● 696 POSTNATAL MATURATION OF HEPATIC BILE FORMATION IN THE RABBIT. Eldon A. Shaffer, D. Grant Gall. GI Research Unit, University of Calgary, Calgary, Alberta, Canada.

The ontogenesis of hepatic bile formation was studied in 4 groups of rabbits: suckling infants at ages 10-14, 18-22, and 26-30 days, and adults. Bile was collected directly from the common duct during three 1 h periods: a basal period followed by adding 1 and then 2 μmol/min/kg of glycodeoxycholic acid. ^{14}C-erythritol and ^{3}H-inulin clearances assessed canalicular bile flow and membrane permeability, respectively. Bile flow and bile salt secretion were significantly ($p<.001$) less in 10-14 d infants and progressively increased with increasing age. Bile flow was linearly related to bile salt secretion. Bile salt-dependent flow, the increment in flow per mass bile salt secreted (μl/μmol), was greater ($p<.01$) in the two youngest groups, 10-14 d (80) and 17-22 d (70) compared to the adult (50) and 25-30 d (44) rabbits. The chloride:bile salt ratio was also higher in the two youngest groups. Bile salt-independent flow at theoretic zero bile salt secretion was absent in the younger groups, but evident in the adult and 25-30 d rabbits. Canalicular flow estimated by erythritol clearance was linearly ($p<.01$) related to bile salt secretion. Inulin clearance relative to erythritol clearance was higher in 10-14 d infants than adults. Thus, bile flow and bile salt secretion are reduced in young adults, but rise to near adult levels at the time of weaning, 25-30 d. The increase in flow results from increased bile salt secretion and the appearance of bile salt-independent flow. In the young, increased biliary permeability maintains bile flow and chloride output despite increased bile salt secretion.

699 NUTRITIONAL BALANCE STUDIES IN VERY-LOW-BIRTHWEIGHT (VLBW) INFANTS: ROLE OF WHEY FORMULA. Jayant P. Shenai, Margaret C. Dame, Helen R. Churella, John W. Reynolds, S. Gorham Babson. Oregon Health Sciences University, Department of Pediatrics, Portland, OR.

Whey protein: casein ratio of 60:40, similar to human milk protein, may be preferable to a ratio of 18:82, similar to cow milk protein, in feeding VLBW neonates. Metabolic balances, serum chemistries, and body measurements were determined in 10 VLBW (<1530 g) infants fed a whey protein formula (WPF) and 9 fed a casein-predominant protein formula (CPF). Nitrogen (N) intakes were 452 and 559 mg/kg/d in WPF and CPF fed infants, respectively, N balances showed comparable urinary and fecal losses, averaging 17% and 9% of N intake, respectively, and comparable N retention values, averaging 74% of N intake. Net N retention was similar to calculated fetal accretion of N in both groups. Serum total protein, albumin, and urea N were within normal range. WPF-fed infants showed a more favorable acid base status, characterized by normal buffer base concentrations and lesser predisposition to metabolic acidosis, than CPF-fed infants. 5/9 infants from CPF group required oral bicarbonate treatment. None from the WPF group required similar treatment. Growth gains were similar.

The data suggests that both whey protein and casein-predominant protein are adequately utilized by VLBW neonates at a protein intake of about 3.0 gm/kg/d. Whey protein is preferable to casein-predominant protein in the diet of VLBW neonates, as it may lesrisk of metabolic acidosis and its potential adverse effects.

697 AGE DEPENDENT DIFFERENCES IN SUPEROXIDE PRODUCTION BY STIMULATED RAT KUPFFER CELLS IN THE PRESENCE OF UNINHIBITED TRYPSIN. Harvey L. Sharp, Judy Longsdorf University of Minnesota, Department of Pediatrics, Minneapolis.

The role of oxidants in hepatocyte injury is currently being considered. Infants and children with α_1AT deficiency are more prone to hepatocyte injury than adults. We have begun in vitro investigations of the cells closest to hepatocytes (Kupffer cells) in regards to their extracellular superoxide production in the presence or absence of an uninhibited protease. Kupffer cells were isolated from rat liver by perfusion and incubation with pronase, centrifugal elutriation, and culturing for 24 hours. Over 95% of the cells studied were viable throughout the experiments as determined by trypan blue exclusion and were identified as Kupffer cells by combined giemsa and peroxidase staining. Superoxide was determined in HBSS by the reduction of cytochrome C in the presence or absence of superoxide dismutase (SOD). Resting cells produced essentially no SO.

SO production (nmoles/1.5x10^6 cells/30 min) from the same rat.

Trypsin	Zymosan	Trypsin/Zymosan	PMA	Trypsin/PMA
275 or less gram rats (4)				
.019	.155	.518	.286	.294
282-345 gram rats (6)				
.051	.237	.217	.226	.080

Trypsin (50 ug incubated for 20 minutes before start of experiment). PMA (Phorbol myristate acetate .002 mg). Opsonized Zymosan (1.25 mg). These results suggest that Kupffer cells from younger rats may respond differently to zymosan and PMA in the production of oxidants in the presence of a protease.

† 700 ESTIMATION OF TOTAL BODY FAT AND PROTEIN BY DENSITOMETRY. Hwai-Ping Sheng, William Deskins, Dean Winter, and Cutberto Garza (Spon/B.L. Nichols). Baylor Coll. of Med., USDA/ARS Children's Nutrition Research Center, Dept. of Pediatr., Univ. of Houston, Dept. of Mech. Eng., Houston, TX.

Densitometry usually is used to estimate body fat and lean body mass (LBM). The method assumes a constant value for density of LBM, which is invalid in the growing infant. The densitometric method was used to estimate total body fat and protein. The body was divided into 4 components: water(w), fat(f), protein(p), and minerals(m). Two fundamental equations were used: eq.1, $W_T = W_w + W_f + W_p + W_m$; and eq. 2, $V_T = V_w + V_f + V_p + V_m$. Using the relationship $V=W/D$, where D=density, eq. 3 was derived from eq. 2: $W_T/D_T = W_w/D_w + W_f/D_f + W_p/D_p + W_m/D_m$. Using eq. 1 and 3 simultaneously, p and f in the human infant can be calculated. Required were the measurements of W_T, W_w using $^2H_2{}^{18}O$ dilution method, and D_T using W_T/V_T. V_T was measured by an acoustic method. The following were taken from the literature: m for the reference fetus and infant, D_w, D_f, D_p and D_m. This 4-component model was validated in 6 infant minipigs. Calculated values of f were compared to those measured chemically; calculations overestimated measured f. Their linear relationship was described by the regression equation: meas. f = -10.9 + .39 x cal f (±13.3). Because of high correlation between measured and calculated f (r=0.98), body fat can be predicted from calculated f using the regression equation. Body protein then can be calculated from eq. 1. The linear relationship between measured and calculated f makes the indirect measurement of f and p possible without assumptions regarding the chemical maturity of the LBM compartment.

● 698 TISSUE CARNITINE RESERVES OF NEWBORN INFANTS. Jayant P. Shenai, Peggy R. Borum. (Spon. by M. Stahlman), Vanderbilt University School of Medicine, Dept. of Pediatrics and Biochemistry, Nashville, TN.

Carnitine (C), β-OH-γ-trimethyl-aminobutyric acid facilitates mitochondrial oxidation of fatty acids. Adequate blood and tissue concentrations of C may enhance utilization of fat. This study assessed tissue reserves of C at birth in a group of neonates dying within 24 hours of birth, prior to possible changes in C status induced by postnatal intervention. These infants (M=9, F=13) were 22-41 wk in gestation, 470-3580 g by birthweight, and without congenital anomalies. Intraventricular hemorrhage was the cause of death in preterm and birth asphyxia in term neonates. None received exogenous C. Tissue samples included psoas muscle, liver, and heart. Values (mean± SD) expressed as nmol/mg NCP (noncollagen protein) are shown in the table.

Birthweight	N	Gestation (wk)	Muscle	Liver	Heart
≤1000 g	10	25.0 ± 2.1	8.4 ± 3.6	3.9 ± 1.4	5.0 ± 1.3
1001-2500 g	9	30.2 ± 1.0	14.0 ± 3.2	4.2 ± 1.5	4.3 ± 1.4
≥2501 g	3	39.0 ± 2.1	19.4 ± 2.6	4.6 ± 1.8	5.6 ± 0.8
Adult controls			27.0 ± 7.3(M)	7.8 ± 3.1	9.3 ± 5.4
			20.3 ± 5.9(F)		

Tissue [C] was highest in the muscle. Muscle [C] correlated positively with gestation ($r=0.832$, $p<0.001$) and with body dimensions. In comparison to adult controls, tissue C was markedly lower. These data suggest that muscle is the principal site of C storage in neonates. Muscle C stores increase with advancing gestation during fetal life. Neonates, prematures in particular, are born with limited tissue reserves of C. Prolonged C-free intravenous nutrition may pose a significant risk of C deficiency in neonates. (Supported by The Nutrition Foundation)

701 THE EFFECT OF FAT AND CARBOHYDRATE COMPOSITION ON THE GASTRIC EMPTYING (GE) OF ISOCALORIC FEEDINGS IN PREMATURE INFANTS. Myron Siegel, Bridget Krantz, Emanuel Lebenthal, SUNY School of Medicine, Children's Hospital, Division of Pediatric Gastroenterology, Buffalo, New York.

The (GE) of 6 infant feedings (20 kcal/oz 60:40 whey:casein) with varying fat and carbohydrate composition was studied. Feedings contained either 100% medium chain triglyceride (MCT) or 91% long chain triglyderide and 9% MCT (LCT) as the fat and either lactose (L), glucose (G), or polycose (P) as the carbohydrate. Eleven premature infants were fed 22cc/kg of all 6 feedings over a 3-4 day period and the volume of gastric contents was measured every 20 minutes using the marker polyethylene glycol 4000. Mean values ± S.D. of gastric contents (% initial volume) were:

Feeding	20 min	40 min	60 min	80 min	100 min
LCT, L	57.0± 9.4	51.9± 8.1	42.5± 8.2	32.8± 8.6	26.0±6.4
MCT, L	39.4±12.1	30.2±11.7	20.6± 9.5	14.3±11.7	6.5±6.3
LCT, G	56.3± 8.7	54.0± 8.0	34.7± 7.2	27.7± 6.9	22.1±6.7
MCT, G	42.8± 8.9	33.4± 8.4	19.0± 6.9	14.4± 7.4	6.6±6.0
LCT, P	47.9±11.2	47.2± 8.4	34.2± 6.6	25.4± 5.0	18.8±8.1
MCT, P	32.0±11.6	20.6±10.0	11.0± 7.2	7.2± 6.9	3.5±4.3

ANOVA demonstrated use of MCT resulted in faster emptying than LCT ($p<.001$). ANOVA and Tukey's test showed use of P instead of G resulted in less gastric volume at 40 minutes ($p<.05$). P instead of L resulted in less volume at 60 and 80 minutes ($p< .05$). GE can be altered by changes in nutrient composition. The difference between MCT and LCT was more pronounced than the differences between the carbohydrates studied. Feedings with MCT may be more suitable than LCT in patients with gastric stasis.