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ORIGINAL ARTICLE

# The preliminary analysis of protein catabolism and nitrogen balance in young gymnasts

*L'analyse préliminaire du catabolisme protéique et de l'équilibre azoté chez les jeunes gymnastes*

P. Sawicki<sup>a</sup>, J.J. Kaczor<sup>b,\*</sup>

<sup>a</sup> Department of Sport, Gdansk University of Physical Education and Sport, K. Gorskiego 1, 80-336 Gdansk, Poland

<sup>b</sup> Department of Physiotherapy, Gdansk University of Physical Education and Sport, K. Gorskiego 1, 80-336 Gdansk, Poland

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## KEYWORDS

Gymnastics;  
Young athletes;  
Nutrition;  
Nitrogen balance;  
Supplementation

## Summary

**Objectives.** – The use of proper diet in athletes is one of the most important elements of sports training. Moreover, the essentials in planning diet for athletes among other things should be taken into account: energy balance, the nutritional value of meals and supplements of diet. The main aim of this study was to estimate the level of whole body proteins catabolism, nitrogen and energy balance in young gymnasts.

**Methods.** – In the present study participated young gymnastics ( $13.0 \pm 0.5$  year), which have been trained artistic gymnastics since  $6.8 \pm 0.45$  year. The investigation contained two times measuring urea in 24 h urine collection, measuring energy expenditure indirect method by 24 h monitoring heart rate, and supplementation by 7 days products contain protein and carbohydrate.

**Results.** – Concentration of urea nitrogen in urine at the first test before supplementation was  $8.0 \pm 0.75$  g/d. The energy expenditure in young boys before supplementation was negative ( $-915 \pm 130$  kcal). The concentration of urea nitrogen was lower in 4 out of 5 examined boys as compared to the first test after supplementation. The difference between the level of nitrogen balance output and the level after supplementation was statistically significant ( $P \leq 0.05$ ).

\* Corresponding author.

E-mail address: [kaczor@awf.gda.pl](mailto:kaczor@awf.gda.pl) (J.J. Kaczor).

## MOTS CLÉS

Gymnastique ;  
Jeunes athlètes ;  
Équilibre de l'azote ;  
Supplémentation

*Conclusion.* – The supplementation with proteins and carbohydrates products immediately after training may lead to decrease concentration of urea nitrogen and whole body protein catabolism. Monitoring energy expenditure, food nutrients, and calories in diet during and after training should be an integral part of planning for long-term training program.

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## Résumé

*Objectifs.* – L'utilisation d'une bonne alimentation chez les sportifs est l'un des éléments les plus importants de la formation sportive. En outre, les principaux éléments de la planification de la nutrition pour les sportifs devraient être : le bilan énergétique, la valeur nutritive des repas et des suppléments de régime alimentaire. Le but principal de cette recherche était d'estimer le niveau de catabolisme des protéines entières, l'équilibre de l'azote et de l'énergie chez les jeunes gymnastes.

*Matériels et méthodes.* – Dans la présente recherche ont participé de jeunes garçons âgés de  $13 \pm 0,5$  ans qui entraînaient la gymnastique sportive pendant  $6,8 \pm 0,45$  ans. Les recherches ont permis de mesurer deux fois l'urée dans la collecte des urines 24 h, mesurer la dépense énergétique indirecte pendant 24 h de surveillance de la fréquence cardiaque et supplémentation des produits glucides–protéines, pendant 7 jours.

*Résultats.* – La concentration de l'azote uréique dans l'urine au premier test avant la supplémentation a donné les résultats  $8,01 \pm 0,75$ . La dépense énergétique chez les jeunes garçons avant la supplémentation était négative  $915 \pm 130$  kcal. Après la supplémentation, la concentration de l'azote uréique était plus faible par rapport au premier test chez quatre des cinq garçons examinés. La différence entre le niveau de sortie de l'équilibre azoté et le niveau après la supplémentation était statistiquement significatif ( $p \leq 0,05$ ).

*Conclusion.* – La supplémentation en protéines et en produits glucidiques immédiatement après l'entraînement peut entraîner une diminution de la concentration d'azote uréique et du catabolisme des protéines du corps entier. Le résultat de la dépense énergétique, des nutriments alimentaires et des calories dans l'alimentation pendant et après l'entraînement devrait faire partie intégrante de la planification d'un programme de formation à long terme.

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## 1. Introduction

To achieve the best results in sport, athletes have to begin special and long lasting trainings at the very early age. Polish young athletes quite often use the training programs adjusted to the athletes from the higher sport categories. This situation may lead to untimely ending of sport career. Therefore, the use of proper diet in athletes is one of the most important elements of sports training. Hence, Polish trainers should not only be focused on the whole training process period, but also on to the proper energy intake. It is necessary component in the appropriate development and achieving the expected progress in sport competitions [1,2].

During the day 300g of whole body proteins are under exchange, from which around 20% is undergone to catabolism reactions. This fact refers to the people with low fitness activity. In professional athletes the ratio of protein catabolism may take even the level of 80%. Approximately 40% of total body mass compose muscles in adults. This value is very similar in the children [3]. Recently, it has been shown that skeletal muscle mass is the major protein molecule deposit which represents about 60% of total body protein [4]. The amount of urea nitrogen determining in urine can be applied in estimation of the level of protein catabolism and defining if their intake is proportional to removal from the body. Nitrogen balance is a traditional method used to define

the optimal protein consumption in subjects with normal style of life and in the athletes. In 1980, reports by Lemon and Mullin [5] and Wagenmakers et al. [6] have shown an increased excretion of urea in low-carbohydrates diet during physical exercise. Furthermore, the above reports have demonstrated that an intensified proteolysis of whole body protein during physical exercise is related to carbohydrates deficiency. Additionally, Smith et al. [7] have observed a negative nitrogen balance and decreased concentration of IGF-1 factor affecting the secretion of growth hormone, where they used low-calorie diet in children (8–11 years). The influence of diet on IGF-1 has already been shown by earlier study [8], where it was demonstrated that the level of IGF-1 decreased in serum using reduced calories and low protein diet. Moreover, from another research study it has been pointed out that carbohydrates play the primary part in the IGF-1 regulation [9].

Assessment of the optimal proteins intake in athletes of various disciplines is still valid and regularly recurrent topic for many years. The contribution of dietary protein during the development of whole body should be between 10–30% [10]. According to the Canadian Medical Institute (CMI) report, the reference values of protein intake for strength sport have been established between 20–40% of daily energetic demands and this is an agreement with the study by Phillips [11]. The average of protein sup-

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