RESEARCH TO PRACTICE 2018
27-29 MARCH 2018
BRISBANE, QUEENSLAND

# ECSS AND ESSA RESEARCH EXCHANGE POSTER PRESENTATIONS

**Tuesday, 27 March 2018**
**5:00pm – 6:00pm**

**Presentations:**

**090**
A novel D2O technique for dynamic quantification of skeletal muscle RNA synthesis in relation to exercise and ribosomal biogenesis
*Matthew Brook*

**091**
Rapid weight loss in Olympic combat sports
*Reid Reale*

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## 090

# A novel $D_2O$ technique for dynamic quantification of skeletal muscle RNA synthesis in relation to exercise and ribosomal biogenesis

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**Introduction:** Cellular protein synthesis is determined by both activity (translational efficiency) and amount (translational capacity i.e. RNA content) of ribosomes. Stable isotopes have routinely shown that bouts of resistance exercise (RE) induce acute increases in translational efficiency i.e. muscle protein synthesis (MPS)[1], cumulatively promoting muscle hypertrophy. Yet, changes in translational capacity (ribosomal biogenesis) are also a key feauture of RET[2]. Nonetheless, no practicable methods exist to quantify dynamic RNA synthesis. We aimed to develop $D_2O$ methods to quantify muscle RNA synthesis *in vitro*, *in vivo* exercise models, and in humans.

**Methods:** Proliferating C2C12 cells were incubated in $^2H$-enriched media (and myotubes: ±50ng·ml$^{-1}$ IGF-1). In rodent studies, quadriceps from untrained (N=9) and exercised (N=13, treadmill 3x3min 80-95% VO2-peak 3/wk) rats were collected after 3-wks. Drinking water was enriched with $D_2O$ and blood samples taken to quantify body water enrichment (BWE). In human trials, 10 (23±1y) men undertook 6-wks unilateral RE (6×8 reps, 75%-1RM 3/wk). Subjects consumed 150ml $D_2O$ (70-Atom%) and then 50ml/wk. BWE was monitored by saliva and RNA synthesis in muscle biopsies 0/3/6wk. RNA was subjected to enzymatic digestion, derivatised to benzyl hydroxylamine tetraacetate derivatives, with mole percent excess (MPE) of ribose from purine nucleotides analyzed on GC-MS/MS via monitoring M/M+1 isotopomers.

**Results:** Proliferating C2C12 cells exhibited an amplification of 2.1 $^2H$ into ribose, with MPE following a rise to plateau i.e. $^2H$ incorporation is reflective of "new RNA" and thereby *de novo* ribosomal biogenesis. IGF-1 increased RNA abundance in myotubes from 76±3ng/ul to 123±3ng/ul, mirrored by increases in MPE to 0.39±0.1% (both P<0.01). Rat quadriceps MPE increased to 0.25±0.01% (P<0.01) and was greater with exercise to 0.36±0.02% (P<0.01). RNA synthesis positively correlated with MPS (P=0.05, $r^2$=0.2). Human muscle RNA MPE increased to 0.06±0.01% and 0.13±0.02% at 3 and 6-wks RE respectively, representing ~1%.d$^{-1}$ turnover. With RE, RNA synthesis was greater at 3 and 6-wks: 1.9±0.3%/d (P<0.01) and 1.6±0.1%/d (P<0.05) respectively. Again, RNA synthesis correlated with MPS (P<0.001, $r^2$ =0.7).

**Discussion:** We have developed and validated a novel method for the measurement of *in vitro* and *in vivo* RNA synthesis, which holds promise for investigating the role dynamic changes in translational capacity has in the mechanistic control of muscle hypertrophy and atrophy.

1-Kumar V, J Physiol. 2009
2-Stec MJ, Am J Physiol. 2016

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## Rapid weight loss in Olympic combat sports

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**Introduction**: Olympic combat sports separate athletes into weight divisions. Official weigh-ins are held 3-24h before competition to ensure no athlete is heavier than permitted. Athletes commonly engage in rapid weight loss (RWL), generally via body water manipulation, before weigh-in then attempt to restore losses before competition on the assumption that performance decrements can be reversed. The belief is that a size/strength/leverage advantage is gained by competing in a division lighter than habitual body mass (BM). Whether RWL improves the chance of success or not is unclear. Thus the aim of these investigations was to examine post weigh-in BM gain (a reflection of RWL) and competitive success. We also collected data on body composition and methods used to achieve and reverse RWL to determine the necessity and suitability of common practices.
**Methods**: Olympic combat sport athletes (n=94) within 2w of competition had body composition assessed by dual energy x-ray absorptiometry and compared to weight division. Athletes (n=227) were surveyed on their aggressiveness of RWL and recovery habits via a previously validated questionnaire (Artiolli et al. 2009) which quantifies a rapid weight loss score (RWLS). Post weigh-in BM gain was measured in judo (n=86) and boxing (n=100) athletes at competitions and compared among a variety of sub groups.
**Results**: All athletes were significantly heavier than their competitive weight division <2w before competition. Athlete calibre had an effect on RWLS (p=0.0042) however sport and sex did not. Differences in post weigh-in BM gain between winners and losers, and medallists and non-medallists in judo were significant at 0.9±0.3% (p=0.0021) and 1.4±0.4% (p=0.0026) respectively. Increased recovery time resulted in differences in post weigh-in BM gain in boxers of 0.37% (p=<0.0001). Surveys suggest athletes recognise the importance of recovery from RWL yet most do not understand optimal methods of recovery and rehydration.
**Discussion**: Many combat sport athletes engage in RWL to make weight, as loss of body fat alone appears inadequate particularly for lighter athletes. Athletes favour combinations of passive/active dehydration and reduced food intake. Higher calibre athletes engage in more aggressive RWL than lower calibre athletes. A strong association between post weigh-in BM gain and success exists in judo which is not found in boxing, possibly due to the shorter recovery time prohibiting meaningful BM fluctuations or the different activity profiles of the sports. Fighters are keenly aware of the importance of recovery and rehydration post weigh-in but are in need of support to optimise their practices.

**References**

Artiolli, G. G, et al. (2009). Scand J Med Sci Sports, 20(1), 177-87

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