Posters

A novel method of measuring gas exchange in ruminant animals

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Background - Techniques for measuring gas exchange in ruminant animals have usually required elaborate chambers in which animals stay for extended periods. Drawbacks to using chambers are that they do not allow the measurement of acute changes in respiration caused by experimental intervention. We investigated PowerLab exercise physiology system (ADinstruments Pty Ltd, Sydney) with modifications for use in sheep to measure acute, real time measurements of gas exchange in sheep fed different nutritional planes.
Objectives - To establish if PowerLab exercise physiology system was suitable for measuring gas exchange in sheep and to determine the effects of plane of nutrition on oxygen consumption.
Design - Three merino lambs (28.8 ± 0.8 kg) and three cross bred lambs (30.2 ± 1.0kg) were allocated to a 72 h fast, maintenance or *ad libitum* diet, in a 2x3x3 (breed, treatment, time) Latin square design. Gas exchange was taken at 0700, 0800, (animals fed at 0900, no measurement) 1000, 1100, 1200, 1400, 1600, 2000, 0100 and 0600 h, for a period of 15min, heart rate and core temperature were also measured at these times. Respiration gases were collected in a mixing chamber and sampled continuously for carbon dioxide and oxygen concentration; expired minute volumes were measured using a spirometer. Data was then analysed using Chart software (ADinstruments Pty Ltd, Sydney).
Outcomes - Prior to feeding (0700 and 0800) average oxygen consumption did not differ between the planes of nutrition (8.1 ± 0.6 vs 8.7 ± 0.7 and 12.3 ± 2.3 mL/min/$kg^{0.75}$ for fasted, maintenance and *ad libitum* fed lambs, respectively,$P>0.05$, data shown as mean ± SEM). Oxygen consumption in the fasted animals did not change ($P>0.05$) throughout the 24 h period. In maintenance fed lambs oxygen consumption increased ($P<0.05$) to 192% and peaked at 197% of pre feeding levels, 3 h and 5h respectively, post feeding. *Ad libitum* post feeding oxygen consumption increased ($P<0.05$) 73% from pre-feed levels within 1 h and oxygen consumption remained ($P<0.05$) elevated, peaking 7 h after feeding at 207% above pre-feeding levels. Heart rates and core temperature generally increased in a similar pattern to oxygen consumption in maintenance and *ad libitum* fed animals and remained low in 72 h fasted animals.
Conclusion - The use of PowerLab exercise physiology system is an excellent tool for measuring differences in oxygen consumption in sheep allocated to various planes of nutrition.

Heterotrophic Australian thraustochytrids as alternate sources of long-chain polyunsaturated fatty acids

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Background - Demand for fish oils rich in omega-3 long-chain polyunsaturated fatty acids (ω3 LC-PUFA), particularly docosahexaenoic acid [DHA, 22:6ω3], is increasing, but most wild fish stocks are fully or over exploited. Marine single-cell oils (SCO) rich in DHA are produced commercially overseas using a heterotrophic dinoflagellate (*Crypthecodinium cohnii*) and two microheteroptrophs known as thraustochytrids (*Schizochytrium* sp. and *Ulkenia* sp.). SCO provide an alternative source of LC-PUFA for incorporation in foods or use as nutraceuticals. Thraustochytrids can be grown heterotrophically using fermentor technology on a large scale with high growth rates and culture density.
Objectives - To isolate and characterize new Australian heterotrophic microorganisms capable of LC-PUFA production for potential use in animal feeds, food and nutraceuticals.
Design - We isolated and characterised the fatty acid profiles of 29 new strains from a range of aquatic habitats within cool-temperate and sub-tropical regions. A subset of the strains was further characterised by sequence comparison of their 18S rDNA genes.
Outcomes - In most strains DHA was the dominant LC-PUFA and comprised an exceptionally high 61% of total fatty acids in one strain. This strain had a simple fatty acid composition with low levels of eicosapentaenoic acid (EPA, 20:5ω3) and docosapentaenoic acid (DPA(6), 22:5ω6) present. Other strains also contained moderate amounts of EPA and DPA(6) (10-15%). Several strains contained moderate levels of the ω6 PUFA, arachidonic acid (AA, 20:4ω6). In one strain, AA was the major LC-PUFA (20% of total fatty acids) and was twice as abundant as EPA. In several strains a series of odd-chain C_{15}-C_{19} saturated fatty acids together with unusual odd-chain C_{19}-C_{23} PUFA were identified by GC-MS of 4,4-dimethyloxazoline (DMOX) derivatives. This is the first report of these odd-chain PUFA being detected in thraustochytrids. The new Australian strains cover a large portion of known biodiversity of this group of microorganisms. They are also a source of novel genes for LC-PUFA synthesis.
Conclusions - The discovery and isolation of these strains provides Australian researchers and industry with a timely opportunity for SCO production.