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DETERMINING OPTIMAL MEASURES OF VARIABILITY TO TRACK THROUGHOUT LOW- AND HIGH-VOLUME HIGH-INTENSITY FUNCTIONAL TRAINING WORKOUTS

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INTRODUCTION

High-intensity functional training (HIFT) is a complex strategy that variably incorporates a variety of multi-modal, functional movements into workouts that are collectively meant to stimulate improvements across multiple aspects of fitness (1,7). Workouts often consist of a list of exercises to be completed as fast as possible, or the list is repeated as a circuit for either a given number of times or as many times as possible within a time limit. In either case, the goal of completing assigned work as fast as possible implies that high-intensity effort is always present (3).

Since high intensity effort cannot be maintained for much longer than a few minutes (8), trainees must carefully select an appropriate pace and breaking/transition strategy to eliminate down time (i.e., time when repetitions are not being completed). The success of their strategy can be evaluated post-exercise by metrics of consistency (i.e., slope, standard deviation [SD]), and a coefficient of variation [CV]). The problem is that each metric says something different about consistency (see Table.1) and quantifying each produces an overwhelming amount of data that is difficult to evaluate. Furthermore, existing research has not settled on the most useful measure of variability (4,5,6).

PURPOSE

The purpose of this study was to determine which measure of variability was most often related to performance in HIFT.

METHODS

Nineteen adults (27.0 ± 7.6 yrs, 173 ± 8 cm, 79.3 ± 11.0 kg) with HIFT experience randomly completed two study visits separated by at least 48 hours. Each visit they completed five rounds of the same HIFT circuit

Five rounds of power cleans (PC; men: 52.2 kg; women: 34.0 kg), toes-to-bar (TTB), and wall balls (WB; men: 9.1 kg medicine ball to a 3.04 m target, women: 6.4 kg medicine ball to a 2.74 m target) that only differed in repetition volume (low [LV]: 5, 10, and 15 repetitions; high [HV]: 10, 15, and 20 repetitions)).

Workouts were video recorded and analyzed to quantify overall repetition completion rate, and the average, slope, SD, and CV (SD divided by average) of time spent on each exercise, repetition completion rate, the quantity and duration of breaks, and transition time across each round.

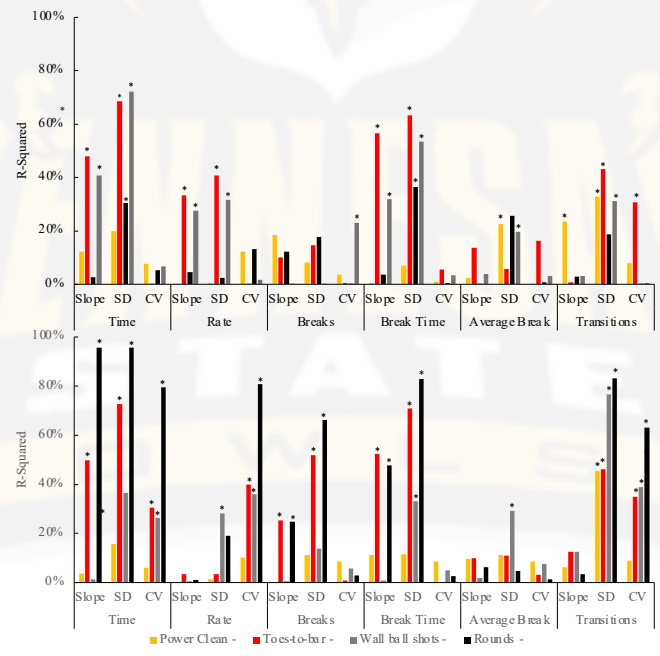
Spearman correlation coefficients were calculated between metrics of variability (slope, SD, and CV) for each workout component and overall repetition completion rates.

RESULTS

Table 1. Descriptions of measures of variability used to assess consistency throughout HIFT workouts (2).

Metric	Measure Type	Consistency Insight	Limitations
Slope	Rate of Change	The rate of change across the workout describes whether a variable is increasing (positive value), decreasing (negative value), or remaining the same (zero).	Primarily affected by the first and last values, and its interpretation depends on what is more desirable for each specific variable.
Standard Deviation	Absolute Variability	Condenses the difference between each round and the average into a single number. Closer to zero means less variable.	The meaning of "close" (to zero) is different for each variable and depends on the size of measurement units.
Coefficient of Variation	Relative Variability	Ratio of standard deviation to the mean places each variable on the same percent scale, allowing for fair comparisons to be made between different exercises and units.	Overly sensitive to minor changes in small mean values.

- Most relationships were seen with SD variables (HV: $n = 13$; LV: $n = 14$). Except for the positive relationships between HV completion rate and the SD of TTB/round completion rate, negative relationships were seen with the SD of time spent on each exercise and round, break time, and transition time.
- All relationships seen with LV were negative. A total of 13 significant ($p < 0.05$) negative relationships were seen when using slope for both LV and HV.
- Of the 11 seen when using CV, most relationships ($n = 9$) were negative and found with the LV workout. With HV, there was a positive relationship seen with the CV of round breaks and a negative relationship with TTB transitions.



CONCLUSIONS and PRACTICAL APPLICATIONS

l three metrics were generally related to various measures of HIFT pacing, but SD was the strongest and most common predictor. Interestingly, this metric has been used least often in research (4,5,6), presumably because scale differences amongst variables makes interpretation difficult. Nevertheless, it appears best for researchers and athletes to evaluate consistency within the context of each pacing variable's unit of measurement.

Slope and CV have often been reported together when describing HIFT workout variability (4,5,6), but each were only relevant to about one-third of all pacing variables. Though quantifying CV allows for fair comparisons to be made between different exercises and units, pacing variables are small (i.e., < 1.00) and any deviation can produce an extremely large CVs. This metric may only be useful for larger, less volatile metrics. Meanwhile, slope has always lacked in describing middle rounds (2), but it can also be affected by uncommon effort in the beginning or end of a workout (e.g., racing to get a few extra repetitions at the end). Still, slope was more consistent than CV across both workouts and may be a useful secondary metric.

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