CORRELATION BETWEEN RATING OF PERCEIVED EXERTION AND PHYSIOLOGICAL VARIABLES DURING THE EXECUTION OF STATIONARY RUNNING IN WATER AT DIFFERENT CADENCES

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ABSTRACT

Alberton, CL, Antunes, AH, Pinto, SS, Tartaruga, MP, Silva, EM, Cadore, EL, Fernando, L, and Kruel, M. Correlation between rating of perceived exertion and physiological variables during the execution of stationary running in water at different cadences. *J Strength Cond Res* 24(x): 000–000, 2010—The purpose of the present study was to correlate the rating of perceived exertion (RPE) with cardiorespiratory and neuromuscular variables during the execution of stationary running in water at different cadences. The sample consisted of 12 apparently healthy women (age: 22.33 ± 0.57 years). During the assessment session, the subjects performed the stationary running exercise in water at 3 different cadences: 60, 80, and 100 bpm. The heart rate (HR), oxygen uptake ($\dot{V}O_2$), ventilation (Ve), and electromyographic (EMG) signal of the vastus lateralis (VL), biceps femoris (BF), rectus femoris (RF), and semitendinosus (ST) muscles were measured during the exercise, and the overall body RPE was measured immediately following the end. Pearson's linear correlation and multiple linear regression were used, with $p < 0.05$. The analyses demonstrate a high and significant relationship between RPE and HR ($r = 0.65$; $p < 0.001$), RPE and %HR maximal ($r = 0.65$; $p < 0.001$), RPE and $\dot{V}O_2$ ($r = 0.60$; $p = 0.001$), RPE and %$\dot{V}O_2$ maximal ($r = 0.71$; $p < 0.001$), and RPE and Ve ($r = 0.77$; $p < 0.001$). However, there was no relationship between the RPE and the EMGs of the VL, BF, RF, and ST muscles. With regard to the regression, the model was significant ($p < 0.001$) with an $r^2 = 0.79$, whereas the variables that explained better the RPE were %$\dot{V}O_2$ maximal and Ve. Hence, these results suggest an association between the perception of exertion and cardiorespiratory variables, which was not the case with the neuromuscular variables evaluated in this study. Therefore, the Borg scale of RPE can be used when prescribing stationary running exercise in water for young women.

KEY WORDS water exercises, rating of perceived exertion, cardiorespiratory responses, neuromuscular responses

INTRODUCTION

There is a growing demand for water-based exercises, especially water aerobics, from people aiming to improve their physical fitness (37), reduce the impact on the joints of the lower limbs (28), or both. Many studies have compared the cardiorespiratory and neuromuscular responses in water-based exercises with similar exercises on land. These studies have shown that during water-based exercises there is a reduction in the maximal heart rate (HR) and oxygen uptake ($\dot{V}O_2$) values (14,26,30), such as in the submaximal responses (3,4), although, as on land, both maintain a linear relationship with the increase in intensity of the exercises (17,36). Likewise, several studies have noted lower neuromuscular responses during water-based exercises comparable to those found with the same exercise performed on land (15,25,33).

Nevertheless, studies demonstrate that, depending on the physical property of the water during the exercise (drag forces and buoyancy), it is possible to obtain HR, $\dot{V}O_2$, ventilation (Ve) values, and an electromyographic (EMG) signal greater or similar to those obtained when the exercise is performed on land (1,8,22,28). Accordingly, when prescribing water exercises it is essential that aspects such as the intensity of the exertion, duration of the activity, and weekly frequency at which the activity is performed are taken into account. Besides HR and $\dot{V}O_2$, there are other physiological indicators of intensity such as ventilatory, neuromuscular, and lactate thresholds and the rating of perceived exertion (RPE). Of these, the most widely used for the prescription of exercises in water aerobics are HR and the RPE (16).

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Many researchers have investigated the application of RPE on land (31,34) and in water-based exercises (7,9,18), but few have analyzed its relationship with the cardiorespiratory and/or neuromuscular variables. Borg and Kaijser (5) compared 3 RPE scales developed by Borg during cycle ergometer exercise on land. The multiple stepwise regression showed that HR was the variable contributing the most to the RPE ratings. Lambrick et al. (24) found a high relationship between Borg 6-20 RPE scale and HR and $\dot{V}O_2$ variables, where the correlation coefficient observed in the $\dot{V}O_2$-RPE relationship was $r = 0.97$, corresponding both to maximal exertion and RPE 13. In water-based exercises, Shono et al. (35) correlated the cardiorespiratory responses and RPE during underwater treadmill walking and found a highly significant linear relationship between RPE and HR ($r = 0.996$, $p < 0.01$).

The subjective sensation of exertion can be defined as the relative tension that occurs in the musculoskeletal, cardiovascular, and pulmonary systems during physical exercise (11). Although the RPE response has an important participation of the tension on the neuromuscular system, which could be analyzed through the EMG signal of large muscle groups involved during the exercise, no approaches were found in the literature that undertake this analysis in water aerobics. According to the study of Borg and Kaijser (5), HR is the variable that most contributes to RPE in exercises on land. However, as shown previously, the behavior of this variable is changed when the subject is immersed in water, which could influence HR contribution to explain the RPE responses found by the authors mentioned earlier. Thus, the importance of the present study lies in that it seeks greater clarification regarding some mechanisms that may influence the RPE in the aquatic environment and so lead to the safer and easier prescription of exercises.

The purpose of the present study was to examine the relationship between the rating of perceived exertion and the cardiorespiratory and neuromuscular variables in the stationary running exercise in water. It was hypothesized that high and significant correlations would exist between the cardiorespiratory variables and RPE and between neuromuscular variables and RPE.

METHODS

Experimental Approach to the Problem

To verify the relationship between RPE and physiological responses in water-based exercises, the subjects spent 3 days collecting data. On the first day the anthropometric measures were taken and a progressive maximal test was performed on a treadmill to obtain maximal oxygen uptake ($\dot{V}O_2$max) and heart rate (HRmax) data. During the following session, the subjects were familiarized with the protocol and the equipment that would be utilized. At the third session, the protocol was performed with the execution of the stationary running exercise in water at 3 randomized cadences (60, 80, and 100 bpm) during which the HR, $\dot{V}O_2$, Ve, and EMG values of vastus lateralis (VL), biceps femoris (BF), rectus femoris (RF), and semitendinosus (ST) muscles were measured. At the end of each cadence the overall body RPE was collected.

Subjects

Twelve physical active healthy women (age: 22.33 ± 0.57 years) volunteered for the present study. Subjects had practiced water aerobics for at least 3 months and had not had any musculoskeletal, bone and joint, or heart or lung diseases and were not taking any medication. Calculation of the sample "n" was carried out in the PEPI program (Abramson JH & Gahlinger PM. Computer Programs for Epidemiologists: PEPI v. 4.0. Sagebrush Press, Salt Lake City, UT, USA) with a power of 80%. All the members of the sample signed an informed consent document approved by the ethics committee for research in humans of the UFRGS (2006566), which is in accordance with the Helsinki Declaration.

Procedures

Experiment Protocol. An initial session was held with the collection of body mass data, percentage of fat, $\dot{V}O_2$max, and HR_{max}. The latter 2 were obtained through the performance of a maximum test on a treadmill. For the maximum test, the collection of the $\dot{V}O_2$ and HR values was begun with the subject at rest and the protocol consisted of an initial speed of $5\ km\cdot h^{-1}$ with 1% of inclination for 2 minutes. Subsequently, the speed was incremented by $1\ km\cdot h^{-1}$ by minute. Subsequently, the speed was incremented by $1\ km/h^{-1}$ by minute, while maintaining the inclination, until the subjects reached maximum exertion. The test was halted when the subject indicated exhaustion by means of a hand signal. The evaluation was considered valid when some of the following criteria were reached at the end of the test (20): (a) a plateau in the $\dot{V}O_2$ with the increase in the treadmill speed; (b) a respiratory exchange ratio greater than 1.15; (c) a maximal respiratory rate of at least 35 breaths/minute; and (d) a rating of perceived exertion of at least 18 units on the Borg scale. The following instructions were given to the subjects for experimental protocol completion: fast for a period of 3 to 4 hours before the test session, do not ingest stimulants, hydrate at will, and avoid practicing intense exercises during the last 24 hours. The sessions were always held in the afternoon, between 4:00 and 7:00 PM.

After the initial session, all the subjects participated in a familiarization session. Initially, all the instructions about the RPE scale were explained to the participants. The Borg 6-20 RPE scale is a scale for determining rates of perceived exertion developed to enable reliable and valid estimates of perceived exertion (6). To familiarize the subjects with the use of the scale, the stationary running was performed in water at all effort levels (very light, light, somewhat hard, hard [heavy], very hard, and extremely hard) progressively to familiarize them with the minimal effort and graduation until the maximal effort by their self-pace. Subjects were instructed to try to understand the degree of tension and fatigue in their muscles, shortness of breath, or chest pain.

The session following the data collection was held in the Swimming Center of the UFRGS School of Physical Education. The subjects executed the following protocol: performance of maximal voluntary contraction (MVC) pre-exercise on land, execution of the water-based exercise protocol, and performance of MVC post-exercise on land. The exercise protocol consisted of the performance of a stationary running exercise for 4 minutes at 3 randomized submaximal cadences (60, 80, and 100 bpm) with a 5-minute interval between each situation. The choice of these cadences was based on previous studies (1,8,21).

Prior to placing the electrodes on the subjects, shaving and abrasion with alcohol were carried out in the muscular belly. After, with the aid of an electrostimulator (model EGF 4030, CARCI, São Paulo, Brazil), the innervation zone (IZ) of the RF, VL, BF (short head), and ST of the right leg of each subject was determined for the positioning of the electrodes. The bipolar electrodes were then positioned 2 cm below the IZ (10). For all subjects, these procedures were always performed by the same researcher. The distance between the centers of the electrodes was maintained at 30 mm. The resistance level between the electrodes and the skin, considered suitable below 3,000 ohms, was measured before each session using a digital multimeter. The reference electrode was positioned on the clavicle.

To avoid noise in the EMG signal resulting from the water, insulation was done with adhesive waterproof tape (Tegaderm, 3M, St. Paul, Minnesota, USA) over the electrodes according to the method described by Figueiredo et al (13). Silicone glue was placed at the exit point of the cables (dried for approximately 1.5 hours) to prevent water entering. The cables and preamplifiers were fixed with adhesive tape (Figure 1). This procedure served to prevent water from contacting the skin-electrodes interface and electrical leakage during the tests. As with the positioning of the electrodes, the insulation procedure was always carried out by the same researcher. Supplex pants were worn over the electrodes to hold the cables in place and minimize any low-frequency interference in the signal resulting from their movement. In addition, the reflexive markers used for the filming were always positioned by the same researcher on the greater trochanter of the femur and the lateral femoral epicondyle.

The isometric MVC of the RF, VL, ST, and BF muscles was performed out of the water prior to and after the water-based exercise protocol. The data from the MVCs pre-exercise were used for the normalization of the collected EMG signal (23). However, the data from the MVCs post-exercise were collected to verify the possible changes in the physiological status from the analyzed muscles and interferences from water in the EMG signal in the end of session through the correlation with the pre-exercise values. For this purpose, the MVC was collected in the isometric situation, with the contraction of the muscle groups in which each of the aforementioned muscles acts as agonist. Three attempts of 5 seconds were realized for each muscle and the highest value was selected.

Stationary running was chosen for this experiment because of its widespread use in water gymnastics and the relative simplicity of the movements involved. The subjects began the exercise standing with their arms lowered at their sides. The ascending phase of the exercise consisted of flexing the right hip and knee to 90 degrees, flexing the left shoulder to 90 degrees, and extending the left elbow with the fist extended; the descending phase consisted of completely extending the right hip and knee, completely extending the left shoulder, and flexing the left elbow to 90 degrees (Figure 2). This movement was repeated while alternating the left and right limbs. The upper-limb movements were performed only to give equilibrium to the movement.

During the exercise, HR, $\dot{V}O_2$, Ve, and EMG signal of the RF, VL, ST, and BF muscles were acquired from the third until the fourth minute of each cadence. Immediately following the end of the exercise the overall body RPE was collected. The scale was visible to the subjects throughout the test session. The subjects were filmed while performing the exercise to allow the EMG signal to be aligned with the angular position of the hip, so permitting the starting and finishing time of each repetition to be determined and later used for slicing the signal corresponding to each cycle of the repetition.

The following instruments were used for data collection: a T61 frequency meter (POLAR, Kajaani, Finland) for HR data, KB1-C gas analyzer (AEROSPORT, Ann Arbor, MI, USA) for $\dot{V}O_2$ and ventilation data, the Borg 6-20 RPE scale (6) for the RPE data, a Miotool 400 electromyograph (Miotec; Biomedical Equipment, Porto Alegre, Brazil) for the EMG

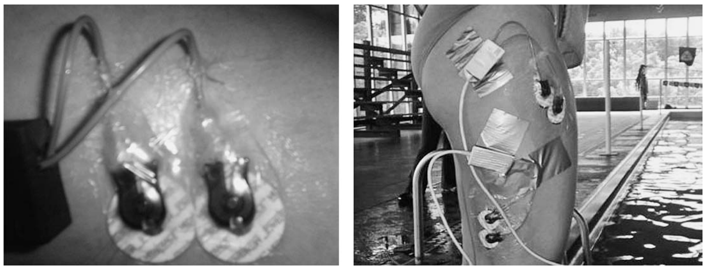

Figure 1. Electrodes insulated and cables and preamplifiers fixed with adhesive tape.

Figure 2. Stationary running exercise.

data, and a 50-Hz JVC GR-DVL9800 Mini DV Digital Camcorder (JVC, Yokohama, Japan) for the filming. A metronome was used to determine the cadences. The exercise protocol was performed in a deep pool measuring 25 × 16 × 2 m. The water temperature was maintained at 30.80 ± 0.42°C. Depth reducers were used to ensure that the subjects remained at immersion depth between the xiphoid process (while standing at rest) and the shoulders (during the movement). Along the sides of the pool there are windows below the surface level of the water through which the subjects were filmed in the sagittal plane at a distance of 3 m.

Cardiorespiratory Data. The $\dot{V}O_2$, Ve, and HR were collected each 20 seconds. The mean values were established between the third and fourth minutes, when the variables reach a steady state. The $\%\dot{V}O_2max$ and $\%HR_{max}$ were calculated from the maximum test performed on a treadmill.

Kinematic Data. Dvideow software (Laboratory of Biomechanics & Institute of Computing, UNICAMP, Brazil) was used to reconstruct the marker positions into bi-dimensional coordinates. The reflexive markers on the greater trochanter of the femur and the lateral femoral epicondyle corresponding to the first 10 repetitions were digitalized either automatically or manually. The angle of the hip was measured using the markers of the hip (greater trochanter of the femur) and the knee (lateral femoral epicondyle) in relation to the vertical line. In the standing position (corresponding to the vertical line), the reference values for the complete extension of the hip and knee were 0 degrees. These data were later filtered using a fifth-order low-pass Butterworth filter, with a cut-off frequency of 8 Hz, and processed in Matlab software (version 5.3; The MathWorks, Inc., Natick, Massachusetts, USA), generating the files of the angular position of the joints of the hip in time. The starting and finishing time points of each repetition were obtained based on the graphs of the angular position of the hip vs. time.

Neuromuscular Data. The signal captured by the electromyograph was recorded in a microcomputer using the Miograph data acquisition software (Miotec). Later, the files were exported for analysis in SAD32 software (Mechanical Measurements Laboratory, Federal University of Rio Grande do Sul, Porto Alegre, Brazil). First, the continuous components of the EMG signal were removed. After this, the digital signal was filtered using a fifth-order band-pass Butterworth filter with cut-off frequencies of between 25 and 500 Hz. The signal curves corresponding to the MVC pre- and post–exercise (5 seconds) were sliced between the 2- and 4-second times to obtain the root-mean-square (RMS) value. The RMS values obtained from the MVC of each muscle during the on-land pre-exercise were used to normalize the data from the different experimental situations. The starting and finishing time points of each repetition were used to make slices of each total repetition of the exercise of each subject for the first 10 repetitions of the acquired signal. Later, the RMS value corresponding to each 1 of the 10 repetitions was obtained. Based on the values obtained, a mean of the central 5 repetitions was made. These values were normalized and expressed as a percentage of the MVC (%MVC) for later statistical analysis.

Statistical Analyses

Lilliefors test was used to analyze the normality of the data. The intraclass coefficient correlation (ICC) was used to verify the reproducibility from the EMG signal in the MVC pre- and post-exercise. Pearson product-moment linear correlation

Table 1. Intraclass correlation coefficients (ICC) for the maximal voluntary contraction variable of the vastus lateralis (VL), rectus femoris (RF), biceps femoris (BF), and semitendinosus (ST) between pre- and post-exercise situations.

Variables	ICC	p
VL (μV)	0,920	$<$0,001
RF (μV)	0,942	0,003
BF (μV)	0,764	0,005
ST (μV)	0,819	0,003

was used to check the level of relationship between the cardiorespiratory and neuromuscular variables with the rating of perceived exertion. Multiple linear regression was carried out using the Enter method to verify the contribution of the variables to explain the RPE. The level of significance adopted in the study was $p < 0.05$.

RESULTS

The values obtained for ICC demonstrate a high and significant relationship for the EMG signal in the MVC pre- and post-exercise (Table 1). These results indicate the reproducibility of the EMG signal, suggesting that the water-based exercise protocol did not elicit alteration in the EMG signal as a result of changes in the physiological status from the analyzed muscles (10) or interferences from water in the insulation.

The results of the correlations can be seen in Figure 3. Because the data for the variable Ve failed to fit normality, a logarithmic transformation was made to make the distribution normal. Therefore, they will be presented in the results section as Ve-log. As we hypothesized, high and significant relationships were observed between the RPE and all the cardiorespiratory variables, with the *r* values varying from 0.60 to 0.77 and $p \leq 0.001$. The EMG values from the VL, BF, RF, and ST muscles showed no correlation with the RPE, in contrast to our hypothesis, as can be seen in Table 2.

Last, multiple linear regression was performed to identify which variables could best explain the RPE. These results can

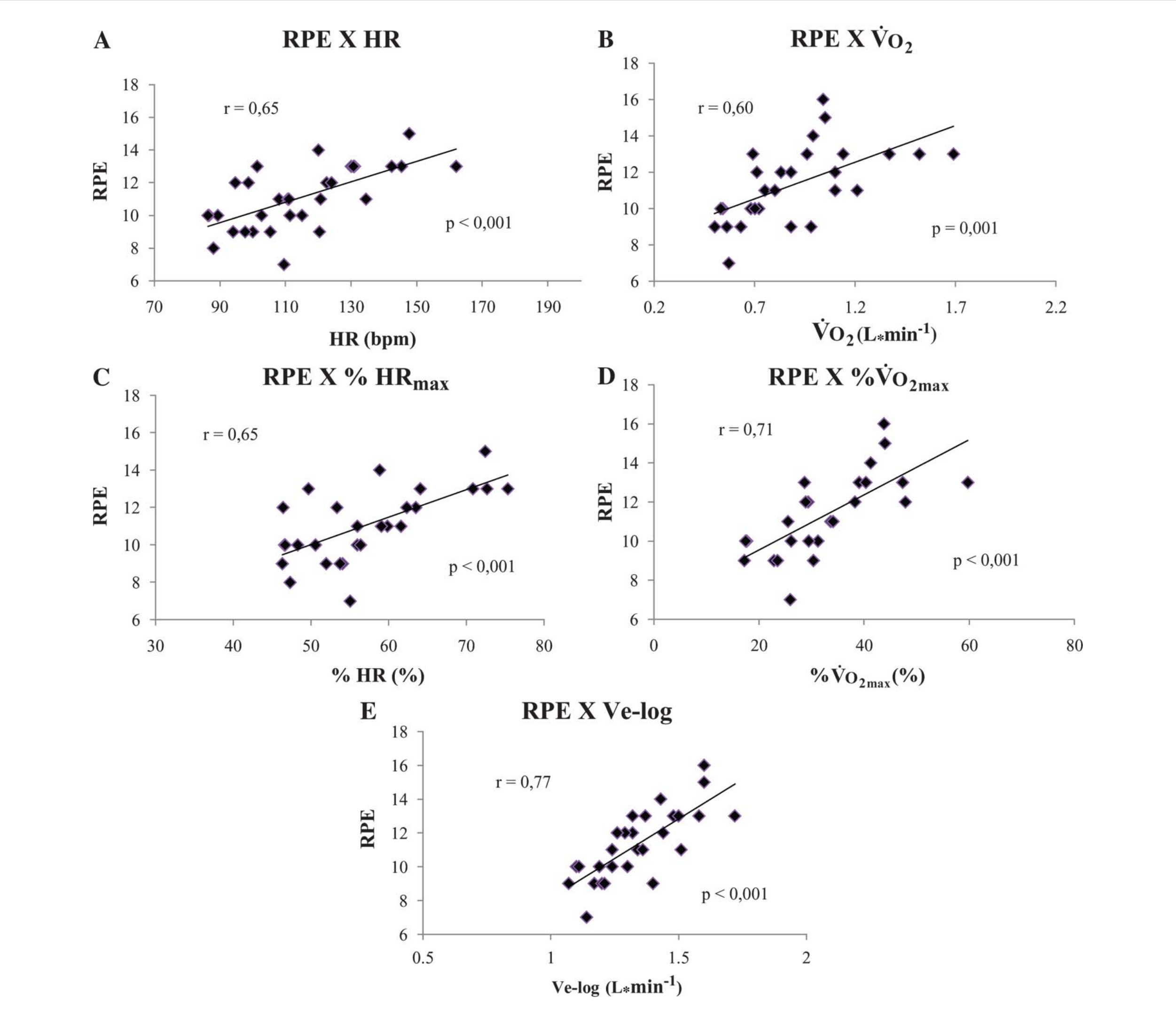

Figure 3. Graphics with the results of the relationship between rating of perceived exertion (RPE) and heart rate (HR) (A), RPE and %HR$_{max}$ (B), RPE and $\dot{V}O_2$ (C), RPE and %$\dot{V}O_2$max (D), and RPE and Ve-log (E). %HR$_{max}$ = corresponding values for the percent of maximum HR; %$\dot{V}O_2$max = corresponding values for the percent of maximum $\dot{V}O_2$; Ve-log = ventilation values after logarithmic transformation.

Table 2. The *r* and *p*-values for the relationship between electromyography (EMG) from the vastus lateralis (VL), biceps femoris (BF), rectus femoris (RF), and semitendinosus (ST) muscles with rating of perceived exertion (RPE).

	r	*p*
VL – RPE	−0.046	0.810
BF – RPE	−0.036	0.844
RF – RPE	−0.026	0.892
ST – RPE	−0.175	0.403

Table 3. Coefficient beta (β) and *p*-values for the variables that entered in the model to explain the rating of perceived exertion. $\%\dot{V}O_2max$ = corresponding values for the percent of maximum $\dot{V}O_2$; Ve-log = ventilation values after logarithmic transformation.

	β	*p*
Constant	−8.582	0.007
$\%\dot{V}O_2max$	−0.092	0.064
Ve-log	17.476	<0.001

be seen in Table 3. The neuromuscular variables were not included in this analysis because they presented no significant correlation with the RPE; therefore, the input variables were Ve-log, $\dot{V}O_2$, HR, $\%\dot{V}O_2max$, and $\%HR_{max}$. Based on the analysis carried out using the Enter method, it was concluded that the regression model was significant ($p < 0.001$) and presented an $r^2 = 0.79$, whereas the variables that best explained the RPE were $\%\dot{V}O_2max$ and Ve-log. The constant and the ventilation were significant; the $\%\dot{V}O_2max$, although marginally significant, entered in the model because its inclusion greatly increased the r^2 value and made the constant significant (29).

Discussion

The relationship existing between HR and $\dot{V}O_2$ is already clear in the literature, occurring both in the exercises performed in the water and in those performed on land (2,19,21,27,35,36). Nevertheless, as pointed out by Okura and Tanaka (32), drugs such as beta blockers, used by people with hypertension, and stimulants (coffee, for example) affect HR, thus reducing its reliability in the prescription of exercises. Likewise, immersion in water also affects HR (39), which means that in a water-based environment HR can only be used as an indicator of intensity if correction formulas have been adopted or maximum tests previously have been carried out in the water (16). Therefore, mainly in water gymnastics exercises, prescription has increasingly been made based on RPE. On land it is already known that RPE is a valid means of regulating exercise intensity (12). On water, however, studies that investigate this validity were not found, which justifies the importance of the present study.

In this study, all the cardiorespiratory variables presented a high and significant relationship with the RPE, demonstrating that the intensity of the water aerobics exercises can be prescribed using the RPE. This results are in agreement with those found by Shono et al. (35), which observed a highly significant relationship between HR and RPE ($r = 0.996$, $p < 0.01$) in an underwater treadmill. Other approaches have been developed with deep water running (DWR); however the cardiorespiratory responses of this modality were compared to the treadmill running, they were not correlated with RPE. Frangolias and Rhodes (14) compared DWR and treadmill running on land and noted that during DWR, the $\dot{V}O_2max$ and HR values were lower than in the treadmill running on land, whereas the Ve and RPE values were similar in both situations. In contrast, in the study by Nakanishi et al. (30) all the cardiorespiratory variables (HR_{max}, $\dot{V}O_2max$, and maximal Ve) obtained lower responses in DWR when compared with land-based running. The RPE, however, was similar in both exercises. The authors explained the reduced ventilation as being a consequence of the increase in intrathoracic blood pressure and hydrostatic compression of the chest, which leads the diaphragm to remain in a position close to full expiration, increasing the strength necessary to inhale and reducing the vital capacity of the lung.

However, although the RPE is greatly influenced by the musculoskeletal system during physical exercise (11), no correlations were found between the neuromuscular variables and the RPE in the present study. No studies were found in the literature in which this type of analysis had been carried out in water-based exercises. It is possible that these results may be explained by the intensity of the exercise because, although the intensity of the exercise increased with the increments in cadences, the increase was not sufficient to increment the neuromuscular activation, observed through the %MVC values that varied from 7.34 to 21.54% of the MVC (VL: 10.11 to 10.87%; RF: 7.34 to 12.03%; BF: 9.45 to 13.18% and ST: 12.25 to 21.54%). This can be explained through the selective recruitment of motor units, as in the study from Tesch et al. (38); it was found that the type IIb fibers are only predominantly used at exertion levels equal to or greater than 60% of the maximum.

It is also possible that this difference in the behavior of the EMG signal in relation to the cardiorespiratory responses may have been a result of the action of other muscle groups that were not analyzed in the present study, given that other muscles than those investigated must have been active. Another factor to be considered is the methodology used in the collection of the neuromuscular activation because there are more active fibers than those that the electrode is able to capture (10). Further studies would be required to examine the relationship between EMG signal and RPE during the stationary running in the aquatic environment but at higher cadences.

A further factor to be taken into account is the methodology used in the present study that concerns the RPE. The subjects in the sample were asked to report their overall body RPE–that is, a set of sensations of perceived exertion (respiratory and muscular). Perhaps if they had been asked to also report 1 specific RPE for the respiratory system and another for the muscular system, as done in earlier studies, we could have obtained more indications regarding the perception of muscular exertion–that is, whether or not it was in line with the cardiorespiratory exertion. In the study from Okura and Tanaka (32) it was noted that the specific RPE for the legs presented a higher correlation with the $\dot{V}O_2$max, although it also had estimated the lowest rates of work when compared to the general RPE and the RPE specifically for breathing.

Regarding the regressions, the r^2 explained 79% of the RPE–that is, 21% can be explained by other variables that were not analyzed in the present study. From the analysis, the variables that best explain the model are Ve-log and %$\dot{V}O_2$max ($r^2 = 0.79$), which were those in which the greatest associations with the RPE were observed. Thus, the results are in line with the definition of subjective sensation of exertion, which have an important pulmonary component, as demonstrated by the fact that the Ve-log has the best relationship with the RPE, along with being the variable that best explains the influence.

The increase in pulmonary ventilation occurs together with the beginning of the physical activity and continues in direct proportion to the needs of the body. This increase, according to Wilmore and Costill (40), is produced by alterations in temperature and the chemical condition of the arterial blood–that is, according to pH levels, which also tend to become elevated during exercise. Accordingly, it can be seen that the ventilation reflects the intensity of the exercise and, because it is highly correlated with RPE, it also represents the cardiorespiratory intensity of the exercise.

Given the results of the present study, it can be concluded that the RPE really is related to the intensity of the stationary running exercise in water and so can be safely used when prescribing the intensity of this exercise for young women.

Practical Applications

Considering the increasingly widespread use of the subjective perception of exertion in the prescription of water gymnastics exercises, the importance of the present study can be noted, given that it showed an important relationship between the RPE and the cardiorespiratory variables in young women.

The results of the present study suggest that the RPE can be used as an indicator of the aerobic intensity during the execution of the stationary running exercise in water for young women at cadences widely used in water-based sessions. The use of the Borg scale of RPE can offer professionals a simple, low-cost, fast, and reliable instrument for measuring intensity. Therefore, the prescription of water gymnastics exercises can be done through the use of the subjective perception of exertion. However, it is important to highlight that suitable instructions and introductory sessions in the use of the scale are fundamental in ensuring effective results. It is important to consider that other aquatic exercises and population must be evaluated.

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