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## **Normative Percent Differences between Inter-day and Inter-Limb Upper Extremity Volume in Healthy Adult Females**

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# Normative Percent Differences between Inter-day and Inter-Limb Upper Extremity Volume in Healthy Adult Females

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## Introduction

Lymphedema is a frequent complication of breast cancer treatments and can become a chronic condition (1).

Diagnosing lymphedema early is essential to reverse the condition and prevent future complications (2).

Segmental circumferential measurements are the most efficient, reliable, and clinically relevant method to measure UE volume (3).

Diagnosing pre-clinical lymphedema requires an understanding of normal inter-day and inter-limb volume differences among healthy women.

## Purpose

The purpose of the study was to establish normative inter-day and inter-limb volume differences among healthy women using segmental circumferential measurements.

## Hypothesis

Best practice diagnostic criteria to determine the presence of lymphedema is using a percent difference from either baseline or contra-lateral limb.

The determination of pre-clinical lymphedema has been established as a 3% difference from baseline, yet the study examined only breast cancer survivors with and without lymphedema (4).

Inter-limb and inter-day volume difference in the UEs of healthy women is important to establish, using the truncated cone formula, in order to determine when a pre-clinical measurement of lymphedema can be made.

## Subjects

Healthy female subjects (n=22) between the ages of 30-63 with no history of breast cancer or lymphedema, recent upper extremity injury or surgery, current use of medications affecting fluid volume, conditions affecting limb volume, or current pregnancy.

## Materials

Scale for height/weight, flexible tape measure, washable marker, plinth

**Table 1.1 – Group Descriptive Data**

	Mean (N = 22)	Std. Deviation
Age	47.8	10.8
Height (meters)	1.65	0.058
Day 1 - Weight (Kg)	69.0	12.13
Day 2 - Weight (Kg)	68.9	12.18
Day 1 - BMI	25.2	3.76
Day 2 - BMI	25.1	3.79
Average BMI Valid N	25.2	3.77

**Table 1.2 Inter-Limb % Difference**

	Mean (N = 22)	Std. Deviation
Day 1 DOM vs Non-DOM	2.9%	2.8%
Day 2 DOM vs Non-DOM	2.4%	1.8%

**Table 1.3 Inter-Week % Difference**

	Mean (N = 22)	Std. Deviation
Inter-Day DOM	1.8%	1.6%
Inter-Day Non-Dom	1.6%	1.2%



**Table 1.4 Total Limb Volume Difference Day 1 vs. Day 2**

	Mean (N = 22)	Std. Deviation	Sig. (2-tailed)
DOM Day 1 vs. DOM Day 2	9.75	43.98	0.31
Non-Dom Day 1 vs. Non-Day 2	20.47	34.48	0.01

**Table 1.5 Total Limb Volume Difference (TLVD): Dominant vs. Non-Dominant**

	Mean (N = 22)	Std. Deviation	Sig. (2 tailed)
TLVD: DOM vs. Non-DOM	3.24	21.2	0.63

## Methods

Participants attended two sessions in which they participated in an initial screening and subsequent measurements. Subjects' height and weight was taken, and arm circumference was measured with subjects lying supine with exposed arms resting in a supinated position.

Circumferential measurements were taken every 10cm from the most distal wrist crease for 5 total circumferential measurements. Total limb volume was calculated using the truncated cone method.

Data were analyzed using paired samples t-tests for inter-day and inter-limb volume differences.

## Results

Inter-limb percent difference for Day1 displayed a mean of  $2.9\% \pm 2.8$ ; Day2 displayed a mean of  $2.4\% \pm 1.8$  (Table 1.2). Inter-week percent difference for dominant displayed a mean of  $1.8\% \pm 1.6$ ; Non-dominant displayed  $1.6\% \pm 1.2$  (Table 1.3). Total limb volume difference of dominant from day 1 vs. to day 2 displayed a mean of  $9.75 \pm 43.98$  with a significance of 0.31; non-dominant day 1 vs. to day 2 presented a mean of  $20.47 \pm 34.48$  with a significance of 0.01 (Table 1.4). Total limb volume difference: dominant vs. non-dominant displayed a mean of  $3.24 \pm 21.2$  with a significance of 0.63 (Table 1.5). P-value was set at 0.05.

## Discussion

Dominant arm changes inter-day show no significant differences, however significant difference was found inter-day in non-dominant arm measurements.

Total limb volume difference of dominant versus non-dominant shows no significant difference.

Determining normative percent differences inter-day and inter-limb in healthy women is advantageous to aid in early detection of lymphedema.

## References

- Hayes SC, et al. *Cancer*. 2012; 118(8 Suppl): 2237-2249.
- Stout NL, Binkley JM, Schmitz KH, et al. *Cancer*. 2012;118(8 Suppl): 2191-2200.
- Stout NL, et al. *Arch Phys Med Rehabil*. 2011; 3(12): 1098-1105.
- Stout NL, et al. *Cancer*. 2008; 122 (12): 2809-2819.