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The Use of Recovery Methods in Professional and Recreational Tennis Players

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ABSTRACT

Top-level athletes use a large number of recovery methods for achieving the best possible results. Current literature points to the presence of positive effects in using recovery methods in relation to the improvement of sports performance, as well as to results. The aim of this study was to research the types and frequency of recovery methods utilisation between professional and recreational tennis players. The research included a total of 80 professional and recreational male and female tennis players (average age 24.1±12.1 years old), among which 44 (55%) male respondents and 36 (45%) female respondents. A standard anonymous survey questionnaire on the methods and means of recovery was used. The results point to the existence of a significant difference between the respondents from the professional and recreational playing categories in the types and frequency of recovery methods. Likewise, a higher frequency of utilising selected recovery methods was proven in professional tennis players. The largest difference was found for dietary supplementation (3.5±1.5 vs. 1.7±0.9; p<0.001), then for use of Kinesio Tape (2.3±1.1 vs 1.1±0.4; p<0.001), as well as for massages which were more often used by professionals in comparison to recreational tennis players (3.3±1.1 vs. 2.2±1.1; p<0.001). A better understanding of the types and frequency of utilising recovery methods, particularly from the aspect of differences between professional and recreational tennis players, is of great importance, both for tennis players, as well as for their accompanying staff members (i.e. coaches, physical therapists, parents, etc.).

Key words: *tennis, recovery methods, professional players, recreational players, questionnaire*

Introduction

Top-level tennis players are faced with a constant increase in the number of competitions and a very compact competition calendar, this being a factor that results in an increased number of injuries[1]. The tennis season lasts for the majority of an entire calendar year with a short preparation phase at the end which lasts between 6–8 weeks. An overloaded tournament schedule can result in chronic fatigue and injuries. Fatigue and injuries can occur due to numerous factors, such as playing style, gender, training status, age, playing surface, type of ball used in training, and environment, which result in various physiological and psychological disorders[2]. During repeated high-level training and competitions, optimal recovery affects the restoration of physiological and psychological processes. This subsequently results in better-quality of readiness in the athletes to be able repeat training and competitive performance. The recovery of athletes is a complex process that depends on the variety of training methods, as well as external factors such as stress. In order to reduce the effect of fatigue and to accelerate and facilitate recovery, athletes use numerous techniques and methods for recovering. The challenge which athletes face is the manner in which different types of training results in different types of fatigue[3]. Fatigue is a result of overload and stress on physiological systems, and quick and optimal recovery is of crucial importance for tennis players. At the professional level, there are a wide variety of recovery techniques (e.g. water immersion, active recovery, stretching, whole-body cryotherapy, compression garments, etc.). The lack of research indicating the types and frequency of using recovery methods presents a problem, particularly from the aspect of differences between professional and recreational tennis players. In a prior research study, it was demonstrated that 80% of tennis players use different recovery methods after exercising, primarily foam rolling, cold-water immersion, warm water immer-

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sion, and protein shake intake[4]. However, studies with top-level tennis players remain limited. A deeper understanding of the types and frequency of recovery method utilisation, especially from the aspect of studying the differences between professional and recreational tennis players, is of great importance for future sports practice. The aim of this research is to determine which methods of recovery are most represented in the world of tennis, as well as if there are differences in the types and frequency of recovery methods between professional and recreational tennis players.

Methods

Respondents

This study was conducted among a sample of tennis players of differing competitive levels. All the players who participated were selected at random. A total of 80 respondents participated in the research, of which 44 were male (55%) and 36 were female (45%). Overall, 27 were currently competing in the professional male category, whereas 17 were competing in the recreational category. In the female category, 19 respondents were competing in the professional female category and 17 in the recreational category. So in total, the majority of the sample (46, 57.5%), consisted of professional tennis players (ATP and WTA level). From the ITF category (lower quality level), there was a total of 17 (21.3%) tennis players, among which eight respondents were under the age of 18. The number of junior players within the category of recreational players was 22. On average, the research respondents were aged 24.1±12.1, with an average height of 174.7±15.6 cm and body mass of 68.4±19 kg. The average duration period of the respondents having played sports was 15.3±11.2 years, with the average weekly training time of 13.7±10.2 hours, and an average weekly competition time of 4.6±4.6 hours. The research received Ethical authorization at the Faculty of Health Studies in Rijeka (July 17, 2020). Upon accepting to participate, the respondents gave their consent and were informed on the methods and purpose of implementing the research. While conducting the survey questionnaire, written parental consent was requested for the athletes under the age of 18.

Measuring instruments

An anonymous survey questionnaire on the methods and means of recovery utilized by tennis players was used to measure data. The mentioned survey questionnaire was a modified version designed according to the variables found in the research implemented by another author[5]. The methods listed in the questionnaire were as follows: cryotherapy, contrast bath therapy, stretching, massage, compression (bandage, compression garments, Flossing), Kinesio Tape, foam rolling, myofascial techniques, dry needling, electro-acupuncture, hyperbaric oxygen therapy (HBOT), Vacusport, lymphatic drainage, sauna, jacuzzi, active recovery, passive recovery, relaxation techniques, nutrition and fluid restoration, supplementation, sleep, and socialization with friends or family. The questionnaire contained questions about the basic socio-demographic data of the tennis player (age, gender, height, body mass), category of tennis level (professionally or recreationally), the duration period of playing tennis, and the level of competition they compete at (ATP, WTA, ITF, recreationally). The questionnaire also included the type of competitions the tennis players participate in (singles or doubles), current ranking position, average weekly number of training hours, and average weekly number of hours in competition. In the questionnaire, the respondents specified the utilized methods of recovery and the frequency of use following activity. Each of the listed methods was designated a scale between 1–5 according to the Likert scale which determines how often the respondent practices a given method (1-never, 2-rarely, 3-sometimes, 4-often, 5-always). In order to facilitate the review of the results, tennis players at the ATP, WTA and ITF level were categorized as professional players, whereas others were included into the category of recreational players.

Statistical data processing

For the purpose of conducting statistical analysis, the IBM SPSS Statistics 25.0 (IBM, Armonk, USA) statistical software was used, and the data was prepared beforehand with the MS Excel 2007 (Microsoft Corp., Redmond, USA). The normality of data distribution was tested with the Shapiro-Wilk test. Descriptive statistics included absolute value and percentage for nominal variables, while numerical variables incorporated arithmetic mean (AM), standard deviation (SD), median, interquartile range (IQR), as well as minimum and maximum value. Fisher's exact test and the Chi-square test were used for determining the differences between the respondents with consideration to their tennis category and gender. For numeric variables of non-normal distribution the Mann Whitney U test was used, while for variables of normal distribution the independent samples T-test was applied. The significance level of $\alpha < 0.05$ was used.

Results

General characteristics of respondents

The general characteristics of the respondents according to the status of playing tennis are presented in Table 1. Professional tennis players had a somewhat greater height ($p=0.001$) and body mass ($p=0.024$) in relation to recreational players. Table 2 demonstrates the playing characteristics of the respondents in accordance with their status of playing tennis. Professional tennis players entered a longer period of playing tennis ($p=0.048$). Statistically significant differences were found in the average weekly time spent in competition in regards to professional and recreational playing status ($p<0.001$). Professional tennis players spend more time within a week in training and competitions in comparison to recreational players

TABLE 1

GENERAL CHARACTERISTICS OF RESPONDENTS BY STATUS OF PLAYING TENNIS (N=80)

	Professional players (N=46)						Recreational players (N=34)						
Variable	AM	SD	median	IQR	min	max	AM	SD	median	IQR	min	max	p
Age	22.5	9.3	20	10	10	52	26.3	15	28.5	26.5	8	63	0.693[c]
Body height (cm)	179.7	12.2	180	13.8	145	198	167.8	17.3	168	24.5	131	202	0.001[c]*
Body mass (kg)	72.9	15.6	73.5	22	32	100	62.4	21.7	58.5	38.5	26	101	0.024[c]*
BMI (kg/m^2)	22.3	2.6	22.5	3.6	15.2	27.7	21.3	3.8	20.9	7.2	15.2	27.8	0.236[d]

Legend of abbreviations: N – sample; AM – arithmetic mean; SD – standard deviation; IQR – interquartile range; min – minimum value; max – maximum value; BMI – body mass index.

[c]Mann Whitney U test; [d]T–T-test for independent samples; *statistically significant.

(p<0.001). A statistically significant difference was also found in the duration of playing tennis between professional and recreational players, 12.5±11.3 vs. 8.5±20.5 years (p=0.048).

Use of recovery methods

Table 3 shows the frequency of using individual recovery methods. The highest use frequency was found in methods of socializing with friends or family (4.3±1) and sleep as a method of recovery (4.2±1). The lowest frequency of use was reported for the method of using hyperbaric oxygen therapy (1.1±0.4), as well as for dry needling and electro-acupuncture (1.3±0.7). Out of the total 21 recovery methods listed, the average number of methods reported by the respondents to be used rarely, sometimes, often or always was 12.3±4.3 per respondent. An average 2.5±1.8 methods per respondent were used often or always. The average respondent never uses 8.7±4.3 out of the total 21 methods that were assessed.

Table 3 also demonstrates the frequency of use for recovery method in regards to the status of playing tennis. A statistically significant difference was determined in the frequency of use in favour of professional tennis players. The biggest difference between professionals and recreational players was found in dietary supplementation (3.5±1.5 as opposed to 1.7±0.9; p<0.001). Following on from this was the use and application of Kinesio Tape (2.3±1.1 vs 1.1±0.4; p<0.001) and massages, which professionals were found to use more often (3.3±1.1) compared to recreational players (2.2±1.1) players (p<0.001).

Table 4 demonstrates the distribution of using recovery methods according to a players status. The vast majority of professional tennis players use stretching and sleep as recovering methods while the vast majority of recreational tennis players use socializing with friends or family.

Discussion

The general purpose of this study was to determine which recovery methods are most represented in the world of tennis, as well as if there are differences in the types and frequency of recovery methods used between professional and recreational tennis players. It was found that there are statistically significant differences between the respondents in the professional and recreational playing category both in the types and frequency of using recovery methods. These results demonstrate that professional tennis players use dietary supplementation more often, as well as the use of Kinesio Tape and massages than those in the recreational category.

This research provides unique and valid results as it is one of only a few studies in which participants were highly ranked tennis players, and focused specifically on the world of professional and recreational tennis. The results of this study indicate that tennis players use a wide range of methods aimed at facilitating the best possible recovery. There is an obvious disparity between the frequency of use of certain recovery strategies and their valid relevance in practice. For example, the efficiency of applying cold recovery methods immediately following a tennis match has been proven[6]. Namely, the timely use of cold baths affects the reduction of neuromuscular efficiency and indirect markers of muscle damage (creatine kinase and concentrations of myoglobin in serum)[6]. Likewise, cold methods can improve a tennis players' performance and reduce heat load[7]. At the same time, previous knowledge indicates that recovery methods are most often used around the day of competition[8]. A common reason for infrequent use of recovery methods are mainly competing disciplinary interests and resource limitations. Players' physical performance and recovery are at risk during multiple tennis matches at tournament events[9]. Different recovery methods, as well as the frequency of their use have been proven to have a significant effect on the recovery and preparation of tennis players for extensive and exhausting competitions[10]. This study found that both professional and recreational tennis players use multiple recovery methods after training and matches. A very small number of respondents from this research stated using only one single recovery method. In previous studies, similar findings were determined, and likewise, it was stated that most tennis players (69.2%) used a combination of multiple recovery methods[11]. By precisely applying a combination of recovery methods, a better recovery effect can be achieved compared to using only one method[7]. Previous research also shows an improvement of

TABLE 2

PLAYING CHARACTERISTICS OF RESPONDENTS ACCORDING TO STATUS OF PLAYING TENNIS

	Professional players (N=46)							Recreational players (N=34)						
Variable	N (%)	AM	SD	median	IQR	min	max	N (%)	AM	SD	median	IQR	min	max	p
Gender															
male	27 (58.7)							17 (50)							0.499[a]
female	19 (41.3)							17 (50)							
Duration period of playing tennis (years)		15.9	8.9	12.5	11.3	5	43		14.5	13.7	8.5	20.5	1	57	0.048[c]*
Organization of participation in competitions															
ATP	15 (32.6)								0 (0)						<0.001[b]*
WTP	5 (10.9)								0 (0)						
ITF	16 (34.8)								1 (2.9)						
recreational playing	10 (21.7)								33 (97.1)						
Tennis playing format															
single	15 (32.6)								11 (32.4)						0.307[b]
double	3 (6.5)								0 (0)						
both	28 (60.9)								23 (67.6)						
Current professional ranking															
top 20	8 (17.4)								1 (2.9)						<0.001[b]*
top 100	5 (10.9)								0 (0)						
top 200	3 (6.5)								0 (0)						
over top 200	8 (17.4)								1 (2.9)						
over top 500	16 (34.8)								0 (0)						
recreational playing	6 (13)								32 (94.1)						
Average weekly time in training (h)		18.3	8.4	18	14	2	40		7.4	9.2	5	5.3	1	40	<0.001[c]*
Average weekly time in competition (h)		6.5	5	5	7.3	0	20		2	2.2	1.3	4	0	10	<0.001[c]*

Legend of abbreviations: N – sample; AM – arithmetic mean; SD – standard deviation; IQR – interquartile range; min – minimum value; max – maximum value.

[a]Fisher's exact test; [b]Chi-square test; [c]Mann Whitney U test; *statistically significant.

player performance was confirmed upon applying a combination of recovery methods (i.e. cryotherapy, compression garments and quality of sleep improvement)[12]. In addition, a significant improvement of lower-body explosive strength was indicated, as well as a reduced perception of pain among the respondents. One of the more recent studies attempted to determine the types and frequency of applying recovery strategies in top-level athletes[13]. Their results point to the fact that elite-level athletes use various recovery methods. The most frequently used recovery methods were as follows: sauna (96,7%), massage (86,9%), day-time sleep (81.0%) and long night-time sleep (at least 9 hours) (61.4%). Recovery methods with proven efficiency, such as cold-water immersion and compression garments, were rarely used.

This research indicates a higher frequency of use of recovery methods among professional tennis players in relation to the recreational group. Likewise, professional tennis players more often use multiple recovery methods as opposed to recreational players. The mentioned finding is consistent with previous research which also points to the presence of significant differences between the use of recovery methods in relation to the tennis playing category (professionally or recreationally)[11]. This study showed that the biggest difference between professional and recreational tennis players was the differing use of dietary supplementation. Food and fluid intake are important for the nutritional aspect of recovery[7]. However more research is needed in order to determine the optimal amount and timing for liquid, carbohydrate and protein intake for post-activity recovery in tennis players, particularly dur-

TABLE 3

FREQUENCY OF USE OF RECOVERY METHODS ACCORDING TO STATUS OF PLAYING TENNIS

	Overall players (N=80)	Profesional players (N=46)	Recreative players (N=34)	
Method	AM±SD (min-max)	AM±SD (min-max)	AM±SD (min-max)	p
Ice bath. cryo sauna. cryo chamber	1.9±1.1 (1–5)	2.3±1.1 (1–5)	1.4±0.7 (1–3)	<0.001[c]*
Contrast bath therapy	2.2±1 (1–4)	2.4±1.1 (1–4)	1.9±1 (1–4)	0.018[c]*
Stretching	3.9±1.1 (1–5)	4.2±1.1 (1–5)	3.6±1 (2–5)	0.006[c]*
Massage	2.9±1.2 (1–5)	3.3±1.1 (1–5)	2.2±1 (1–5)	<0.001[c]*
Compression (bandage. compression garments. flossing)	1.7±1.1 (1–5)	2.1±1.1 (1–5)	1.3±0.5 (1–3)	<0.001[c]*
Kinesio Tape	1.8±1 (1–5)	2.3±1.1 (1–5)	1.1±0.4 (1–3)	<0.001[c]*
Foam rolling	2.3±1.5 (1–5)	2.9±1.1 (1–5)	1.4±0.9 (1–4)	<0.001[c]*
Myofascial techniques	1.5. a±0.9 (1–5)	1.8±1.1 (1–5)	1.1±0.3 (1–3)	<0.001[c]*
Dry needling. electro-acupuncture	1.3±0.7 (1–4)	1.5±1.1 (1–4)	1.1±0.4 (1–3)	0.004[c]*
HBOT (Hyperbaric Oxygen Therapy). Vacusport	1.1±0.4 (1–3)	1.2±1.1 (1–3)	1±0.2 (1–2)	0.176[c]
Lymphatic drainage (manual. mechanical)	1.4±0.8 (1–5)	1.6±1.1 (1–5)	1.1±0.4 (1–3)	0.004[c]*
Equipment (Tecar. Indiba. electroteraphy)	1.5±0.8 (1–4)	1.8±1.1 (1–4)	1±0.2 (1–2)	<0.001[c]*
Sauna	1.8±1.1 (1–5)	1.9±1.1 (1–4)	1.6±1.2 (1–5)	0.024[c]*
Jacuzzi	1.8±1.1 (1–5)	2±1.1 (1–5)	1.6±1.1 (1–5)	0.015[c]*
Active recovery (light aerobic activity)	3.1±1 (1–5)	3.4±1.1 (1–5)	2.8±1 (1–5)	0.003[c]*
Passive recovery	2.9±1.1 (1–5)	2.9±1.1 (1–5)	2.8±1.2 (1–5)	0.797[c]
Relaxation techniques (meditation. biofeedback. hypnosis. breathing)	2±1.2 (1–5)	2.2±1.1 (1–5)	1.7±1 (1–4)	0.134[c]
Nutrition and fluid	3.8±1.1 (1–5)	3.8±2.2 (2–5)	3.7±1.2 (1–5)	0.839[c]
Supplementation (protein shakes. BCAA branched-chain amino acids. recovery)	2.7±1.5 (1–5)	3.5±1.1 (1–5)	1.7±0.9 (1–4)	<0.001[c]*
Sleep	4.2±1 (1–5)	4.2±1.1 (1–5)	4±1.1 (2–5)	0.472[c]
Socializing with friends or family	4.3±1 (1–5)	4.1±1.1 (1–5)	4.4±1 (1–5)	0.086[c]

Legend of abbreviations: N – sample; AM – arithmetic mean; SD – standard deviation; min – minimum value; max – maximum value.

[c]Mann Whitney U test; [d]U–test; *statistically significant between professional and recreative players.

TABLE 4

DISTRIBUTION OF USING RECOVERY METHODS ACCORDING TO STATUS OF PLAYING TENNIS

	Overall sample (N=80)					Professional players (N=46)					Recreational players (N=34)				
Method	Never	Rarely	Sometimes	Often	Always	Never	Rarely	Sometimes	Often	Always	Never	Rarely	Sometimes	Often	Always
Ice bath, cryo sauna, cryo chamber	38	18	16	7	1	13	13	12	7	1	25	5	4	0	0
Contrast bath therapy	29	16	27	8	0	12	10	17	7	0	17	6	10	1	0
Stretching	1	9	18	20	32	1	4	5	12	24	0	5	13	8	8
Massage	15	15	25	17	8	5	5	14	15	7	10	10	11	2	1
Compression (bandage, compression garments, flossing)	44	24	6	1	5	18	17	5	1	5	26	7	1	0	0
Kinesio Tape	41	21	15	1	2	11	18	14	1	1	30	3	1	0	0
Foam rolling	41	7	11	13	8	12	7	8	11	8	29	0	3	2	0
Myofascial techniques	56	14	6	3	1	23	14	5	3	1	33	0	1	0	0
Dry needling, electro-acupuncture	63	8	8	1	0	31	7	7	1	0	32	1	1	0	0
HBOT (Hyperbaric Oxygen Therapy), Vacusport	74	3	3	0	0	41	2	3	0	0	33	1	0	0	0
Lymphatic drainage (manual, mechanical)	63	8	7	1	1	31	7	6	1	1	32	1	1	0	0
Equipment (Tecar, Indiba, electrotherapy)	55	14	9	2	0	22	13	9	2	0	33	1	0	0	0
Sauna	44	16	14	4	2	19	13	12	2	0	25	3	2	2	2
Jacuzzi	44	16	12	6	2	19	13	9	4	1	25	3	3	2	1
Active recovery (light aerobic activity)	6	11	37	20	6	2	4	19	17	4	4	7	18	3	2
Passive recovery	10	20	27	18	5	5	11	17	11	2	5	9	10	7	3
Relaxation techniques (meditation, biofeedback, hypnosis, breathing)	39	16	14	7	4	20	9	8	5	4	19	7	6	2	0
Nutrition and fluids	4	5	19	28	24	0	5	11	16	14	4	0	8	12	10
Supplementation (protein shakes, BCAA, recovery)	25	13	18	6	18	7	4	12	5	18	19	9	6	1	0
Sleep	1	7	10	23	39	1	2	5	15	23	0	5	5	8	16
Socializing with friends or family	2	2	12	22	42	1	1	9	15	20	1	1	3	7	22

ing their preparation for tournament play. A significant difference in using recovery methods between professional and recreational tennis players was also determined for the application of Kinesio Tape and massages, which are more frequently used by professionals than by recreational players. Finally, the strengths and limitations of this study are discussed below. A key strength of this study is that a substantial proportion of the sample were professional ATP and WTA players, which is uncommon in quantitative and sport science research. The main limitation of the study was its cross-sectional design and the inability to generalize the results. The recommendation for future research is to see the effectiveness of the methods used in professional and recreational athletes and whether the use of these methods in minor athletes is justified.

Conclusion

In the last decade, more and more research is being done in relation to recovery in the world of sport. The aim of numerous studies is to understand how to limit fatigue and weariness, as well as to accelerate and optimise recovery. The challenge certainly results from the fact that different types of training also result in different types of fatigue. This study shall be of significant help to tennis and physical conditioning coaches, as well as other staff members of expert teams in understanding the types and frequency of using recovery methods in both professional and recreational players. By understanding the current habits of tennis players, expert teams shall be better at planning the preparation and recovery of athletes, which could ultimately assist in optimizing their performance, reducing injuries, and maximizing the results.

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PRIMJENA SREDSTAVA OPORAVKA KOD PROFESIONALNIH I REKREATIVNIH TENISAČA

SAŽETAK

U vrhunskom sportu sportaši koriste veliki broj metoda oporavka za postizanje što boljih rezultata. Dosadašnja literatura ukazuje na postojanje pozitivnih učinaka pri korištenju metoda oporavka na poboljšanje sportske izvedbe kao i na rezultate. Cilj ovog rada bio je ispitati vrstu i učestalost korištenja metoda oporavka između profesionalnih i rekreativnih tenisača. Obuhvaćeno je ukupno 80 profesionalnih i rekreativnih tenisača i tenisačica (prosječne dobi 24,1±12,1 godina starosti), od čega je 44 (55%) ispitanika i 36 (45%) ispitanica. Korišten je standardni anonimni anketni upitnik o metodama i sredstvima oporavka. Rezultati ukazuju postojanje značajne razlike između ispitanika profesionalne i rekreativne kategorije igranja u vrsti i učestalosti korištenja metoda oporavka. Također, dokazana je veća učestalost korištenja odabranih metoda oporavka kod profesionalnih tenisača. Najveća razlika utvrđena je za suplementaciju prehrane (3,5±1,5 vs.1,7±0,9; p<0,001), zatim primjena Kinesio Tape-a (2,3±1,1 vs 1,1±0,4; p<0,001) te masaže koje su profesionalci češće primjenjivali (3,3±1,1) u odnosu na rekreativne (2,2±1,1) igrače (p<0,001). Bolje razumijevanje vrsta i učestalost korištenja metoda oporavka, posebice s aspekta razlika između profesionalnih tenisača i rekreativaca, od velikog je značaja kako za tenisače, tako i za njihovo popratno osoblje (npr. treneri, fizioterapeuti, roditelji, itd.).