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Children and Youth in Organized Sports

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WORKLOAD AND PERCEPTION OF EFFORT IN SWIM TRAINING

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1. INTRODUCTION

Knowledge of the effects of exercise on the conduction of training is important in reaching desired outcomes, especially when athletes undertake prolonged training loads. Several procedures can be followed to monitor these effects. The usual markers, especially physiological, are often invasive. The stressful character of this methodology, its associated cost, as well as the requirement of laboratories and specialized staff, make them relatively inaccessible to many in the sport community. However, it is possible to register of the subjective perception of effort or fatigue in order to estimate the influence of a specific training load on athletes.

Perception of effort scales were first introduced in cardiac rehabilitation as a way of monitoring the impact of exercises (Borg, 1985, 2000). It is also suggested the perception of effort is the best single indicator since it integrates several sources of information related to the muscles and joints directly involved, and the cardiovascular, respiratory and nervous systems (Borg, 2000). The signs, perceptions and experiences are integrated into a global configuration labeled the perception of effort. These scales have been used to evaluate the fatigue or physiological stress in isolated tasks (Maglischo, 1993; Costil and Wilmore, 1994; Rushal, 1995). The validity of these instruments in activities that involve elevated indices of fatigue makes them very useful in the monitoring of training. Further, the technique involves the athlete as an active agent in the evaluation of effects resulting from the application of specific workloads.

This study evaluates two scales of perception of effort as indicators of accumulated training load in national and regional level competitive swimmers belonging to the same sport clubs and training together. Over the course of 26 weeks of a winter (short season), training load (volume and intensity of weekly training) was monitored in 23 national and 23 regional level swimmers. During each week of the training season, the swimmers recorded their perception of effort in each micro cycle with two scales: the Portuguese version of RTL (Training Load Rating, Berglund and Säfström, 1994), and the Cr10 scale of Borg (1982).

2. THE SUBJECTIVE PERCEPTION OF EFFORT

The intention of detecting and interpreting the sensations produced during physical exercise goes back to the 1950s. Borg (1982, 2000) considered the association between physiological events and the conscientious perception of effort signals in a three-dimensional model. The conceptualization of this model was based on the fact that, with the increase of intensity of exercise, alterations occur in the physiological processes and their perception by the individual. During or soon after an intense bout of physical exercise, the meaning of fatigue and perception of effort are very similar, with the later being related with the concept of intensity of the exercise, although there are important differences between the two concepts.

According to Borg (2000), the three components of the effort (perception, physiological, performance) give partially different information, and the variables concerned are not linearly related. In order to have a valid and complete estimate of the effort of an individual, it is important to integrate information from the three components of the effort.

Perception of effort is the sensation of how heavy and exhausting a physical task is. This definition is basic, but does not offer any measure of the degree of the perceived effort. A measure of perception of effort is then the degree of experienced resistance and tension during physical work that is estimated with a specific classification method. Therefore, it is necessary to quantify the perception of effort, which is not a measure by itself.

2.1. SCALES OF PERCEPTION OF EFFORT

The capacity to evaluate level of effort is highly developed in humans (Borg, 2000; Baron, 2003). The association of sensations provides essential information to determine the degree of well being or level of threat. The perception of the effort is a control behaviour that uses information sources that are necessary to determine attitudes, which lead to the preservation of health and which play an important role in adaptation. Several perception scales have been used to attain this objective (Borg, 2000).

The evaluation of the energy cost of exercise can be made through the use of physiological techniques. However, it is the subjective cost of the exercise that determines if the activity will be continued or not, or if the rhythm of work needs to be increased or reduced. Assessment of subjective sensations is possible only through the use of personal estimates of the intensity of the associated sensations (Nobles and Bruce, 1986; Baron, 2003).

Borg's scale was originally developed with the objective of monitoring perception of effort during cardiac rehabilitation. The initial intention was to construct a scale that reflected the correspondence between the perceived

level of effort and cardiac frequency (RPE 6-20). Patients were taught to equate the intensities of work based on cardiac frequency (FC) to values on a subjective scale. The original RPE scale (Rating of Perceived Exertion) was intended to reflect the relationship between the perception of effort and the pulse rate, a linear relationship between cardiac frequency and exercise intensity. The scale extended from 6 (no sensation) to 20 (maximum effort). It was soon realized that the RPE 6-20 scale was not appropriate for studies that involved the associated sensation of physiological variables, such as lactate accumulation, whose behaviours are not linearly related with intensity of the exercise (Noble and Robertson, 1996).

A new scale of 10 was later introduced. It was better adjusted to the subjective sensations of physical tasks and is known as Cr10 (Category Ratio scale, Borg, 1982). Zero refers to the total absence of sensation and 0,5 to slightly perceivable sensation. The category of maximum was placed beyond 10 (extremely difficult), after noting that athletes tended to never use this category (Noble and Robertson, 1996). Borg (2000) also reported a high correlation between the new scale and blood and muscle lactate levels.

0 – Nothing at all
0.5 – Extremely weak
1 – Very weak
2 – Weak (light)
3 - Moderate
4 – Somewhat strong
5 – Strong (heavy)
6 -
7 – Very strong
8 -
9 -
10 – Extremely strong (almost max)
• - Maximal.

Figure 1 Borg's Cr10 scale (adapted from Noble and Robertson, 1996).

Maglischo (1993) applied identical procedures with swimmers in an attempt to have them use the scales to monitor the intensity of training. One of the main advantages of using the scale was the fact that it was possible for the swimmers to progress in intensity of training not as a function of pre-set plans, but as a function of their perception of present capacity. The main disadvantage was a lack of quantification of intensities of training.

Maglischo (1993) related perception of effort determined by the Cr10 scale with different levels of intensity of swim training (Table 1). Bergglund and Säfström (1994) used another scale to identify perceived effort - the Rating of Weekly Training Load - RTL (Figure 2), and included a measure of psychological effects of training. In a study of 14 elite canoeists, 9 men and 5 women, there was a linear relationship between the RTL and the Profiling of Mood States questionnaire (POMS, Macnair, 1992). The proposed RTL scale ranged from 0 (rest) to 16 (very, very difficult).

Table 1. Borg's Cr10 in relation to possible training effects and level of training (adapted from Maglischo, 1993)

Rating scale	Perceived Effort	Possible Training Effects	Level of Training
10	Extremely difficult	Improves anaerobic metabolism	Lactate tolerance
9	Very difficult	Improves anaerobic capacity anaerobic and VO_2 max; intensity is above the present anaerobic threshold	Lactate tolerance End-3
7-8	Hard but manageable	Overloads aerobic metabolism; work at or slightly bellow the present anaerobic threshold	End-2
5-6	Moderate effort	Improves aerobic capacity, while providing some relief from intense training	End-1
3-4	Easy	Maintains aerobic endurance while recovering from intense training	End-1
1-2	Very Easy	Is useful for warming up and swimming down	

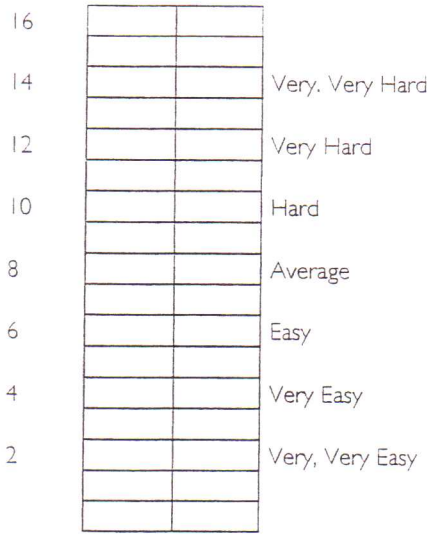

Figure 2 Rating of weekly training load (*RTL) scale* (adapted from Berglund and Säfstrom,1994)

2.2. FACTORS THAT INFLUENCE SUBJECTIVE PERCEPTION OF EFFORT

Perception of effort depends on the type of exercise and specific muscular work (Ben Sira, 1986) The relationship between increased perception of effort and duration of the exercise is well established. There is a difference in the perception of effort between short and long duration exercises. In the first case, the individual tends to evaluate his effort in relation to his maximum capacity, while in the second case the individual might evaluate his effort with the objective of maintaining a particular level of effort during a greater period of time (Ben Sira, 1986). When comparing equal productions of work, perceived effort is greater in low frequency/high resistance activities compared high frequency/low resistance activities (Mihevic, 1981)

With training adaptation, athletes tend to show lower levels of perceived effort for the same workload. There is some speculation about possible differences between men and women on the perception of effort. It has also been observed that, for the same type of physical task, women significantly classify the effort as heavier than men. The perception of effort and possible variations do not depend only on the intensity, duration and volume of the exercise, physical factors, and the environment and/or context, but also on psychological factors. Factors related to motivation, emotional state and personality may also influence perception of effort. Highly motivated individuals (e.g., former athletes) tend to underestimate perception of effort. Emotional factors or temporary mood states (depression, anxiety, anger, joy) also influence the perception of effort.

3. SAMPLE

The sample inlcuded 46 swimmers, 23 of each gender, from sport clubs of the same regional swimming association. The mean age for the total sample was16.6±1.8 years, 17.5± 1.9 years in males and 15.7±1.3 years in females. The swimmers represented two competitive levels, 23 national swimmers with access to the Portuguese National Championships and 23 regional level swimmers. The age composition of the sample was primarily 16 to18 years (74%), which reflected the distribution of registered swimmers in the geographic area in which the study was conducted. All swimmers were informed of the objectives and procedures of the study and gave their written consent. In the case of younger athletes, written consent was given by their parents.

Table 2. Characteristics of the sample by age, sex and level of competition.

Age - group	National		Regional		Total
	Male	Female	Male	Female	
14-15		3		5	8
16-18	12	6	7	9	34
19-24	2		2		4
Total	14	9	9	14	46

Table 3. Body weight, stature and arm span by sex and level of competition (mean ± standard deviation).

	National		Regional	
	Female	Male	Female	Male
Weight, kg	59.3 ± 6.8	63.2 ± 5.7	51.5 ± 5.8	68.5 ± 10.5
Height, cm	165.8 ± 4.5	170.3 ± 4.8	158.9 ± 6.6	173.2 ± 6.8
Arm span, cm	165.4 ± 6.6	176.1 ± 4.9	159.8 ± 7.3	179.7 ± 8.1

4. METHODS

All of the participants registered their level of perception of effort in a tabular calendar using the two scales mentioned indicated earlier. Entries were made at the beginning of each week, using the previous week as a reference. The beginning of the study was coincident with the first week of the season in September and ended after the main competition of the short season in March, for a total of 26 weeks. Although use of the scales was sufficiently simple, the swimmers had some initial difficulties in faithfully expressing their perception of effort.

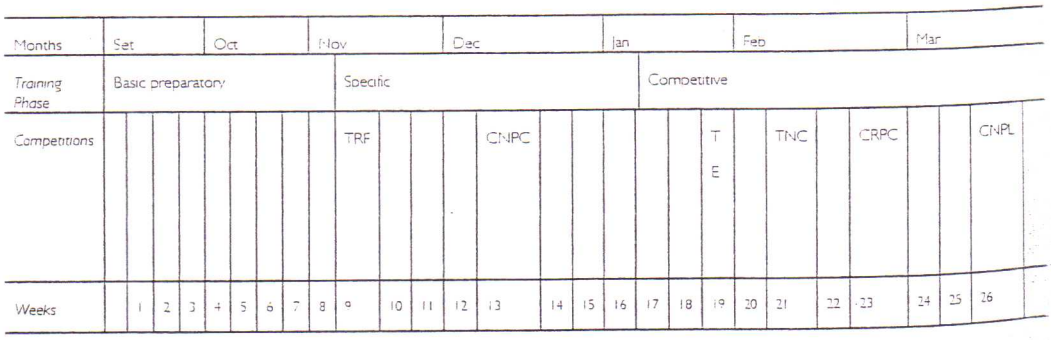

Figure 3. Tabular calendar used in the study

The swimmers were asked to adopt the following procedure. First, to look at the description that most closely matched the level of perception of effort of the last week of training, and to quantify this sensation. Several basic points need to be taken into consideration to use the scale correctly (Noble and Robertson, 1996):

1. To define perception of effort;
2. To be able to link the category of sensation to the associated value;
3. To explain the nature and use of the scale;
4. To explain that the perception can be localised or global depending on the objective of the study;
5. To be as honest as possible;

Records were checked weekly to see if the process was done correctly. The daily workload was also registered.

QUANTIFICATION OF TRAINING LOAD

The use of the total distance swam does not clearly reflect the physiological stress produced at different levels of intensity (Sharp, 1993). Training load was determined through the total amount of meters swam (volume) and also by the balance of the distance completed at each level of intensity (Mujika *et al.*,1995; Navarro, 2001; Chatard and Mujika 1999). The use of indices of difficulty has been established in reference to the probable values of blood lactate accumulation normally associated with the different tasks of swimming training. Factors of intensity 1, 2, 3, 4, 6, 8 and 10 were matched with the volume done in each zone of intensity (I,II, III, IV, V, VI and VII). The magnitude of the load was then expressed in dimensionless units of load, or arbitrary units of load (AUL), quantified from the obtained rate of the sum of the volumes swam in each of the weighed zones multiplied by the respective index and the total volume effectively completed. This procedure allows adjustment to the exponential function determined by the curve of lactate accumulation in relation to the intensity of a swim.

Table 4. Intensity levels, objectives, average velocity on tasks, probable lactate, and stress indices for swim training

Intensity Level	Objective	Average velocity	Lactate mmol.l^{-1}	stress indices
I	Warm-up and swim down	under 60%	-	1
II	Aerobic capacity	60 - 70%	2 - 3	2
III	Anaerobic Threshold	≈ 80%	3 - 4	3
IV	Misted	≈ 85%	6 - 9	4
V	Lactate Tolerance	≈ 90%	>8	6
VI	Lactate Production	≈ 95%	>8	8
VII	Sprint	maximal	-	10

The micro cycle or weekly load is quantified by two factors: *volume* - total of meters swam, and *intensity* determined through the sum of the resulting dimensionless units of load of each session of training.

5. RESULTS

5.1. TRAINING LOAD

Because both regional and national level swimmers trained together it was important to verify if the training load between the two groups was indeed different or if the competitive level attained was due to other factors such as talent. The values of the training load show great variability due to the heterogeneous weekly training frequency of the two groups of swimmers. The national group had a weekly minimum frequency of five training sessions, and this criterion was fulfilled by all of the swimmers with few exceptions associated with injury or illness. The national level sample swam, on average, 27.7±4.3 km per week, and a total of 728.5±132.7 km (Table 5). Intensity (weighed volume for intensity zone) corresponded to a weekly mean of 14.3± 4.3 AUL and a total mean of 377.3±122.9 AUL. Corresponding values for regional level swimmers followed a similar pattern, on average, for the season: weekly volume, 24.2±5.4 km; total volume, 626.1±157.1 km, intensity, 12.5±3.9 AUL; and total intensity, 324.8±109.8 AUL.

Table 5. Means, standard deviations and Student-t tests for training variables by level of competition: week volume, total volume, mean week intensity and sum of AUL.

	Level	Mean ± sd	t	p
Week Volume, m	National	27,742 ± 4,270	2.50	≤0.05
	Regional	24,170 ± 5,357		
Total Volume, m	National	728,470 ± 132,722	2.39	≤0.05
	Regional	626,053 ± 157,124		
Intensity, AUL	National	14.3 ± 4.3	1.94	n.s.
	Regional	12.5 ± 3.9		
Σ of AUL	National	377.3 ± 122.9	1.53	n.s.
	Regional	324.8 ± 109.8		

The volumes of national level swimmers are significantly ($p \leq 0.05$) higher than those of regional level swimmers (Table 5). When the workload was compared by specific weeks, differences were significant in seven weeks (Table 6). The overall differences in mean weekly intensity and mean total sum of intensity between national and regional swimmers, though higher in the former) are not significant (Table 5). However, mean weekly intensities differ significantly ($p \leq 0.05$) in eight weeks (Table 7). It seems that the training load fulfilled by the two groups of swimmers differed in the amount of meters swam. Regional swimmers, although fulfilling fewer kilometres, seem to dedicate more attention to tasks of higher intensity, trying to overcome insufficient exposure to the load. The criterion intensity (AUL), which express meters swam, weighted according to level of intensity, does not allow for the discrimination of workload between the two groups of swimmers. Nevertheless, the national group fulfilled a greater volume in high intensity levels (14.3±4.3 AUL) compared to regional swimmers (12.5±3.9 AUL).

Table 6. Means and standard deviations of volume (m) and Student-t tests for the weeks with a statistical significance between the national and regional swimmers.

	Level	Mean ± sd	t	p
VOL9	National	32,519 ± 7,821	2.609	≤0.05
	Regional	26,605 ± 7,550		
VOL11	National	21,547 ± 5,009	2.298	≤0.05
	Regional	18,025 ± 5,380		
VOL15	National	36,730 ± 9,030	3.495	≤0.01
	Regional	26,252 ± 10,838		
VOL16	National	29,105 ± 9,808	2.403	≤0.05
	Regional	22,053 ± 8,424		
VOL18	National	34,359 ± 6,227	3.405	≤0.01
	Regional	26,388 ± 9,138		
VOL21	National	31,704 ± 8,529	2.743	≤0.01
	Regional	23,917 ± 10,611		
VOL24	National	29,404 ± 6,116	2.375	≤0.05
	Regional	25,309 ± 5,567		

Table 7. Means and standard deviations for intensity (AUL) and Student-t tests for weeks with a statistical significance between national and regional swimmers.

	Level	Mean ± sd	t	p
INT9	National	17.3 ± 4.6	2.16	≤0.05
	Regional	14.2 ± 5.1		
INT11	National	12.9 ± 4.6	2.29	≤0.05
	Regional	10.0 ± 3.7		
INT13	National	14.9 ± 5.2	2.19	≤0.05
	Regional	11.4 ± 5.7		
INT15	National	17.6 ± 5.6	2.86	≤0.01
	Regional	12.7 ± 5.6		
INT16	National	14.7 ± 7.2	2.16	≤0.05
	Regional	10.4 ± 4.9		
INT18	National	18.2 ± 5.5	2.01	≤0.05
	Regional	14.8 ± 5.9		
INT19	National	15.1 ± 5.8	2.38	≤0.05
	Regional	11.2 ± 5.4		
INT21	National	14.2 ± 5.3	2.02	≤0.05
	Regional	10.9 ± 5.8		

5.2. EFFORT PERCEPTION

There were no significant differences in perceived effort between male and female swimmers. Hence, the data are reported for the sexes combined.

5.2.1. Perception of effort using the RTL scale

Data for the perception of effort was analysed from the second week of training onward because some athletes initiated the season later and/or showed some initial difficulties in recording perception of effort. The lowest value of perception of effort, independently of the scale used, occurred in the beginning or at the end of the season. This behaviour was expected, since the athletes had just returned from holidays and the initial approach to training was made very slowly. The last week of the study corresponded to a period of recovery after the most important event of the season.

Table 8. Means, standard deviations and significant Student-t tests for perception of effort using the RTL scale in regional and national swimmers.

	Level	Mean ± sd	t	p
RTL9	National Regional	9.77 + 1.74 8.68 + 1.46	2.25	≤0.05
RTL14	National Regional	9.45 + 1.87 8.05 + 2.19	2.29	≤0.05
RTL22	National Regional	10.05 + 1.80 8.00 + 1.88	3.65	≤0.01
RTL23	National Regional	10.23 + 1.77 8.22 + 2.63	2.99	≤0.01
RTL24	National Regional	11.14 + 3.21 8.65 + 2.84	2.75	≤0.01
RTL25	National Regional	10.30 + 2.30 7.83 + 1.56	4.27	≤0.01
RTL26	National Regional	9.30 + 2.42 7.28 + 1.67	3.03	≤0.01

As shown in Table 8, national swimmers recorded the highest mean of perceived effort in the 24th week of the season (11.1±3.2). The lowest mean, 6.6±2.4, was recorded in the 2nd week of training. Looking at the highest value for the perception of effort and training workload, week 24 had a mean volume of 29403±6116 km. Looking at intensity, this week was the second in a cycle of great intensity (17.2±5.4 AUL). For regional swimmers, the highest value for perception of effort was recorded in the 7th week (9.6±2.3) and the lowest was recorded in the first week of the study (5.3±2.4). Considering the dynamics of the training load of this group, the 7th week corresponded to the week following the micro cycle which registered the highest values for volume and intensity. The slightly dislocated temporal coincidence can be explained by a process of insufficient recovery in the subjective perception of effort and by mechanisms of accumulated fatigue.

The analysis of mean values for perception of effort shows that, at all times, national level swimmers presented higher mean scores than regional swimmers. Differences in perception of effort using the RTL scale between national and regional level swimmers were significant ($p \leq 0.05$) in weeks 9, 14,

22, 23, 24, 25 and 26. These weeks corresponded to moments of increasing training load determined by the increase of intensity or volume. However, when analysing the temporal coincidence of training load and perception of effort, only at weeks 22 and 25 were the differences in perception of effort coincident with differences in volume swam by the two groups. This occurred for intensity only at week 9.

It seems that the swimmers, independently of competitive level, perceived the effort of the training tasks without isolating them from their daily activities. Factors such as the presence or lack of competitions, school obligations, social relationships, and others, may contribute to the perception of effort.

Table 9. Means, standard deviations and significant Student-t tests for perception of effort using the Cr10 scale in regional and national swimmers.

	Level	Mean ± sd	t	p
Cr10 15	National Regional	4.30 ± 1.83 3.71 ± 1.35	2.425	≤0.01
Cr10 17	National Regional	5.13 ± 2.24 4.03 ± 1.38	2.076	≤0.05
Cr10 23	National Regional	5.64 ± 1.68 3.59 ± 1.65	4.403	≤0.01
Cr10 24	National Regional	6.27 ± 2.69 4.09 ± 2.15	4.075	≤0.01
Cr10 25	National Regional	5.04 ± 2.18 3.52 ± 1.12	3.015	≤0.01
Cr10 26	National Regional	4.72 ± 2.20 3.06 ± 1.30	2.972	≤0.01
Cr10 27	National Regional	2.95 ± 1.35 2.07 ± 1.02	2.366	≤0.05

5.2.2. Perception of Effort from CR10 Scale

National level swimmers scored the highest values on the Cr10 scale in week 24 (6.3±2.7), and the lowest score at the beginning of the season (2.4±1.3). The 24th week coincided with period of important volume and the intense participation in competition. Regional level swimmers recorded the highest score for perceived effort with the Cr10 scale was in the 7th week (4.7±2.0) and the lowest at the beginning of the study (1.9±1.3). Consistent with results for the RTL scale, the 7th week was the week with the highest mean volume done by this group.

5.2.3. Behaviour of the Sample Relative to Scale of Perception of Effort Used

The analysis of Table 10 shows in a consistent manner that national level swimmers recorded greater perception of the effort than regional

swimmers. This helps to confirm the potential of these instruments in discriminating between athletes in the same sport who have different levels of participation. Analysis of mean values for perception of effort with both scales showed significant differences by level of swimming competition.

Table 10. Means, standard deviations and Student-t tests for perception of effort using the RTL and CrI0 scales with regional and national swimmers.

	Level	N	Mean ± sd	t	p
CR10	National	23	4.25 ± 0.99	3.293	≤0.01
	Regional	23	3.57 ± 0.76		
RTL	National	23	9.09 ± 0.88	3.725	≤0.01
	Regional	23	8.05 ± 1.01		

The values of perception of effort over the 26 weeks of the study with the RTL scale showed a higher mean for national (9.1±0.9) than for regional (8.0±1.0) swimmers ($p \leq 0.01$). The mean value of national level swimmers with the RTL scale fell between the "average" and "hard" categories, while that of regional swimmers fell in the "average" category.

With the CrI0 scale, the mean value for perception of effort for national swimmers was 4.3±1.0, which corresponded to the "somewhat strong" category. The mean value for regional swimmers was 3.6±0.8, which corresponded to the "moderate" and "somewhat strong" categories. The difference between groups of swimmers was significant ($p \leq 0.01$). This result may be related to several factors, such as more demanding training in volume and intensity, as well as participation in competitions of greater significance.

Only during one of the 26 weeks of the season was a maximum mean value of 10.5±2.5 recorded, which corresponded to a perception of the effort between "hard" and "very hard" for national swimmers, while the regional group recorded a maximum mean of 9.6±2.3, which was anchored in the "hard" category. As noted by Borg (2000), athletes tend to underestimate their perception of effort. It is thus possible that throughout the season, the natural adaptation to the training tasks can lead to a disregard of the difficulty of the workloads.

Table11. Means and standard deviations for perception of effort with the RTL and Cr10 scales by age group.

	Age-Group	N	Mean ± sd
RTL	14-15	9	8.84 ± 0.62
	16-18	33	8.60 ± 1.07
	19-24	4	7.68 ± 1.68
	Total	46	8.57 ± 1.08
Cr10	14-15	9	3.43 ± 0.66
	16-18	33	4.23 ± 0.94
	19-24	4	3.40 ± 1.22
	Total	46	3.40 ± 0.97

Although numbers were small in some age groups, there were not significant differences in perception of effort by age within each sex (Table 11). And as noted earlier, males and females did not differ significantly in perception of effort on either scale. However, the difference with the Cr10 scale approached significance (Table 12).

Table 12. Means and standard deviations for perception of effort with the RTL and Cr10 scales by sex.

		N	Mean ± sd	t	df	p
CR10	Male	23	4.26 ± 1.01	1.858	44	n.s.
	Female	23	3.74 ± 0.88			
RTL	Male	23	8.70 ± 1.21	0.84	44	n.s.
	Female	23	8.44 ± 0.94			

5.3. CORRELATIONAL ANALYSIS

Correlations among variables are summarized in Table 13. The two scales of perception of effort are highly correlated, r=0.95 ($p \leq 0.01$). Training load components are also strongly correlated with perception of effort as assessed by both scales. Correlations for volume were r=0,84 and r=0.85 ($p \leq 0.01$), respectively, for the Cr10 and RTL scales. Corresponding correlations for intensity were, respectively, r=0.73 and r=0.71 ($p \leq 0.01$) for the Cr10 and RTL scales.

Table 13. Person's correlation coefficient for the perception of effort determined for the RTL and Cr10 scales and workload - volume (km) and intensity (AUL)

		RTL	Volume	Intensity
	Cr10	0.95**	0.84**	0.73**
	RTL		0.85**	0.71**

** $p < 0.01$

6. CONCLUSION

The results highlight the validity of using scales of perception of effort to monitor and control training. Higher values of perceived effort in national level swimmers, who had higher training loads, were observed.

Although the majority of this sample was 16 to 18 years, age did not seem to influence perception of effort scores. This may partially be explained by the adoption of similar training loads by all age groups. Sex differences in perception of effort were not significant, which may also be explained by the adoption of similar training loads by male and female swimmers. This is generally a characteristic of training among swimmers. There may be sex differences in sports with a greater variability of tasks and training intensities.

Perceived effort differs between the two performance levels during a period when participation in competition is more frequent, i.e., the last 6 to 7 weeks. It appears that perception of effort is affected by participation in competitions and/or the approach of important competitions.

The results suggest that the use of perception of effort scales can function as auxiliary instruments to monitor the training process in swimming. The scales correlate strongly with the volume and intensity of training load. Both scales (CR10 and RTL) have similar potential to function as instruments to help monitor and control the training process in swimming.

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