

Turkish Version of the Subjective Training Quality Scale and Its Association With Wellness Measures in Collegiate Athletes

Bora Başat¹ , Gizem Fındık^{2*} , Zekiye Elif Yıldız¹ , Mustafa Söğüt¹ 

¹ Middle East Technical University, Ankara, Türkiye

² Atılım University, Ankara, Türkiye

* Correspondence: gizem.findik@atilim.edu.tr; +90 312 586 8632

ABSTRACT

Background: Evaluating the training quality of athletes can be the gateway to more efficient training and thus, achievement of the goals. The purpose of this study was to translate and validate the Subjective Training Quality Scale.

Methods: The scale consists of three Likert-type questions, with every question focusing on a different aspect of the training session. A total of 94 athletes (22.71 ± 2.64) who participated in nine team sports were included in this study. Each athlete completed the scale for two consecutive sessions in a single micro-cycle. The translated questionnaire and wellness scales were used together throughout the research.

Results: The results revealed that the scale was compatible with the Turkish sample. Besides, a significant relationship ($p < .05$) between general wellbeing and quality of training was observed.

Conclusion: Coaches may use this scale to track the training quality and gain insight into their athletes' wellness.

Keywords: Athlete monitoring, team sports, training metrics, preparedness, wellbeing index

1. INTRODUCTION

The pursuit of excellence in performance forces athletes and coaches to question the effectiveness of the training they utilise. Kellmann (2010) pointed out the importance of the balance between stress and recovery and stated that subjective assessment of athletes is very important to prevent overtraining. Halson (2014) stated that monitoring training load is a modern, scientific approach to understanding athletes' training responses and competition readiness, minimising uncertainty, and increasing confidence by providing clarity on the possible causes of changes in performance. In addition, it allows for the examination of load-performance relationships, optimises training and competition planning, reduces the risk of injury and illness, improves team

selection, and evaluates the competition preparation of athletes (Bourdon et al., 2017; Halson, 2014). The two identified types of training loads are internal and external training loads; internal loads include biological stressors such as heart rate, blood lactate, and perceived exertion, while external loads are determined by objective measurements such as power output, speed, and GPS data (Burgess, 2017; Scanlan et al., 2014). According to Bourdon et al. (2017), these metrics are used to evaluate athletes' stress levels and performance throughout practice and competition. Coaches and sports scientists may now quantify internal and external training loads in great detail due to technological advancements, which help them monitor and optimise the training dose (Lovell et al., 2013).



Coaches should ensure that their athletes are highly engaged in the training. Previously, training quality was used similarly to training intensity (Mujika et al., 2018). According to Shell et al. (2023), training quality is the athlete's capacity to complete a training session to the desired level. On the other hand, Sandbakk et al. (2023) argued that training quality has two dimensions; the holistic training process and the specific training session. The quality of the holistic training process includes establishing goals, analysing gaps, and applying training principles for extended progress. The quality of a specific training session also includes enhancing the processes affecting the intended purpose of the session.

Sandbakk et al. (2023) have also stated that the effect of training does not only depend on the external load parameters like volume and intensity. Performance metrics may provide insight into how the athletes are doing physically, but may be insufficient for predicting the mental and technical aspects. Having more of an idea of how their athletes are feeling, coaches can adjust the training load more appropriately since mood can be indicative of overtraining and future performance (Meeusen et al., 2013; Raglin, 2001). Shell et al. (2023) argued that the Subjective Training Quality Scale (STQS) may be complementary to the performance metrics gathered by the traditional measurement tools. That way, all aspects of the training quality can be tracked. While subjective self-reported measures consistently reflect changes in athlete wellbeing with greater sensitivity than physiological markers (Saw et al., 2016), the complexity of the constructs they measure means they cannot be assumed to be valid across different cultures (Bullinger et al., 1998). Before an established instrument can be used internationally, it must undergo proper translation and validation to ensure conceptual and functional equivalence. Therefore, a validated Turkish version of the STQS is necessary to provide a culturally accurate tool for athlete monitoring in Türkiye. The purpose of this study is to translate and validate the STQS and examine its association with wellness measures in collegiate athletes. A training quality scale may be a good tool for coaches and athletes to evaluate the effectiveness of the training session, and also, coaches may create a roadmap for further improvement of athletes by getting continuous mental, physical, and technical feedback. Furthermore, utilising a standardised scale would simplify gathering and analysing the feedback that the athletes provide.

2. METHODS

Research model

This study employed a cross-sectional design with both psychometric and correlational analysis.

Research groups

A total of 94 collegiate athletes (36 females, 54 males, and 4 not specified) with a mean age of 22.71 ± 2.64 years, who were actively involved in team sports participated in the study. They were in teams from a variety of sports branches, including American football, ultimate, fencing, water polo, volleyball, basketball, flag football, rugby, and hockey. Gagné and Hancock (2006) claimed that a sample size of 50–100 might be sufficient depending on the number of indicators per factor and factor loadings. For a single factor with three indicators ($p/f = 3$) and standardised loadings of .78, .90, and .64, construct reliability was $\omega = .82$ and $H = .87$. Considering Gagné and Hancock's (2006) simulation results, these values exceed the thresholds associated with satisfactory model convergence at $N = 100$ ($\omega \geq .78$, $H \geq .81$), supporting the adequacy of the present sample size of 94 for this measurement model.

Data collection tools

Demographic Information Form

A Demographic Form was used to collect the background information of the participants. This included age, sex, and the sport they played.

Wellness Questionnaire

To assess the pre-training biological and psychological state of the athletes, a 5-item Wellness Questionnaire was administered (McLean et al., 2010). The instrument evaluates muscle soreness, sleep quality, mood, fatigue, and stress. Each item is rated on a 5-point Likert-type scale, where 1 indicates poor wellness (high fatigue/stress, low sleep quality/mood) and 5 indicates excellent wellness. A composite overall wellness score is calculated by summing the scores of the five items.

Subjective Training Quality Scale

Post-training evaluations were conducted using the STQS, originally developed and validated by Shell et al. (2023). The STQS is designed to assess the athlete's capacity to execute a training session according to intended goals. The scale consists of three items focusing on the physical, technical, and mental quality of the session. Responses were recorded on a 10-point Likert-type scale ranging from 1 (*lower level of quality*) to 10 (*higher level of quality*).

Ethical approval

Ethical approval was obtained from the Human Subjects Ethics Committee of Middle East Technical University (Protocol number: 0282-ODTÜİAEK-2024).

Collection of data

Convenience sampling method was used to reach participants. Potential participants were recruited to the study through their coaches. Specifically, coaches of teams were contacted and asked to encourage their athletes to take part in the study. Those athletes who agreed to take part in the study were then reminded by the coaches to complete the self-report surveys during a single training micro-cycle, which lasted for seven days and included at least two trainings with the team. Athletes filled in a short form including questions regarding background information (e.g. age, sex, type of sports activity) and five wellness questions from McLean and his colleagues' (2010) study prior to each training session. Wellness questions were rated on a 5-point Likert-type scale (1 = *low levels of sleep quality and mood, and high levels of fatigue, stress, and muscle soreness*; 5 = *high levels of sleep quality and mood and low levels of fatigue, stress, and muscle soreness*). After training, they completed the STQS, which includes three items rated on a 10-point Likert-type scale (1 = *lower level of physical, technical, and mental training quality*; 10 = *higher level of physical, technical, and mental training quality*). The original English version of the STQS was translated into Turkish by a linguist holding an undergraduate degree from an English-language department and pursuing a doctoral degree in Physical Education and Sports, ensuring both linguistic precision and familiarity with sport-specific terminology. The Turkish version was subsequently back-translated into English by an independent translator, after

which a native English speaker reviewed both versions to evaluate linguistic consistency and semantic equivalence. The research team then conducted a final review of the Turkish version to assess cultural appropriateness and clarity, informed by their English proficiency, extensive experience in sport, and professional engagement within an English-medium university setting.

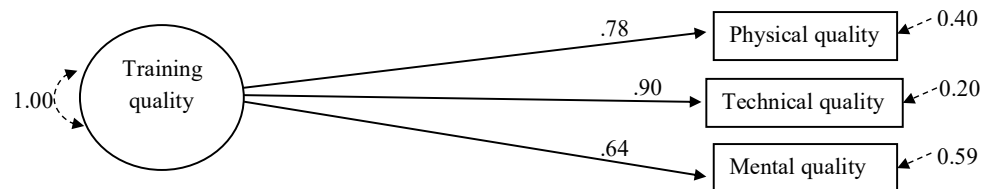
Analysis of data

Reliability of the Turkish version of the STQS was examined via Cronbach's alpha internal consistency score as well as intraclass correlation coefficient (ICC) for test-retest reliability. Additionally, factor structure of the scale was investigated using a confirmatory factor analysis (CFA). Because a single-factor model with three indicators is just-identified ($df = 0$), global fit indices are mathematically constrained to perfection ($\chi^2 = 0.00$, $CFI = 1.00$, $RMSEA = 0.00$). Consequently, model evaluation was based on parameter-level estimates. Univariate skewness and kurtosis statistics were examined for each variable. In examining the relationship between demographic factors, wellness indicators, and subjective training quality, Pearson correlation coefficients were calculated. All the statistical analyses were carried out using the jamovi software version 2.4.11.

3. RESULTS

Before examining the factor structure of the STQS and its association with the wellness indicators, the skewness and kurtosis values were examined to ensure the linearity of data. Skewness values of the wellness and training quality subscales ranged between -0.676 and 0.417 , and kurtosis values ranged between -0.489 and 0.800 . These values were within the acceptable range of -1.5 and 1.5 , suggested by Tabachnick and Fidell (2019).

Figure 1. Graphical representation of the CFA model



As suggested by Shell and her colleagues (2023), STQS was used as a 3-item questionnaire without including rate of perceived exertion (RPE) as the 4th item. Therefore, the CFA was conducted with three items. Standardised factor loadings were .78 for physical domain, .90 for technical domain, and .64 for mental domain (see Figure 1). All domains were significantly loaded on the training quality latent factor at $p < .001$. As global fit indices were not suitable for interpretation, parameter-level estimates were calculated. Specifically, average variance extracted (AVE) was .61 and composite reliability (CR) was .82, which indicate acceptable levels of structural validity and internal consistency reliability, respectively (Aydoğdu, 2023). Cronbach's alpha value was .80 for the scale, also indicating adequate internal consistency (Zeller, 2005). A two-way mixed effect, single measure,

absolute agreement ICC was used to assess test–retest reliability of overall training quality. The analysis yielded an ICC estimate of 0.53, indicating moderate stability over time (Koo & Li, 2016).

Relationships between background variables, wellness, and training quality were explored via Pearson correlation analysis. According to the results, there were a number of significant associations between pre-training wellness indicators and post-training training quality domains. Specifically, improved sleep quality ($r = .23$, $p < .05$) and increased general muscle soreness ($r = .22$, $p < .05$) were related to increased mental quality. Additionally, the overall wellbeing index was positively correlated with overall subjective training quality ($r = .22$, $p < .05$). For a detailed review of all correlation coefficients, see Table 1.

Table 1. Pearson correlations among the study variables

	TA	Fa	Sl	MS	St	Mo	OW	PQ	TQ	MQ	OQ
Age	.695***	.211*	.164	.300**	.277**	.266**	.372***	.161	.263*	.299**	.288**
TA		.079	.166	.128	.092	.107	.177	.044	.205*	.140	.155
Fa			.353***	.497***	.220*	.274**	.717***	.191	.078	.091	.138
Sl				.039	.300**	.046	.600***	-.006	.104	.230*	.138
MS					.353***	.202	.636***	.169	.004	.220*	.159
St						.411***	.718***	.123	-.002	.166	.116
Mo							.538***	.176	.101	.097	.144
OW								.189	.087	.259*	.215*
PQ									.696***	.496***	.840***
TQ										.571***	.879***
MQ											.833***

Notes: TA = training age (in months), Fa = fatigue, Sl = sleep quality, MS = muscle soreness, St = stress, Mo = mood, OW = overall wellbeing, PQ = physical quality, TQ = technical quality, MQ = mental quality, OQ = overall quality. * $p < .05$, ** $p < .01$, *** $p < .001$.

4. DISCUSSION

This study aimed to translate the STQS into Turkish and validate it by applying it to a Turkish sample of 94 athletes. The results indicated that the STQS was shown to be compatible with the Turkish sample. Also, there was a positive relationship between overall wellbeing and training quality. The results further revealed that higher sleep quality and low levels of muscle soreness were positively related to the mental training scores of the participants. Overall stress levels may be responsible for the positive relationship between the training quality and the wellness of the athletes. The overall stress imposed on the athletes by the events of their daily life and training may affect both their wellbeing and training quality, resulting in a positive relationship between them.

According to the authors' knowledge, there is limited research investigating relationships between training quality and wellness and training metrics. One study that analysed training quality was Shell et al. (2023), which is the original study developing the STQS. They identified different aspects of training quality as physical, technical, and mental by interviewing 15 swimmers and then, they developed a subjective scale assessing these constructs. They further validated this scale by testing it with 252 athletes from different sports and found that it shows high internal consistency ($\alpha = .85$) and face validity. With a Cronbach's alpha value of .80, our study indicates a slightly lower, yet satisfactory level of internal consistency. As the factor loadings were not reported in the original study (Shell et al.,

2023), further comparison between the two versions of the scale was not possible. Still, the findings of this study suggested that the Turkish version of the STQS was potentially a reliable and a valid tool.

Possible limitations of the study include biases in self-reporting. Athletes might have underestimated or overestimated the quality of their sessions. Another limitation of this study is the generalisability of the results to other populations since participants were collegiate athletes from Türkiye engaging in nine team sports. Also, it is important to note that nearly all athletes participating were in their competitive period. Future studies should explore the effect of the STQS on athletes in different periods of the competitive year. Moreover, the compatibility of this scale should be tested with athletes who are not Turkish. Furthermore, while the wellness questionnaire by McLean et al. (2010) is a widely used monitoring tool, to the authors' knowledge, there are no existing Turkish validation studies for this specific instrument. Lastly, longitudinal studies may provide more comprehensive guidance for optimising training programmes.

5. CONCLUSIONS

This study provided preliminary evidence supporting the internal reliability and structural validity of the STQS in the Turkish sample. Besides, the relationship between wellness and training quality was highlighted. Higher levels of sleep quality and muscle soreness were positively associated with higher mental quality scores. Considering the psychometric constraints and correlational nature of the findings, further longitudinal research is needed to establish the scale's long-term predictive validity, and establishing cause-effect relationship with wellness measures. This scale shows promise as a practical tool for coaches to evaluate the quality of their athletes' training. Information on different aspects of the training can be collected through the scale and used as an aid in determining the performance and the needs of the athletes.

Author Contributions: Conceptualisation, B.B., G.F., Z.E.Y., and M.S.; formal analysis, G.F.; data curation, B.B. and Z.E.Y.; writing—original draft preparation, B.B., G.F., and Z.E.Y.; writing—review and editing, M.S.; supervision, M.S. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Clinical Trial Registration: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Ethical Approval: Ethical approval was obtained from the Human Subjects Ethics Committee of Middle East Technical University on 6 May 2024 (Protocol number: 0282-ODTÜİAEK-2024).

Acknowledgements: The authors would like to thank all the athletes and their coaches for their valuable participation, time, and support throughout the study.

Conflicts of Interest: The authors declare no conflict of interest.

Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

AI Use Statement: No generative AI and AI-assisted technologies were used in the research or the drafting of the manuscript.

REFERENCES

- Aydoğdu, F. (2023). *AVE and CR calculation system*. Fuat Aydoğdu Official Website. <https://www.fuataydogdu.com/avecr>
- Bourdon, P. C., Cardinale, M., Murray, A., Gastin, P., Kellmann, M., Varley, M. C., Gabbett, T. J., Coutts, A. J., Burgess, D. J., Gregson, W., & Cable, N. T. (2017). Monitoring athlete training loads: Consensus statement. *International Journal of Sports Physiology and Performance*, 12(s2), S2–170. <https://doi.org/10.1123/ijsp.2017-0208>
- Bullinger, M., Alonso, J., Apolone, G., Leplège, A., Sullivan, M., Wood-Dauphinee, S., Gandek, B., Wagner, A., Aaronson, N., Bech, P., Fukuhara, S., Kaasa, S., & Ware, Jr. J. E. (1998). Translating health status questionnaires and evaluating their quality. *Journal of Clinical Epidemiology*, 51(11), 913–923. [https://doi.org/10.1016/s0895-4356\(98\)00082-1](https://doi.org/10.1016/s0895-4356(98)00082-1)
- Burgess, D. J. (2017). The research doesn't always apply: Practical solutions to evidence-based training-load monitoring in elite team sports. *International Journal of Sports Physiology and Performance*, 12(s2), S2–141. <https://doi.org/10.1123/ijsp.2016-0608>
- Gagné, P., & Hancock, G. R. (2006). Measurement model quality, sample size, and solution propriety in confirmatory factor models. *Multivariate Behavioral Research*, 41(1), 65–83. https://doi.org/10.1207/s15327906mbr4101_5
- Halson, S. L. (2014). Monitoring training load to understand fatigue in athletes. *Sports Medicine*, 44(S2), 139–147. <https://doi.org/10.1007/s40279-014-0253-z>
- Kellmann, M. (2010). Preventing overtraining in athletes in high-intensity sports and stress/recovery monitoring. *Scandinavian Journal of Medicine and Science in Sports*, 20(s2), 95–102. <https://doi.org/10.1111/j.1600-0838.2010.01192.x>
- Koo, T. K., & Li, M. Y. (2016). A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *Journal of Chiropractic Medicine*, 15(2), 155–163. <https://doi.org/10.1016/j.jcm.2017.10.001>
- Lovell, T. W. J., Sirotic, A. C., Impellizzeri, F. M., & Coutts, A. J. (2013). Factors affecting perception of effort (Session rating of perceived exertion) during rug-

by league training. *International Journal of Sports Physiology and Performance*, 8(1), 62–69. <https://doi.org/10.1123/ijspp.8.1.62>

McLean, B. D., Coutts, A. J., Kelly, V., McGuigan, M. R., & Cormack, S. J. (2010). Neuromuscular, endocrine, and perceptual fatigue responses during different length between-match microcycles in professional rugby league players. *International Journal of Sports Physiology and Performance*, 5(3), 367–383. <https://doi.org/10.1123/ijspp.5.3.367>

Meeusen, R., Duclos, M., Foster, C., Fry, A., Gleeson, M., Nieman, D., Raglin, J., Rietjens, G., Steinacker, J., & Urhausen, A. (2013). Prevention, diagnosis and treatment of the overtraining syndrome: Joint consensus statement of the European College of Sport Science (ECSS) and the American College of Sports Medicine (ACSM). *European Journal of Sport Science*, 13(1), 1–24. <https://doi.org/10.1080/17461391.2012.730061>

Mujika, I., Halson, S., Burke, L. M., Balagué, G., & Farrow, D. (2018). An integrated, multifactorial approach to periodization for optimal performance in individual and team sports. *International Journal of Sports Physiology and Performance*, 13(5), 538–561. <https://doi.org/10.1123/ijspp.2018-0093>

Raglin, J. (2001). Psychological factors in sport performance: The mental health model revisited. *Sports Medicine*, 31(12), 875–890. <https://doi.org/10.2165/00007256-200131120-00004>

Sandbakk, S. B., Walther, J., Solli, G. S., Tønnessen, E., & Haugen, T. (2023). Training quality—What is it and how can we improve it? *International Journal of Sports Physiology and Performance*, 18(5), 557–560. <https://doi.org/10.1123/ijspp.2022-0484>

Saw, A. E., Main, L. C., & Gustin, P. B. (2016). Monitoring the athlete training response: Subjective self-reported measures trump commonly used objective measures: A systematic review. *British Journal of Sports Medicine*, 50(5), 281–291. <https://doi.org/10.1136/bjsports-2015-094758>

Scanlan, A. T., Wen, N., Tucker, P. S., & Dalbo, V. J. (2014). The relationships between internal and external training load models during basketball training. *The Journal of Strength and Conditioning Research*, 28(9), 2397–2405. <https://doi.org/10.1519/jsc.0000000000000458>

Shell, S. J., Slattery, K., Clark, B., Broatch, J. R., Halson, S. L., & Coutts, A. J. (2023). Development and validity of the subjective training quality scale. *European Journal of Sport Science*, 23(7), 1102–1109. <https://doi.org/10.1080/17461391.2022.2111276>

Tabachnick, B. G., & Fidell, L. S. (2019). *Using multivariate statistics* (7th ed.). Pearson.

Zeller, R. A. (2005). Measurement error, issues and solutions. In K. Kempf-Leonard (Ed.), *Encyclopedia of social measurement* (pp. 665–676). Elsevier. <https://doi.org/10.1016/b0-12-369398-5/00109-2>