

Comparison of FRC and TLC measured in whole body plethysmography and Multiple Breath Washout in healthy adult volunteers

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INTRODUCTION

Measurement of lung volumes is an essential part of lung function testing. Functional Residual Capacity (FRC) and Total Lung Capacity (TLC) can be measured using body plethysmography or multiple breath washout (MBW) techniques. MBW has the advantage that parameters of ventilation inhomogeneity such as the Lung Clearance Index may be calculated at the same time. In comparison to plethysmography, trapped gas is not measured by MBW. Therefore, lung volumes may be lower when using MBW.

AIM

- To compare FRC and TLC measured by Nitrogen Multiple Breath Washout (N₂ MBW) and body plethysmography in healthy adult volunteers.

METHODS

- MBW was performed using N₂ as tracer gas and 100% oxygen for the wash out (EasyOne Pro LAB, nnd Medical technologies, Switzerland). MBW was directly followed by a Slow Vital capacity manoeuvre (SVC).
- Subsequently body plethysmography was performed (Master Screen Body, Fa Jaeger/ CareFusion, USA). Plethysmographic measurement consisted of normal regular breathing, shutter and SVC manoeuvres.
- At least 2 MBW maneuvers with an FRC agreement within 10% and at least three plethysmographic FRC measurements within 5% were performed.

- 19 healthy adults were included.
- Patient characteristics are described in table 1, measured lung volumes in table 2.

Table 1: Characteristics healthy adult volunteers

	Healthy adults (n =19)	
Age [years] *	32	(20-67)
Male ‡	6	(31.6)
Height [cm] *	168	(158-195)
Weight [kg] *	67	(48-102)
Smoking ‡		
Never	13	(68.4)
In history	5	(26.3)
Active	1	(5.3)

* Median (range), ‡ Absolute number (%)

Table 2: Lung volumes measured by N₂ MBW and plethysmography

	N ₂ MBW	Plethysmography	P	Difference in % ‡	
VC [l] †	4.32 (0.95)	4.29 (0.97)	0.502	0.7	(5.6)
FRC [l] †	2.50 (0.54)	2.96 (0.67)	<0.001	- 14.8	(8.9)
RV [l] †	1.71 (0.42)	2.17 (0.55)	<0.001	- 19.6	(14.9)
TLC [l] †	6.00 (1.11)	6.46 (1.30)	<0.001	- 6.6	(6.5)

† Mean (SD), ‡ Difference = N₂ MBW – plethysmography (SD)

RESULTS

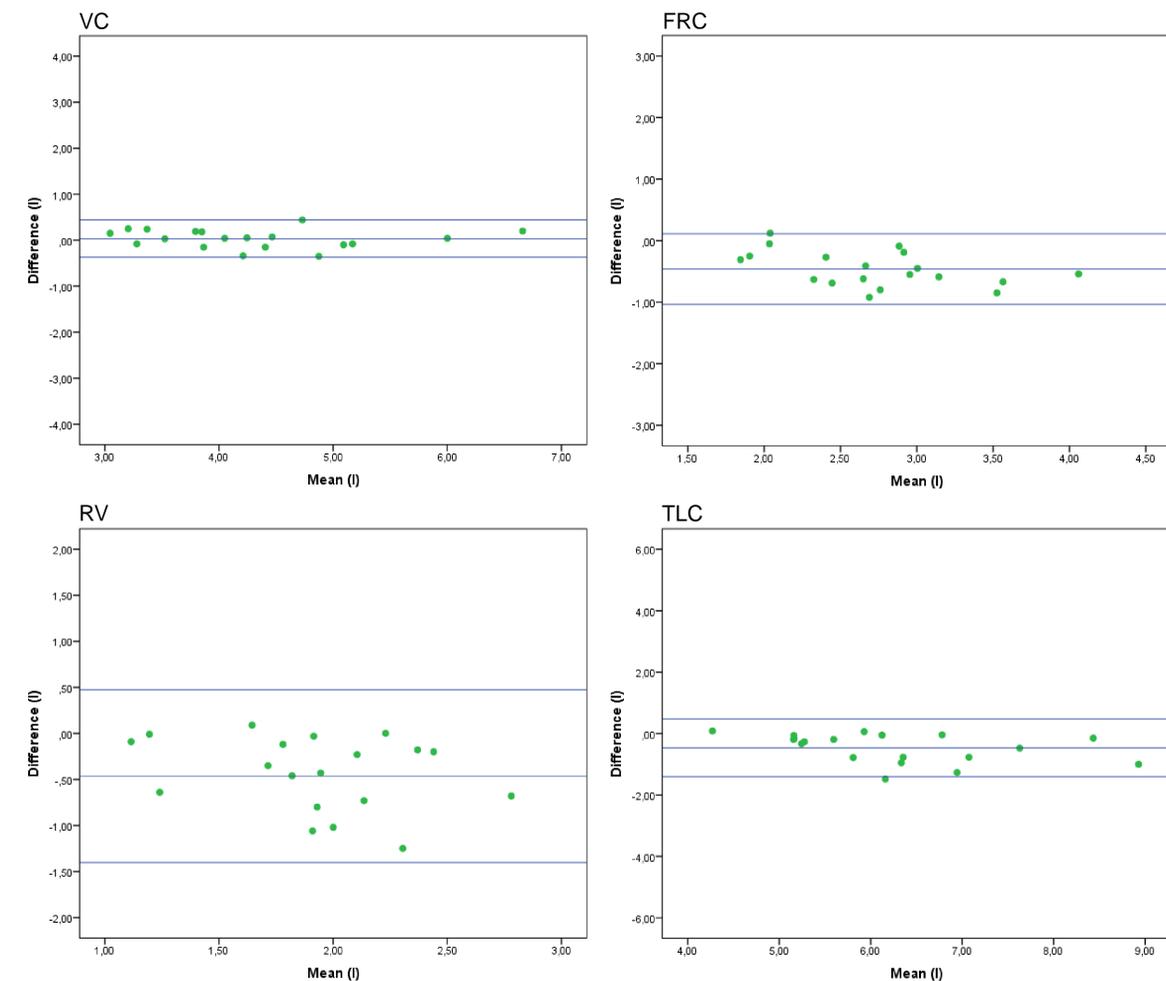


Figure 1: Bland-Altman plots of lung volumes measured by N₂ MBW versus plethysmography

DISCUSSION

- The two devices showed excellent agreement of VC measurements, demonstrating that flow-volume measurements are accurate with both devices.
- There was a significant difference between FRC, RV and TLC measured by N₂ wash out and bodyplethysmography with MBW yielding lower values than plethysmography.
- This difference was independent of the size of individual volumes measured and within the range reported in the literature.
- It may be attributed to physiologically trapped gas that is not measured when performing gas washout. It may also be that the software algorithms contribute to this difference.
- Lung volume measurements using the different techniques can not be used interchangeably.