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**ENERGY EXPENDITURE AND ENERGY REQUIREMENTS
IN CLASSICAL BALLET DANCERS**

RJ Hill, PSW Davies 1

Determining the energy requirements of sporting individuals is of great importance with respect to optimal performance as well as general health and wellbeing. This is often difficult as many techniques either rely on self-reports of activity or energy intake, for example activity diaries or food records, or place restrictions upon the subject's activities or lifestyle, for example direct calorimetry. In the 1980's however, the development of the doubly labelled water (DLW) technique made it possible to determine total energy expenditure, and hence energy requirements, in free-living populations without altering their lifestyles.

Classical ballet is an aesthetic art form associated with long hours of training. For the female dancer, a prerequisite for success is a lean body accompanied by a high standard of strength and technical proficiency similar to that required by all high-performance athletes. To date, the energy expenditure of classical ballet dancers has not been measured using the gold standard DLW technique and hence it has not been possible to accurately determine their energy requirements.

We have therefore, for the first time, measured the energy expenditure of eleven female classical ballet dancers using the DLW technique and thereby determined their energy requirements.

Total energy expenditure was measured over a 14 day period using the DLW technique. Subjects were given a single loading dose of ²H₂O (0.05g/kg body weight) and H₂¹⁸O (0.125g/kg body weight). Isotopic enrichment of both ²H and ¹⁸O in urine samples were measured using isotope ratio mass spectrometry (Hydra, Europa Scientific Ltd, UK). Mean (± SD) age, height and weight of the ballet dancers was 18.7 years (1.2), 169.1 cm (4.6) and 57.3 kg (3.8), respectively. The average daily total energy expenditure was 2987 kcal (267).

The total energy expenditure, and thus energy requirements, measured in this study were significantly higher than previously reported recommendations. This is consistent with the results of DLW studies involving other athletic groups implying there is a need to re-evaluate the recommended dietary allowances for particularly active populations in order to maintain short term and long term health.

**IMPROVED GUT MORPHOLOGY IN PRE-WEAN PIGLETS DOES NOT REDUCE THE
EFFECT OF WEANING ON VILLOUS HEIGHT**

Michael R King, PCH Morel, DK Revell, EAC James, MJ Birtles, JR Pluske 2

At weaning marked changes in piglet small intestine morphology occur, characterised by a dramatic reduction in villous height. Oral administration of IgG and IGF-I may improve gut integrity, growth and function. In the present experiment, it was hypothesised that providing a supplementary source of IgG and IGF-I for piglets during the lactation period would improve gut morphology, and may reduce the impact of weaning on gut integrity.

Ten litters of Large White X Landrace piglets were allocated to two treatment groups. From day seven to weaning (day 28), piglets received one of two creep-fed diets: Standard pre-weaner feed (solid, PW) and Immulac7.5TM (liquid, IM). Diet IM contained 19 mg/ml IgG, and 62 ng/ml IGF-I. At weaning piglets were fed standard weaner diet. Six piglets were randomly selected from each treatment group at weaning, and four from each group at 24 hours post-weaning. Selected piglets were sedated and euthanased. Gut sections and histological measurements were taken using the methodology of Pluske *et al.* (1996). Small intestine sites (S) referred to as S2, S4 and S6 (Table 1) correspond to the proximal jejunum, mid jejunum and distal ileum.

Table 1. Least square means (LSM) of histological gut measurements in piglets fed liquid or solid diets during the lactation period, taken at weaning and 24hrs post-weaning.

| | Solid diet (PW) | | Liquid Diet (IM) | |
|----|--------------------|--------------------|--------------------|--------------------|
| | Weaning | Post-weaning | Weaning | Post-weaning |
| S1 | 563 ^{Aa1} | 501 ^{Ab1} | 682 ^{Aa2} | 512 ^{Ab2} |
| S4 | 578 ^{Aa1} | 512 ^{Ab1} | 698 ^{Aa2} | 520 ^{Ab2} |
| S6 | 456 ^{Ba1} | 396 ^{Ba1} | 425 ^{Ba1} | 476 ^{Aa1} |

* Lsmeans with different subscripts differ (P<0.001). Capital subscript compares sites within diet and period, small cap subscript compares period within diet and site, numerical superscript compares period across diet and site. ImmulacTM significantly increased proximal and mid-jejunum villous height (VH) in the pre-weaning period, compared to the PW treatment. Small intestine site also significantly affected VH in both periods. Weaning significantly reduced VH regardless of treatment - an effect confined to the proximal and mid-jejunum - which does not support the current hypothesis. It is concluded that, although the provision of supplementary ImmulacTM liquid feed during the lactation period improves gut morphology, this effect is lost during the immediate post-weaning period. Supported by New Zealand PORK and New Zealand Dairy Ingredients, Te Puke, New Zealand.

Pluske, J.R., Williams, I.H. And Aherne, F.X. (1996). Animal Science. 62: 131-144.

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