



# Comparison of Self-report and Clinician Measured Body Mass Index Calculations for Lower Limb Amputees

Lucarevic JL,<sup>1,2</sup> Gailey RS,<sup>1,2</sup> Kim JC,<sup>1</sup> Gondo GC,<sup>3</sup> Gaunaord IA,<sup>1,2</sup>

<sup>1</sup> University of Miami, Miller School of Medicine, Department of Physical Therapy, Coral Gables, Florida

<sup>2</sup> Miami Veterans Affairs Healthcare System, Miami, Florida.

<sup>3</sup> Amputee Coalition, Manassas, Virginia.

## INTRODUCTION

Weight gain is typical following lower limb amputation, with the likelihood of obesity increasing the more proximal the lower limb amputation at a rate of 37.9% and 48.0% for those with unilateral transtibial and transfemoral amputation, respectively.<sup>1</sup> Body Mass Index (BMI) is a measure of weight adjusted for height ( $\text{kg}/\text{m}^2$ ) and has been found to be a surrogate measure of body fat, predictor of obesity, and indicator of type 2 diabetes, hypertension, and cardiovascular disease in adults.<sup>2,3</sup> More than one-third (35.7%) of American adults are considered obese ( $\text{BMI} > 30$ ).<sup>3</sup> For persons with lower limb amputation this calculation factors in the weight and length of the missing limb using a mathematical formula. The Amputee Coalition and members of the Scientific and Medical Advisory Committee (SciMAC) developed a BMI Calculator for People with Limb Loss. The tool is available online and can rapidly generate a BMI score.

The purpose of this study is to determine the validity of using self-reported height and weight and an estimated residual limb length for BMI calculations when compared to clinician measured anthropometric values.

## METHOD

**Subjects:** A convenience sample of 72 subjects were recruited at the 2016 Amputee Coalition National Conference in Greensboro, North Carolina. Eligible subjects were between 18-80 years of age, with a unilateral transtibial, knee disarticulation, or transfemoral amputation.

**Procedures:** Subjects completed the online Amputee Coalition BMI Calculator ( $\text{BMI}_s$ ) at intake using self-reported height, weight, and level of amputation. The formulas to calculate  $\text{BMI}_s$  with this tool are:

$$\text{BMI}_s = [W_e(\text{lb})/\text{height}(\text{in})^2] \times 703$$

$$W_e = W_0/(1 - P)$$

**Figure 1.**  $\text{BMI}_s$  Formulas. Where  $W_e$  = estimated weight,  $W_0$  = weight without the prosthesis, and  $p$  = percentage of total body weight of missing limb (TTA = 3.26, TFA = 9.96)

The research staff then measured height, weight, residual limb length, and sound limb segment length using standard equipment and calculate  $\text{BMI}_c$ .

$$\text{BMI}_c = [W_e(\text{kg})/\text{height}(\text{m})^2]$$

$$W_e = W_{wp} - W_{pro}/(P - (\text{RL}/\text{intact}))$$

**Figure 2.**  $\text{BMI}_c$  Formulas. Where  $W_e$  = estimated weight,  $W_{wp}$  = weight with the prosthesis,  $W_{pro}$  = weight of the prosthesis, and  $P$  = percentage of total

body weight of missing limb (TTA = 0.985, TFA = 0.941), RL = residual limb length, intact = sound limb segment length (tibia or femur)

**Data Analysis:** The two methods of calculating BMI were compared using correlation analysis and paired t-tests. SPSS Software version 21 (IBM corp., Armonk, NY).

## RESULTS

The average  $\text{BMI}_c$  was 29.95 (range 15.4-55.8). Three subjects had calculated  $\text{BMI} < 18.5$ , indicating underweight status. Fifteen subjects had a calculated BMI in the normal range (18.5-24.9  $\text{kg}/\text{m}^2$ ). Eighteen subjects (25%) were classified as overweight ( $\text{BMI} 25$ -29.9), and 36 subjects (50%) were classified as obese.

The two methods of calculating BMI were highly correlated  $r = 0.95$ ,  $p < .001$ . There was no significant difference in calculated BMI between the self-reported value and the clinician administered measurements (paired t-test,  $p = 0.36$ ). The clinician administered  $\text{BMI}_c$  calculations were an average of 0.25  $\text{kg}/\text{m}^2$  higher.

## DISCUSSION

The BMI equation developed by the Amputee Coalition using self-reported height, weight, and level of amputation produced similar BMI for unilateral lower limb amputees when compared to traditional methods. The clinician measured calculations required significantly more time to administer. Surprisingly, the rate of obesity in this sample of unilateral lower limb amputees is much higher (50%) than the prevalence in the US adult population (35.7%).<sup>3</sup>

## CONCLUSION

The Amputee Coalition BMI Calculator is a quick and valid method for calculating BMI in unilateral lower limb amputees

## CLINICAL APPLICATIONS

Healthcare providers can use the Amputee Coalition BMI Calculator to generate valid BMI calculations for unilateral lower limb amputees while saving valuable clinical time.

## REFERENCES

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