity with further research is required to ascertain whether these cytokines may be used as reliable early predictors of infant adiposity.

ABS 29

THE ASSOCIATION BETWEEN MATERNAL NUTRITION AND LIFESTYLE DURING PREGNANCY AND OFFSPRING ADIPOSITY AT 2 YEARS OF AGE – ANALYSIS FROM THE ROLO STUDY

M.K. Horan[1], J.M. Donnelly[1], C.A. McGowan[1], E.R. Gibney[2], F.M. McAuliffe[1]

[1]UCD Obstetrics and Gynaecology, School of Medicine and Medical Science, University College Dublin, Dublin, Ireland

[2]University College Dublin School of Agriculture & Food Science, Dublin, Republic of Ireland

[3]National Maternity Hospital, Dublin, Ireland

INTRODUCTION

The *in utero* environment is important not only for fetal growth and development but is also involved in fetal programming. While there is greater understanding of fetal programming in the case of small for gestational age infants there remains a paucity of data in relation to large for gestational age infants.

PATIENTS AND METHODS

This was an analysis of 337 mother and infant pairs from the ROLO study (Randomised cOntrol trial of LOw glycaemic index diet versus no dietary intervention to prevent recurrence of fetal macrosomia), the mean SD birthweight of this cohort was 4,051 (SD 471). Food diaries and lifestyle questionnaires were completed during pregnancy and infant feeding and maternal lifestyle questionnaires were completed 2 years postpartum. Maternal anthropometry was measured throughout pregnancy and infant and maternal anthropometry was measured 2 years postpartum.

RESULTS

Infant waist: length circumference ratio at 2 years of age, a measure of central adiposity, was negatively associated with father and mother height; R^2_{adj} 0.165 (f = 4.079, p < 0.001). Triceps: subscapular skinfold ratio was positively associated with trimester 1 glycaemic index and trimester 2 saturated fat; R^2_{adj} 0.069 (f = 2.627, p = 0.010). BMI-for-age z-score was negatively associated with maternal trimester 1 (pre-intervention) glycaemic index and positively associated with maternal BMI 2 years postpartum; R^2_{adj} 0.043, (f = 2.400, p = 0.022). Sum of all skinfolds at two years of age, a measure of overall adiposity, was negatively associated with T1 glycaemic index; R^2_{adj} 0.080 (f = 2.324, p = 0.031). When examined further, the negative associations between maternal trimester 1 glycaemic index and 2 year old adiposity were only present in the control group (**Tab. 1**).

CONCLUSIONS

Maternal height was negatively associated with offspring central adiposity. Maternal macronutrient intake, antenatal glycaemic index and BMI at 2 years were positively associated with offspring adiposity. Negative associations between adiposity and maternal pre-intervention glycaemic index were only in the control group indicating that the low glycaemic index intervention may have ameliorated this effect. Pregnancy provides an opportunity to influence childhood overweight and obesity.

Table 1 (ABS 29). Association of maternal and paternal characteristics and maternal diet with offspring adiposity at 2 years of age – multiple regression.

Variable	B	SEB	p	R^2_{adj}	F	p
Weight-for-age z-score						
Mother weight booking (kg)	0.029	0.009	0.001	0.159	4.297	0.000
Macrosomia (y/n)	0.367	0.135	0.007			
Trimester 3 saturated fat (%TE)	0.041	0.023	0.080			
Trimester 3 polyunsaturated fat (%TE)	-0.091	0.040	0.023			
2 year mother BMI (kg/m^2)	-497.827	251.657	0.050			
Age given drinks other than breast milk (weeks)	-0.014	0.005	0.007			
BMI-for-age z-score						
Trimester 1 GI	-0.038	0.017	0.027	0.043	2.400	0.022
Macrosomia (y/n)	-0.231	0.135	0.088			
2 year mother BMI (kg/m^2)	424.593	157.496	0.008			
Length-for-age z-score						
Trimester 2 saturated fat (%TE)	0.314	0.122	0.011	0.031	2.740	0.020
Mid-upper arm circumference for-age z-score						
Mother baseline smoking	-1.445	0.569	0.012	0.046	2.471	0.035
Chest circumference						
Minutes of moderate activity/week	0.019	0.006	0.003	0.118	3.434	0.002
Thigh skinfold thickness						
Father height (cm)	-0.167	0.068	0.016	0.152	2.947	0.004
Trimester 3 protein (%TE)	0.363	0.164	0.030			
Age given drinks other than breast milk (weeks)	-0.082	0.033	0.015			
Waist/length circumference ratio						
Father height (cm)	-0.001	0.000	0.012	0.165	4.079	0.000
Mother height (cm)	-0.001	0.000	0.009			
Sum of all skinfolds						
Trimester 1 GI	-0.364	0.168	0.033	0.080	2.324	0.031
Triceps/subscapular skinfold thickness ratio						
Trimester 1 GI	0.008	0.004	0.030	0.069	2.627	0.010
Trimester 2 saturated fat (%TE)	0.014	0.005	0.005			

ABS 30

COMPARISON OF FAT MASS INDEX, PERCENTAGE OF FAT MASS AND BODY MASS INDEX AS INDICATORS IN MONITORING THE TREATMENT OF OBESITY IN PREPUBERTAL CHILDREN

L. Pereira-da-Silva[1], M. Pitta-Grós-Dias[1], E. Dionísio[1], D. Virella[2], M. Alves[2], G. Cordeiro-Ferreira[1]

[1]*Nutrition Lab, Hospital de Dona Estefânia, Centro Hospitalar de Lisboa Central, Lisbon, Portugal*

[2]*Research Unit, Centro Hospitalar de Lisboa Central, Lisbon, Portugal*

INTRODUCTION

An early, accurate recognition of success in treating obesity may increase the compliance of obese children and their families to intervention programs. We aim to evaluate the sensitivity and time required to detect significant reduction of adiposity estimated by body mass index (BMI), percentage of

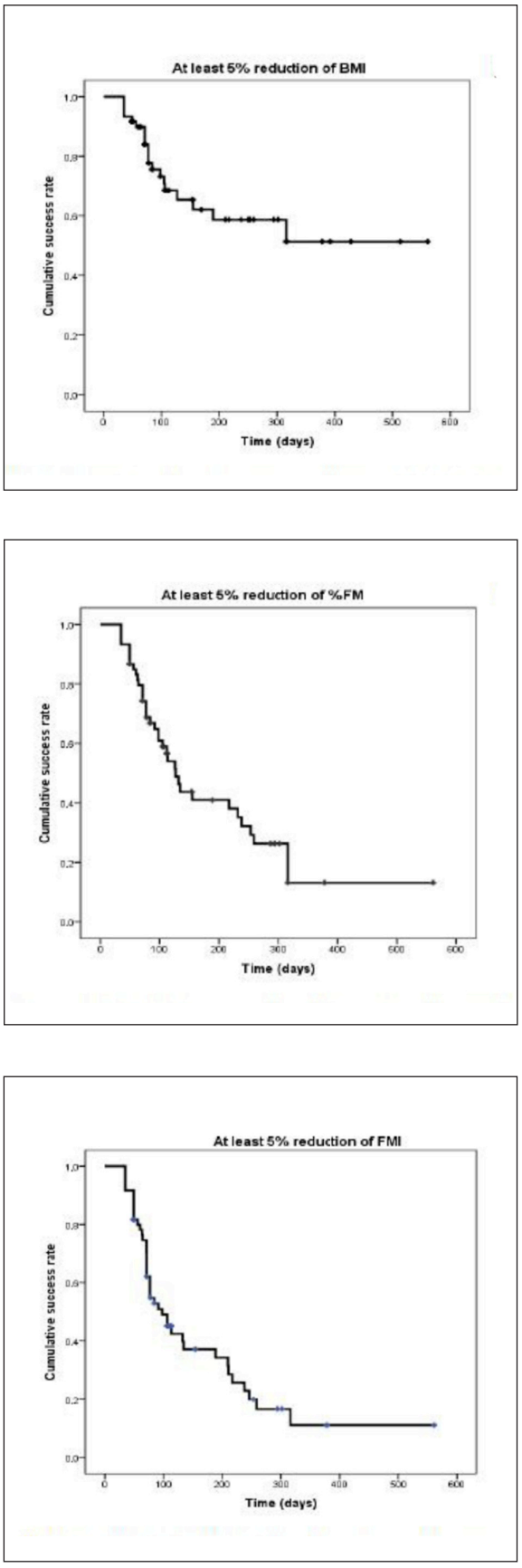


Figure 1 (ABS 30). Time to achieve success (reduction ≥ 5% for each indicator) for the whole sample and for each indicator (**A**: BMI, **B**: %FM, **C**: FMI); Kaplan-Meyer survival curves.

fat mass (%FM), and fat mass index (FMI) during intervention in prepubertal obese children.

PATIENTS AND METHODS

In a cohort of prepubertal obese children included in a customized outpatient program for treatment of obesity BMI, %FM and FMI were monthly monitored, the later two measured by air displacement plethysmography (BOD POD®, COSMED). The outcome measures were the reduction of at least 5% of each indicator and the time to achieve it. Time to achieve success for the whole sample and for each indicator was described with Kaplan-Meyer survival curves. Time to achieve success by those that achieved it, was described with median and extremes for each indicator of adiposity and compared using Kruskall-Wallis test.

RESULTS

The success detection rate was 33.3% (95% CI 25.9-41.6) using BMI, significantly lower ($p < 0.001$) than either 63.3% using %FM (95% CI 50.6-74.8) or 70.0% (95% CI 57.5-80.1) using FMI. The median time to detect success was 71 days using FMI, shorter than 88 days using %FM, and similar to 70 days using BMI (**Fig. 1**). The agreement between the success detected by FMI and by %FM was high (k 0.701), but very low between the success detected by BMI and either FMI (k 0.231) or %FM (k 0.125).

CONCLUSIONS

The best combination of sensitivity and precocity to detect reduction of the adiposity estimate was achieved by FMI.

Perinatal growth

ABS 31

MATERNAL NUTRITION AND GLYCAEMIC INDEX DURING PREGNANCY IMPACTS ON OFFSPRING ADIPOSITY AT 6 MONTHS OF AGE – ANALYSIS FROM THE ROLO RANDOMISED CONTROLLED TRIAL

M.K. Horan[1], C.A. McGowan[1], E.R. Gibney[2], J. Byrne[1], J.M. Donnelly[1], F.M. McAuliffe[1,3]

[1]UCD Obstetrics and Gynaecology, School of Medicine and Medical Science, University College Dublin, Dublin, Ireland

[2]University College Dublin School of Agriculture & Food Science, Dublin, Republic of Ireland

[3]National Maternity Hospital, Dublin, Ireland

INTRODUCTION

Childhood obesity is associated with increased risk of adult obesity and metabolic disease. Diet and lifestyle in pregnancy are known to result in fetal programming, however the influence of specific dietary components remains incompletely understood.

AIM

To examine the effect of a low glycaemic index (GI) dietary intervention in pregnancy on 6 month old offspring adiposity and to explore the association between diet and lifestyle factors in pregnancy and infant body composition at 6 months of age.

PATIENTS AND METHODS

This was an analysis of 280 6 month old infant and mother pairs, 142 from the control and 138 from the intervention group of the ROLO study, who received low GI dietary advice in pregnancy. Food diaries and lifestyle questionnaires were

Table 1 (ABS 31) Maternal characteristics and maternal nutrient intakes associated with 6 month old offspring adiposity – adjusted analysis[a].

	B	SEB	p	R^2_{adj}	F	p
Weight for length z-score						
Trimester 1 sodium	0.0003	0.0001	0.003	0.079	4.434	0.001
Weight for age z-score						
Trimester 2 saturated fat (%TE)	0.075	0.027	0.005	0.141	7.685	< 0.001
Length for age z-score						
Trimester 1 carotene	9.629E-05	0.00004	0.013	0.186	7.593	< 0.001
Trimester 1 PUFA (%TE)	0.159	0.049	0.002			
BMI for age z-score						
Trimester 1 sodium	0.0003	0.0001	0.003	0.071	4.031	0.002
Mid-upper arm circumference-for-age z-score						
Trimester 3 sodium	0.0003	0.0001	0.009	0.182	4.336	0.001
Gestational weight gain (kg)	0.059	0.018	0.002			
Triceps skinfold-for-age z-score						
Trimester 3 vitamin C	-0.005	0.003	0.035	0.088	3.461	0.003
Trimester 3 glycaemic index	0.053	0.023	0.023			
Subscapular skinfold-for-age z-score						
Moderate physical activity baseline (number of 20-min intervals/day)	0.115	0.045	0.013	0.071	2.380	0.045
Thigh circumference						
Trimester 1 sodium	0.001	0.0003	0.013	0.099	3.453	0.001
Trimester 1 carotene	0.0002	0.00008	0.038			
Trimester 3 carbohydrate (%TE)	-0.081	0.034	0.019			
Biceps skinfold						
Trimester 1 thiamine	0.603	0.207	0.004	0.109	2.974	0.003
Baseline minutes sitting/weekday	0.002	0.001	0.064			
Trimester 3 glycaemic index	0.121	0.040	0.003			
Sum of triceps and subscapular skinfolds						
Trimester 2 vitamin C	-0.015	0.005	0.007	0.067	2.595	0.015
Waist/hip circumference ratio						
Trimester 1 vitamin B6	-0.028	0.012	0.019	0.163	4.732	< 0.001
Trimester 3 potassium	3.01e-05	8.39e-06	< 0.001			
Trimester 1 glycaemic index	-0.004	0.001	0.004			
Trimester 2 saturated fat (%TE)	0.006	0.002	< 0.001			

Backwards stepwise multiple linear regression was used for this analysis [a]adjusted for well-established influences on neonatal size. Group affiliation was also included in all models (i.e. control or intervention). Z-score values were adjusted for education, intervention group, breastfeeding and definite underreporting (Goldberg ratio ≤ 0.9). Non-z-score values were adjusted for education, infant age at measurement, infant gender, intervention group, breastfeeding and definite underreporting (Goldberg ratio ≤ 0.9). $p < 0.05$ was considered statistically significant.
BMI: Body Mass Index; %TE: percentage of total energy.

completed during pregnancy and infant feeding and maternal lifestyle questionnaires were completed 6 months postpartum. Maternal anthropometry was measured throughout pregnancy and infant and maternal anthropometry was measured 6 months post-delivery.

RESULTS

There was no difference in 6 month infant adiposity between the control and intervention groups. Maternal trimester 3 GI, trimester 2 saturated fat intake and trimester 1 and 3 sodium intake were positively associated with 6 month old offspring adiposity while trimester 2 and 3 vitamin C intake was negatively associated (**Tab. 1**).

CONCLUSIONS

There was no effect of low GI intervention in pregnancy on offspring adiposity. Associations were observed between maternal dietary intake and GI during pregnancy and offspring adiposity at 6 months of age. While further research is necessary to determine optimal diet during pregnancy, improving maternal nutrition may be a simple public health intervention to reduce childhood obesity.

ABS 32

PREGNANCY COMPLICATIONS AND EARLY POSTNATAL GROWTH VELOCITY IN VERY PRETERM INFANTS

L. Gagliardi[1], R. Bellù[2], E. Bertino[3], C. Corchia[4], E.M. Edwards[5], J.D. Horbar[5], R.F. Soll[5], E. Spada[6], R. Zanini[2]

[1]*Italian Neonatal Network, Viareggio, Italy*

[2]*Italian Neonatal Network, Lecco, Italy*

[3]*Italian Neonatal Network, Turin, Italy*

[4]*Italian Neonatal Network, Rome, Italy*

[5]*University of Vermont and Vermont Oxford Network, Burlington, VT, USA*

[6]*Italian Neonatal Network, Milan, Italy*

INTRODUCTION

Growth of very preterm infants is often poor in the first few weeks of life. Little is known about how complications of pregnancy representing antecedents of preterm birth affect postnatal growth velocity (GV).

Aim of this study was to assess weight gain during the initial hospitalization of a large prospective cohort of very preterm infants born to mothers with hypertension (H), chorioamnionitis (C), or neither, while controlling for several variables.

PATIENTS AND METHODS

We studied 8,181 infants (23-29 weeks gestation) without major birth defects born from 2008 to 2013, hospitalized for 15 to 175 days at 85 hospitals in the Italian Neonatal Network, and discharged home. Average GV (g/kg/day) was computed using a two-point exponential model based on weights at birth and discharge (Patel, 2009). Analyses were adjusted for core confounders (sex, multiple birth, birth year, antenatal steroids, ventilation, major morbidity, mode of delivery), and additionally for size using birth/discharge mean weight, using generalized estimating equations. All variables were defined as in Vermont-Oxford Network. Results are presented as differences in GV using the non-H, non-C category as reference. 1,520 infants were born after H, 1,230 after C, and 5,431 after neither disease.

RESULTS

Overall mean GV was 11.95 g/kg/d (SD 2.33). In unadjusted analyses, infants born after H had a higher GV (1.10 ± 0.07 [SE] g/kg/d) than reference. The effect of H became only slightly lower after adjusting for core confounders (0.99 ± 0.07, $p < 0.001$). Given that being small for gestational age was an important determinant of postnatal growth (+1.79 ± 0.1 g/kg/d, $p < 0.001$), we also adjusted the analysis for birth/discharge weight: infants born after H still had a higher GV (0.66 ± 0.07 g/kg/d, $p = 0.65$).

A recent year of birth, antenatal steroids, a small size at birth and female sex were associated with increased GV, while major morbidities, ventilation, postnatal steroids use, and vaginal delivery were associated with decreased GV.

CONCLUSIONS

Maternal hypertension is associated with increased growth velocity for infants 23 to 29 weeks gestation. The mechanism responsible for this association is uncertain, and is only partly explained by fetal growth restriction in infants born to hypertensive mothers or by other non-nutritional factors. C did not influence GV.

ABS 33

CORD BLOOD LEPTIN AND IGF-1 ARE SUITABLE BIOCHEMICAL MARKERS TO DISTINGUISH BETWEEN NEWBORNS WITH SIMPLE FETAL MACROSOMIA AND INFANTS OF A DIABETIC MOTHER

R. Hentschel[1], J. Trost[1], M. Thill[1], A. Krause[2], M. Kunze[3], O. Schwab[2]

[1]University Hospital Freiburg, Department of General Pediatrics and Adolescent Medicine, Division of Neonatology/Intensive Care Medicine, Freiburg, Germany
[2]University Children's Hospital Freiburg, Department of General Pediatrics and Adolescent Medicine, Freiburg, Germany
[3]University Hospital Freiburg, Department of Obstetrics and Gynecology, Freiburg, Germany

INTRODUCTION

The prevalence of infants born large-for-gestational-age (LGA) is increasing, probably attributable in part to a higher prevalence of overweight young women. To be born LGA may result from constitutional (ethnic) factors or from multiparity ("simple" macrosomia), but some newborns may be infants of a diabetic mother (IDM) with either unknown or inadequately controlled diabetes. Sometimes IDMs may be appropriate-for-gestational-age (AGA), for instance following a good diabetes control in pregnancy. It might be prudent to identify IDMs early, if necessary by biochemical markers, because of (a) their specific perinatal problems, and (b) the heritability of the diabetic predisposition.

PATIENTS AND METHODS

An observational study was conducted at a level III obstetric and neonatal university department over a period of 5 months. Included were: (a) pregnant women with the suspicion of diabetes (fetal macrosomia [FM] in antenatal ultrasound, previous delivery of an LGA infant), proven gestational diabetes (GDM) (pathological tests for oral glucose tolerance or for blood or urine specimens) and their newborns; and (b) all other newborns born LGA in the study period. Anthropometric data (AD) and blood glucose profiles (GLU) of included newborns were recorded. Measurements of IGF-1, insulin, leptin, retinol binding-protein 4 (RBP4) and fructosamine as potential markers of disturbed glucose homeostasis were done in cord blood. Statistics: Mann-Whitney U test or Fisher's exact test, as appropriate.

RESULTS

63 mother-infant dyads with GDM/IDM, 17 with FM, and 47 controls (C) were enrolled. Overall there was a good adherence to the national guidelines for diabetes screening in pregnancy in all 3 groups, so only 9.5% of IDMs were above the 90th centile. FM infants were significantly heavier than IDMs and C infants, with no difference between IDMs and C. GLU in FM infants and IDMs differed significantly from C. Leptin ($p < 0.001$) and IGF-1 ($p < 0.05$) both were significantly higher in FM than in IDM or C infants, whereas the other 3 parameters did not differ. No significant differences of the 5 biochemical markers were found between the IDM and the C group (**Tab. 1**).

CONCLUSIONS

With a high grade of adherence to screening guidelines of pregnant women and a high compliance with medical recommendations for GDM conditions LGA status of IDMs may vanish and biochemical parameters may be normal, except for a decreased postnatal blood glucose level, which, however, is apparent in FM infants as well. Cord blood leptin and also IGF-1 may be suitable to distinguish between IDMs and FM infants.

ORAL COMMUNICATIONS

ABS 34

MATERNAL ANTIBIOTICS AND TERM INFANT GUT COLONIZATION

G. Zachariassen[1], N. Hyldig[2], K. Shamrulazhar[3], L. Krych[3], G. Greisen[4], D.S. Nielsen[3]

[1]Paediatric Department, Hans Christian Andersen Children's Hospital, Odense University Hospital, Odense, Denmark

Table 1 (ABS 33). Birth weight and 5 biochemical markers in infants of a diabetic mother (IDM), fetal macrosomia (FM) and control (C) groups.

	IDM group (n = 63)			FM group (n = 17)			C group (n = 47)		
	n	mean	SD (±)	n	mean	SD (±)	n	mean	SD (±)
Birth weight (g)	63	**3.336**^{**1}	436	17	**4.342**^{**1**2}	212	47	**3.326**^{**2}	361
IGF-1 (ng/mL)	63	**71.7**^{*1}	26.9	17	**98.3**^{*1*2}	23.0	47	**69.0**^{*2}	24.5
Insulin (mIU/L)	62	67.1	69.9	15	58.2	33.1	43	55.6	39.5
Leptin (ng/mL)	62	**9.4**^{**1}	10.8	17	**14.9**^{**1*2}	5.3	46	**9.0**^{*2}	5.4
RBP4 (ug/mL)	63	18.9	5.5	17	22.0	6.6	47	19.1	4.7
Fructosamine (umol/L)	63	196	19	17	190	18	47	190	21

*$p < 0.05$; **$p < 0.001$; ¹IDM vs. FM; ²FM vs. C.
IDM vs. C: no significance.

[2]Obstetric Department, Odense University Hospital, Odense, Denmark
[3]Department of Food Science, University of Copenhagen, Copenhagen, Denmark
[4]University of Copenhagen, Copenhagen, Denmark

INTRODUCTION

To document if maternal exposure to antibiotics (cefuroxime) during cesarean delivery influences the infant gut bacterial colonization and to measure cefuroxime clearance among infants exposed to antibiotics during caesarean delivery.

PATIENTS AND METHODS

Intervention

Mothers were randomly assigned into one of two groups receiving a single dose of intravenous cefuroxime 1.5 g. In the "intervention group" cefuroxime were administrated 15 to 60 minutes before skin incision and in the "control group" cefuroxime were administrated immediately after umbilical cord clamping.

Outcome

In the intervention group one blood sample was taken from the umbilical cord and two blood samples (0.5 ml of capillary blood) were taken from the infant 3-4 hours and 8-10 hours after delivery. The blood samples were analysed for content of cefuroxime. Faecal samples were collected from all infants 10 days after birth and gut microbiota (GM) composition determined by MiSeq-based tag-encoded 16S rRNA gene targeted high throughput amplicon sequencing.

RESULTS

The level of cefuroxime content varied significantly among infants ($p < 0.001$), while the rate of decline did not ($p = 0.24$). Mean cefuroxime half-life was 3.7 hrs and the individual half-life's ranged from 2.7 to 5.4 hrs. The GM of both groups was dominated by the genera *Bifidobacterium*, *Lactobacillus* (relative abundance of both genera ~10-15%), *Veillonella* (~20-30%) and family *Enterobacteriaceae* (~25-30%). Neither un-weighted, nor weighted uniFrac distance matrix analysis revealed major differences between the 2 groups.

CONCLUSIONS

Cefuroxime half-life is 2-5 times longer in healthy term newborn in the hours after birth compared to normal adults. However, very early and short exposure to cefuroxime does not have major influence on infant GM colonisation.

ABS 35

INITIATION OF ENTERAL FEEDING DIET-DEPENDENTLY AFFECTS INTESTINAL DNA METHYLATION IN PRETERM PIGS

X. Pan, F. Gao, T. Thymann, P. Sangild

Comparative Pediatrics and Nutrition, University of Copenhagen, Copenhagen, Denmark

INTRODUCTION

Epigenetics is an important mechanism whereby environmental factors regulate gene expression of various tissues during early development and such epigenetic changes may have life-long consequences. The immature intestine of preterm infants is exposed to dramatic environmental changes immediately after birth, including bacterial colonization and initiation of enteral milk feeding. Using preterm pigs as models for preterm infants, we hypothesized that enteral feeding affects intestinal epigenetics differently than total parenteral nutrition (TPN). In mammalian DNA, methylation is a key epigenetic mechanism that takes place mainly for cytosine residues of CpG dinucleotides.

PATIENTS AND METHODS

Preterm newborn piglets were given TPN or slowly advancing volumes (16-64 ml/kg/d) of bovine colostrum (COL) or preterm infant formula (FOR) for five days after birth (n = 13-15). On day 5, pigs were euthanized and the intestine collected for analyses of a series of structural and functional endpoints. From a subsample of pigs from each group (n = 2), DNA from the middle intestine was extracted and subjected to reduced representation bisulfite sequencing (RRBS) to assess the genome scale DNA methylation. The BSMAP software was used for sequencing reads alignment and methylation level was calculated for each genomic sites. Chi-square test was used to identify differentially methylated regions (DMRs) specific to each of the three feeding protocols.

RESULTS

Both the COL and FOR feeding protocol increased intestinal mass and some digestive enzyme activities (DPPIV, ApN, ApA) on day 5, relative to TPN. Only the FOR diet was associated with necrotizing enterocolitis (NEC) lesions in the colon, nutrient malabsorption, and increased intestinal permeability and pro-inflammatory cytokine levels (IL-8) on day 5. Compared with TPN (methylation level 56.3%), both the COL and FOR diets increased global CpG methylation in the intestine (to 61.7% and 62.3%, respectively). The coding sequence (CDS) showed the largest increase (+5.7% for COL and +7.2% for FOR) and the 5' untranslated region (UTR) the smallest increase (+1.3% and +1.1%, respectively). A large number of DMRs was identified between

TPN and enteral feeding (COL: 333, FOR: 268), with less difference between the two diets (171 DMRs).

CONCLUSIONS

Initiation of enteral feeding induces a global methylation increase in the preterm intestine. Despite the marked diet-dependent differences in intestinal structure and function, diet type had less effect on gene methylation than feeding itself. The results suggest that early enteral feeding may be important to mature the intestine short-term, but it may also induce long-term effects on intestinal gene transcription by epigenetic regulation.

Metabolism

ABS 36

GROWTH AND DEVELOPMENT OF PIGLETS FED INFANT FORMULAS VARYING IN PROTEIN QUANTITY AND QUALITY

P.S. Worsøe[1], J.B. van Goudoever[2], B. Koletzko[3], E.M. van der Beek[4], M. Abrahamse-Berkeveld[5], B.J.M. van de Heijning[5], P.T. Sangild[1], T. Thymann[1]

[1]Department of Veterinary Clinical and Animal Sciences, University of Copenhagen, Copenhagen, Denmark

[2]Department of Pediatrics, VU University Medical Center, Amsterdam, the Netherlands

[3]Dr. von Hauner Children's Hospital University of Munich Medical Centre, Munich, Germany

[4]Nutricia Research, Singapore

[5]Nutricia Research, Utrecht, the Netherlands

INTRODUCTION

High protein intake during infancy associates with later life obesity prompting an incentive to reduce protein levels in infant formulas. We designed novel infant formulas with a reduced total N content but with an optimized AA composition based on a recent series of studies on the specific AA requirements for infants. We hypothesized that a formula with a reduced N level and an optimized AA composition would not limit growth, intestinal health and clinical characteristics compared to a control product. We further anticipated that the food form in which the AAs are provided, i.e. as either free AA or as intact protein, would affect the clinical outcomes.

PATIENTS AND METHODS

Seven-day old piglets were randomly allocated to one of four iso-energetic infant formulas (n = 14-19 per group), and were fed individually for 20 days thereafter. Three of the diet groups (ST75, O75, and O75AA) had 25% reduced total N intake (protein equivalents) relative to the ST100 group (7.0 vs. 9.4 g protein equivalent/kg/d). The source of N in the standard (ST) and optimized (O) groups was a combination of intact proteins (70%) and added specific free AAs (30%), whereas for the O75AA diet group it was free AAs only. The optimized diets (O) contained an adapted BCAA ratio with reduced leucine levels compared to ST. Growth, selected clinical biochemical parameters, and intestinal morphometry and enzyme activities were analyzed in this protein- and growth-restricted model.

RESULTS

Weight gain (in g) was highest in the ST100 piglets. Weight gain in the O75 group was numerically higher than in ST75 piglets, but did not reach statistical significance. The gain-to-nitrogen ratio did not significantly differ between the ST75 and O75 group. The O75 piglets had higher total bilirubin, ASAT, BASP and total cholesterol levels than ST75. Also, higher blood urea nitrogen (BUN) levels (+124%, $p < 0.001$), isoleucine and valine levels were present in the O75 piglets (+223% and +233% respectively, $p < 0.001$). The O75AA piglets showed lowest growth, and a much lower gain-to-nitrogen ratio than the O75 piglets ($p < 0.001$). This was accompanied by lower DPP-IV and lactase activities in the proximal intestine ($p < 0.05$), and a tendency to lower sucrase, ApN and ApA activities ($p < 0.10$). There were no signs of mucosal damage, and morphology was similar among the four diet groups.

CONCLUSIONS

A formula with optimized but reduced total N, mainly provided as intact protein, did not negatively affect growth. The reduced growth observed in the O75AA diet group confirms that a formula entirely based on free AAs requires a higher N level to ensure adequate growth compared to an iso-nitrogenous protein-based formula. There were some indications that the AA composition designed to be optimal for children was not optimal for piglets.

Necrotising Enterocolitis

ABS 37

MATERNAL RISK FACTORS FOR NEC IN PREMATURES INFANTS WITH GA UNDER 28 WEEKS

G. Olariu[1], L. Olariu[2], S. Olariu[1], M. Tunescu[2]

[1]Neonatology Department, Municipal Emergency Hospital Timisoara, Timisoara, Romania

[2]Louis Turcanu Children's Hospital Timisoara, Timisoara, Romania

AIM
To identify maternal risk factors predictive for NEC in prematures infants with GA under 28 weeks.
PATIENTS AND METHODS
The study was retrospective and we included 988 newborn in five years (2010-2014) with GA under 28 weeks, from nine level III Centers from Romania. The predictive factors that we studied were: chorioamnionitis, prolonged rupture of membranes more than 18 hours, pregnancy-induced hypertension, eclampsia, maternal diabetes, antepartum hemorrhage, antenatal corticosteroids, type of birth, place of birth as possible factors involved in the development of NEC.
RESULTS
The incidence of NEC was 10.4% and the maternal predictive factors involved were statistically analyzed by multiple regression. The identifiers, in order of significance, were: the lack of antenatal steroids (p = 0.001), birth outside the center (p = 0.002), eclampsia (p = 0.03), prolonged rupture of membranes > 18 hours (p = 0.02).
The factors not involved in NEC were: chorioamnionitis (p = 0.15), antepartum hemorrhage (p = 0.37), maternal diabetes (p = 0 40), type of births (p = 0.19), maternal hypertension (p = 0.16).
CONCLUSIONS
The key to prevent NEC is to reduce premature birth. In our study, born outside the center without maternal corticosteroid administration needs a rigorous control of infections.

ABS 38

DOES DELAYED PASSAGE OF MECONIUM AND LOWER FREQUENCY OF STOOLS PRECEDE DEVELOPMENT OF NECROTISING ENTEROCOLITIS?

E. Lilja, K. Sandberg, A. Elfvin

Department of Pediatrics, Division of Clinical Sciences, Sahlgrenska Academy, Gothenburg University, Gothenburg, Sweden

INTRODUCTION
Necrotising enterocolitis (NEC) is an acute ischemic necrotizing disease of the bowel that primarily affects preterm infants. Early stages of NEC have been linked to feeding intolerance and affected abdominal status. Early diagnosis is of great importance to minimize morbidity and mortality.
OBJECTIVE
To evaluate whether preterm infants who develop NEC have early signs of affected gastrointestinal motility compared to controls.
PATIENTS AND METHODS
A retrospective study of 83 infants born before gestational week 28^{+0} and treated at the NICU at the Queen Silvia Children's Hospital in Gothenburg, Sweden. The NEC group (n = 39) was diagnosed according to modified Bell's staging criteria ≥ 2A, and the controls (n = 44) were preterm infants not diagnosed with NEC. Age at passage of first stool was recorded. Data concerning feeding volume, gastric residuals and frequency of stools were recorded from the day of NEC diagnosis and 6 days prior. As average age at NEC diagnosis was 13 days, data from the controls were recorded from day 13 of life and 6 days prior.
RESULTS
There were no significant differences in gestational age (GA) or birth weight (BW) between the groups (**Tab. 1**). Feeding was initiated during the first day of life in the majority of the infants (85% NEC group, 89% controls), using human milk. The mortality rate was higher in the NEC group. Passage of first stool was significantly later in the NEC group compared to controls and the frequency of stools was significantly lower on the day of NEC diagnosis and 6 days prior compared to the control group (day 7-13). There was no significant difference in the volume or frequency of gastric residuals between the groups. The NEC group had a lower feeding volume during the studied period compared to the control group.

Table 1 (ABS 38). Main characteristics of the two groups.

Category	NEC group (n = 39)	Control group (n = 44)	p-value
GA w (mean ± SD)	25.0 ± 1.3	25.4 ± 1.3	n.s.
BW g (mean ± SD)	770.4 ± 183	818.6 ± 213.4	n.s.
Sex (M/F)	20/19	23/21	n.s.
Days to passing of first stool (mean ± SD)	4 ± 2.3	2.9 ± 1.8	0.012
Frequency of stool per day (mean ± SD)	1.8 ± 0.5	3.5 ± 0.4	< 0.001
Mortality	9/39	1/44	0.006

GA: gestational age at birth; BW: birth weight.

CONCLUSIONS

NEC patients born before gestational week 28^{+0} have a significantly delayed passage of meconium and significantly lower frequency of stools prior to NEC development compared to controls. It is unclear if this contributes to the development of NEC, or if it is an indication of early gut vulnerability.

ABS 39

THE EFFECT OF GESTATIONAL AGE ON THE CLINICAL PRESENTATION OF SEVERE NECROTISING ENTEROCOLITIS: A UK POPULATION STUDY

C. Battersby, S. Mandalia, N. Fitz-Simon, N. Modi

Imperial College, London, UK

INTRODUCTION

We conducted a comprehensive population-based study of neonatal necrotising enterocolitis (UK Neonatal Collaborative Necrotising Enterocolitis Study: UKNC-NEC). The National Neonatal Research Database (NNRD) holds detailed extracts from the Electronic Patient Record (EPR) of all infants admitted to National Health Service neonatal units. Here we address the null hypothesis that clinical and radiological signs indicative of NEC do not differ in relation to gestational age at birth.

PATIENTS AND METHODS

All neonatal units in England participated in UKNC-NEC. Clinicians were able to record predefined clinical and radiological signs (**Tab. 1**) in the EPR when an abdominal x-ray was obtained. We extracted data for infants who had severe NEC (defined as confirmed at surgery and/or post-mortem) between November 2011 and May 2014 from the NNRD. We used logistic regression to estimate the probability with advancing gestation of each clinical and radiological sign occurring in severe NEC and plotted corresponding smoothed curves to depict this visually. The underlying trend by gestational age, for each clinical and radiological sign, was assessed using the likelihood ratio test statistic (two tailed).

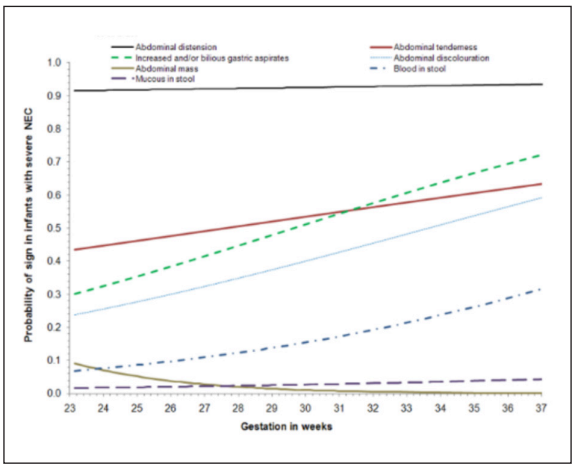
RESULTS

Clinical and radiological signs were recorded for 128 of a total of 529 infants with severe NEC in England during the 30 month study period. Abdominal distension was a near universal finding; abdominal mass, blood or mucous in stool, air in the liver, a fixed bowel loop and gasless abdomen

Table 1 (ABS 39). Prevalence of clinical and radiological signs in infants who had severe NEC.

	Number of infants (%) n = 128
Clinical signs	
Abdominal distension	118 (92.2)
Abdominal tenderness	64 (50.0)
Increased and/or bilious gastric aspirates	56 (43.8)
Abdominal discolouration	44 (34.4)
Abdominal mass	4 (3.1)
Blood in stool	16 (12.5)
Mucous in stool	3 (2.3)
Radiological signs	
Pneumatosis	68 (53.1)
Air in the liver	3 (2.3)
Pneumoperitoneum	36 (28.1)
Fixed bowel loop	10 (7.8)
Gasless abdomen	10 (7.8)

A.



B.

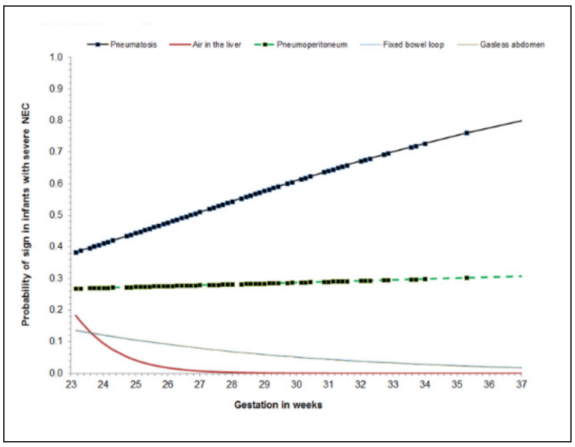


Figure 1 (ABS 39). Probability curves for clinical (**A**) and radiological (**B**) signs.

were uncommon, and occurred in 10 or less infants (**Tab. 1**). **Fig. 1** shows the smoothed probability curves for clinical (**Fig. 1A**) and radiological (**Fig. 1B**) signs. For increased and/or bilious aspirates and pneumatosis we identified a linear relationship with gestational age (% increase per week [95% confidence interval], bilious aspirates 14% [1% to 29%]; p = 0.036; pneumatosis 13% [1% to 30%]; p = 0.037).

CONCLUSIONS

Infants with NEC born at younger gestational ages are less likely than more mature infants to present with pneumatosis or increased and/or bilious aspirates. Given the rarity of severe NEC, a feared neonatal disease, improved diagnostic accuracy, a standardised case-definition, and international collaboration, are required to deliver studies with adequate statistical power to advance the prevention and treatment of this condition.

ABS 40

A STUDY OF IMPACT OF STANDARDISED FEEDING REGIME AND PROBIOTICS ON INCIDENCE AND SEVERITY OF NECROTIZING ENTEROCOLITIS IN PRE-TERM BABIES, A SINGLE CENTRE EXPERIENCE

K. Mansoor[1], A. Upasani[1], A. Minocha[1], O. Kazeem[2], R. Roy[2]

[1]Paediatric Surgery Department, Norfolk & Norwich University Hospital, NHS Foundation Trust, Norwich, UK

[2]Neonatology Department, Norfolk & Norwich University Hospital, NHS Foundation Tust, Norwich, UK

INTRODUCTION

Necrotizing enterocolitis (NEC) is the most common gastrointestinal emergency occurring in preterm infants. As survival of preterm infants has increased with improvement of neonatal intensive care, incidence of NEC has also increased. One of the major contributory factors is the type of feeding regime used in this population. The two relatively new developments in preterm infants feeding strategy is the use of standardised feeding regime (SFR) and probiotics. Both these interventions have been associated with a reduction in the incidence and severity of NEC. We studied the impact of these interventions over 3 time phases.

PATIENTS AND METHODS

This is a retrospective chart review of infants ≤ 36 weeks managed for NEC, at our hospital over three phases. We studied the incidence and severity of NEC over three phases in infant's ≤ 36 weeks of gestation. The first phase was from Jan. 2009 to Dec. 2010, which studied the incidence of NEC in pre-term infants whilst not on SFR or probiotics. The second phase was from Jun. 2011 to Dec. 2012, introduction of SFR. The third phase was from Jan. 2013 to Dec. 2014 when babies received both SFR and probiotics. All babies who were diagnosed and managed as NEC based on clinical or radiological diagnosis were included in the study. Patients referred from other hospitals were excluded. Patients labelled as advanced NEC signify the ones who's NEC progressed to require a surgical intervention.

RESULTS

In the first phase 671 preterm infants were admitted to NICU who didn't follow a SFR. 50 (7.45%) developed NEC out of which 21 (3.12%) developed advanced NEC. There were 7 deaths of which 5 were post-surgical intervention. In the second phase we had 575 preterm infants admitted to NICU and all were fed on a SFR. 35 (6.08%) went on to develop NEC out of which 5 (0.86%) had advanced NEC. There was no mortality in this phase. In the third phase 678 preterm infants were admitted to NICU who were fed on a SFR and received probiotics (Infloran®). 52 (7.66%) developed NEC out of which 9 (1.32%) had advanced NEC. 2 infants with advanced NEC died in this phase (**Tab. 1**).

CONCLUSIONS

Based on our results we conclude that a non-structured feeding regime resulting in inadvertent rapid advancement of enteral feeds may significantly contribute to an increased incidence of NEC. Introduction of SFR has reduced the incidence and has significantly decreased the rate of advanced NEC by nearly four-fold. The introduction of probiotics along with SFR did not have any further significant impact on either the incidence or the severity of NEC in our study group.

Table 1 (ABS 40). Rate of NEC in preterm infants during 3 time phases at Norfolk & Norwich University Hospital (NNUH).

NEC	1st (n = 671)	2nd (n = 575)	3rd (n = 678)
Med NEC, n (%)	50 (7.45)	35 (6.08)	52 (7.66)
Advanced NEC, n (%)	21 (3.12)	5 (0.86)	9 (1.32)
NEC-related death, n (%)	7 (1.04)	0 (0)	2 (0.29)
Total NEC, %	7.45	6.08	7.66

ABS 41

EARLY POSTNATAL HYDROCORTISONE FAILS TO PROTECT AGAINST NECROTIZING ENTEROCOLITIS IN PRETERM PIGS

P.S. Worsøe[1], T. Skeath[2], M.M. Birck[1], T. Thymann[1], P.T. Sangild[1]

[1]Comparative Pediatrics and Nutrition, Department of Veterinary Clinical and Animal Sciences, University of Copenhagen, Copenhagen, Denmark

[2]Neonatal Department RVI Hospital, Newcastle, UK

INTRODUCTION

Postnatal corticosteroids are used in preterm infants to prevent hypotension and chronic lung disease but it may also induce gut maturation and improved necrotizing enterocolitis (NEC) resistance. Potential adverse side effects are impaired growth, brain damage and immunosuppression but low-dose, physiological hydrocortisone (HC) could be less detrimental than high-dose dexamethasone. We hypothesized that early low-dose HC treatment would help organ adaptation, and reduce NEC, without adverse effects.

PATIENTS AND METHODS

Preterm caesarean-delivered pigs were treated for 4 days twice daily with decreasing doses of intra-arterial HC 6 to 2 mg/kg/day (n = 19) or an equivalent dose of sterile saline (CON, n = 19). Over the same time pigs were fed increasing doses of infant formula (0-80 mL/kg/d) together with parental nutrition. The clinical state, including respiratory function and blood pressure, blood biochemistry and hematology was monitored. On day 5, pigs were euthanized, organs weighed, lung volume measured and the gut was evaluated for macroscopic NEC lesions.

RESULTS

More diarrhea and feeding intolerance were observed in CON pigs ($p < 0.05$) while no other of the measured clinical parameters differed between groups. Growth and relative organ weights were similar, except for a smaller spleen ($p < 0.05$) in the HC group. A high incidence of NEC lesions was present in both groups (HC = 17/19, 89% vs. CON = 15/19, 79%) but small intestinal NEC-like lesions were more frequent in HC pigs (16/19, 84% vs. 9/19, 47%; $p < 0.05$). These HC pigs also showed transient hypoxia shortly after birth (oxygen saturation < 90%, up to 6 h after birth), although this disappeared within the first day of life.

CONCLUSIONS

Early postnatal HC treatment did not improve NEC resistance, respiration or cardiovascular function in formula-fed preterm pigs. Postnatally, HC treatment may be beneficial only following hypotension or chronic lung disease. The HC-related small intestinal NEC-lesions and reduced spleen weight deserve further study but could reflect negative effects of HC on intestinal barrier function and systemic immunity.

ABS 42

FECAL MICROBIOTA TRANSPLANTATION DECREASES NECROTIZING ENTEROCOLITIS BUT IS ASSOCIATED WITH INCREASED NEONATAL MORTALITY IN PRETERM PIGS

L. Martin, M.S. Cilieborg, M.M. Birck, T. Thymann, P.T. Sangild

Comparative Pediatrics and Nutrition, University of Copenhagen, Copenhagen, Denmark

INTRODUCTION

Necrotizing enterocolitis (NEC) remains a common gastrointestinal disease in preterm infants. Inappropriate bacterial colonization of the gut, together with enteral formula feeding, predispose to NEC in both preterm infants and preterm pigs. Regardless, it remains unclear how and when to manipulate the gut microbiota (e.g. by use of pre-, pro- or antibiotics) to improve mucosal immunity and NEC resistance. We hypothesized that fecal microbiota transplantation (FMT) to neonatal preterm pigs would support their initial gut colonization and thereby reduce formula-induced NEC development.

PATIENTS AND METHODS

Fifty-eight caesarean-delivered preterm pigs were fed slowly increasing volumes of a preterm formula (3 to 15 mL/kg/3 h until 5 days after birth). Pigs were randomly allocated into a control group (CON; n = 30) or an FMT group (n = 28), receiving homogenized colon contents pooled from five 14 day-old, healthy suckling pigs. The transplant was given as gastric and rectal administration of 10^9 CFU bacteria twice daily on day 1 and 2. Clinical condition, body temperature and diarrhoea (score 1-7) were recorded daily. Pigs were euthanized on day 5 and macroscopic NEC lesions in the stomach, intestine and colon were recorded (score 1-6), together with parameters of intestinal function.

RESULTS

Diarrhoea score increased in both groups with age but tended to be lower in FMT pigs (3.9 vs. 5.4 on day 4; $p < 0.05$) and with a lower frequency of bloody stools (0 vs. 5 pigs; $p = 0.08$). FMT pigs showed reduced NEC incidence on day 5 (18 vs. 60%; $p < 0.01$), and NEC lesion scores were reduced particularly in colon (1.5 vs. 3.1; $p < 0.01$). FMT pigs showed less gastric residual after a test meal on day 5 (19 vs. 27 g; $p < 0.05$) and lower gastric acidity (pH 4.7 vs. 4.0; $p < 0.05$). Intestinal lactase, maltase and DPPIV activities were increased in the FMT group ($p < 0.05$). Spontaneous mortality and euthanasia prior to day 5 (due to poor clinical condition) occurred more often in FMT pigs (11 vs. 4 pigs during first 3 days; $p < 0.05$). The clinical condition and autopsy of these FMT pigs indicated that sepsis was part of the clinical complications observed for preterm pigs during the first days after FMT.

CONCLUSIONS

Use of FMT just after preterm birth improves NEC resistance and intestinal function in pigs, but may also increase mortality, potentially due to early excessive bacterial colonization and sepsis. Further research on the optimal dosage, route and timing of transplantation is required to balance the proposed benefits and potential harm of enhanced development of gut bacterial colonization, digestive function and immunity in preterm neonates by FMT.

ABS 43

TRANSCRIPTOMICS PROFILING OF HUMAN NECROTIZING ENTEROCOLITIS

E. Tremblay[1], M.P. Thibault[1], E. Ferretti[2], C. Babakissa[3], V. Bertelle[4], M. Bettolli[5], K. Burghardt[6], J.F. Colombani[7], D. Grynspan[8], E. Levy[9], S. Mayer[10], D. Ménard[1], O. Mouterde[11], I.B. Renes[12], E.G. Seidman[13], J.F. Beaulieu[1]

Research Consortium on Child Intestinal Inflammation:

[1]Department of Anatomy and Cell Biology, CHUS, Sherbrooke, QC, Canada

[2]Division of Neonatology, Department of Pediatrics, CHEO, Ottawa, ON, Canada

[3]Department of Pediatrics, CHUS, Sherbrooke, QC, Canada

[4]Division of Neonatology, Department of Pediatrics, CHUS, Sherbrooke, QC, Canada

[5]Department of Pediatrics, CHU de Martinique, Fort-de-France, France

[6]Division of Gastroenterology, Hepatology & Nutrition, CHEO, Ottawa, ON, Canada

[7]Department of Medical Pediatrics, CHU de Rouen, Rouen, France

[8]Department of Pathology and Laboratory Medicine, University of Ottawa, Ottawa, ON, Canada

[9]Département de Nutrition, Centre de Recherche, CHU Sainte-Justine, Université de Montréal, Montréal, QC, Canada

[10]Department of Surgery, CHEO, Ottawa, ON, Canada

[11]Department of Surgery, CHUS, Sherbrooke, QC, Canada

[12]Division of Neonatalogy, Department of Pediatrics, Erasmus MC-Sophia, Rotterdam, the Netherlands

[13]Department of Gastroenterology, McGill University, Montréal, QC, Canada

INTRODUCTION

Necrotizing enterocolitis (NEC) is the most frequent life-threatening gastrointestinal disease experienced by premature infants in neonatal intensive care units. The challenge for neonatologists is to detect early clinical manifestations of NEC. One strategy would be to identify specific markers that could be used as early diagnostic tools to identify preterm infants most at risk of developing NEC or just at the onset of the disease. As a first step in this direction, we sought to determine the specific gene expression profiles in NEC.

PATIENTS AND METHODS

Next-generation sequencing (RNA-seq) was used to establish gene expression profiles in ileal samples obtained from preterm infants diagnosed with NEC and non-NEC conditions. The prepared libraries were then sequenced using Illumina®'s HiSeq 2000 to obtain 50-bp single-end reads. The RNA-Seq data were mapped to the hg19 reference genome using TopHat for Illumina® (v. 1.5) with default options. Assembly of transcripts and estimation of their abundance (FPKM: fragments per kilobase of exon per million fragments mapped) were calculated using Cufflinks software (v. 0.0.6). We used the program Cuffdiff (v. 0.0.7) to test for differential transcript expression between CTRL and NEC ($p < 0.05$). Data were analyzed with Ingenuity® Pathway Analysis (IPA) and ToppCluster software.

RESULTS

IPA and ToppCluster analyses indicated that the most significant functional pathways over-represented in NEC neonates were associated with innate immune functions, such as altered T and B cell signaling, B cell development, the role of pattern recognition receptors in the recognition of bacteria and viruses, and lymphocyte and leukocyte migration, establishing a basis signature of biological functions associated with NEC. Among the genes that were strongly modulated in NEC neonates, we identified genes known to be involved in the inflammatory processes, innate immunity and antimicrobial responses: CXCL10, TLR4, TLR10, DEFA5, DEFA6, REG3A,

LCN2, TFF3, HBA2 and HBG2. Taken together, these gene expression profiling results suggest that specific alterations in the intestinal innate immune response could contribute to the NEC pathogenesis.

CONCLUSIONS

In summary, our results revealed a predominantly altered innate immune response in the intestine of NEC neonates. Gene expression profile analysis led to the identification of several differentially expressed genes in intestinal samples of premature infants affected with NEC that could be of clinical interest as potential biomarkers for the prediction of the disease and its diagnosis.

Nutrition of the Very Preterm

ABS 44

CURRENT ESPGHAN RECOMMENDATIONS FOR PRETERM PARENTERAL NUTRITION – A RECIPE FOR SEVERE BIOCHEMICAL DISTURBANCES?

S. Mulla[1], S. Cowey[1], R. Close[1], S. Pullan[1], R. Howe[2], J. Jones[1], L. Radbone[2], P. Clarke[2]

[1]Neonatal Unit, Norfolk and Norwich University Hospitals NHS Foundation Trust, Norwich, UK

[2]East of England Neonatal Operational Delivery Network, UK

INTRODUCTION

ESPGHAN currently recommends up to 4 g/kg/day of amino acids and a Ca^{2+}:PO_4 ratio within the range of 1.3-1.7:1 for preterm parenteral nutrition (PN). Accordingly, East of England regional NICUs introduced a new PN formulation in early 2013. Post-implementation, we noted frequent cases of severe hypercalcaemia and/or hypophosphataemia during the first postnatal week. Our hypothesis was that the electrolyte disturbances were secondary to the 'placental interrupted feeding syndrome'. We therefore instituted a workaround: the bespoke addition of extra PO_4 to match Ca^{2+} in an equimolar (1:1) ratio. We report first-week biochemistry in epochs before and after extra PO_4 supplementation.

PATIENTS AND METHODS

Casenotes, PN charts, and serum biochemistry results were reviewed retrospectively for all preterm infants who received first-week PN in two discrete 6-month epochs: Phase 1 was May-Dec 2013 (before addition of extra PO_4) when a Ca^{2+}:PO_4 ratio of 1.3-1.4:1 was delivered; Phase 2 was Dec 2013-May 2014, the period of ad-hoc increased PO_4 supplementation to achieve a Ca^{2+}:PO_4 ratio of 1.0:1. The PN recipe was otherwise unchanged across epochs with Ca^{2+} content 1.7 mmol / 100 mL. We assessed the incidence and severity of biochemical derangements in the first postnatal week. We defined severe hypercalcaemia as serum Ca^{2+} > 3.0 mmol/L, hypophosphataemia as PO_4 < 1.5 mmol/L, severe hypophosphataemia as PO_4 < 1.0 mmol/L and hypokalaemia as < 3.5 mmol/L. We analysed by intention to treat (supplement).

RESULTS

Baseline characteristics in the two phases, including amino acid intakes, were similar. **Tab. 1** shows median (range) first-week serum Ca^{2+}, PO_4 and K^+ concentrations and numbers of infants with deranged biochemistry in the two phases.

Table 1 (ABS 44). First-week serum Ca^{2+}, PO_4 and K^+ concentrations and deranged biochemistry in the two phases.

	Phase 1 n = 51	Phase 2 n = 49	p-value
Calcium			
Peak Ca^{2+} concentration, mmol/L	3.05 (2.67-3.73)	2.84 (2.20-3.15)	< 0.0001
Ca^{2+} > 3.0 mmol/L, n	31 (61%)	11 (22%)	0.0001
Phosphate			
Nadir PO_4 concentration, mmol/L	1.37 (0.43-1.98)	1.59 (0.59-2.62)	0.004
PO_4 < 1.5 mmol/L, n	31 (61%)	11 (22%)	0.0001
PO_4 < 1.0 mmol/L, n	17 (33%)	7 (14%)	0.04
Potassium			
Nadir K^+ concentration, mmol/L	3.5 (2.7-5.0)	3.6 (2.7-4.9)	0.22
K^+ < 3.5 mmol/L, n	23 (45%)	12 (24%)	0.03

Data are median (range).

CONCLUSIONS

Introduction of a PN recipe meeting current ESPGHAN guidelines led to severe first-week hypercalcaemia/hypophosphataemia in most infants in our NICU. Giving extra PO_4 from day 1 of PN to achieve a 1:1 Ca^{2+}:PO_4 ratio helps to avoid the severe biochemical disturbances as seen with the 'refeeding syndrome'. An equimolar Ca^{2+}:PO_4 ratio appears preferable for achieving the amino acid intakes requisite for growth in the vital first postnatal days.

ABS 45

GROWTH AND NUTRITIONAL BIOMARKERS OF PRETERM INFANTS FED A NEW POWDERED HUMAN MILK FORTIFIER: A MULTICENTER, RANDOMIZED, CONTROLLED, DOUBLE-BLIND CLINICAL TRIAL

J. Spalinger[1], J.-M. Hascoët[2], C. Billeaud[3], J.-C. Picaud[4], F. Mosca[5], A. Rubio[6], E. Saliba[7], M. Radkë[8], U. Simeoni[9], B. Guillois[10], P. Steenhout[11], J. Jaeger[11], L. Ameye[12], N.P. Hays[13], J. Rigo[14]

[1]Children's Hospital of Lucerne, Lucerne, Switzerland

[2]Maternité Régionale, Nancy, France

[3]CIC 005 Pediatrique INSERM, Centre Hospitalier Universitaire (CHU) de Bordeaux, Bordeaux, France

[4]Hôpital de la Croix Rousse, Hospices Civils, Lyon, France

[5]Università degli Studi di Milano, Milan, Italy

[6]Hôpital Couple Enfant, CHU de Grenoble, Grenoble, France

[7]Hôpital Clocheville, CHU de Tours, Tours, France

[8]Klinikum Ernst von Bergmann, Potsdam, Germany

[9]AP-HM & Aix-Marseille University, Marseille, France

[10]Hôpital Clemenceau, CHU de Caen, Caen, France

[11]Nestlé Clinical Development Unit, Lausanne, Switzerland

[12]Nestlé Nutrition R&D, Vevey, Switzerland

[13]Nestlé Nutrition R&D, King of Prussia, PA, USA

[14]University of Liège, Liège, Belgium

INTRODUCTION

Human milk is beneficial for preterm infants, but lacks sufficient nutrients to support adequate growth and bone mineralization; thus fortification is essential. Our primary objective was to assess growth of preterm infants fed human milk (HM) supplemented with a new powdered HM fortifier (nHMF) containing 8.3 g protein/100 kcal (partially hydrolyzed whey), 4.0 g fat/100 kcal (99% medium-chain triglycerides plus DHA), 8.4 g carbohydrate (CHO)/100 kcal, and higher micronutrients, or a powdered commercial HMF (cHMF) with 5.8 g protein/100 kcal (extensively hydrolyzed whey), 0.1 g fat/100 kcal, 19 g CHO/100 kcal, and lower micronutrients. Biomarkers of nutritional status and gut inflammation were assessed.

PATIENTS AND METHODS

Clinically stable preterm infants (n = 153) with birth weight ≤ 1,500 g or gestational age ≤ 32 weeks were randomized to receive nHMF (n = 77) or cHMF (n = 76). Study was conducted at 11 sites in Europe. HM + HMF was fed enterally until neonatal unit discharge or medical decision (minimum 21 days). Infant weight was measured daily; length and head circumference (HC) were measured weekly, with z-scores calculated using the Fenton preterm growth reference. Primary outcome was weight gain (g/day) from day 1 (full-strength fortification with volume intake of 150-180 mL/kg/day) until day 21 ± 3. Weight gain was evaluated for both non-inferiority (margin = -1 g/d) and superiority (margin = 0 g/d) in nHMF vs. cHMF. Protein and bone metabolic status and gut inflammation were assessed by blood and fecal biochemistries.

RESULTS

Adjusted mean weight gain (using ANCOVA) was 2.3 g/d greater in nHMF vs. cHMF (intent-to-treat, n = 150); the lower limit of 95% CI (0.4 g/d) exceeded both non-inferiority ($p < 0.001$) and superiority margins ($p = 0.01$). Per-protocol analysis (n = 139) confirmed the results. Weight gain rate was 18.3 (nHMF) and 16.8 g/kg/d (cHMF) between days 1-21; day 21 weight-for-age z-score was greater in nHMF vs. cHMF (**Tab. 1**). While length and HC gains between days 1-21 were not different, HC z-score at week 40 corrected age was greater in nHMF vs. cHMF ($p = 0.003$). The nHMF group had higher serum BUN, pre-albumin, alkaline phosphatase, calcium (all within normal ranges) ($p < 0.001$, 0.02, 0.02, 0.02) and DHA in red blood cell phosphatidylethanolamine ($p = 0.02$), and lower fecal α-1 antitrypsin (gut inflammation marker) ($p = 0.01$) at day 21 vs. cHMF. Both HMFs were well tolerated with similar incidence of GI adverse events.

Table 1 (ABS 45). Day 21 weight-for-age z-scores (ANCOVA model, ITT population).

	Estimate	SE	95% CI	p-value
cHMF	-0.97	0.07	-1.10, -0.84	
nHMF	-0.85	0.07	-0.98, -0.71	
nHMF – cHMF	0.12	0.05	0.03, 0.22	0.013

ITT: intent-to-treat; SE: standard error; CI: confidence interval; cHMF: commercial human milk fortifier; nHMF: new powdered human milk fortifier.

CONCLUSIONS

Findings of non-inferiority and superiority of the new HMF vs. commercial HMF for weight gain velocity suggest improving the nutrient profile of human milk fortifier can enhance growth of preterm infants. Results also indicate feeding human milk supplemented with the new HMF may lead to favorable differences in markers for protein status, bone metabolism, and gut health. These outcomes support the safety and nutritional benefits of the new HMF.

ABS 46

ULTRAVIOLET-C IRRADIATION OF DONOR HUMAN MILK IMPROVES GROWTH, INTESTINAL FUNCTION AND SYSTEMIC IMMUNITY IN PRETERM PIGS

Y. Li[1], D.N. Nguyen[1], M. de Waard[2], A.M. Bojesen[3], T. Thymann[1], S.B. Bering[1], P.T. Sangild[1]

[1]*Comparative Paediatrics and Nutrition, University of Copenhagen, Copenhagen, Denmark*

[2]*Dutch Human Milk Bank, VU University Medical Center, Amsterdam, the Netherlands*

[3]*Department of Veterinary Disease Biology, University of Copenhagen, Copenhagen, Denmark*

INTRODUCTION

Donor human milk (DM) for preterm infants is usually Holder pasteurized (HP, 62.5°C for 30 min) to eliminate transmissible contaminants, but this may also destroy many milk bioactive factors. Ultraviolet-C irradiation (UVC) and HP treatment have shown similar efficacy to remove bacteria from DM, while UVC better preserves bile-salt stimulated lipase and alkaline phosphatase (ALP) activities, and helps to maintain immunoglobulin, lactoferrin (LF) and lysozyme levels in DM compared with HP. We hypothesized that UVC-treated DM stimulates intestinal maturation, diarrhoea resistance and systemic immunity in preterm pigs, used as a model for preterm infants.

PATIENTS AND METHODS

Sixty litres of DM (Danish Donor Milk Bank, Hvidovre Hospital, Denmark) were pooled and divided into three aliquots that received no treatment (raw milk, RM), HP or UVC treatment. Fifty-seven caesarean-delivered preterm pigs received increasing volumes of RM, HP or UVC treated DM (n = 19 each, 24-120 mL/kg/d on days 1-5, 144 mL/kg/d on days 6-8). Parenteral nutrition was administered throughout the study period with the same dosage and composition to each group to supplement fluid and nutrient intake. Pigs were euthanized on day 8 for collection of blood and organs. The main outcome parameters were growth, diarrhoea, necrotizing enterocolitis (NEC), intestinal function, and bacteria in blood and bone marrow.

RESULTS

HP and UVC reduced the bacterial density (cfu/mL) from 6×10^5 in RM to 9×10^3 and 7×10^2, respectively. HP abolished milk lipase and ALP activities, and reduced the level of LF by 50%, while UVC maintained levels similar to RM. During the last days of the experiment, weight gain was reduced in HP pigs, relative to RM and UVC pigs ($p < 0.05$). Only on day 5, diarrhoea incidence increased in HP pigs relative to RM ($p < 0.05$), with a similar trend relative to UVC pigs ($p = 0.10$). Osteomyelitis incidence (bacteria present in bone marrow) was higher in HP vs. UVC pigs (68 vs. 28%, $p < 0.05$) while presence of bacteria in blood was similar among groups (33% across all groups). Intestinal NEC, nutrient absorptive capacity and permeability did not differ, while distal intestinal aminopeptidase N activity was higher in UVC pigs than RM pigs ($p < 0.01$), and tended to be higher than HP pigs ($p = 0.07$).

CONCLUSIONS

UVC treatment effectively reduced the bacterial contamination of RM and preserved bioactive factors in DM, relative to HP. UVC-treated DM improved weight gain and peptidase activity, and reduced systemic infections in preterm pigs. UVC may be used as a novel technology to pasteurize DM and limit the breakdown of bioactive milk factors that may be important for intestinal maturation, bacterial resistance and systemic immunity in preterm infants.

Obesity and risk factors for cardiovascular diseas

ABS 47

CIRCULATING SALICYLIC ACID IN OBESE CHILDREN: ASSOCIATION WITH FRUIT AND VEGETABLE CONSUMPTION

E. Verduci, C. Lassandro, B. Mariani, M. Brambilla, G. Radaelli, G. Banderali

Department of Pediatrics, San Paolo Hospital, Department of Health Sciences, University of Milan, Milan, Italy

INTRODUCTION

Salicylates are widely distributed throughout the plant kingdom, including fruits and vegetables (FV). It has been suggested that beneficial effects of consuming FV may be due, in part, to salicylates. A study performed on young adults showed that circulating salicylic acid (SA) was significantly related to FV consumption. Moreover, treatment with salicylates seems to reduce blood glucose and glycated haemoglobin levels. Studies are lacking in pediatric age. The aim of this study was to evaluate the association between salicylaemia levels and daily consumption of FV in obese children.

PATIENTS AND METHODS

Fourty-four obese children (25 girls and 19 boys, mean age [SD] 10.2 [2.1] y) entered the study. Obesity was defined according to International Obesity Task Force. BMI Z-scores were calculated. Exclusion criteria comprised chronic or acute therapies with anti-inflammatory drugs. Parents recorded children's food intake for 3 days to evaluate dietary consumption and, especially, FV intake. Blood pressure was measured. Fasting blood glucose, insulin and lipids were measured. Insulin resistance and insulin sensitivity were evaluated by HOMA (Homeostasis Model Assessment) and QUICK (Quantitative Insulin-Sensitivity Check) indexes, respectively. SA serum concentration (salicylaemia) was measured using a gas chromatography coupled to mass spectrometry (GC-MS) method.

RESULTS

In obese children BMI z-score was 2.2 [0.4] and salicylaemia was 0.11 [0.08] μmol/l. Salicylaemia was not associated with mean daily FV consumption. No significant association was observed between salicylaemia and dietary intake of SA. A positive association between salicylaemia and QUICK index ($p = 0.039$) and a negative association between salicylaemia and HOMA index ($p = 0.039$) were shown. Salicylaemia was negatively associated with systolic blood pressure ($p = 0.002$). No association between salicylaemia and blood lipids was observed. FV consumption was associated neither with glucose metabolism indicators (blood glucose, insulin, HOMA index and QUICK index) nor with blood lipids, except for a positive association between fruit intake and blood HDL Cholesterol levels ($p = 0.049$).

CONCLUSIONS

In this study salicylaemia was not associated with mean daily FV consumption. Salicylaemia was positively associated with insulin sensitivity. However, lack of association between salicylaemia and dietary intake of SA could be due to probable simplification of reporting and imprecision in dietary recording in obesity condition. Further studies are needed to verify the association between salicylaemia and fruits and vegetables intake in children.

Perinatal growth

ABS 48

PRE- AND POSTNATAL GROWTH RESTRICTION IS A RISK FACTOR FOR SEVERE RETINOPATHY OF PREMATURITY DEPENDENT ON GESTATIONAL AGE AT BIRTH

S. Klevebro[1], P. Lundgren[2], U. Hammar[1], L. Smith[3], M. Domellöf[4], M. Bottai[1], B. Hallberg[1], C. Löfqvist[2], A. Hellström[2]

[1]*Karolinska Institute, Stockholm, Sweden*

[2]*Institute of Neuroscience and Physiology, Sahlgrenska Academy at University of Gothenburg, Gothenburg, Sweden*

[3]*Department of Ophthalmology, Boston Children's Hospital, Harvard Medical School, Boston, MA, USA*

[4]*Department of Clinical Sciences, Paediatrics, Umeå University, Umeå, Sweden*

INTRODUCTION

Retinopathy of prematurity (ROP) is a potentially blinding disease affecting preterm infants. Gestational age (GA) at birth and birth weight (BW) are major risk factors for ROP. In this study we aim to describe the relationship between postnatal weight development and severe ROP in correlation to GA at birth.

PATIENTS AND METHODS

In total 1,956 infants born at GA < 29 weeks (wks) were eligible from six cohorts of preterm infants: Swedish (EXPRESS) (n = 492), North American (n = 976), Boston (n = 177), Gothenburg 1 (n = 87), Stockholm (n=154) and Gothenburg 2 (n = 70). Data was retrieved regarding GA at birth, BW, gender, maximum ROP stage and weekly weight measurement until 36 wks postmenstrual age

(PMA). Weight standard deviation scores (WSDS) were calculated with a Swedish gender specific reference. Mixed effects model was used calculating differences in weight development between infants developing severe ROP (ROP Stages 3-5) or no ROP at all.

RESULTS

In infants born at GA ≤ 23 wks there was no significant difference in postnatal WSDS between infants developing severe ROP or no ROP. In infants born at GA 24 wks there were significant differences from PMA 33 wks and onwards. In infants born at GA 25 wks a significant difference detected at 27 wks PMA (0.3 WSDS; $p < 0.05$) increased to 0.8 WSDS at 36 wks PMA ($p < 0.001$). In infants born at GA 26-28 wks, significant differences were found in birth weight SDS. In infants born at GA 26 wks the difference increased from 0.6 WSDS at birth to 0.9 WSDS at 36 wks PMA. In infants born at GA 27 wks the difference initially decreased from 1.3 WSDS at birth to 1.0 WSDS at 31-32 wks PMA followed by an increase back to 1.3 WSDS at 36 wks PMA. In infants born at GA 28 wks the difference decreased from 1.6 WSDS at birth to 1.2 WSDS at 32-34 wks PMA followed by a slight increase to 1.3 WSDS at 36 wks PMA (**Fig. 1**).

CONCLUSIONS

Infants who develop severe ROP have worse postnatal growth compared to infants with no ROP. In more mature preterm infants the weight differences are statistically significant at birth. In the most immature preterm infants this difference develops over time.

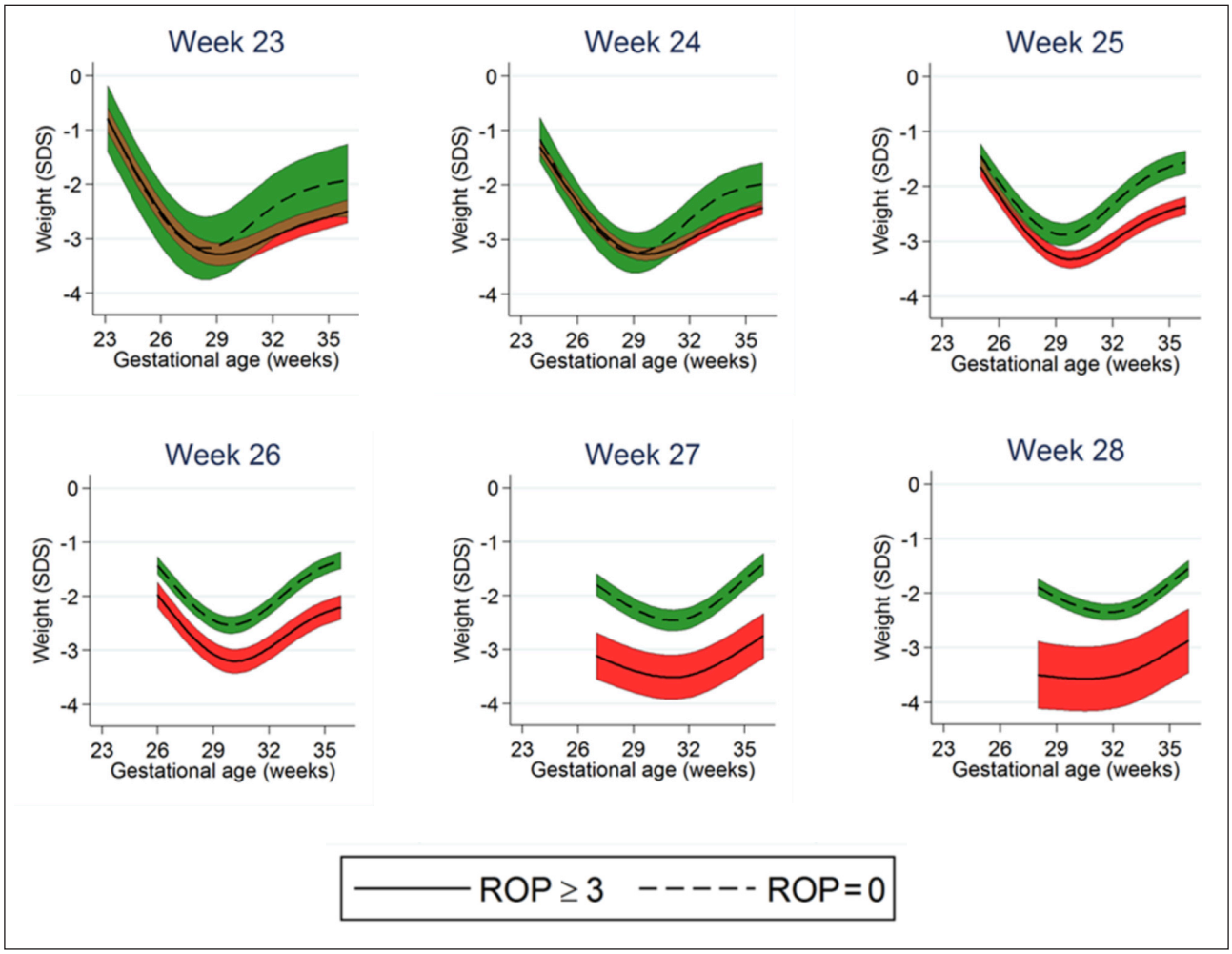


Figure 1 (ABS 48). Postnatal growth in preterm infants born at < 29 weeks of gestational age with and without retinopaty of prematurity (ROP).