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COMPARISON OF SAMPLE PREPARATION APPROACHES FOR DEUTERIUM (D) IN DOUBLY LABELED WATER STUDIES. C.A. Leitch and P.J.H. Jones (SPON: J. Leitcher). Div. of Human Nutrition, Univ. of British Columbia, Vancouver, B.C., Canada V6T 1W5.

Despite the advantages of doubly labeled water for non-restrictive energy expenditure measurement, difficulties remain with the water-zinc reduction assay. We examined the influence of preparation line construction, reduction tube composition, and water transfer method on accuracy and precision of D measurement. Two μ l samples, transferred by direct addition (DA) or vacuum distillation (DI) to quartz (Q) or pyrex (P) tubes, were reduced over 60 mg zinc at 510°C for 30 min, then analyzed by IRMS. For water samples with enrichments ranging from -428 ‰ to 1000 ‰ vs SMOU (n=33) use of an all-glass preparation/distillation system produced values for DA versus DI yielding agreement of 1.9±0.7 ‰ (SE). Regression analyses of observed enrichments of known standards using Q and P demonstrated significant linearity (theor ‰ = 1.05 obs ‰ - 6.86, r=.99 and 1.08 obs ‰ = 10.30, r=1.00, respectively). For urine samples in both Q and P, DA yielded improved replicate agreement (CV=.0190, n=12) compared with DI (CV=.0429, n=12) and increased sample yields. Enrichment values were systematically higher using DA vs DI. Calculated 6 day D elimination rates agreed to within 4.8% for DA in Q vs P. Use of DA and P tubes may significantly reduce time and cost of measurements of body composition or energy expenditure using biological samples. (Sup by Canada Dept of Defence)

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CONTINUOUS MEASUREMENTS OF THE THERMIC EFFECT OF FOOD IN SUBJECTS WHILE BEING FED.

N.P. Wong, C.W. Miles, W.V. Rumpler and P.A. WELLS. Energy & Protein Nutrition Laboratory, Beltsville Human Nutrition Research Center, ARS, USDA, Beltsville, MD 20705.

Using a canopy system that measures the thermic effect of food (TEF) by indirect calorimetry (previously described, Federation Proceedings, March 1969) energy expenditure was measured continuously while subjects were being fed. A slight modification allowed a tube to be inserted into a mouthpiece through which liquid or semi-liquid diets were consumed. Using this system, measurements were made on 4 subjects consuming 16 oz (480 Kcal) commercially prepared liquid food, 16 oz (0 kcal) diet soda or water and 16 oz (380 kcal) semi-solid food. After an overnight fast, subjects were measured for 1 hr. to determine a resting energy expenditure (REE), then fed and continuously measured for 3 hrs. After a 15 min. break, subjects were measured again for 2 hrs if necessary. The subjects whose REE ranged from .91 to 1.16 (average 1.07) kcal/min showed an average 9.92% recovery of the calories fed. When subjects were fed liquids containing zero calories the basal rate showed a small immediate response of short duration but no thermic effect (energy expenditure above baseline) was measured for 5 hrs. This system allows both uninterrupted measurement of energy expenditure while consuming a meal and precise measurements of the onset of TEF.

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DAILY ENERGY NEEDS AND RESTING METABOLIC RATE IN ENDURANCE ATHLETES. N. Almeida, N. Mimsault, G. Ferrasse, W.R. Boulay and A. Tremblay. Physical Activity Sciences Laboratory, Laval University, Ste-Foy, Quebec, Canada G1K 7P4.

We evaluated daily energy needs and resting metabolic rate (RMR) in seven male cross-country skiers whose values were compared to those obtained in eight sedentary subjects. Daily energy expenditure was determined with the heart rate-VO₂ method whereas RMR was measured using indirect calorimetry. As expected, total daily energy expenditure was significantly higher in the trained subjects. Non-aerobic daily energy expenditure was comparable in the two groups. However, when this variable was expressed in units per body weight, the skiers displayed higher levels than those observed in the control subjects. RMR was also found to be higher in the athletes. These results suggest that the increase in RMR in the trained subjects was sufficient to prevent any decrease in their non-aerobic daily energy needs.

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EFFECT OF CIRCADIAN VARIATION IN ENERGY EXPENDITURE ON THE THERMIC EFFECT OF FOOD. C.W. Miles, N.P. Wong, W.V. Rumpler and P.A. WELLS. Energy & Protein Nutrition Laboratory, Beltsville Human Nutrition Research Center, ARS, USDA, Beltsville, MD 20705.

Some studies on the thermic effect of food (TEF) that have not used their subject's energy expenditure return to baseline after a three to four hour measurement have attributed this circadian elevation in energy expenditure to a circadian increase in resting energy expenditure (REE) over the morning of the measurement. To determine how much correction we would need to make to account for this circadian increase, the energy expenditure of 9 subjects (5 male and 4 female) was measured continuously after an 11 hour fast, by indirect calorimetry while seated in a chair over 470 minutes with three 15 minute breaks. During these breaks urine was collected. Energy expenditure and substrate utilization were calculated from the total O₂ consumption, CO₂ production and urinary nitrogen excretion. The subjects' energy expenditure ranged from 1.01 to 1.42 kcal/min or on a 24-hour basis between 28.2 and 34.9 kcal/kg LBM. Substrate utilization was variable (% kcal from fat 40.4 to 66.3, \pm 56.3; from protein 9.8 to 26.8, \pm 20.8; from carbohydrate 11.1 to 38.4, \pm 22.8). We found no circadian increase in energy expenditure over the 470 minutes of the study and concluded that no correction needs to be made to TEF data for circadian increases in REE over the almost 8 hour measuring period of the study.

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The Effects Of Sodium:Carbohydrate (Na:Carb) Ratios In Rehydration Beverages (RB) On Plasma Glucose (PG), Osmolality (PO), Volume (PV), and Subject Tolerance (ST). L. Wong, C. Jensen and J. Whittan. Shaklee Health Sciences, San Francisco, CA 94111.

Following dehydration, lost body water can be more fully restored with water and sodium chloride capsules than with water alone. To test the efficacy of Na:Carb ratios in RB on PG, PO, PV and ST during exercise, 4 trained male cyclists cycled at 70% VO_{2max} on ergometers for up to 3 hrs while consuming four different RB at a rate of 1 L/hr. Blood was drawn at 0, 30, 60 and 120 min. Per 250 ml, the RB provided the following Na:Carb ratios (mg:g): RB 1) 122:27; RB 2) 214:27; RB 3) 122:14; and RB 4) 0:0 (control). RB 1, 2 and 3 elicited higher mean PG levels (p<0.05) than did RB 4 at two or more time points during the study. RB 1 and 2 induced higher mean PO (p<0.05) than RB 4 at one or more time points. Mean PV decreased similarly for all RB. RB 1, 3 and 4 were well-tolerated, while RB 2 (high sodium) led to gastrointestinal distress and decreased ST. In summary, RB 1 surpassed RB 4 in maintaining PG and PO, and surpassed RB 2 in ST. RB 3 did not differ from RB 4 in its effect on PO. (The assistance of Dr. E. Nadel, John B. Pierce Foundation Laboratory is gratefully acknowledged).

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EFFECT OF A PROTEIN SUPPLEMENT ON LACTATE ACCUMULATION DURING SUBMAXIMAL AND MAXIMAL EXERCISE. K. Karshisnik, M. Vukovich, S. Thompson, D.S. King, and R.L. Sharp (SPON: R. Seifass).

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Eleven trained (TR) subjects (mean VO_{2max}, 4.36 l/min) performed graded exercise after one wk of protein supplementation (PS, 0.8 g/kg body wt.) and after one wk of placebo (CON), assigned in a double blind fashion. The exercise consisted of 3 min exercise bouts eliciting 40, 60, 80, and 100% VO_{2max} and a 2 min exercise bout at 120% VO_{2max}, each separated by 10 min of active recovery at zero pedal resistance. Subjects then performed a 30s Wingate test (WIN) to assess anaerobic exercise capacity. PS resulted in significant (P<0.05) increase in resting and post WIN serum alanine concentrations. PS resulted in a significant (P<0.05) decrease in serum lactate concentrations at each work load. Mean power output during the WIN was not significantly different in PS compared with CON. The mean percent decline in power output was also not different in PS compared with CON. The increased levels of serum alanine and decreased levels of serum lactate may reflect increased transamination of pyruvate. This decreased accumulation of serum lactate had a marginal, if any, effect on performance during anaerobic exercise.

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ABSTRACTS
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