RESEARCH ARTICLE

Initial Validation of a 33-Item Recovery-Stress Questionnaire for Italian Athletes

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Abstract:

Background: The Recovery-Stress Questionnaire for Athletes (RESTQ-Sport-36) is a self-report measure intended to monitor the recovery-stress balance in athletes. A validated Italian version of this instrument was not available so far.

Objective: The aim of this study was to provide an initial validation in Italian language of the RESTQ-Sport-36.

Methods: A sample of Italian athletes (N = 339; women = 148; men = 191) from various sports completed the RESTQ-Sport-36 and the Italian Mood Scale (ITAMS). We examined the factorial validity and the internal consistency of the RESTQ-Sport-36 and its concurrent validity with the ITAMS.

Results: A confirmatory factor analysis supported a 12-factor structure after the removal of 3 items. Reliability analysis showed a satisfactory internal consistency of the 33-item Recovery-Stress Questionnaire for Athletes (RESTQ-Sport-33). Pearson correlation coefficients revealed that the RESTQ-Sport-33 and ITAMS share some common variance but measure different constructs.

Conclusion: Our results provided support to the factorial validity and reliability of the RESTQ-Sport-33. This instrument can be used to reliably monitor recovery-stress balance of Italian athletes throughout the season.

Keywords: CFA, Internal consistency, Monitoring, Recovery demands, Stressor, ITAMS.

1. INTRODUCTION

Athlete monitoring is an increasingly scientific approach that modern sport is adopting to athletic preparation [1]. This approach consists of carefully monitoring and managing stress and recovery of athletes to improve and/or optimize their performance and avoid underperformance, injury, or illness [1-3]. Among athlete monitoring methods, athlete self-report measures are gaining increasing attention. These are paper-based or electronic records of an athlete’s perceived physical, psychological, and/or social well-being, completed on a regular basis. Athlete self-report measures can assess dimensions such as mood (Profile of Mood States) [4]; emotions (Emotional Recovery Questionnaire) [5]; stress and/or symptoms (Daily Activities of Life Demands; Perceived Stress Scale) [6, 7]; or stress and recovery (Recovery-Stress Questionnaire for Athletes; RESTQ-Sport) [8].

As concerns stress and recovery dimensions, when a mismatch between stress states and recovery demands is present and athletes have to deal with high stress/low recovery or low stress/high recovery situations, performance most likely is poor [2, 9, 10]. A key factor of recovery-stress balance in
sport is represented by training load [11, 12]. Generally, an insufficient training load leads to underperformance in athletes [13]. On the other hand, exceeding in training load could cause injuries, non-functional overreaching and/or overtraining, impairing not only performance but also athletes’ wellbeing [14]. Consequently, recovery-stress balance monitoring represents a prominent factor for athletes’ health and deserves increased attention [2, 9, 15].

Over the previous decade, the RESTQ-Sport has become widely popular in research to monitor the recovery-stress balance [8]. This self-report measure indicates the extent to which an athlete is physically and/or mentally stressed, as well as whether the athlete is able to use individual strategies for recovery and which strategies are used [14]. This questionnaire encompasses physical and psychobiopsychosocial dimensions of both stress and recovery. For example, it includes physical stress or fitness measures that are useful in identifying possible mismatches between stress and recovery due to training or competition [11]. The 76-item version of the RESTQ-Sport has been administered during training camps, and across preparation and competition phases [16, 17]. However, when the questionnaire needs to be administered repeatedly for effective monitoring, a shorter version of RESTQ-Sport is preferable for practical reasons.

The original 76-item version encompasses 19 scales with 4 items each. Seven scales—General Stress, Emotional Stress, Social Stress, Conflicts/Pressure, Fatigue, Lack of Energy, and Physical Complaints—assess social-emotional stress in general, performance stress, and physical aspects of stress. Five scales—Success, Social Recovery, Physical Recovery, General Well-being, and Sleep Quality—measure nonspecific recovery activities. Three scales—Disturbed Breaks, Emotional Exhaustion, and Injury—and other four scales—Being in Shape, Personal Accomplishment, Self-Efficacy, and Self-Regulation—assess sport-specific aspects of stress and recovery, respectively. Generally, the appraisal of the recovery-stress state is represented by a quantitative assessment of the frequency of stress and recovery related events in the past three days/nights. As mentioned above, in line with the necessity of shortening this version to allow multiple administrations for effective recovery-stress monitoring, Kellmann and Kallus [8] from the 76-item questionnaire. The short version (i.e., the RESTQ-Sport-36) includes 12 scales consisting of 3 items each. From confirmatory factor analysis (CFA) results, the 3 items with higher standardized factor loadings and lower cross-loadings were retained on each scale. The questionnaire also includes a “warm-up” item not included in the scoring. The 12 scales conceptually belong to 4 categories—Overall Stress, Overall Recovery, Sport-specific Stress, and Sport-specific Recovery—consisting of 3 scales each [8]. Specifically, General Stress, Social Stress, and Fatigue pertain to Overall Stress category, while Social Recovery, General Well-being, and Sleep Quality pertain to Overall Recovery. Disturbed Breaks, Emotional Exhaustion, and Injury are included in the Sport-specific Stress category, while Being in Shape, Personal Accomplishment, and Self-Efficacy are included in the Sport-specific Recovery category. At a higher level, the scales included in the Overall Stress and Sport-specific Stress belong to the general factor named Stress, while the scales included in the Overall Recovery and Sport-specific Recovery belong to the general factor named Recovery. Participants are required to indicate how often they were involved in specific activities during the past three days/nights using a 7-point Likert-type scale ranging from 0 (never) to 6 (always). In a sample of French athletes, Nicolas, Vacher, Martinent, and Mourot [14] reported acceptable fit indices for the 12-factor correlated model, CFI = .951, RMSE = .05 (90%CI = .05–.06). Moreover, average inter-item correlation values of the questionnaire scales (ranging from 0.21 to 0.60) provided general evidence for the reliability of the instrument.

2.2.2. ITAMS

An Italian validated version of the RESTQ-Sport-36 would enable scholars of different countries to devise common research projects and exchange their results in a reliable manner [20]. It would also provide practitioners with a proper measure to assess the athletes’ recovery-stress balance in their own language and cultural context.

2. MATERIALS AND METHODS

2.1. Participants

Eligibility criteria for participating in our study included that participants were at least 14 years old and that they were competitive athletes. Three hundred and thirty-nine Italian athletes (148 women, 191 men; Mean age = 22.32 ± 6.42) voluntarily participated in the study and signed a written consent form before the testing procedure. They were involved in a variety of different individual and team sport activities such as soccer (n = 90), basketball (n = 80), volleyball (n = 70), tennis (n = 50), swimming (n = 20), rugby (n = 15), or gymnastics (n = 14), and competed at different levels (i.e., international, national, regional, and local). The study was approved by the local ethics committee for biomedical research and was undertaken in compliance with the Declaration of Helsinki and the international principles governing research on humans.

2.2. Instruments

2.2.1. RESTQ-Sport-36

Grounded on empirical, theoretical, and practical considerations, seven scales (i.e., Emotional Stress, Conflicts/Pressure, Lack of Energy, Physical Complaints, Success, Physical Recovery, and Self-Regulation), considered rather weak for the sport-specific context, were removed by Kellmann and Kallus [8] from the 76-item questionnaire. The short version (i.e., the RESTQ-Sport-36) includes 12 scales consisting of 3 items each. From confirmatory factor analysis (CFA) results, the 3 items with higher standardized factor loadings and lower cross-loadings were retained on each scale. The questionnaire also includes a “warm-up” item not included in the scoring. The 12 scales conceptually belong to 4 categories—Overall Stress, Overall Recovery, Sport-specific Stress, and Sport-specific Recovery—consisting of 3 scales each [8]. Specifically, General Stress, Social Stress, and Fatigue pertain to Overall Stress category, while Social Recovery, General Well-being, and Sleep Quality pertain to Overall Recovery. Disturbed Breaks, Emotional Exhaustion, and Injury are included in the Sport-specific Stress category, while Being in Shape, Personal Accomplishment, and Self-Efficacy are included in the Sport-specific Recovery category. At a higher level, the scales included in the Overall Stress and Sport-specific Stress belong to the general factor named Stress, while the scales included in the Overall Recovery and Sport-specific Recovery belong to the general factor named Recovery. Participants are required to indicate how often they were involved in specific activities during the past three days/nights using a 7-point Likert-type scale ranging from 0 (never) to 6 (always). In a sample of French athletes, Nicolas, Vacher, Martinent, and Mourot [14] reported acceptable fit indices for the 12-factor correlated model, CFI = .951, RMSE = .05 (90%CI = .05–.06). Moreover, average inter-item correlation values of the questionnaire scales (ranging from 0.21 to 0.60) provided general evidence for the reliability of the instrument.

2.2.2. ITAMS

The ITAMS [15] is an Italian validated questionnaire developed to examine mood responses in sport and exercise.
fields. It encompasses 24 items assessing six dimensions of mood, namely Anger, Confusion, Depression, Fatigue, Tension, and Vigor. Participants can indicate their feelings on a 5-point Likert-type scale ranging from 0 (not at all) to 4 (extremely). As concerns its internal consistency and reliability, Cronbach’s alpha values were .74 for Anger, .79 for Confusion, .80 for Depression, .75 for Fatigue, .80 for Tension, and .78 for Vigor.

2.3. Procedures

2.3.1. Translation

The translation of the RESTQ-Sport-36 was conducted using the forward-backward translation method [21] by two Italian English-speaking researchers and a native English speaker with a good command on Italian. All researchers were knowledgeable about sport science and sport psychology. The original version of the questionnaire was translated independently by the researchers and then the translated text was discussed extensively. When a consensus on a pre-version of the questionnaire was reached, the questionnaire was reverse translated by a native English speaker. The original English questionnaire and the translated and retranslated texts were examined carefully for accuracy. Just a few minor discrepancies on the syntax emerged. These were discussed until agreement on the changes was reached. The item 4 (pertaining to Sleep Quality scale) is reversely formulated in comparison to the items in the same scale and thus reversely scored. As a result of the experts’ discussion, this item was reformulated to conform with the items of the same scale, and therefore to make it clearer to the athletes. A convenience sample of competitive athletes (n = 30), not included in the final sample, was involved in a preliminary assessment of the Italian version of the RESTQ-Sport-36. Participants reported a good understanding of guidelines, item contents, and response options.

2.3.2. Recruitment

Participants were recruited by phone, email, or in person using informal and professional networks (i.e., clubs and sport centres). Coaches and athletes were informed regarding the study purpose, methodology, and eligibility criteria for study participation. The study details were explained to the eligible athletes, and those who agreed to participate signed an informed consent as mentioned above. Participants completed the RESTQ-Sport-36 as well as the ITAMS during the first week of their summer training camp. The assessment took about 10 min to complete.

2.4. Statistical Analysis

Data were initially screened for multivariate outliers and normal distribution [22]. Neither missing values nor outliers were identified. Examination of histograms, skewness, and kurtosis of the variable scores showed that there were no substantial deviations from normality. The factor structure of the questionnaire was examined through CFA using M plus8.5 [23]. We estimated CFA models using the maximum likelihood parameter estimates with standard errors and a mean-adjusted chi-square (χ²) test statistic that is robust to non-normality. The CFA model was evaluated according to different fit indices: root mean square residual (RMR), root mean square error of approximation (RMSEA), Tucker Lewis fit index (TLI), and comparative fit index (CFI). An acceptable fit is obtained when RMR and RMSEA value are less than .08 [24, 25], TLI and CFI values greater than .90 are also considered as indicative of acceptable fitting models [26]. The reliability of the questionnaire was assessed in terms of internal consistency using Cronbach’ alpha values, omega values, composite reliability, and average variance extracted of the latent variables [27]. Furthermore, concurrent validity was assessed using a Pearson product-moment correlation coefficient between the RESTQ-Sport-36 and ITAMS subscales.

3. RESULTS

The original 12-factor correlated model (i.e., first-order factor model) with 3 items in each scale did not show acceptable fit (Table 1). After scrutiny of factor loadings, we decided to delete item 16 of the Social Recovery scale, item 4 of the Sleep Quality scale, and item 22 of the Emotional Exhaustion scale based on factor loadings smaller than .50 [28]. Because of this deletion, the goodness of fit indices of a first-order model encompassing 12 correlated scales and 33 items was acceptable (Table 1). CFA indices of hierarchical models did not reach cut off criterion values. The first hierarchical model tested consisted of four higher-order factors (i.e., Overall Stress, Overall Recovery, Sport-specific Stress, Sport-specific Recovery) and 12 lower-order factors (i.e., General Stress, Social Stress, Fatigue, Social Recovery, General Well-being, Sleep Quality, Disturbed Breaks, Emotional Exhaustion, Injury, Being in Shape, Personal Accomplishment, Self-Efficacy). The second hierarchical model tested consisted of two higher-order factors (i.e., Stress and Recovery) and four lower-order factors (i.e., Overall Stress, Overall Recovery, Sport-specific Stress, Sport-specific Recovery).

Table 1. CFA indices for the 36 and 33 items structure and for the two hierarchical (higher-order) models of the RESTQ-Sport.

| Model | χ² | p    | df | RMSR | RMSEA | TLI | CFI |
|-------|-----|------|----|------|-------|-----|-----|
| First-order factor model, 36 items | 5388.289 | <.001 | 630 | .067 | .040 | .864 | .886 |
| First-order factor model, 33 items | 4867.500 | <.001 | 528 | .052 | .051 | .927 | .941 |
| Four higher-order factor model | 1086.421 | <.001 | 477 | .861 | .061 | .869 | .882 |
| Two higher-order factor model | 1130.233 | <.001 | 480 | .088 | .063 | .861 | .874 |

Note: The two hierarchical (higher-order) models were tested on the 33 items structure. χ² = Chi-square, df = degrees of freedom, RMR = root mean square residual, RMSEA = root mean square error of approximation, TLI = Tucker Lewis fit index, CFI = comparative fit index. N = 339 athletes.
Standardized factor loadings and error variances of the first-order factor models are presented in Table 2.

Correlation values among the 12 scales of the 33-item, first-order factor model are reported in Table 3.

All reliability (i.e., internal consistency) values are reported in Table 4.

The Anger, Confusion, Depression, Tension, and Fatigue subscales of the ITAMS correlated positively with the stress scales of the RESTQ-Sport-33 (i.e., General Stress, Social Stress, Fatigue, Disturbed Breaks, Emotional Exhaustion and Injury) and negatively with the recovery scales of the same instrument (i.e., Social Recovery, General Well-being, Sleep Quality, Being in Shape, Personal Accomplishment, and Self-Efficacy). The Vigor subscale of the ITAMS was related negatively and positively with the stress and recovery scales of the RESTQ-Sport-33, respectively (Table 5).

Table 2. Standardized factor loadings (SFL) and error variances (SEV) for the first-order factor model comprised of 12 correlated factors with 36 and 33 items.

| - | 36 Items | 33 Items |
|---|---|---|
| | SFL | SEV | SFL | SEV |
| General Stress | | | | |
| Item 12 | - | .790 | .376 | .791 | .375 |
| Item 18 | - | .828 | .314 | .828 | .314 |
| Item 27 | - | .577 | .667 | .574 | .669 |
| Social Stress | - | - | - | - |
| Item 8 | - | .767 | .412 | .767 | .412 |
| Item 14 | - | .879 | .227 | .879 | .228 |
| Item 31 | - | .778 | .395 | .778 | .394 |
| Fatigue | - | - | - | - |
| Item 3 | - | .682 | .535 | .682 | .535 |
| Item 23 | - | .710 | .496 | .705 | .503 |
| Item 30 | - | .815 | .336 | .819 | .329 |
| Social Recovery | - | - | - | - |
| Item 5 | - | .607 | .631 | .538 | .710 |
| Item 16 | - | .417 | .826 | / | / |
| Item 29 | - | .751 | .437 | .776 | .397 |
| General Well-being | - | - | - | - |
| Item 10 | - | .724 | .476 | .721 | .481 |
| Item 25 | - | .789 | .378 | .785 | .384 |
| Item 32 | - | .844 | .288 | .850 | .278 |
| Sleep Quality | - | - | - | - |
| Item 4 | - | .385 | .852 | / | / |
| Item 19 | - | .783 | .387 | .782 | .388 |
| Item 36 | - | .729 | .469 | .714 | .490 |
| Disturbed Breaks | - | - | - | - |
| Item 13 | - | .529 | .720 | .528 | .721 |
| Item 21 | - | .652 | .574 | .652 | .574 |
| Item 33 | - | .576 | .668 | .577 | .668 |
| Emotional Exhaustion | - | - | - | - |
| Item 11 | - | .776 | .399 | .796 | .366 |
| Item 22 | - | .385 | .851 | / | / |
| Item 26 | - | .781 | .391 | .781 | .390 |
| Injury | - | - | - | - |
| Item 9 | - | .866 | .250 | .866 | .249 |
| Item 15 | - | .909 | .174 | .908 | .175 |
| Item 28 | - | .572 | .673 | .572 | .673 |
| Being in Shape | - | - | - | - |
| Item 2 | - | .668 | .554 | .667 | .555 |
| Item 24 | - | .760 | .423 | .760 | .422 |
| Item 35 | - | .749 | .439 | .749 | .439 |
| Personal Accomplishment | - | - | - | - |
| Item 7 | - | .739 | .453 | .740 | .453 |
Table 2 continued...

| S.no | 36 Items | 33 Items |
|------|----------|----------|
| Item 17  | - | .625 | .609 | .624 | .610 |
| Item 34  | - | .594 | .647 | .595 | .646 |
| Self-Efficacy | - | - | - | - | - |
| Item 6  | - | .750 | .437 | .751 | .436 |
| Item 20  | - | .772 | .404 | .772 | .403 |
| Item 37  | - | .709 | .498 | .708 | .499 |

Note: In the first-order factor model comprised of 33 items, items 16, 4, and 22 were deleted because of SFLs less than .50; N = 339 athletes.

Table 3. Correlation values among the 12 scales of the first-order factor model comprised of 33 items.

| S.no | Scale          | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 |
|------|----------------|----|----|----|----|----|----|----|----|----|----|----|
| 1    | General Stress | -  | .456** | .492** | .598** | .495** | .451** | - .195** |
| 2    | Social Stress  | -  | -  | .770 | .781 | .780 | .780 | .547 |
| 3    | Social Recovery| -  | .453 | .361 | .328 | .238 | .351 | .655 |
| 4    | General Well-being | -  | -  | .843 | .850 | .850 | .850 | .544 |
| 5    | Sleep Quality  | -  | -  | .775 | .781 | .781 | .781 | .446 |
| 6    | Disturbed Breaks| -  | .229 | .227 | .208 | .446 | .211 | .622 |
| 7    | EmotionalExhaustion | -  | -  | .717 | .717 | .717 | .717 | .434 |
| 8    | Injury         | -  | -  | .763 | .767 | .767 | .767 | .622 |
| 9    | Being in Shape | -  | .219 | .171 | .816 | .831 | .834 | .364 |
| 10   | Personal Accomplishment | -  | .300 | .115 | .770 | .770 | .770 | .430 |
| 11   | Self-Efficacy  | -  | -  | .668 | .618 | .611 | .611 | .554 |

Note: All the correlations are significant at p < .001; N = 339 athletes.

Table 4. Reliability (i.e., internal consistency) values of the 12 scales of the RESTQ-Sport-33.

| Scale                    | I  | M     | SD   | α     | ω     | CR    | AVE   |
|--------------------------|----|-------|------|-------|-------|-------|-------|
| General Stress           | 3  | 1.082 | 0.949| .770  | .781  | .780  | .547  |
| Social Stress            | 3  | 1.330 | 1.059| .843  | .850  | .850  | .655  |
| Fatigue                  | 3  | 2.003 | 1.113| .775  | .781  | .781  | .544  |
| Social Recovery          | 2  | 3.096 | 1.169| .589  | .590  | .609  | .446  |
| General Well-being       | 3  | 3.499 | 1.252| .825  | .829  | .829  | .620  |
| Sleep Quality            | 2  | 2.644 | 1.255| .717  | .717  | .717  | .561  |
| Disturbed Breaks         | 3  | 1.010 | 0.789| .668  | .618  | .611  | .346  |
| EmotionalExhaustion      | 2  | 1.139 | 0.966| .763  | .767  | .767  | .622  |
| Injury                   | 3  | 2.119 | 1.171| .816  | .831  | .834  | .634  |
| Being in Shape           | 3  | 3.300 | 1.165| .770  | .772  | .770  | .528  |
| Personal Accomplishment  | 3  | 2.934 | 1.290| .700  | .770  | .770  | .430  |
| Self-Efficacy            | 3  | 3.002 | 1.145| .778  | .791  | .788  | .554  |

Note: I = Number of items, M = mean, SD = standard deviation, α = Cronbach’s alpha, ω = omega, CR = composite reliability, AVE = average variance extracted, N = 339 athletes.

Table 5. Pearson correlation coefficient between RESTQ-Sport-33 and ITAMS subscales.

| RESTQ-Sport-36 | ITAMS | | |
|----------------|-------|---|---|---|---|---|
| General Stress | .456**| .492**| .598**| .495**| .451**| -1.95**|
| Social Stress  | .473**| .361**| .328**| .238**| .351**| .044 |
| Fatigue        | .229**| .227**| .208**| .446**| .211**| -0.65 |
| Social Recovery| -.150**|-0.082| -.245**| -.136*| -.132*| -.170*|
| General Well-being| -.280**| -.226**| -.391**| -.310**| -.262**| -.358**|
| Sleep Quality  | -.193**| -.208**| -.269**| -.325**| -.251**| .334**|
| Disturbed Breaks| -.250**| -.239**| -.247**| -.230**| -.284**| -.015 |
4. DISCUSSION

The aim of this study was to examine the construct validity and the internal consistency of the Italian version of RESTQ-Sport-36 and its concurrent validity with the ITAMS subscales. This represents a first stage for scholars of different countries to develop and share research projects and exchange results. Additionally, practitioners could assess athletes’ recovery-stress balance in their own cultural context.

Differently from the original version of the instrument, which includes 36 items [8], the Italian version comprised 33 items loading into 12 correlated latent factors. All scales included three items, except for Social Recovery, Sleep Quality, and Emotional Exhaustion that comprised two items each. Despite a rigorous methodology applied to the translation of the questionnaire, some issues probably emerged in the adaptation to the Italian culture. Cross-cultural adaptation issues also occurred in a Spanish adaptation of the 76 items version of the questionnaire [29]. Study findings, indeed, yielded poor factor loadings of some items in the expected factor. However, these issues do not necessarily mean that the original 36-item instrument should be abandoned. Additional research is needed to further assess the factor structure of the measure, in particular by involving homogeneous samples of athletes practicing a same sport.

Notwithstanding the Italian version included 33 out of 36 items of the RESTQ-Sport-36, the results of the CFA revealed the multi-dimensionality nature of this self-report questionnaire. Specifically, CFA results suggested that the recovery-stress balance of athletes is reflected in 12 specific yet correlated factors [14]. The low internal consistency of two scales (i.e., Social Recovery and Disturbed Breaks) may be due to the small number of items [30]. However, most of the scales showed high reliability, thus indicating a satisfactory internal consistency of the questionnaire.

In the current study, the hierarchical models revealed poor fit to the data. However, drawing on the notion that fit indices of a second-order model are generally lower than fit indices of an equivalent first-order model [31], we suggest that hierarchical models should be considered when the focus is on the global assessment of recovery-stress states of athletes. On the other hand, for a more detailed assessment of the recovery-stress dimensions, the 12-factor model of the instrument would be the most adequate [2]. This model would indeed provide a more accurate representation of those intercorrelated factors that have a specific impact on both performance and health of athletes.

The concurrent validity of the RESTQ-Sport-33 with the ITAMS subscales revealed a pattern of relationships in the expected direction, which is in line with the correlation pattern found in previous research between the RESTQ-Sport-76 and the Profile of Mood State scales [8]. The results indicate that the two questionnaires share some common variance, but at the same time they measure different constructs [20]. Based on this finding, we should expect that administering both the RESTQ-Sport-33 and ITAMS would enable a more accurate assessment of the athletes’ recovery-stress condition to prevent underperformance and overtraining. The strongest correlation observed between General Stress and Depression ($r = .598$) concurs with the notion that stress is one of the major determinants of depression [32, 33], even in athletes.

CONCLUSION

The current study has some limitations that should be addressed in future research. In particular, the construct validity of the instrument (e.g., concurrent, convergent, discriminant) should be further scrutinized. Moreover, predictive validity should be examined by combining self-reported measures with psychophysiological indicators of recovery-stress balance and behavioural evaluations.

Notwithstanding some limitations, this study contributes to previous research on stress and recovery by providing initial evidence in support of the RESTQ-Sport-33 as a reliable and valid tool for estimating the recovery-stress state of Italian athletes. Our results support the 12-factor correlated model comprising 33 out of 36 items of the original version. The initial validation of the RESTQ-Sport-33 in Italian language can enable a regular monitoring of Italian athletes throughout the season. A regular monitoring is essential to lower the risk of injury [9] in athletes and prevent underperformance and more serious problems such as non-functional overreaching or overtraining syndrome. Moreover, the questionnaire can stimulate research on relevant aspects of recovery and fatigue in athletes.

LIST OF ABBREVIATIONS

RESTQ-Sport = Recovery-Stress Questionnaire for Athletes
ITAMS = Italian Mood Scale
CFA = Confirmatory Factor Analysis
RMR = Root Mean Square Residual
RMSEA = Root Mean Square Error of Approximation
TLI = Tucker Lewis Fit Index
CFI = Comparative Fit Index

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

All research procedures in this study were performed in accordance with the ethical standards of the responsible committee of University “G. d’Annunzio” of Chieti-Pescara on
human experimentation.

**HUMAN AND ANIMAL RIGHTS**

No animals were used in this research. All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

**CONSENT FOR PUBLICATION**

Written informed consent was obtained from each participant.

**AVAILABILITY OF DATA AND MATERIALS**

The datasets generated for this study are available on request to the corresponding author [S.F.]

**FUNDING**

This study was funded by MUR-Ministry of Education, Universities and Research | Programme: PON Ricerca e Innovazione 2014-2020- Attraction and International Mobility (AIM)

**CONFLICT OF INTEREST**

The authors declare no conflict of interest, financial or otherwise.

**ACKNOWLEDGEMENTS**

Declared none.

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