Sports training: planning methods, methodological practices and load management in basketball, soccer, futsal and tennis.

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Training Load | Methodology | Team Sport

Headline

In recent decades, sports science has undergone great changes, providing an important framework of scientific evidence on training methodology (1). Much of the researchers' efforts have been focused on studying the most effective strategies to reduce injury risk (2,3). Among these, the load management in training and competition, fatigue monitoring (4) or strength training (5) stand out.

Aim

To provide information on methodological training practices as well as on workload control and fatigue monitoring methods that are used in four of the most popular sports worldwide.

Methods

Subjects. 261 coaches and physical trainers of teams or individual athletes (in the case of tennis) from 20 different countries (Argentina, Australia, Azerbaijan, Chile, China, Colombia, Ecuador, Spain, United States of America, Finland, France, Mexico, Monaco, Norway, Portugal, United Kingdom, Dominican Republic, Serbia, Switzerland and Vietnam) participated in the study. 52 of the respondents worked with women and 209 with men, all of them aged between 12 and 39 years old. Sample distribution according to sport and competitive level is reflected in Table 1. All the participants voluntarily agreed to participate in the study in accordance with the Declaration of Helsinki.

Procedure. The survey design and distribution were carried out through the online platform Qualtrics XM (Utah, United States).

Statistical Analysis. The Chi Square test was used to compare the results according to sport. In the variables "frequency of non-specific training" and "time dedicated to non-specific training" a one-way ANOVA was used. In all cases, the Bonferroni post hoc test was used to analyze the possible existence of significant differences between sports. After verifying that there were no significant differences according to sex in the studied variables, no distinction was made between men and women for the analysis.

Competitive Level	Basketball	Soccer	Futsal	Tennis
Local (8.05%)	6.7%	9.5%	5.6%	0%
Regional (40.61%)	40%	40.5%	38.9%	43.5%
National (38.70%)	43.3%	37.9%	55.6%	26.1%
International (12.64%)	10%	12.1%	0%	30.4%
Total (n=261)	**30**	**190**	**18**	**23**

Table 1. Sample distribution according to competitive level and sport.

Model	Basketball	Soccer	Futsal	Tennis	p
Classic	$16.7\%_{a}$	$5.3\%_{a}$	$27.8\%_{b}$	$30.4\%_{b}$	0.000***
Block	$30\%_{a}$	$6.3\%_{b}$	$5.6\%_{b}$	$47.8\%_{c}$	0.000***
ATR	$13.3\%_{a}$	$5.3\%_{a}$	$5.6\%_{a}$	$17.4\%_{a}$	0.096
Microcycle	$66.7\%_{a}$	$84.2\%_{a}$	$66.7\%_{a}$	$17.4\%_{b}$	0.000***
Other	$3.3\%_{a}$	$1.1\%_{a}$	$0\%_{a}$	$0\%_{a}$	0.625

Table 2. Planning models according to sport.

Results

Short-term planning, based on the weekly microcycle, is by far the most widely used in soccer, basketball and futsal. Block periodization and classical periodization are much more frequent in tennis.

There are no differences between sports in relation to the frequency with which they incorporate non-specific or complementary training (p=0.533). In all cases it was carried out between 1 and 2 days a week. However, we find significant differences in the time allocated to non-specific training in each of those sessions (p=0.000). In basketball and tennis they usually spend between 30 and 45 minutes while in soccer and futsal this time is between 10 and 30 minutes. Strength is the main non-specific content in all sports. However, while in basketball, soccer, and futsal, strength training is incorporated in approximately 90% of teams, in the case of tennis it is only used with 65% of athletes. Endurance, meanwhile, has a much greater role as non-specific content in tennis than in other sports. As can be seen in Table 3, other contents with a prominent role during non-specific training are range of motion (ROM) and movement quality.

Most of the respondents stated that they control training loads, without differences between sports (p=0.764). The same occurs with fatigue monitoring (p=0.423). On the contrary, the load control in competition does show statistically significant differences (p=0.000). All the data are reflected in figure 1.

Analyzing training load quantification methods, we found statistically significant differences in the variable "global and local positioning devices" (GPS/LPS) (p=0.001). These are more used in soccer and tennis than in basketball and, especially, in futsal. Similarly, differences also appear in the use of rating of perceived exertion (RPE) (p=0.002), very common in soccer, but only used with 50% of tennis players. Likewise, the use of video tools during training is much higher in tennis

Content	Basketball	Soccer	Futsal	Tennis	p
Strength	$89.3\%_{ab}$	$91.1\%_{a}$	$93.3\%_{a}$	$65\%_{b}$	0.005**
Flexibility	$7.1\%_{a}$	$16.1\%_{a}$	$26.7\%_{a}$	$15\%_{a}$	0.399
Endurance	$21.4\%_{ab}$	$13.9\%_{a}$	$0\%_{a}$	$45\%_{b}$	0.001**
ROM	$64.3\%_{a}$	$66.7\%_{a}$	$73.3\%_{a}$	$45\%_{a}$	0.241
Mov. Quality	$57.1\%_{a}$	$58.9\%_{a}$	$33.3\%_{a}$	$60\%_{a}$	0.288
Speed	$32.1\%_{a}$	$30.6\%_{a}$	$20\%_{a}$	$40\%_{a}$	0.650
Other	$3.6\%_{a}$	$2.8\%_{a}$	$6.7\%_{a}$	$5\%_{a}$	0.831

Table 3. Non-specific training content according to sport.

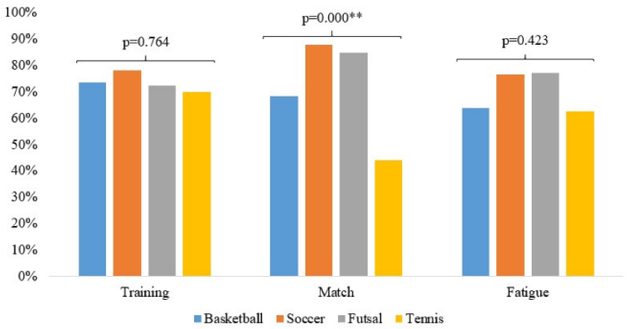

Fig. 1. Training load, competition load and fatigue control according to sport.

Method	Basketball	Soccer	Futsal	Tennis	p
GPS/LPS	11.1%$_a$	47.5%$_b$	0%$_a$	33.3%$_{ab}$	0.001**
Accelerometer	11.1%$_a$	13.7%$_a$	0%$_a$	8.3%$_a$	0.574
Potentiometer	5.6%$_a$	2.9%$_a$	0%$_a$	0%$_a$	0.759
Heart Rate	16.7%$_a$	28.1%$_a$	9.1%$_a$	33.3%$_a$	0.379
RPE	77.8%$_{ab}$	89.2%$_b$	90.9%$_{ab}$	50%$_a$	0.002**
Biochemical	5.6%$_a$	5%$_a$	0%$_a$	8.3%$_a$	0.832
Radar	0%$_a$	5.8%$_a$	0%$_a$	8.3%$_a$	0.578
Tactic Scales	22.2%$_a$	14.4%$_a$	18.2%$_a$	8.3%$_a$	0.733
Video	27.8%$_a$	35.3%$_a$	45.5%$_{ab}$	83.3%$_b$	0.008**

Table 4. Training load quantification methods according to sport.

Method	Basketball	Soccer	Futsal	Tennis	p
Wellness	57.1%$_{ab}$	79.6%$_b$	60%$_{ab}$	10%$_a$	0.000***
Other Scales	35.7%$_a$	34.5%$_a$	20%$_a$	20%$_a$	0.638
Biochemical	21.4%$_a$	12.4%$_a$	0%$_a$	20%$_a$	0.414
Jump Test	50%$_a$	33.6%$_{ab}$	20%$_{ab}$	0%$_b$	0.055
Isometric Test	0%$_a$	1.8%$_a$	0%$_a$	0%$_a$	0.894
HRV	42.9%$_a$	15.9%$_a$	20%$_a$	100%$_b$	0.000***

Table 5. Fatigue monitoring methods according to sport.

than in the other disciplines, especially soccer and basketball ($p = 0.008$).

Finally, fatigue monitoring methods also differ depending on the sport. The wellness scales are widely used in soccer but have little role in tennis (p=0.000). On the other hand, the heart rate variability (HRV) was used in 100% of the professionals dedicated to tennis, while it does not have as much weight in basketball, soccer and futsal ($p = 0.000$).

Discussion

The results of the survey reveal that there are differences in planning models, in methodological proposals, and in load management and fatigue monitoring methods according to sport.

Coaches and physical trainers of team sports mainly resort to short-term planning, carried out through the weekly microcycle. Classical and block periodization are the most widely used in tennis. These methods have been the most studied in this sport (6). The competitive calendar is important when choosing the planning method used (7). Considering that many of the professional tennis players end up playing more than 50 matches a year, the authors asked ourselves if long-term planning methods are the best strategy.

In all sports, at least 10 minutes per week of non-specific training are carried out. However, in basketball and tennis the average volume of each session is between 30 and 45 minutes, being higher than that used in soccer and futsal. The optimal complementary training volume for injury prevention is between 30 and 60 minutes per week, with a distribution in 2 or 3 sessions a week (8). In this way, only in basketball and tennis could they approach these values. In soccer and futsal, less complementary work is carried out than that recommended for the reduction of injury risk.

Strength training is the most recurrent complementary work, especially in team sports. ROM or movement quality also have a strong presence. Flexibility, on the other hand, is generally the content with less prominence. These results seem close with different studies, which highlight the importance of muscular strength to reduce the risk of injury (5,9), with evidence of a greater magnitude than that shown by other contents such as flexibility, balance or agility (10).

Load control is one of the main strategies to reduce injury risk (11,12). In our study, a significant proportion of the respondents affirm that they control the training loads, without differences between sports. Something similar occurs with fatigue monitoring, also associated with the likelihood of injury (13). In contrast, the competition load control is significantly higher in soccer than in tennis. Understanding that workload management must include both training and competition loads, we find it surprising to find these differences.

RPE is the most widely used method of load control in team sports. Its validity and usefulness have been amply demonstrated (14). However, and even though its specific utility for load control in tennis has also been recently highlighted (15), according to our results it is only used in half of tennis players. In this sport, video tools are by far the most widely used, well above the other three sports. GPS/LPS devices stand out in soccer, in relation to what was previously published by Akenhead and Nassis (16), while in basketball they appear very marginally and in futsal none of the professionals claim to have used them. Despite the fact that local positioning devices (LPS) allow the collection of this type of data in indoor environments, this circumstance seems to continue to be a major impediment in indoor sports.

Finally, subjective wellness questionnaires stand out as the most widely used methods to monitor fatigue. Simplicity in its application goes hand in hand with great utility, according to Thorpe et al. (13) However, there are significant differences between its use in soccer, widely spread, with respect to tennis, which is only used by 10% of coaches. In contrast, HRV appears as an instrument used with 100% of tennis players, possibly influenced by the high proportion of respondents who worked with international athletes in this sport.

Practical Applications

The authors consider that the data derived from this survey should make us reflect on our methodological practices. Specifically, it is reflected that:

- Traditional periodization models are widely used in tennis. We consider that they may not be the best option considering the characteristics of the current competitive calendar in this sport.
- Time dedicated to non-specific training contents is less than that recommended to reduce the risk of injury, indicating that we should most likely increase it, especially in soccer and futsal.
- Furthermore, in relation to the workload control, there is an underuse of subjective tools such as RPE, especially in tennis, a sport in which something similar occurs with the fatigue, well-being or subjective recovery questionnaires. The ease of application and usefulness of these tools should,

in our opinion, constitute sufficient reasons for increasing their use, especially when the technical and financial resources do not allow other methods.

Limitations

The imbalances in the sample, in which soccer coaches and trainers stand out, constitutes the main limitation. In the same way, the proportion of coaches and physical trainers who works with athletes with international or local competitive levels is much lower than those of regional and national categories. In future studies it would be interesting to achieve a more homogeneous distribution between sports and competitive levels, or to exclusively analyze athletes of the same competitive level, obtaining enough sample to be able to carry it out.

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