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ÉDITORIAL

Devenu établissement à statut particulier suite à la signature du décret n° 2016/427 du 26 Octobre 2016, l'Institut National de la Jeunesse et des Sports (INJS) entend, comme toute institution de l'Enseignement Supérieur, mettre la recherche au centre de son action de formation.

C'est ainsi qu'après avoir œuvré pour la parution des deux premiers numéros de la Revue Scientifique Interdisciplinaire de l'Institut National de la Jeunesse et des Sports (RESI) en janvier 2021 et 2022, l'administration de l'INJS poursuit la promotion de la recherche à travers ses deux centres de recherche créés en août 2020, l'un en Sciences et Techniques des Activités Physiques et Sportives, et l'autre en Sciences et Techniques de l'Animation, des Loisirs et de l'Éducation Civique. Ces centres, par le biais des activités de leurs différents laboratoires (Biologie Appliquée aux Activités Physiques et Sportives, Sciences Humaines et Sociales Appliquées aux Activités Physiques et Sportives, Sciences de l'Intervention, Sciences de l'Education Civique, Sciences Humaines et Sociales Appliquées à l'Education Permanente, Sciences des Loisirs) constituent la matérialisation de la volonté du staff de l'INJS de donner à la recherche, une place centrale parmi les nombreuses missions assignées à l'institution. Ces centres de recherche sont en effet un cadre non seulement d'organisation d'activités scientifiques (communications, conférences, tables rondes), mais sont aussi la matrice de publication d'ouvrages et/ou articles traitant des thématiques relatives aux référentiels-métiers de l'Education Physique et du Sport, ainsi que de l'Animation, des Loisirs et de l'Education Civique. L'INJS veut donc aujourd'hui plus qu'hier :

- favoriser le développement de la recherche dans les spécialités reconnues par le Conseil Africain et Malgache pour l'Enseignement Supérieur (CAMES) ;
- mutualiser les idées de ses partenaires des métiers du Sport et de l'Éducation Physique, de l'Animation, de la Jeunesses des Loisirs et de l'Éducation Civique ;
- susciter l'esprit d'émulation scientifique sans lequel l'objectif d'améliorer la masse critique des enseignants ne saurait être atteint;
- inciter les enseignants-chercheurs à publier dans la mesure du possible, des travaux de recherche originaux et interdisciplinaires ;
- améliorer la qualité de l'image de l'institution tant sur le plan national qu'international à travers les publications.

La publication du troisième numéro de la RESI amène à saluer et à encourager le mérite de toute l'équipe qui a contribué à la rendre concrete, en dépit des nombreuses difficultés rencontrées. Le lancement effectif des activités du Master Recherche en Sciences et Techniques des Activités Physiques et Sportives, Jeunesse et Loisirs (STAPS-JL), ainsi que l'implémentation de l'Unité de Formation Doctorale en collaboration avec l'Université de Yaoundé II-Sao en cette année 2023, de par l'engouement qu'ils vont susciter auprès de tous les acteurs de la recherche, augurent à n'en point douter de lendemains meilleurs pour notre revue.

Bon vent à la RESI et bonne lecture à tous.

DIRECTEUR DE L'INSTITUT NATIONAL
DE LA JEUNESSE ET DES SPORTS,
EBAL MINYE Edmond

EDITORIAL

Having become an establishment with a special status following the signing of Decree No 2016/427 of 26 October 2016, the National Institute of Youth and Sports (NIYS) like any other Institution of Higher Education intends to put research at the center of its training activity.

Thus, after having worked for the publication of the first two papers of the Interdisciplinary Scientific Review of the National Institute of Youth and Sports (ISRI) in January 2021 and 2022, the administration of the NIYS continued with the promotion of research via its two research centers created in August 2020; one in the Sciences and Techniques of Sports and Physical Activities, and the other in the Sciences and Techniques of Animation, Leisure and Civic Education. These centers, through the activities of their various laboratories (Biology Applied to Sports and Physical Activities, Human and Social Sciences Applied to Sports and Physical Activities, Intervention Sciences, Sciences of Civic Education, Human and Social Sciences Applied to Permanent Education, Sciences of Leisure) constitutes the materialization of the will of the staff of the NIYS to give research a central place among the many missions assigned to the Institution. These research centers are indeed a framework not only for the organization of scientific activities (communications, conferences, round tables, etc.), but are also the matrix for the publication of works and/or articles dealing with themes relating to reference Sports and Physical Education, as well as activities related to Leisure and Civic Education. Thus, the NIYS more than ever intends to;

- Promote the development of research in specialties recognized by the African and Malagasy Council for Higher Education (CAMES),
- Harmonize ideas of its partners in the fields of Sports and Physical Education, as well as in activities related to Leisure and Civic Education,
- Arouse the spirit of scientific emulation without which the objective of improving the critical mass of teachers cannot be achieved,
- Encourage teacher-researchers to publish original and interdisciplinary research works as much as they can,
- Improve the quality of the image of the Institution both nationally and internationally through publications.
- The publication of the Third Paper of ISRI leads us to salute and encourage the merit of the entire team who contributed to making it effective, despite the difficulties encountered. The effective launch of the activities of the Research Master in the Sciences and Techniques of Sports and Physical Activities-Youth and Leisure, as well as the implementation of the Doctoral Training Unit in collaboration with the University of Yaoundé II-Soa in the 2023 Academic Year, the enthusiasm they will arouse among all those involved in research undoubtedly augurs a better future for our journal.

Good Luck to the ISRI and Good Reading to all.

THE DIRECTOR OF THE NATIONAL INSTITUTE OF YOUTH AND SPORTS,
EBAL MINYE Edmond

PARTIE 1

BIOLOGIE APPLIQUÉE AUX ACTIVITÉS PHYSIQUES ET SPORTIVES

DO UNIVERSITY ATHLETES REALLY EXPRESS THE DIFFICULTY OF THE EFFORT DURING CARDIORESPIRATORY ENDURANCE TESTS?

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Abstract

Objective and subjective measurements of the Rating of Perceived Exertion (RPE) are two methods to determine the difficulty of the effort but, it is not known if athletes express similarly the RPE through both methods. The aim of this study was mainly to investigate the convergence of the RPE subjective (S-RPE) assessment (6-20 RPE-scale) with that of the objective (O-RPE) assessment (HRmax = RPE * 10). Thirty-one university athletes moderately trained were submitted to two field tests spaced 48 hours apart: the VAMEVAL test and the 20 m squared shuttle test (20mST). Physiological parameters were recorded before and at the end of each test, and the maximal heart rate (HRmax) was collected during the test. The subjective-RPE (S-RPE) was determined using the Borg 15-point RPE scale, and the objective-RPE (O-RPE) was estimated from the relation HRmax = RPE x 10. Significant differences were recorded (P< 0.0001) in the values of VO2max, and SpO2, obtained in the VAMEVAL test and the 20mST. In contrary, there was no significant difference between both tests in the values obtained in the HRmax (P= 0.4238) and [BLa] (P= 0.3346). Significant differences were noted between S-RPE and O-RPE in each test (P<0.0001). The university athletes do not express the real difficulty of the effort. The S-RPE and the O-RPE must be used complementary.

Keywords: Rating of perceived exertion; university athletes; VAMEVAL test; 20 m shuttle test.

Résumé

*Les mesures objectives et subjectives de perception de la difficulté de l'effort (RPE) sont deux méthodes pour déterminer la difficulté perçue de l'effort, mais on ne sait pas si les athlètes expriment de manière similaire la RPE par les deux méthodes. L'objectif de cette étude était principalement d'étudier la convergence de l'évaluation subjective de RPE (S-RPE) (échelle-RPE 6-20 points) avec celle de l'évaluation objective (O-RPE) (HRmax = RPE * 10). Trente et un athlètes uni-*

versitaires moyennement entraînés ont été soumis à deux tests terrain espacés de 48 heures : le test VAMEVAL et le test navette de 20 mètres carré (20mST). Les paramètres physiologiques ont été enregistrés avant et à la fin de chaque test, et la fréquence cardiaque maximale (FC max) a été enregistrée pendant le test. Le RPE subjectif (S-RPE) a été déterminé à l'aide de l'échelle RPE de Borg à 15 points, et le RPE objectif (O-RPE) a été estimé à partir de la relation HRmax = RPE x 10. Des différences significatives ont été notées (P< 0,0001) dans les valeurs de VO2max et SpO2, obtenues dans le test VAMEVAL et le 20mST. Par contre, aucune différence significative n'a été observée entre les deux tests dans les valeurs de HRmax (P= 0,4238) et [BLa] (P= 0,3346). Des différences significatives ont été enregistrées entre S-RPE et O-RPE dans chaque test (P<0,0001). Les athlètes universitaires n'expriment pas la réelle difficulté de l'effort. S-RPE et O-RPE doivent être utilisés de manière complémentaire.

Mots clés : *Difficulté de l'effort perçu, sportifs universitaires, test VAMEVAL, test navette de 20 m.*

Introduction

The high level sport is characterized by performance, and the trainers as well as sporters are often subjected to observe requirements in order to avoid fatigue and over-training. They have many simple possibilities to monitor their training programme as the rating of perceived exertion (RPE). Despite the fact that RPE is often the prescription method of choice for patients taking medication that affects exercise heart rate (Ritchie, 2012), RPE is also helpful for athletes (Hamer and Slocombe, 1997).

The RPE is a recognized marker of intensity and of homeostatic disturbance during exercise (Eston, 2012). It can be used in such diverse fashions as to predict exercise capacity, assess changes in training status, explain changes in pace and pacing strategy and self-regulate exercise (Eston, 2012). The RPE is used to subjectively quantify an indivudual's perception of the physical demands of an activity, and is provided as an exercise intensity guide (Ritchie, 2012). Moreover, it is a useful tool due to its potential to facilitate the monitoring of exercise training in the sport performance field (Morris et al., 2009).

Many studies have already confirmed the predictive efficacy of physiological parameters (heart rate, VO2max, VO2peak, etc.) from RPE in health, fitness and sport performance fields (Laurent et al., 2010 ; Coquart et al., 2009a, 2009b ; Eston, 2009 ; Eston and Evans, 2009 ; Faulkner and Eston, 2007 ; Lambrick et al., 2009 ; Morris et al.,

2009). The use of the RPE in sport, exercise, and rehabilitation is founded on its strong relationships with exercise intensity (eg, work, speed, power) and physiological factors (eg, heart rate, ventilation, oxygen uptake, blood lactate) (Eston, 2012).

In practice, trainers use RPE to regulate exercise intensity in non-clinical environments, which lack the availability of sophisticated laboratory-based monitoring procedures (Morris et al., 2009). RPE are commonly used as a practical, non-invasive adjunct when monitoring physiological and psychological markers of impending fatigue during exercise (Laurent et al., 2010 ; Borg, 1998 ; Noble and Robertson, 1996). The utility of monitoring RPE during exercise has clear advantages from a practical standpoint as it eliminates the need for invasive blood drawns or cumbersome equipment (Laurent et al., 2010).

There is several manners to determine the RPE during or after an effort. In one hand, the subjective option concerns the use of the RPE scales and estimates the strain that simultaneously reflect both physiological and psychological variables (Gillach et al., 1989). The Borg 15-points RPE scale is one of the main tools commonly used in the subjective assessment of RPE (Borg, 1982). In the other hand, it has been demonstrated that Borg scale is linerealy linked to the work objective load, as well as maximal heart rate (HRmax) (Acevedo et al., 2006). The RPE was constructed to be linearly related to maximum heart rate and maximum oxygen uptake during ergocycle exercise and, this relationship was extended to running and an equation establishing this link has been determined : HRmax = RPE * 10 (Borg, 1973). Many physiological parameters (oxygen consumption, blood pressure, blood lactate concentration, heart rate, etc.) reflect exercise intensity and constitute the objective assessment of the RPE (Gillach et al., 1989).

To our knowledge, there is no study that has evaluated the convergence of the two methods of determining the RPE in university athletes. Then, the main aim of the present study was to investigate the convergence of the RPE subjective (S-RPE) assessment (6-20 RPE-scale) with that of the objective (O-RPE) assessment (HRmax = RPE * 10). Secondly, we compared the physiological responses from the two field tests used to estimate athlete's aerobic capacity.

1- Material and methods

Participants

Following approval of the research project by the directorate of studies of the National Institute of Youth and Sports, 29 university athletes (26.6 ± 3.4 years ; 75.3 ± 7.8 kg ; 1.80 ± 0.10 m) provided written consent which allowed them to par-

ticipate in the study. All the participants were physically active, asymptomatic of illness and pre-existing injury. The study was conducted according to the Declaration of Helsinki of 1975.

Procedures

Each participant completed randomly two tests : the VAMEVAL test in a 400 m athletic tracks (VAMEVAL) and the 20 m shuttle run test (20mST). Tests were scheduled at the same hour of the day for each subject, to avoid effects of circadian rhythm on physiological and psychological functions. Forty eight hours at least elapsed between two successive tests, during which subjects were compelled to refrain undertaking any heavy exercise.

The investigation started after a 10-min resting on a sitting position during which anthropometric and resting cardiorespiratory parameters of participants were determined. Weight was measured using a bio-impedance-meter scale TANITA BC 532 (Tokyo, Japan), and the height was measured with height meter. Oxygen saturation (SpO2) and resting heart rate (rHR) were measured with an electronic pulse oximeter (ChoiceMMed, OxyWatchC20, Beijing, China). Systolic blood pressure (SBP) and diastolic (DBP) were determined using an electronic blood pressure device (Medisana AG, Neuss, Germany).

During each test the maximal heart rate (HRmax) of each participant was recorded using heart rate monitor Polar RS800CX (Polar electro Oy, Finland).

At the end of each test, physiological parameters were collected again (SpO2, HRmax, SBP, DBP) and the subjective rate of perceived exertion (S-RPE) was determined using the Borg 15 point scale (Borg, 1982). In addition, using the HRmax, the objective RPE (O-RPE) was estimated from the relation HRmax = RPE x 10 (Borg, 1973). Blood lactate concentration [BLa] was determined after each test at the 5th minute of recovery using the blood lactate analyzer Lactate Scout (Barleben, Germany).

Statistical analysis

All statistical analyses were conducted using Statview 5.0 software (SAS Institute Inc., Cary, NC, USA) and data were expressed as mean values ± standard deviations. The comparison post-test measured parameters between the VAMEVAL test and the 20 meter shuttle run test (20mST) was done using t-test for paired samples. In each test, the comparison between the S-RPE and the O-RPE was also done through the t-test for paired samples.

2- Results

The baseline anthropometric and physiological characteristics of participants are summarized on Table 1.

Table 1 : Baseline characteristics of participants.

Characteristics	M±SD	Min	Max
Age (years)	26,6±3,4	19,0	32,0
Weight (cm)	75,3±7,8	59,7	90,2
Height (m)	1,76±0,08	1,55	1,89
SBP (mmHg)	126,9±12,3	101,0	155,0
DBP (mmHg)	81,1±9,8	60,0	103,0
SpO_2 (%)	98,1±0,6	97,0	99,0
rHR (bpm)	81,2±11,9	56,0	110,0

SBP: Systolic blood pressure; DBP: Diastolic blood pressure; rHR: Resting Heart Rate; SpO2: Oxygen Saturation.

Table 2: Comparison of post-test measured parameters

Tests	VO_{2max} (mL/min/Kg)	HRmax (bpm)	[BLa] (mmol/L)	SpO_2 (%)
VAMEVAL	45.7±2.4	190.5±9.1	11.4±2.6	97.5±1.8
20mST	50.7±4.0	191.7±7.4	12.1±2.9	95.0±2.4
P-value	< 0.0001*	0.4238NS	0.3346NS	< 0.0001*

:Significant differences at P< 0.0001. VO2max: maximal oxygen Consumption; HRmax: Maximum Heart Rate; [BLa]: Blood lactate concentration; SpO2: Oxygen Saturation. Values are presented as mean ± Standard deviation.

Significant differences were recorded (P< 0.0001) in the values of VO2max, and SpO2, obtained in the VAMEVAL test and the 20mST. In contrary, there was no significant difference between both tests in the values obtained in the HRmax (P= 0.4238) and [BLa] (P= 0.3346).

Figure 1 illustrates the comparison between subjective (S-RPE) and objective (O-RPE) perceived difficulties int each test.

O-RPE: Objective rating of perceived exertion; S-RPE: Subjective rating of perceived exertion

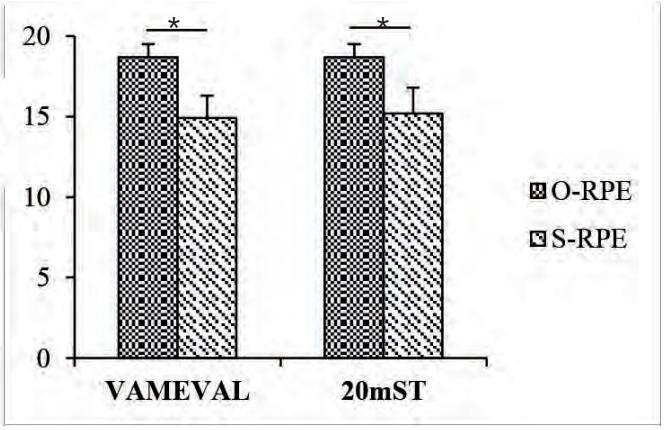

Figure 1: Comparison of objective (O-RPE) and subjective difficulties (S-RPE) in each test

Significant differences were noted between S-RPE and O-RPE in each test (P<0.0001).

3- Discussion

This study was mainly designed to investigate the convergence of the RPE subjective (S-RPE) assessment (6-20 RPE-scale) with that of the objective (O-RPE) assessment (HRmax = RPE * 10). The results revealed significant differences between S-RPE and O-RPE. This result means that athletes do not express the real difficulty of the task during evaluation. Eston (2012) previously reported that the RPE is moderated by psychological factors (eg, cognition, memory, previous experience, understanding of the task) and situational factors (eg, knowledge of the end point, duration, temporal characteristics of the task).

When comparing the objective (O-RPE) and subjective difficulties (S-RPE) in the present study, significant differences were noted between S-RPE and O-RPE in each test (P<0.0001). This resul suggest that athletes do not express really the exercise difficulty through the 15-points Borg scale. They underestimate the perception of the difficulty of the exercise as it was revealed in a study by Schneider et al. (2022), where the perception difficulty was underestimated by men in comparison to women, and by younger and older adults in comparison to middle-aged adults. In our study, the objective measurement of the RPE was based on the heart rate. In a previous study condcuted by Boyd et al. (2017) aiming at determining objective and subjective measures of exercise intensity during constant intensity yoga in a hot and thermoneutral environment, it was showed that, according to established exercise intensities, hot yoga was classified as light-intensity exercise based on percentage of maximal oxygen consumption but moderate-intensity exercise based on %HRmax and RPE while thermo-neutral yoga was classified as light-intensity exercise based on percentage of maximal oxygen uptake, %HRmax, and RPE.

Furthermore, other study aiming at assessing the distribution of exercise intensity in long-distance recreational athletes (LDRs) preparing for a marathon and to test the hypothesis that individual perception of effort could provide training responses similar to those provided by standardized training methodologies suggested that in recreational LDRs most of the training time is spent at low intensity and that this is associated with improved performances (Manzi et al., 2015).

In another study (Iturricastillo et al., 2017), that aimed at analyse the training load in wheelchair basketball small-sided games and determine the relationship between heart rate (HR)-based training load and perceived exertion (RPE)-based training load methods among small-sided games bouts, it was suggested that HR-based and RPE-based training loads provide different infor-

mation, but these two methods could be complementary because one method could help us to understand the limitations of the other.

Conclusion

There is no convergence between the objective (based on the 15-point RPE-scale) and the subjective (based on the HR) measurements of the RPE in university athletes. Nevertheless, the two methods could be complementary and must be used by the trainers to determine the intensity of the exercise during training sessions.

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