BENEFITS OF APICULTURAL PRODUCE IN STRENGTH TRAINING IN TENNIS PLAYERS

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Abstract. *Sports activities ask for continuing increase of the level and complexity of physical effort. Besides the issues related to the training, most coaches and athletes focus on nutrition, on effort and recovery. Due to its high nutritious value and benefits for health, bee honey has been used as both food and medicine from times immemorial. Natural bee honey contains water, sugars, vitamins, minerals, amino acids, proteins, inhibin, and antioxidants. The supply of carbohydrates, amino acids, minerals, vitamins, fats, and antioxidants ingested while drinking associated with strength training ensures the premises for improvement of force and strength in legs and contributes to the recovery after effort and to ensuring optimum health by increasing immunity and control of hydration before, during, and after effort. Research was carried out between January 15 and March 15, 2015, on a group of 15 junior tennis players aged 1-14 (5 girls and 10 boys). First, we analysed the chemical composition of the pollen and bee honey ingested by the athletes. Each athlete ingested daily, two months before, during, and after the effort, a drink made of 3 lemons, 20-30 g of polyflorous pollen, and 40-50 g of polyflorous bee honey dissolved in 1 l of water.The subjects were assessed at the beginning and at the end from the point of view of their body composition, explosive strength (during the triple extension of the legs) and flash while jumping five times. To assess force and explosive strength in the legs, we used the Myotest System (Sion, Switzerland). For a detailed analysis of the body composition, we used a multi-frequency bio-impedantometer (InBody 720). Thus, we determined several parameters such as overall muscle weight, fat weight, or segmental muscle weight. Re-assessment of the subjects after eight weeks of training shows a significant improvement of such Results show the benefits of strength training in junior tennis players associated with ingestion of apicultural produce before competitions. Most parameters of muscle performance analysed here improved as well as strength development pliometrics.*

Key words: *apicultural produce, physical training, strength, body weight, tennis*

INTRODUCTION

Athletic activity supposes a permanent increase of the level and complexity of the *physical* effort. Besides *training*-related problems, the interest of most coaches and *athletes* focuses on nutrition, supporting the effort and recovery. Supporting the effort during training and competitions helps reaching the goals and recovering between training and competitions, maintaining an ideal body weight, and reducing the risk of accident and disease. It is well known that the possibility of solving an athletic task through training is conditioned by and directly proportionally to biological performance. Being performant depends on several factors among which come first energy generating sources, neuro-muscular and neuro-psychic functions, capacity of recovery, etc. Any disturbance of each of these factors, if not corrected in due time through recovery, can lead to pathological fatigue in athletes. In sports, the quality

of the training process, the environment in which takes place the sports events, motivation, state of health and stress are of equal importance.

Going beyond the optimum ratio between training and recovery can lead to **pathological fatigue**: first, so-called signs of residual fatigue and then, by cumulating, true pathological fatigue. High-performance sports are particularly challenging for the different organs of the human body, which leads to higher health risks.

Optimal biological state for effort and recovery can be obtained first through correct, methodical training and proper diet from the perspective of the qualitative and quantitative balance of the trophines consumed, metabolised energetically and recovered permanently by the exogenous supply. Tennis is characterised by stops and quick starts, by repetitive movements that involve many muscle groups during different shoots that fluctuate randomly over maximal or almost maximal short periods of effort up to periods of effort of moderate intensity or of lower intensity. Tennis is the only sport practiced on different areas, with different types of balls, and matches consist most often of three or five sets. Changes in the system of scoring, in the duration of the match, in the game area, in the type of ball affect physically and mentally the tennis player during a match. These variables can determine the profile of the successful tennis player.

The training programme in tennis and the fitness features of the tennis players have changed dramatically these last 10-15 years. A tennis match involves a combination of periods of maximum and minimum effort, and tennis can be considered a sport with anaerobic intermittences combined with periods of aerobic recovery. Observations from national analyses and data on the physiological traits of the players supplied by tennis players monitored during intense training supply considerable information on the player's physiological needs and on the activity models related to the duration of the match and the period of recovery. All these information can be used by coaches to establish training programmes and game tactics. Tennis is a sport with repeated sprints, with medium or high aerobic and anaerobic requirements: the mean value of training intensity is, in general, below 60-70% VO_2max and maximum mean values of the heart rate of 60-80%. The mean duration of the effort and recovery during the tennis match is 5-10 sec and 10-20 sec, respectively (the recovery ratio being 1:1 up to 1:4); training should be specific to tennis with training intervals of 5-15 sec and rest periods of 10-60 sec.

Due to the high nutritive value and to the huge benefits for health, bee honey has been used as food and medicine since times immemorial. Natural bee honey contains water, sugars, vitamins, amino acids, proteins, inhibin, and antioxidant substances. All these substances confer bee honey a high nutritive value, hence its particular importance for health (Ajibola et al., 2012). Numerous researchers have noticed that antioxidant substances in bee honey have a favourable influence on the state of health (Frankel et al., 1998; Al-Waili, 2003; Schramm et al., 2003; Alvarez-Suarez et al., 2010). To improve performances and to regenerate muscles in people that exercise, we need to consume energetic substances. According to Kreider et al. (2002), the use of bee honey by athletes supplies the necessary energy, improves heart rate and maintains a constant level of glucose in the blood. Earnest et al (2004) have noticed an improvement in the cyclists' performance after consuming bee honey and run for 65 km. Bee honey can be a source of carbohydrates for performers better than any other source of glucose because, due to its content in fructose and glucose, bee honey supplies constant energy first from burning glucose and then from fructose that metabolises slower. Bee honey also contains

low-burning sugars that replace the energy consumed and help muscle recovery (Ajibola et al., 2012).

High content in proteins (10-40%), amino acids, minerals, vitamins, fats, antioxidant substances and other substances make pollen a complex food, particularly important for human diet.

OBJECTIVES

The study aims at emphasising the importance of strength training in tennis players associated with the consumption of apicultural produce before competitions. The supply of carbohydrates, amino acids, minerals, vitamins, fats, antioxidant substances from the drink consumed on a daily basis associated with strength training ensure the premises for improving results in testing strength in the lower limbs contributing to recovery after effort and to optimum health state by increasing immunity and controlling hydration before and after effort.

METHODS

Research was carried out between January 15 and March 15 2015 on a sample of 15 junior tennis players aged 10-14 (5 girls and 10 boys). First, we carried out the chemical analysis of pollen and bee honey consumed by the athletes. We need to mention from the very beginning that apicultural produce were collected from a non-polluted plain area.

Protein content was determined through the Kjeldahl method as percentage of total nitrogen multiplied by 6.25.

Amino acids were determined using ionic exchange chromatography after hydrolysis with 6 M HCI for 24 h at 110°C. Methionine and cystine were determined through acid hydrolysis using formic acid. Chromatographic conditions were DIONEX ICS-3000 Amino Analizor, analytic column AMINOPAC PA10 (2x250 mm, P/N 055406), analytic column protection AMINOPAC PA10 (2x50 mm, P/N 055407), mobile phase: E1: water, E2: rate of 250 µL, Debit: NaOH 250 mM, E3: NaAc 1 M, Reference electrode: pH/Ag/AgCl, volume Flush 0.25 ml/min, column temperature 30°C. The level of minimum detection of the standard was 5 ng/L for each amino acid and it was established based on the noise signal at ratios of 3:1. The linear dynamic interval of the detector reaction was checked. The medium correlation coefficient ranged between 0.9884-0.994.

Vitamin C was determined from samples of 15 g each, majored energetically with about 10 cm^3 solution of HCl 2% and 2.5 g of quartz sand or glass powder for 10 min. The mixture thus obtained was passed into a balloon of 50 ml and equalled with HCl 2% and the filtered. We dropped 10 cm^3 of filtered substance into an Erlenmeyer balloon of 100 ml; we added 30 ml of distilled water, 5 ml of KI, 5 ml of HCl and 1.5 ml solution of starch and then filtered with a solution of KIO_3 until it turned blue. When adding potassium iodine over the mixture containing potassium salt we generated iodine that oxidises vitamin C. after vitamin C was completely oxidised, the iodine generated formed with the starch a complex of inclusion coloured in vivid blue. The colour needs to persist for 30 sec. The analysis was repeated twice and we calculated the mean value of the titres (V in ml).

Determining **vitamin A** in the bee honey samples was done through the Carr-Price spectrophotometric method. Vitamin A forms, with stibium trichloride (the Carr-Price reactant) in chlorophormic solution a blue coloration with a maximum of absorption at 620 nm. The reaction is also caused by the β-carotene, hence the previous dosage of carotenes.

As for the tracing of the calibration curve, the method is linear for the concentration domain of 10-150 μg retinol. The equation of linear regression obtained is y = 0.0042x – 0.0053, and the value of the correlation coefficient is 0.9966.

The analysis of **minerals** contained in bee honey and pollen was done on samples of 5 g to which we added 5 ml nitric acid 65%. The acid sample was heated to 80° C for about 2 h until dry. The process was repeated twice, after which we added 5 ml of deionised water. The suspension was filtered through quick filtering filter paper (180 mm thick, pores 20-25 μ), and the filtered substance was added deionised water up to 50 ml. In the filtered material we found such heavy metals as Pb, Ni, Cd, Zn, Mn, Co, Fe with a VARIAN 220 FAA atomic absorption spectrophotometer. Wavelengths in the readings were Cu 324.7 nm, Fe 259.9 nm, Zn 206.1 nm, Cr 205.5 nm, Ni 231.6 nm, and Pb 220.3 nm.

Each athlete consumed daily, for two months, a drink from 3 lemons, 20-30 g of polyfloral pollen, and 40-50 g of polyfloral bee honey dissolved in 1 l of water.

The subjects were evaluated at the beginning and at the end of the study from the perspective of their body composition, explosive strength (during the triple extension of the lower limbs) and expansion during five jumps in height. According to results, we established individual programmes of training. To evaluate the intensity of the effort during training sessions, we used monitors of cardiac frequency (Polar F3 pulse meters, Finland).

To evaluate force and explosive strength in the lower limbs, we used the Myotest System (Sion, Switzerland), that supplies recommendations regarding the loading and execution speed during the strength and resistance training. Using this system, we evaluated strength and explosive strength at the level of the lower limbs muscles, expansion and speed of execution, with the help of an acceleration meter at the level of the basin. To do so, all participants were barefoot and had to make five free jumps starting from the sitting position (the "Counter movement jump" test).

The training programme consisted in five training sessions per week of 2 h each and three specific physical training per week of 1 h each. During the physical training programme, we used the isotonic method, the ballistics and the pliometrics to develop strength: low impact jumps (jumping steps, leaped steps, robe jumping, jumps over lines and fences or low benches – 30 cm, and higher impact exercise including jumping over 50 cm fences, on high benches, deep jumps followed by steeple chase and medicinal ball exercise, and throwing. The parameters of the training were load 40-60%, 3-5 exercise, 10-20 repetitions per series, 3-6 series per training, 2-5 min rest intervals, explosive sped of execution, 3 times a week.

RESULTS

Re-evaluating the subjects 8 weeks later shows a significant improvement of such parameters as skeletal muscular weight, expansion and explosive strength of the lower limbs that are so important in tennis.

Expansion (cm)	38.71±6.894	39.07±7.628	p=0.021
Explosive strength (W/kg)	52.08±14.61	53.34±13.54	p=0.007
Explosive force (N/kg)	24.80±3.893	25.13±2.973	p=0.391
Skeletal muscular weight (kg)	29.17±6.471	29.98±6.829	p=0.019

Explosive force increased without reaching statistic significance threshold, from 24.80±3.893 to 25.13±2.973 N/kg, p=0.391

Skeletal muscle weight increased significantly statistically from 29.17±6.471 to 29.98±6.829 kg, p=0.019.

CONCLUSIONS

The results of the study show the benefits of strength training in junior tennis players associated with consumption of apicultural produce before competitions. Most muscle performance parameters analysed improved. This suggests that strength training 2-3 times a week for 8 weeks has a beneficial effect on the muscular profile. We also noted that the development of the lower limbs muscles (expansion, strength or muscular force) is due particularly to muscle contractions of exocentric type during pliometric exercise. We believe that, besides physical activity, proper nutrition (rich in proteins, essential amino acids, carbohydrates, vitamins and minerals from the drink based on apicultural produce and lemon) contributed to the improvement of the muscular profile, to better preparation of the glycogen reserve before training; likewise, the recovery time after effort decreased as a result of adaptation to effort and we assume that this is the effect of supplements based on apicultural produce. Another very important aspect during the study was hydration before and after effort. We could see that the increase of immunity in athletes during this period prevented them from catching viroses or other diseases of the respiratory tract. The increase of the muscular strength and expansion is largely due to the complexity, intensity and load volume [16]. It also seems to be the result of the increase of neuro-muscular activity and of the improvement of coordination rather than of muscular hypertrophy [17]. The increase in strength and muscular resistance through physical training is the result of both higher neuro-muscular activation (through the increase of the number of motor units and of the synchronism of muscular contractions) and of better metabolic adaptation (through the improvement of energy use) at the level of muscular fibres [17-21].

Previous studies regarding the strength training suggested that the adaptations previously mentioned are absent in young athletes mainly because of circulating androgens in children [21, 22].

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