25 EFFECT OF NON NUTRITIVE SUCKING (NNS) ON ENERGY, NITROGEN AND FAT BALANCE IN PRETERM INFANTS

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NNS by an infant is sucking on a dummy. The effect of NNS on Energy (E), Fat (F) and Nitrogen (N) balances was studied in 10 preterm infants with birthweight and gestation (M±SD) of 1111±189 g, 28.8±2.3 weeks between 7-89 day of life. All infants were well, gaining weight and fed by tube at 2 hourly intervals. Each baby received a 3 day period of conventional feeding (control period: CP) and a 3 day period during which infants were encouraged to suck a dummy for the duration of feed (NNS). Starting allocation to C.P. or NNS was randomized. 6 infants were fed with expressed breast milk (EBM) and 4 with a preterm formula (P.F.). No significant difference was observed in the 10 infants between C.P. and NNS periods in the E intake (131±24 vs 129±20 Kcal/kg/d), Metabolizable E (110±24 vs 105±19 Kcal/kg/d); N intake (520±112 vs 501±107 mg/kg/d), N Retention (336±68 vs 336±83 mg/kg/d); F intake (6.2± 1.0 vs 6.1±0.9 g/kg/d); F absorption coefficient (80±7 vs 78±11%). No significant difference was observed considering individually EBM and P.F. fed infants. NNS does not improve F absorption or N or E retention.

26 ORAL L-CARNITINE SUPPLEMENTATION IN LOW-BIRTH-WEIGHT NEONATES MAINTAINED ON POOLED MILK

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As the carnitine /C/ content of human milk declines during lactation, it is doubtful, that its amount is adequate to statisfy the daily needs of premature infants fed with pooled milk. Effects of supplementation have been studied in 2o AGA premature infants /weight at birth 12oo to 18oo g; gest. age 28 to 34 wk/. Throughout 7 days, started at postnatal ages of 1o to 33 days, infants were fed exclusively with pooled human milk containing 3oo nmol/ml C as added supplement. Total, free and acyl C were significantly elevated in the plasma at the end of study with an increase in beta hydroxybutyrate /22.9±2.5 vs 38.4±3.9 umol/l, means±SEM, p < o.o5/ and a decrease in triglyceride /1.67±o.o8 vs 1.29±o.o7 mmol/l, p < o.oo1/ and urea levels /1.72±o.o9 vs 1.36±o.o7 mmol/l, p < o.oo5/. In the urine both fractions of C significantly increased at the end of study as compared to presupplementary control days. Urinary excretion of total nitrogen /77.3±6.7 vs 62.4±2.4 mg/kg/day, p < o.o5/ and urea /1.88±o.11 vs 1.25± o.o9 mmol/kg/day, p < o.oo5/ decreased. The present data suggest, that improved carnitine availability resulted in increased fat oxidation, utilization of amino acids/proteins decreased. It is suggested, that the nutritional value of pooled milk for low-birth-weight infants should be reconsidered because its low carnitine content.

27 POSTHEPARIN PLASMA LIPOPROTEIN LIPASE AND CARNITINE IN SMALL-FOR-GESTATIONAL-AGE AND VERY-LOW-BIRTH-WEIGHT INFANTS.

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Lipropotein lipase (LPL) is the rate limiting enzyme for the hydrolysis of triglycerides in plasma lipoproteins whereas carnitine is essential for facilitated transport of long-chain free fatty acids across the mitochondrial membrane for oxidation. Postheparin lipolytic activity and fat tolerance tests suggest that LPL activity is low in very-low-birth-weight (VLBW) and small-for-gestational-age (SGA) infants. On the other hand, carnitine-free nutrition tends to reduce carnitine concentration in serum and urine of preterm infants.

With specific methods we measured postheparin plasma LPL activities and serum concentrations and urinary excretions of carnitine in 26 preterm infants. The infants had gestational ages of 26 to 35 weeks, birth weights of 840 to 2280 g, and SD-scores of -3.2 to +1.4. (SD-score indicates birth weight in SDs from the mean birth weight of the corresponding age group). Six infants were SGA (SD-score < -2.0) and 13 infants were VLBW (birth weight less than 1500 g). During the first days all infants received glucose intravenously, and also breast milk in increasing amounts.

LPL activity measured during the first week was independent of gestational age. However, LPL activity correlated positively with birth weight (r=0.67, p<0.001) and SD-score (r=0.65, p<0.001). LPL activity was lower (p<0.02) in VLBW infants (35.5 umol FFA/ml/h, SEM 2.4) than in infants weighing more than 1500 g (57.3 umol FFA/ml/h, SEM 7.2). LPL activity was lower (p<0.01) in SGA infants (30.5 umol FFA/ml/h; SEM 3.2) than in infants appropriate for gestational age (52.3 umol FFA/ml/h; SEM 5.2).

Serum carnitine concentration decreased from 32.0 (SEM 2.3) to 23.7 nmol/ml (SEM 1.6) during the first week of life and increased thereafter with increasing intake of carnitine from breast milk. When comparing SGA or VLBW infants with other preterm infants, serum carnitine concentrations at the age of seven days were found to be similar. However, urinary excretion of carnitine was larger (p<0.001) in SGA infants (750 nmol/mg of creatinine, SEM 200) than in other preterm infants (160, SEM 22).

In conclusion, postheparin plasma LPL activity in VLBW and SGA infants was lower than in other preterm infants. In addition, utilization of fat may be further impaired by the large excretion of carnitine in SGA infants.

28 THE EFFECT OF MEDIUM CHAIN TRIGLYCERIDE (MCT) DIET ON PLASMA LIPID LEVELS OF THE PREMATURE INFANT.

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The fatty acids of MCT are not deposited to any appreciable extent in fat stores and MCT diets diminish fat accretion in animals and probably in obese humans. No data are available in the newborn infant. Plasma levels of triglyceride (TG), cholesterol esters (ChE), free cholesterol (FCh), total cholesterol (TCh), phospholipids (PL), free fatty acids (FFA) and total lipids (TL), were measured weekly from the 2nd to the 5th week of postnatal age in two groups of premature AGA infants fed either own mother's milk (OMM) or medium chain triglyceride formula (MCTF). Energy and macronutrient (protein, fat, and CHO) balances and anthropometry were performed simultaneously. OMM (n=16) group and MCTF (n=20) group were comparable for birthweight: 1541 ± 55 vs. 1451 ± 41, grams and gestational age: 30.7 ± 0.4 vs. 30.9 ± 0.3, weeks (M ± SE).

Results: MCTF fed group showed significantly greater weight gain and significantly diminished skinfold thickness. Fluid and energy intakes and metabolizable energy were comparable in the two groups. Metabolizable CHO was higher in MCTF in Week 4 and metabolizable fat was higher in OMM in week 3, but otherwise there were no significant differences. Metabolizable protein intake was lower in the OMM group after the 4th week. Plasma lipid content was lower in MCTF in Week 3 and 4. The reduction of plasma triglycerides contributed most significantly to the lipid lowering effect of MCT diet (see table below).

Postnatal Age (wks)	2	3	4	5
OMM (mg/dl)	120.1 ± 20.8	121.2 ± 11.5	107.0 ± 11.4	101.2 ± 9.5
MCTF (mg/dl)	68.8 ± 7.6	63.7 ± 4.4*	74.6 ± 7.1*	70.4 ± 6.1*

M ± SE - * marked values are significantly different at p<0.05

Conclusions: 1) the main effect of the MCT diet is the reduction of the plasma triglycerides either by decreasing the synthesis of chylomicrons and/or the very low density lipoproteins in the liver and/or the small intestine. 2) the long-term consequences of this dietary change on the development of the premature infant and its impact on the lipid metabolism later in life deserves serious consideration

29 Fatty acid utilization of MCT containing fat emulsion in newborn infants.

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Medium-chain triglycerides(MCT)are applied mainly in enteral nutrition of newborn infants.As results of oxidative utilization of MCT after parenteral application have not yet been published,we investigated MCT oxidation in neonates using the ^{13}C trioctanoin breath test.We carried out 16 breath tests on 11 newborn patients between the first and the thirty-fifth day of life.The patients were nourished with 1,0-6,7g/kg/day glucose i.v.,1,0-2,3g/kg/day l-amino acids i.v.,1,0g/kg/day fat emulsion i.v.and 12-183ml/kg/day formula.They received parenterally 10mg/kg l-$^{13}C_3$ trioctanoin emulsified with Lipofundin MCT/LCT 10% R. The expired $^{13}CO_2$ resulting from fat oxidation was determined by the use of a ratio-mass-spectrometer.The amount of ^{13}C contained in the expired air gives the rate of the fatty acid oxidation. Within 8 hours between 31,6%and 89,6% of the applied tracer amount was oxidized.The fatty acid oxidation showed a significant negative correlation with simultaneous supply of carbohydrates (r=-0,95,p≤0,001).The oxidation rates of MCT were about twice as high as those of long-chain triglycerides.Because of their high energetic level MCT-containing fat emulsions are,in principle,also suitable for parenteral nutrition of newborn infants.The oxidative MCT utilization is apparently reduced by a high carbohydrate intake.Therefore,the simultaneous administration of carbohydrates must be considered during i.v.supply of MCT-containing fat emulsion.Further investigations are necessary before recommendation can be given for clinical application in neonates.

30 PREVENTION OF NEONATAL HYPOGLYCEMIA BY MEDIUM CHAIN TRIGLYCERIDES (MCT).

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In previous studies we showed that oral administration of lipids with 67% MCT results in a hyperglycemic response. In the present prospective investigation, we studied the prophylactic effect of these lipids on the prevention of neonatal hypoglycemia.Fifty one low birth weight neonates were included in the investigation before the postnatal age of 10 hours. All but 4 were small-for-gestational age.They were randomly allocated to a control group(n=23) or to a supplemented group (n=28).There was no significant difference for gestational age, birthweight or ponderal index.Feeding with banked human milk was similar in both groups.The study group was supplemented lipids with 67% MCT (3g/24h).Hypoglycemia (i.e. plasmaglucose lower than 1.72 mM) occurred during the first four days in 2/28 neonates of the supplemented vs 8/23 neonates of the control group (X^2 = 4.49 ; p< 0.05).Hypoglycemia occurred espacially on Day2 after inclusion in the study in the control group 5/23 vs 1/28 in the supplemented group(p< 0.01).The total number of hypoglycemic episodes was also higher in the control group(9/23) than in the supplemented group(2/28):p< 0.02.On the 2nd day of the study serum β-hydroxybutyrate was similar in the supplemented group (median:304µM =125-950) and in the control group(405µM=122-1080). These data suggest that lipids with 67% MCT can prevent hypoglycemia in the low birth
This result is observed without inducing a dangerous Ketosis.