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Reproducibility of Internal and External Training Load During Recreational Small-Sided Football Games

Abstract

Purpose: The aim of this study was to evaluate the reproducibility of internal and external load parameters during recreational small-sided football games. *Methods:* Ten healthy untrained young adult males (age: 20.2±1.9 yr, body mass: 69.2±6.3 kg, height: 175.4±5.9 cm, body fat: 19.7±5.2%) performed two 2x20-min sessions of four versus four plus goalkeeper small-sided games (SSG) one week apart on a standard, outdoor, 40x20-m artificial grass pitch. Twelve external (total distance, peak speed, player load, work rate and distance covered at 0–2, 2–5, 5-7, 7–9, 9–13, 13–16, 16–20 and >20 km/h) and seven internal load parameters (heart rate and time spent in different heart rate zones [<70%, 71-80%, 81-90%, 91-95%, 96-100%, 91-100%) were measured. Reproducibility was reported as intraclass coefficient correlation (ICC), the coefficient of variation (CV), and the typical error of measurements (TE). *Results:* No statistical differences (*p*>0.05) between sessions were found in any measures. Minimal test-retest variability was noted for mean and peak heart rate (HR_{peak}) relative to HR_{peak} with CV values of 3.4% and 2.6%, respectively. Acceptable variability (CV<10%) was demonstrated for total distance covered, distance covered at 2–5 km/h, and peak speed. Distance covered in different speed zones (CV=15.7–47.6%) and percentage of time in each HR zone showed large-to-very large variability (CV=36.2–128.4%). Mean heart rate (HR_{mean}), HR_{peak}, distance covered at 5–7, 13–16 and >20 km/h, and percentage of time above 95%HR_{peak} were the most reliable variables (ICC=0.74–0.79), followed by total distance covered, peak speed, and percentage of time at 80–90% HR_{peak} (ICC=0.39-0.67). The lowest reliability was observed for distance covered in the moderate speed zones 7–9 km/h (ICC=0.12) and 9–13 km/h (ICC=-0.09), and percentage of time at 70–80% HR_{peak} (ICC=-0.01). *Conclusions:* Small sided games can be used when planning training-induced exercise responses in relation to total distance covered, peak speed, and mean heart rate. This evidence further supports the use of SSG when

organizing recreational football training, in young adult males, with the purpose of improving health profile due to high reproducibility of HR_{mean} and total distance covered.

Key words: soccer, activity profile, GPS, movement pattern.

One of the most important public health priorities is to increase the levels of physical activity according to recommendations and guidelines (WHO, 2013). However, a large number of adults worldwide do not meet the usual recommendations, due to lack of interest or motivation (Kilpatrick, Hebert & Bartholomew, 2005). Consequently, sport-based physical activities have been introduced as being highly motivating compared with conventional exercise programmes for improving wellbeing and fitness (Castagna, de Sousa, Krustrup & Kirkendall, 2018; Milanović, Pantelić, Ćović, Sporiš & Krustrup, 2015). However, these activities can vary greatly in terms of physical and physiological responses (Randers, Orntoft, Hagman, Nielsen & Krustrup, 2018), therefore determining the reproducibility of training load is of great importance.

Recreational small-sided football has received a lot of attention in recent years due to its broad spectrum health-related fitness benefits regardless of gender and fitness level (Milanović et al., 2018). Many factors can influence the intensity of small-sided games (SSG), including pitch size, game duration, and number of players (Randers, Nielsen, Bangsbo, & Krustrup, 2014; Randers et al., 2010; Randers, Ørntoft, Hagman, Nielsen, & Krustrup, 2018). It is therefore of major importance to understand the internal and external load components of recreational football. Previous studies (Milanovic, Pantelic, Covic, Sporis & Krustrup, 2015; Milanović et al., 2018; Randers et al., 2010) have established an average intensity of 80–85% of maximal heart rate (HR_{max}), with 15–50% of total training time in the highest aerobic training zone above 90% HR_{max}, total distance of 3–4 km, including ~900 intermittent activity changes, and 100 high-intensity runs during one recreational football game. However, little is known about the reproducibility of the internal and external load components of 5-a-side recreational football in young adult males, despite it is the most applicable game format.

A recent study (Beato, Jamil & Devereux, 2018) has proven the reliability of internal and external load parameters in recreational football. After replicating matches, the authors found very high reliability for mean HR (ICC = 0.82), percentage of maximal heart rate (ICC = 0.78), total distance covered (ICC = 0.66), high-speed running (ICC = 0.77), and acceleration (ICC = 0.62). Moreover, Beato (2018) has proven the reliability of internal and external load parameters in 6-a-side and 7-a-side recreational football, presenting high consistency in the produced workload for both formats. However, the reliability of work rate, player load, and distance covered in different speed zones, and fraction of training time in each heart-rate zone remains unproven due to the scarcity of research attention.

Most studies on SSGs have dealt with professional players (Aguiar, Botelho, Goncalves & Sampaio, 2013; Dellal et al., 2008; Dellal, Drust & Lago-Penas, 2012; Little & Williams, 2007; Owen, Wong del, McKenna & Dellal, 2011) or amateur players (Dellal, Hill-Haas, Lago-Penas & Chamari, 2011), whereas less attention has been given to untrained individuals (Randers et al., 2010). At the moment, the assertion of internal and external load in recreational small-sided football has not been established in details and this raises the question of the reliability of load parameters in untrained young adult males. Limited evidence is available regarding work rate, player load and distance covered in different speed zones elicited during recreational football SSG, with most of the available data focused on only total distance covered (Beato, 2018; Beato et al., 2018). All aforementioned activity parameters provides insight into the physical workloads which is associated with physical fitness and health. Specifically larger amount of time spend in higher intensity zones (>85% HRmax) improves cardiorespiratory fitness more likely than moderate continuous running despite average intensity is similar during both training mode (Milanović, Sporiš & Weston, 2015). However, excessive workload or large amount of high intensity running in recreational players may contribute to overreaching, therefore workloads should be evaluated. Therefore, the reproducibility of internal load distribution is considered as an important in examining whether cardiovascular stress is consistent during recreational football. Consequently, further investigation on this topic using separate analysis for each speed zone or each heart-rate zone are needed to better understand reproducibility of load distribution and amount of high intensity running encountered during football SSG in recreational players. Although the variability of the physical and physiological responses during recreational SSGs has been previously mentioned, an understanding of the reproducibility of the physiological responses and movement demands of these games when completed between different training sessions is also important. On this basis, the purpose of this study was to evaluate the reproducibility of internal and external load parameters during recreational small-sided football games. We hypothesised that recreational 5-a-side football games will produce similar internal and external load during different training sessions in young adult males.

Methods

Participants

Ten healthy untrained young adult males (age: 20.2±3.9 yr, body mass: 69.2±6.3 kg, height: 175.4±5.9 cm, body fat: 19.7±5.2%) participated in the study. The participants were instructed to avoid any type of physical exercise for 3 days before the first and second recreational football sessions. Additionally, they were instructed to maintain their normal daily routines, including dietary habits. All the participants were non-smokers and free from injury and medical conditions based on self-reported data obtained through structured interviews. All the participants were informed of the study procedures and provided written informed consent prior to participation. All procedures were approved by an institutional Human Research Ethics Committee.

Procedures

The experimental design of the study was similar to that of a previous manuscript (Pantelić et al., 2018). The participants performed two training sessions of four versus four plus goalkeeper (4v4+GK) 1 week apart on a standard, outdoor, artificial grass pitch. Both training sessions were conducted on the 40x20-m pitch, with a relative pitch area of 80 m^2 per player and consistent goal sizes (2 m high x 3 m wide). Each training session lasted approximately 60 min, including a 10-min low-intensity warm-up followed by 2x20-min periods of play interspersed with 5 min of passive rest and ending with a 5-min cool-down. Both sessions were performed between 10:00 and 11:00 under similar weather conditions (temperature: 25.6±0.4°, humidity: 40±1%). The warm-up, half-time and cool-down periods were not included in the analysis. The participants were not allocated playing positions. However, after every 5 minutes of each half, the goalkeeper was replaced by another player to give a balance between time as an outfield player and time as a goalkeeper. Both training sessions were supervised by one of the investigators, who also acted as referee. Official football rules were used except for the offside rule. There was no external encouragement from other than the players themselves during sessions. Several additional balls were placed around the pitch to minimize the time that the ball was out of play and provide similar total session times with the ball in play.

Time-motion analysis was performed to measure the participants' movement using GPS units (MinimaxX S4, Catapult Sports, Canberra, Australia) at a 10-Hz sampling rate. A standard procedure was used during both training sessions, with a GPS unit placed in a harness on the player's upper back, as described by the manufacturer. The number of satellites during session one and session two was 13.1±1.9 and 13.3±1.6, respectively. Furthermore, horizontal dilution of precision was similar for both sessions (session 1: 0.87±0.14, session 2: 0.86±0.11). Total distance, work rate, heart rate, peak speed, number of efforts (speed zone entries), and distance covered at 0–2, 2–5, 5-7, 7–9, 9–13, 13–16, 16–20 and >20 km/h were measured. In addition, heart rate (HR) was measured during both sessions and expressed as absolute and relative to individual maximal heart rate (HR_{max}). HR_{max} was determined as the highest observed HR during the two sessions (Randers et al., 2018). Relative HR is presented in HR zones <70, 70–80, 80–90, 90–95, and 95–100% HR_{max}. Player load (PL) was measured by the accelerometers built into the GPS units at a 100-Hz sampling rate. PL is an estimate of physical demand combining the instantaneous rate of change in acceleration in three planes.

Statistical analysis

Data analyses were performed using IBM SPSS Statistics (v19.0; IBM Corp., Armonk, NY, USA). Normality of data distribution and equality of variances were checked using the Kolmogorov-Smirnov test and Levene's test for twelve and seven variables of external and internal load markers, respectively. All data are presented as means ± standard deviation (SD) with 95% confidence intervals. A paired t-test was used to determine differences in player load, distance covered, and percentage of time in each training zone between session one and session two. The Cohen's d effect size (ES) was also calculated for each outcome measure using the following formula:

$$ES = (mean_1 - mean_2) \Bigg/ \sqrt{\frac{(\sigma_1^2 + \sigma_2^2)}{2}}$$

where $mean_1$ and $mean_2$ are the means for outcome measure in the first and second session, σ_1 and σ_2 standard deviations for outcome measure in the first and second session. In order to determine the magnitude of the changes, the following criteria were used: *trivial* = <0.19, *small* = 0.20–0.59, *moderate* = 0.60–1.19, *large* = 1.20–1.99, and *very large* = >2.0 (Hopkins, 2007). For further reliability assessment, an established spreadsheet (Hopkins, 2007) was used to calculate the intraclass coefficient correlation (ICC), the coefficient of variation (CV), and the typical error of measurements (TE). ICC values were interpreted as: *low* = <0.10, *moderate* = 0.11–0.30, *high* = 0.31–0.50, *very high* = 0.51–0.70, *nearly perfect* = 0.71–0.90 and *perfect* = 0.91–1.0 (Hopkins, 2007). The statistical significance was set at $p<0.05$.

Results

The means±SD for each outcome measure performed during session 1 and session 2 are shown in Table 2. All variables were normally distributed. No statistical differences (p>0.05) between session 1 and session 2 were found in any measures (Table 1). Trivial, non-significant differences between session 1 and session 2 were observed for total distance covered (ES=-0.06, p=0.865), work rate (ES=-0.06, p=0.883), player load (ES=0.17, p=0.608), peak heart rate (HR_{peak}) (ES=-0.04, p=0.881), and peak speed (ES=0.08, p=0.785). Moreover, trivial to small changes were noted for distance covered in different speed zones and percentage of time in each heart rate zone, with ES ranging from 0.04 – 0.54 and 0.17 – 0.47, respectively.

****Table 1 about here****

Test-retest variability and reliability statistics for outcomes measures are displayed in Table 2. Minimal test-retest variability was noted for mean and peak heart rate relative to HR_{peak} with CV of 3.4% and 2.6%, respectively (Table 2). Both HR_{mean} (CV=6.0%) and HR_{peak} (CV=4.2%) showed very low variability between session 1 and session 2. In addition, total distance covered (CV=7.8%), work rate (CV=7.9%), distance covered at 2–5 km/h (CV=8.5%), and peak speed (CV=8.5%) demonstrated acceptable variability. Moderate test-retest variability was observed for total player load (CV=12.9%) and player load per minute (CV=12.6%). However, the majority of distance covered in different speed zones showed large test-retest variability (CV=15.7–47.6%). Also, percentage of time in each heart rate zone showed very large variability (CV=36.2–128.4%).

HR_{mean}, HR_{peak}, distance covered at 5–7, 13–16, and 20–39 km/h and percentage of time above 95% HR_{peak} were the most reliable variables with nearly perfect ICC ranging between 0.74 and 0.79. High to very high reliability was noted for total distance covered (ICC=0.39), work rate (ICC=0.39), player load (ICC=0.54), player load per minute (ICC=0.54), peak speed (ICC=0.63), and percentage of time at 80–90% HR_{peak} (ICC=0.67). Distance covered at 0–2 km/h (ICC=0.32) and 2–5 km/h (ICC= 0.59) were also highly reliable. In contrast, the lowest reliability was observed for distance covered in the moderate speed zones 7–9 km/h (ICC=0.12) and 9–13 km/h (ICC=-0.09), and for percentage of time at 70–80% HR_{peak} (ICC=-0.01).

****Table 2 about here****

Discussion

The aim of this study was to determine reproducibility in external and internal workload measures during recreational SSG. As expected, reproducibility was higher for internal measures than external measures of workload. These results indicate acceptable reproducibility for absolute HR responses and external load measures, including total distance covered, work rate, and peak speed.

Relative reproducibility refers to the magnitude of the association of repeated measurements by quantifying the correlation between them (ICC), while absolute reliability refers to the variability of the outcomes from trial to trial (within-participant variability, CV) (Atkinson & Nevill, 1998; Hopkins, 2000). The reproducibility of internal load measures is important in examining whether cardiovascular stress is consistent within football players. A nearly perfect relative reproducibility rating was noted for absolute HR responses (HR_{mean}: ICC=0.74; HR_{peak}: ICC=0.75), while small non-significant test-retest differences were observed (HR_{mean}: ES=0.26; HR_{peak}: ES=0.24). These findings are congruent with past research reporting an 'excellent' relative reliability score for HR_{mean} (ICC=0.66–0.82) in middle-aged recreational football players (Beato, 2018; Beato et al., 2018). In addition to relative reproducibility, our absolute reproducibility HR data (CV=2.56–6.03) were slightly higher compared with the results in young (CV=2.2–3.4%) (da Silva et al., 2011) and professional football players (CV=1.3–2.8%) (Little & Williams, 2006). Lower within-participant variability in young and professional players could be explained as a logical consequence of the selection process. In addition to mean HR response, it is also important to consider the amount of time spent in certain relative HR zones. As far as we know, this is the first study to report on the test-retest variation in HR zones during recreational SSG in football, and thus comparison with previous literature is not possible. In contrast to running-based conditioning, where workload intensity can be easily manipulated, the unpredictable and intermittent nature of SSG makes it impossible to constrain the intensity of activities within specific HR zones throughout the game. Consequently, percentage of time in each heart rate zone showed very large variability (CV=36.2–128.4%). Nevertheless, overall these data suggest that SSG provides reliable internal mean HR responses and should therefore be used as an effective strategy for developing and maintaining cardiorespiratory fitness.

The evaluation of external load measures provides a better understanding of the requirements of recreational football. Pairwise comparisons showed trivial to small non-significant differences across test-retest trials in external load measures, demonstrating the absence of learning effect. High to nearly perfect relative reproducibility was noted for total distance covered (ICC=0.39), work rate (ICC=0.39), player load (ICC=0.54), player load per min (ICC=0.54), peak speed (ICC=0.63), and distance covered at 0–2, 2–5, 5–7, 13–16, 16–20 and >20 km/h (ICC=0.32–0.75). The relative reliability for total distance covered was congruent with past research reporting ‘good’ (0.66) (Beato et al., 2018), and ‘excellent’ ICC (0.82) (Beato, 2018). Likewise, distance covered (CV=7.8%), work rate (CV=7.9%), and peak speed (CV=8.5%) demonstrated acceptable absolute reproducibility. Knowledge of this reliability data allows researchers to detect ‘real’ changes in distance covered, work rate and peak speed during intervention-type studies. In contrast, our absolute reproducibility data across running speeds displayed greater variability, suggesting that external load demands encountered during SSG are inconsistent. These findings parallel those observed in elite young soccer players (1 vs 1 and 2 vs 2), who exhibited large variance (CV=13.6–141.1%) in very-high-speed running (19.9–25.2 km/h) and sprinting (>25 km/h) (Ade, Harley & Bradley, 2014). It is difficult to make CV comparisons by speed zone between our results and those produced previously due to disparities in methodological procedures, including activity categorisation and game format. It should be noted that GPS receivers generally report greater variability at higher speed thresholds (Hill-Haas, Dawson, Impellizzeri & Coutts, 2011). In addition, these results are somewhat inevitable when considering the inherent characteristics of SSG, such as unpredictability and complexity, requiring players to adapt their actions to situational demands. Based on these results, readers should be cognisant of these values when interpreting changes in the aforementioned variables. Our findings were obtained in recreational football players, so the applicability of these results remains limited to other playing groups given that physiological response and external load have been shown to differ according to playing level.

What does this article add?

The SSG is a reliable protocol that can be used to profile exercise-induced change in HR response, total distance covered, work rate, and peak speed, so the aforementioned variables can be used to investigate the effect of a game format (number of players, presence/absence of goalkeepers, continuous vs interval regime) on exercise intensity as well as the efficacy of training interventions in recreational football players. However, the inconsistent findings for HR zones and speed zones generated by the GPS receiver should be considered by researchers when interpreting these measures across intervention-type studies.

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Competing interests: None

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Table 1. Differences between session 1 and 2 in internal and external loading for small-sided recreational football games for young adults

	Session 1	Session 2	Mean Difference (95%CI)	Effect size (95%CI)	% diff	p-value
	Mean ± SD	Mean ± SD				
Internal and external load						
Distance covered (m)	3597±240	3615±322	-17.9 (-249.6, 213.8)	-0.06 (-0.94, 0.81)	-0.5	.865
Work rate (m/min)	89.90±6.10	90.30±8.10	-0.4 (-6.4, 5.6)	-0.06 (-0.93, 0.82)	-0.4	.883
Player Load (AU)	367.60±44.22	359.6±49.47	8.0 (-26.1, 42.1)	0.17 (-0.71, 1.05)	2.2	.608
Player load per min (m/min)	9.30±1.06	9.00±1.25	0.3 (-0.7, 1.3)	0.26 (-0.62, 1.14)	3.3	.520
HRmean (bpm)	166±9	164±10	2.4 (-3.2, 8.0)	0.24 (-0.64, 1.12)	1.5	.355
HRpeak (bpm)	189±8	190±8	-0.3 (-4.7, 4.1)	-0.04 (-0.91, 0.84)	-0.2	.881
HRmean (%HRpeak)	85.86±2.10	84.65±3.68	1.2 (-1.7, 4.1)	0.40 (-0.48, 1.29)	1.4	.373
HRpeak (%HRpeak)	97.9±2.4	98.1±2.6	-0.2 (-2.5, 2.2)	-0.06 (-0.94, 0.81)	-0.2	.879
Peak speed (km/h)	24.7±1.9	24.5±2.3	0.2 (-1.2, 1.5)	0.08 (-0.80, 0.96)	0.7	.785
Distance covered in speed zones						
0-2 km/h	100±21	90±14	9.3 (-5.9, 24.5)	0.52 (-0.37, 1.41)	10.3	.199
2-5 km/h	1002±67	1024±106	-22.8 (-84.0, 38.4)	-0.26 (-1.14, 0.62)	-2.2	.421
5-7 km/h	642±73	634±92	7.9 (-38.9, 54.7)	0.09 (-0.78, 0.97)	1.3	.712
7-9 km/h	442±76	432±83	9.8 (-66.5, 86.1)	0.12 (-0.75, 1.00)	2.3	.778
9-13 km/h	754±125	760±113	-5.6 (-130.5, 119.3)	-0.05 (-0.92, 0.83)	-0.7	.921
13-16 km/h	322±67	359±83	-36.8 (-78.6, 5.0)	-0.49 (-1.37, 0.40)	-10.3	.078
16-20 km/h	235±50	237±71	-2.7 (-46.0, 40.6)	-0.04 (-0.92, 0.83)	-1.1	.891
>20 km/h	101±42	78±43	23.0 (-0.9, 46.9)	0.54 (-0.35, 1.43)	29.6	.058
Percentage of time in each heart rate zone						
<70 %	6.9±5.5	8.0±6.8	-1.1 (-7.7, 5.6)	-0.17 (-1.05, 0.70)	-13.4	.724
70-80 %	13.8±5.3	12.3±4.2	1.5 (-3.3, 6.3)	0.31 (-0.57, 1.20)	12.2	.501
80-90 %	34.9±14.1	41.9±15.3	-7.0 (-16.2, 2.3)	-0.47 (-1.36, 0.41)	-16.6	.121
90-95 %	31.4±7.4	29.0±14.6	2.4 (-8.3, 13.1)	0.21 (-0.67, 1.09)	8.4	.620
95-100 %	13.0±13.7	8.9±14.3	4.1 (-3.0, 11.3)	0.29 (-0.59, 1.18)	46.6	.224
90-100 %	44.3±13.6	37.8±22.3	6.5 (-9.3, 22.4)	0.35 (-0.53, 1.24)	17.3	.375

CI – confidence interval

Table 2. Reliability statistics for internal and external training load between session 1 and 2 for young adults

	TE (95% CI)	ICC (95% CI)	%CV (95% CI)
Internal load			
Distance covered (m)	229.04 (157.54, 418.14)	0.39 (-0.27, 0.81)	7.80 (7.41, 8.18)
Work rate (m/min)	5.72 (3.94, 10.45)	0.39 (-0.27, 0.81)	7.88 (7.49, 8.26)
Player Load (AU)	33.67 (23.16, 61.46)	0.54 (-0.09, 0.86)	12.88 (11.77, 14.00)
Player load per min (m/min)	0.84 (0.58, 1.54)	0.54 (-0.09, 0.86)	12.60 (11.49, 13.72)
HRmean (bpm)	5.51 (3.79, 10.06)	0.74 (0.26, 0.93)	6.03 (5.81, 6.24)
HRpeak (bpm)	4.35 (2.99, 7.94)	0.75 (0.26, 0.93)	4.15 (4.05, 4.25)
HRmean (%HRpeak)	2.88 (1.98, 5.26)	0.08 (-0.55, 0.65)	3.39 (3.31, 3.46)
HRpeak (%HRpeak)	2.29 (1.58, 4.19)	0.19 (-0.46, 0.71)	2.56 (2.52, 2.60)
Peak speed (km/h)	1.35 (0.93, 2.47)	0.63 (0.05, 0.89)	8.45 (8.02, 8.87)
Distance covered in speed zones			
0-2 km/h	15.01 (10.33, 27.41)	0.32 (-0.35, 0.77)	18.35 (16.06, 20.64)
2-5 km/h	60.47 (41.59, 110.39)	0.59 (-0.02, 0.88)	8.52 (8.08, 8.95)
5-7 km/h	46.28 (31.83, 84.48)	0.74 (0.25, 0.93)	12.95 (11.88, 14.03)
7-9 km/h	75.39 (51.86, 137.63)	0.12 (-0.52, 0.67)	18.24 (16.06, 20.41)
9-13 km/h	123.51 (84.95, 225.46)	-0.09 (-0.65, 0.54)	15.71 (14.18, 17.24)
13-16 km/h	41.36 (28.45, 75.50)	0.75 (0.27, 0.93)	22.10 (18.18, 26.02)
16-20 km/h	42.79 (29.43, 78.12)	0.57 (-0.05, 0.87)	25.65 (19.47, 31.83)
>20 km/h	23.65 (16.27, 43.18)	0.74 (0.25, 0.93)	47.59 (-45.21, 140.38)
Percentage of time in each heart rate zone			
<70 %	6.56 (4.51, 11.97)	-0.16 (-0.70, 0.49)	81.71 (-68.82, 232.24)
70-80 %	4.78 (3.29, 8.72)	-0.01 (-0.61, 0.6)	36.23 (29.5, 42.95)
80-90 %	9.11 (6.26, 16.62)	0.67 (0.12, 0.91)	38.29 (12.63, 63.96)
90-95 %	10.54 (7.25, 19.25)	0.19 (-0.46, 0.71)	36.47 (-26.10, 99.04)
95-100 %	7.06 (4.86, 12.89)	0.79 (0.37, 0.94)	128.44 (35.03, 221.85)
90-100 %	15.66 (10.77, 28.6)	0.32 (-0.35, 0.77)	43.66 (-52.35, 139.67)

TE – typical error; ICC – interclass correlation; CV – coefficient of variation