

## Monitoring training loads: from training to competition

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

### Abstract

**Purpose:** Monitoring is a new method that allows coaches and physical trainers to manage training in order to meet the needs of athletes. This study aims to evaluate through a scientific approach the homogeneity between the training program established by the coach in the pre-competition period, and the characteristics of the competition.

**Material:** The study was conducted at the FAR (Royal Armed Forces) Sports Association in Salé from February 10, 2019 to March 16, 2019, on a sample of 12 taekwondo athletes (5 girls and 7 boys), category "senior" with a middle age of  $26.28 \pm 1.97$  for boys and  $24.4 \pm 3.32$  for girls. The data collection concerns two different periods, the training and the competition period, in order to make a comparison between the different phases of the combat situations (preparation phase, exchange phase and recovery phase) during these two periods.

**Results:** For the combat in the training period we saw that the percentage of the preparation phase was 80.11%, the exchange phase was 19.69%, and the recovery phase was 0.18%, however, in the competition period, the percentage of the preparation phase is 21.60%, the exchange phase is 39.84%, and the recovery phase is 38.54%. The study of the correlation between the three phases of combat in the training period and the competition shows that there is no link between the different phases except between the exchange phase and the recovery phase ( $\text{sig} = 0.021 < 0.05$ ).

**Conclusions:** Our study was able to reveal that the requirements of the competition were not taken into consideration by the coach, which influenced the performance of the athletes during the competition. Therefore, a monitoring program is necessary in order to better plan the training and even predict the results of the competition.

**Keywords:** monitoring, taekwondo, training load, performance, competition, combat, Morocco.

### Introduction

In preparing an athlete for a competition, we must consider two important criteria: the training load and the fatigue. Generally, any coach seeks to push the fatigue limits without exceeding the threshold at which the athlete risks overtraining [1, 2]. This strategy is complicated to apply since a taekwondo coach addresses his/her athletes as a group and not as individuals, thus a standard workout can suit some athletes, while causing others to either under or over train, eventually impacting their competitiveness [3, 4].

Observing, monitoring and verifying the progress and quality of training over a set period of time are very important steps in determining if the training program is well suited for an athlete, and can help prevent injuries. This is defined as Monitoring. A new method that allows coaches and physical trainers to manage training to meet the needs of athletes [5]. The monitoring of athletes is becoming a necessity, and this to better understand the athlete and to know if the training carried out is coherent or not with the competition [6, 7]. Despite the lack of data on high level athlete's publications, athlete tracking can provide an explanation of performance changes. This can help reduce the degree of uncertainty related to the results during the competition. More importantly, load monitoring is also put in place to reduce the risk of injury, especially in combat sports as taekwondo [8].

**Hypothesis:** the surveillance of athletes training may help the coach to determine the problems related

to the training program, in order to prevent any kind of overtraining or athletes exhaustion, and also for a better training planning which will be in correlation with the competition requirement.

**Purpose:** The objective of our study is to evaluate by a scientific approach the conformity between the training established by coaches in the phase of preparation, and the characteristics of the competition.

### Material and methods:

#### Participants:

The studied population consisted of 12 "senior" taekwondo athletes (5 girls and 7 boys), with a mean age of  $26.28 \pm 1.97$  for boys and  $24.4 \pm 3.32$  years for girls. They practice at the Royal Armed Forces Sports Club of Salé "FAR" league center. These athletes were qualified for the finale of Morocco's championship.

#### Research design:

The study focuses on the collection of several variables described in Table 1 and 2, in two different periods, training and competition, in order to make a comparison between combat situations during training and competition, the number of athletes participating for the training phase was 12, of which only four will be followed in the competition phase due to the lack of materials and human resources to carry out the follow-up for the whole sample (12 athletes).

#### Statistical analysis

For the analysis of the link between the two groups we chose the study of correlation between the different phases

**Table 1.** The different variables studied in the training phase

<b>Training Phase:</b>	
<b>Variables</b>	<b>Objective</b>
Warm up	-time ; -nature : - General warm up ; - Specific warm up ;
Recovery time	The time taken for recovery
Cognitive engagement	The time taken to explain the exercises by the coach.
Motor Engagement	the application time of the exercises explained by the coach - Number of fights;
Combat situation	- The duration of each phase of the fight - The techniques performed in each fight;
Return to the initial state	Method with which the athletes return to the initial state (stretching ....)

**Table 2.** The different variables studied in the competition phase

<b>Competition Phase</b>	
<b>Variables</b>	<b>Objective</b>
Preparation Phase	This is the exploration phase, looking for rifts in the opponent's game, feints, false attacks, displacements, footwork.
Exchange Phase	As soon as one of the two fighters triggers an action, we enter a so-called exchange phase that ends with the last action of one of the two protagonists. An exchange is constituted at least by an action (kick or punch) or more. - The techniques performed in each fight
Referee phase	Corresponds to the time of passivity where the referee stops the game to intervene and where the fighters do nothing. -Nature:
Recovery	-The number and duration of preparation of attack and displacement (active recovery). -The duration of passive recovery.

**Table 3.** Table representing the analysis of the warm-up part

<b>Times</b>	<b>Duration (%)</b>
T.T	26min (100%)
S.T	3min22s (11.53%)
E.T = T.T-ST	23min22s (88,47%)

**Warming up:**

This table presents the analysis of the warm-up part which lasts in total (TT) 26minutes, the stopping time (ST) is 3m22s and that of effort (ET) is 23min22s and represents a percentage of 88 , 47% of the total time.

Note: T.T: total time, S.T: stopping time, E.T: effort time, R: recovery.

**Table 4.** Table showing the analysis of the motor Engagement (effort time) part.

<b>Times</b>	<b>Duration (%)</b>
E.T	32,84min (80,87%)
S.T	5min (9,85%)
R	3,98ms (9,80%)

**Motor Engagement:**

The table shows that the motor engagement time or the effort time represents 80.87% of the total time, the stopping time represents 9.85%, and the recovery time represents 9.80%.

Note: T.T: total time, S.T: stopping time, E.T: effort time, R: recovery.

of the combat in the training and in the competition, with the software SPSS version 25.

And for the monitoring and data collection we used:

- An observation sheet;
- A stopwatch;
- A camera;
- Software SPSS;
- DARTFISH software.

## Results

### *Training phase:*

The average duration of sessions of the program 1h48min (tabl. 3, 4).

### *Recovery time analysis:*

According to the analysis of this phase we note that the recovery was active with a percentage of 13.01% of the total time of the session which corresponds to 12min12s.

### *Analysis of combat situations:*

According to the results obtained throughout the program, the time devoted to combat situations represents 8 minutes (11.13%) of the total time.

### *Analysis of the combat phases in the training:*

From the table below, we note that the percentage of the preparation phase is 80.11%, the exchange phase is 19.69%, and finally the recovery phase with a percentage of 0.18%.

**Table 5.** Evaluation of the combat phases in training

training		
Combat Phases	Duration	Percentage
Preparation phase	01min 07s 00ms	80,11%
exchange phase	0min 31s 22ms	19,69%
recovery phase	0min00s30ms	0,18%

### *Competition phase:*

This table represents the characteristics of each subject, as well as the results of the competition.

**Table 6.** Characteristics of the subjects studied

subjects	height (m)	weight (kg)	gender	competition result
1	1,93	87	male	wins
2	1,71	58	female	wins
3	1,60	46	male	lose
4	1,90	68	female	lose

### *Analysis of the combat phases for the 4 subjects*

From the table below, we note that the average percentage of the preparation phase is 21.60%, the exchange phase is 39.84%, and finally the recovery phase with a percentage of 38.54%.

**Table 7.** Evaluation of the combat phases in the competition.

Competition		
combat phases	Durée	Percentage
preparation phase	01min 22s 00ms	21,60%
exchange phase	2min 31s 22ms	39,84%
recovery phase	2min26s30ms	38,54%

### *-The correlation between combat in training and competition:*

According to the table below, there is a difference between the techniques used, the number of shots and the points scored by each technique between the fight in the training phase and the fight in the competition phase.

From Table 9 we find that there is a significant correlation between the exchange phase and the recovery phase (sig = 0.021 <0.05). While there is no correlation between the other phases of training and competition.

## Discussion

At the international level, many coaches and physical trainers are taking an increasingly scientific approach to design and monitor their training programs, whereas in Morocco these approaches are rarely used. This demonstrate itself by the huge lack of bibliography in this sense, despite the fact that the training supervision allows to reach a sufficiently large load to improve the targeted qualities, with managing the magnitude of the fatigue that can lead to the fateful threshold leading to the injury [9, 10]. With this in mind, we sought to identify the gaps that may exist between training and competition in the precompetitive period among qualified taekwondo athletes practicing within the FAR Sports Association in Salé, Morocco.

The descriptive analysis of the training phase allows us to see that the average duration of the sessions of the program that was 1h48min, the warm-up time lasts in total before each session 26 minutes which is a good result, due to the role warm-up in the prevention of injuries during intense training sessions [11].

The analysis of the training program allows us to say that the athletes work the same training program, which is explained by the fact that the coach does not follow the most important training principle, which is individualization. It is a fundamental factor for the progression of athletes, and allows to establish a training program according to the athlete's abilities, characteristics and needs [12-15].

Calculating the average part of the combat situation throughout the entire program, we found out its percentage to be around (11.13%). It is a very small and negligible result given that the athletes were in a pre-competition period. This negligible percentage does not benefit athletes since it doesn't give them the opportunity to experience combat situations as part of their training in order to ready themselves for real matches [12].

From these results, we found that there is no correlation between the different phases of the combat during training and during the competition, which proves that the training plan does not support the characteristics of the competition, except between exchange and recovery (sig = 0.021 <0.05), which can be explained by the fact that the more the exchange time (effort time) increases the more the athlete needs time to recover [16-19].

Several techniques used by the athletes in the competition have not been established in the training program namely; DWITT TCHAGUI for athlete number 2 and subject 4 on the table 8, who used this technique in

**Table 8.** Analysis of techniques used during training combat and those used in competitive combat:

Subjects	Techniques	Training		competition	
		Shots number	points scored	Shots number	Points scored
1	YOP TCHAGUI	10	4	3	0
	DOLYEU TCHAGUI	18	9	39	7
	MON DOLYEU TCHAGUI	0	0	0	0
	DWITT TCHAGUI	9	2	4	1
	NELYEU TCHAGUI	5	0	2	3
	PUNCHE	12	8	8	3
2	YOP TCHAGUI	12	3	1	1
	DOLYEU TCHAGUI	24	8	20	1
	MON DOLYEU TCHAGUI	0	0	0	0
	DWITT TCHAGUI	0	0	13	2
	NELYEU TCHAGUI	8	2	0	0
	PUNCHE	12	4	17	3
3	YOP TCHAGUI	12	6	10	0
	DOLYEU TCHAGUI	21	3	76	4
	MON DOLYEU TCHAGUI	0	0	0	0
	DWITT TCHAGUI	5	0	1	0
	NELYEU TCHAGUI	4	3	0	0
	PUNCHE	6	4	10	5
4	HITCHEU	2	0	0	0
	YOP TCHAGUI	17	5	6	0
	DOLYEU TCHAGUI	12	3	31	4
	MON DOLYEU TCHAGUI	0	0	0	0
	DWITT TCHAGUI	0	0	9	0
	NELYEU TCHAGUI	2	0	2	0
	PUNCHE	6	1	12	0

**Table 9.** Correlation between the preparation phase, exchange and recovery in training and competition.

Indicators	Training phase				
	Preparation	Exchange	Recovery		
Competition	Preparation	- C. c -Sig.(bilateral)	1,000	0,095	0,279
	Exchange	-C. c	0,095	1,000	0,786
Phase	Recovery	-Sig.(bilateral)	0,823		<b>0,021*</b>
		- C. c	0,279	0,786	1,0000
		-Sig.(bilateral)	0,503	<b>0,021*</b>	

\*. The correlation is significant at the **0.05 (bilateral)**. **C.C:** coefficient of correlation

the competition without being able to try it in the training period.

### Conclusion

The monitoring or the surveillance of athletes using technological tools, can help the coach to fairly judge their athletes, and to better program trainings that are based on tangible data. This study revealed that the requirements of the competition were not taken in consideration by the coach, which influenced the performance of the athletes during the competition. However, this method can also be used to analyze the game of potential opponents during the preparation stage of competitions.

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### Contributions of the authors

All the authors contributed to the conduct of this work.

### Conflicts of interest

There is no conflict of interest.

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