sured after specific (Lf) or polyclonal stimulation of Peyer's patches cells and splenocytes.

The uptake of Lf induces both a stimulation of total IgA, IL-2 and IL-5 productions and a stimulation of IL-2 and IL-5 secretions by Peyer's patches cells and splenocytes respectively. Increasing level of anti-Lf IgA and to a lesser extent IgG antibodies production was observed in intestinal secretions during the 4 weeks of feeding. In sera, the mice have developed an IgG specific response. These effects on the immune system are corroborated by the dose-dependent proliferation response of the same cells.

In conclusion, the ingestion of bovine Lf with low digestibility in the mice induces a mucosal immune response which probably acts in preventing its systemic absorption.

Energy expenditure during heavy sustained exercise. P Ritz [1], N Fellmann [2], P Rousset [1], J Ribeyre [2], A Chamoux [2], B Beaufrère [1], J Coudert [2] *([1] Laboratoire de nutrition humaine; [2] Laboratoire de biologie et de physiologie du sport; [1,2] CRNH-Auvergne, Clermont-Ferrand, France).*

Adequate energy (EI) and water intakes are key conditions for physical performance. Whereas EI measurements are often biased, the doubly labelled water (DLW) method is the only method for the measurement of total energy expenditure (TEE) and water fluxes that does not interfere with physical exercise. Energy expended during exercise can be estimated from heart rate (HR) recordings, the relationship HR-VO_2 having been calibrated during the assessment of VO_{2max}. The aim of this study was to measure energy and water needs during a 7-day endurance raid.

Nine subjects (42.1 ± 7.8 year, mean ± SD) engaged in a triathlon of 595 km and 13 100 m cumulative gain in altitude. On day 1 they drank a DLW dose (150 mg/kg ^2H and ^{18}O). Saliva/urine samples were collected before, 4, 5, and 6 h after the dose (for total body water estimates, TBW) then daily till day 7 (for measurement of isotope rate constants). TBW was measured again on day 8. HR monitoring was performed during each exercise session with portable HR monitors, and transformed into VO_2 to calculate energy expended during exercise, and relative exercise intensity (% of VO_{2max}).

Time spent on exercise varied between 622 ± 43 min (day 1) and 521 ± 16 min (day 7). Relative intensity of exercise decreased between day 1 (57.6 ± 5.0% of VO_{2max}) and day 7 (47.4 ± 5.1%, $P < 0.001$). TBW increased by 4.1 ± 2.0 L (day 1 to day 7, $P < 0.001$) although body weight was kept constant (68.4 ± 6.5 kg day 1, 68.1 ± 6.8 kg day 7). Water outflow rate (skin, respiratory and urine losses) was 6.44 ± 0.89 L/day. Mean energy expended daily during exercise was 16.9 ± 1.4 MJ/day. TEE was 32.1 ± 4.6 MJ/day, ie, 561 ± 44 kJ/kg lean body mass.

In conclusion, heavy sustained exercise is accompanied by a TEE almost three times as high as sedentary subjects. Water retention observed in the present study suggests a massive energy deficit.

The present study was supported by GREESE-Volvic.

Comparison of methods for determining energy expenditure of elderly people in free-living conditions. B Morio, P Ritz, E Verdier, C Montaurier, Y Boirie, B Beaufrère, M Vermorel *(Inra, laboratoire de nutrition humaine, centre de recherche en nutrition humaine, 58, rue Montalembert, BP 321, 63009 Clermont Ferrand cedex 1, France).*

The aim of the study was to compare three methods available to determine daily energy