

Relationship between energy metabolism and bone metabolism: a pilot study on gymnasts

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Background

Bone mineral density (BMD) is modified by environmental factors like diet, nutritional status and exercise. Athletes have higher bone turnover than sedentary individuals but prolonged exercise might result in a negative remodeling balance and compromises skeletal health. Strenuous exercise and fasting may induce osteoclastic activity that is not necessarily accompanied by a compensatory increase in osteoblastic activity. The purpose of this study was to understand if there is specific nutrition to allow best performance and reduce bone resorption that occurs after exercise in athletes.

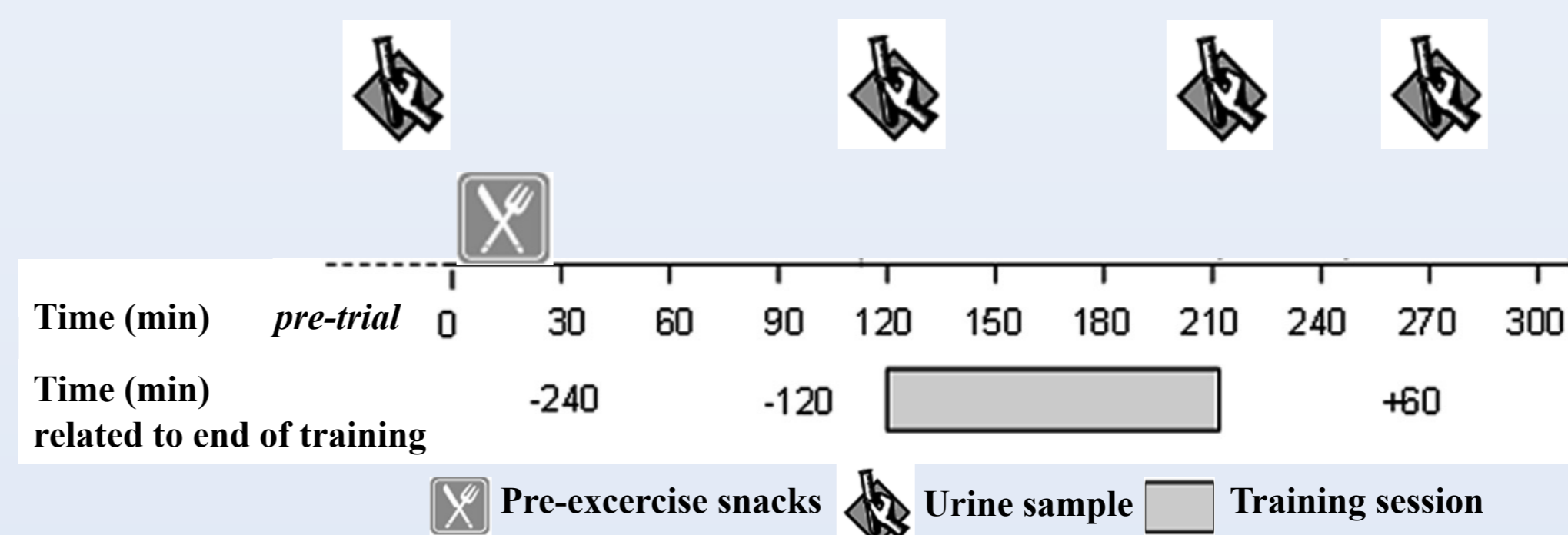
Materials and Method

Subjects

A group of 28 gymnasts aged between 9 and 14 years old ($13 \pm 1,71$) play artistic gymnastics for at least 6 years at a pre-competitive level and with were enrolled in our study. The athletes were randomly divided into two groups to which were provided two different snacks: one carb-based snacks and the other carb/protein based snacks, called sandwich group (SG) and cereal group (CG).

Experimental design

Subject measurements were taken, according to the methodology described below once during the study.



Meal

The different isocaloric meals of 330 kCal had the composition shown in table 1. The food was administered 90 minutes before training.

Nutrient	Pre-exercise different snacks	
	Sandwich group (SG)	Cereal group (CG)
Energy (kJ/kg)	330 kCal	330 kCal
Carbohydrate (g/kg)	40.6g	68g
Protein (g/kg)	13.85g	7g
Fat (g/kg)	4.7g fats	2g

Table 1. Macronutrient composition of two different snacks

Measurements

Before administered the meal lean, fat and bone mass were assessed by a body composition scale (Tanita RD545) (Tab.2). Moreover self report questionnaires (ESPQ, Energy Self-Perception Questionnaire) at the end of the training session to check the energy status of the athletes after taking the two different snacks.

Subject data	Sandwich group (SG)	Cereal group (CG)
Age (years)	$11,5 \pm 2,00$	$11,9 \pm 6$
Weight	$44,0 \pm 13,6$	$43,3 \pm 9,8$
Height (m)	$1,51 \pm 0,11$	$1,52 \pm 0,10$
BMI (kg / m ²)	$19,0 \pm 3,7$	$18,4 \pm 2,5$
Fat mass (%)	$19,4 \pm 4,6$	$18,6 \pm 3,2$
Lean mass (%)	$39,7 \pm 0,8$	$39,7 \pm 0,9$
Bone mass (%)	$9,4 \pm 0,2$	$9,4 \pm 0,2$
Water (%)	$56,3 \pm 1,1$	$55,3 \pm 5,1$
Training (years)	$6,3 \pm 2,9$	$5,1 \pm 1,9$

Table 2. Anthropometric measurements of gymnasts

Results

The snacks provided had a positive effect on the performance of the gymnasts. In particular, 55% felt a change in their performance and 36% reported an increase in energy and attention during training. How to concern the assessment of the biomarkers of bone resorption Pyridinium cross-links pyridinoline (PYD) and deoxypyridinoline (DPD) were measured as markers of bone resorption and urinary concentrations and were expressed as molar ratios (Fig 1). The preliminary data showed decreases in post exercise bone resorption of the SG groups when compared to CG subjects.

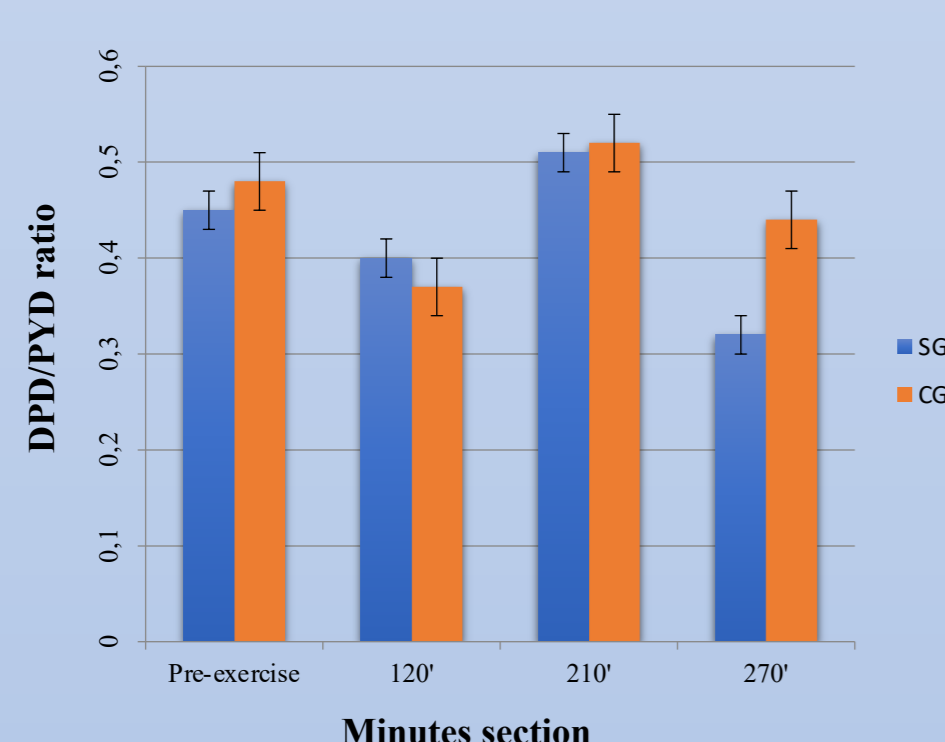


Fig. 1. Urinary concentrations of PYD and DPD are expressed as molar ratios

Conclusions

In conclusions how to concern the assessment of the biomarkers of bone resorption, there are some evidence that show a change following the snacks intake. In particular the results suggests that the consumption of a protein meal before training reduces post exercise resorption in athletes.

This is a pilot study that needs a deep investigation to confirm the preliminary results obtained.

Bibliography

Physical Activity, Nutrition, And Bone Health Amato A, Baldassano S, Cortis C, Cooper J, Proia P. Human Movement 2018; 19(4): 1–10

Influence of nutrition and genetics on performance a pilot study in a group of gymnasts. Amato A, Sacco A, Macchiarella A, Contrò V, Sabatino E, Galassi C, Proia P. Human Movement 2017;18(3): 12–16