

Test-retest reliability of the Lumen® hand-held metabolic device

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Abstract

Background

Lumen is a non-invasive, hand-held metabolic measurement tool used for personal and investigative purposes.

Using sophisticated algorithms and a unique breathing maneuver, Lumen produces a personalized metabolic status in real time.

Based on the respiratory exchange ratio (RER), it is possible to determine the primary source of energy a person uses.

RER is calculated as the ratio between produced carbon dioxide ($v\text{CO}_2$) and consumed oxygen ($v\text{O}_2$).

Carbohydrate oxidation will exhibit higher values while fat oxidation will exhibit lower values (1). In a recent study, $\% \text{CO}_2$ from Lumen was found to be in agreement with RER from the metabolic cart, which is the gold standard for measuring metabolic fuel consumption (2).

Understanding the short-term repeatability of Lumen will provide valuable insight into its reliability.

Objective

Assess and quantify the short-term repeatability of the Lumen device. This will serve as a continuation of the Lumen validation study (2).

In order to define the extent to which measurements can be replicated, it is important to measure the test-retest reliability.

This is defined as the quantification of the variation in repeated measurements on the same subject under identical conditions over a short period of time (3).



Methods

Participants

The study involved 30 healthy Lumen employees. Table 1 describes their characteristics.

| Gender | Count | Age (years) | Weight (kg) | Height (cm) | BMI (kg/m ²) |
|--------|-------|-------------|--------------|--------------|--------------------------|
| Male | 17 | 34 ± 8.07 | 78.5 ± 13.36 | 177.7 ± 6.85 | 24.8 ± 3.66 |
| Female | 13 | 31.3 ± 3.79 | 58.9 ± 6.44 | 162.5 ± 3.83 | 22.3 ± 2.75 |
| Total | 30 | 32.8 ± 6.61 | 70 ± 14.6v | 171.1 ± 9.5 | 23.7 ± 3.48 |

Data are presented as mean ± SD.

Trial Design

All participants were familiarized with both the Lumen device and the Lumen app prior to the study.

Participants arrived at Lumen HQ following 12-hours fasting.

They were then instructed to undertake a resting session of ten minutes, during which they watched a neutral, relaxing short movie.

During the rest period, mobile phones and similar devices were forbidden.

Next, participants took 5 consecutive Lumen breathing measurements with an interval of 40 seconds in between. %CO₂ levels were recorded at each measurement. The duration of the entire procedure was about 15 minutes.

Statistical Analysis

Repeatability was quantified by using the intraclass correlation coefficient (ICC), a widely used indicator of test-retest used for measuring reproducibility of measurements (3,4).

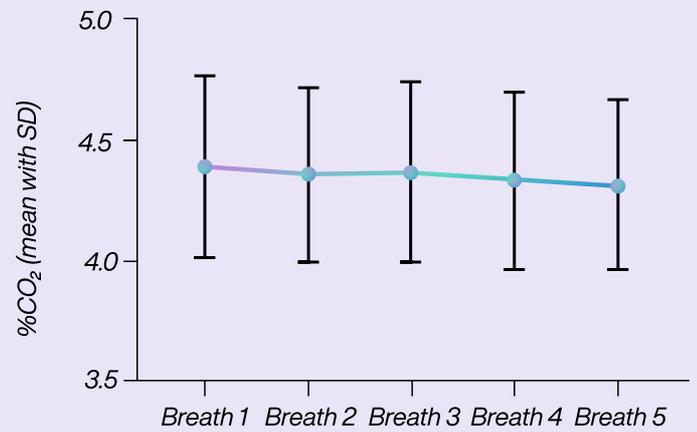
The analysis considered variations within and between participants.

ICC reliability is measured between 0 and 1, with values closer to one indicating a higher degree of reliability. It aimed for an ICC value of greater than 0.8 (5).



Results

Lumen hand-held metabolic tracker device was found to be highly repeatable, ICC (95%CI) = 0.893 (0.82-0.94). Additionally, mean coefficient of variance (CV) was 2.5. No changes in average %CO₂ levels were observed between the breaths.



Conclusion

The %CO₂ measurements using the Lumen device are highly repeatable, exhibiting a good to excellent ICC reliability value. Therefore, this supports the formerly established validity of the Lumen device.

References

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