

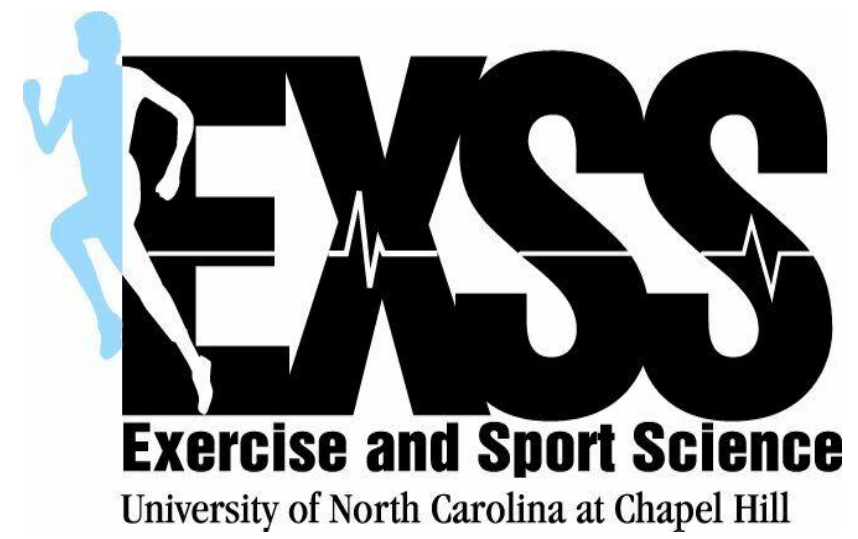
Effects of Adiposity Grade and Body Composition on Adjusted Resting Energy Expenditure in Women



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INTRODUCTION

Resting energy expenditure (REE) represents an individual's **absolute minimum energy requirement** to support basic cellular processes and being awake; **REE is strongly associated with body size.**

Fat-free mass (FFM) is regarded as the largest determinant of REE, accounting for up to **80% of variance**, but this relationship is nonlinear and complicated by obesity (Bosy-Westphal 2009).

PURPOSE:

To compare adjusted REE (REE_a) and contributions of skeletal lean mass (SM) and fat mass (FM) to REE_a in women of varying levels of adiposity.

FORMULAS

Skeletal lean mass (SM) and fat mass (FM) assessed via dual-energy X-ray (DXA) absorptiometry: **SM = Lean Mass (LM) arms + LM legs**

SM and FM Contribution to REE:

| BMI | FM | SM |
|----------|-------------------------|--------------------------|
| BMI ≤ 30 | FM (kg) * 4.5 kcal/kg/d | SM (kg) * 13.0 kcal/kg/d |
| BMI > 30 | FM (kg) * 4.4 kcal/kg/d | SM (kg) * 12.7 kcal/kg/d |

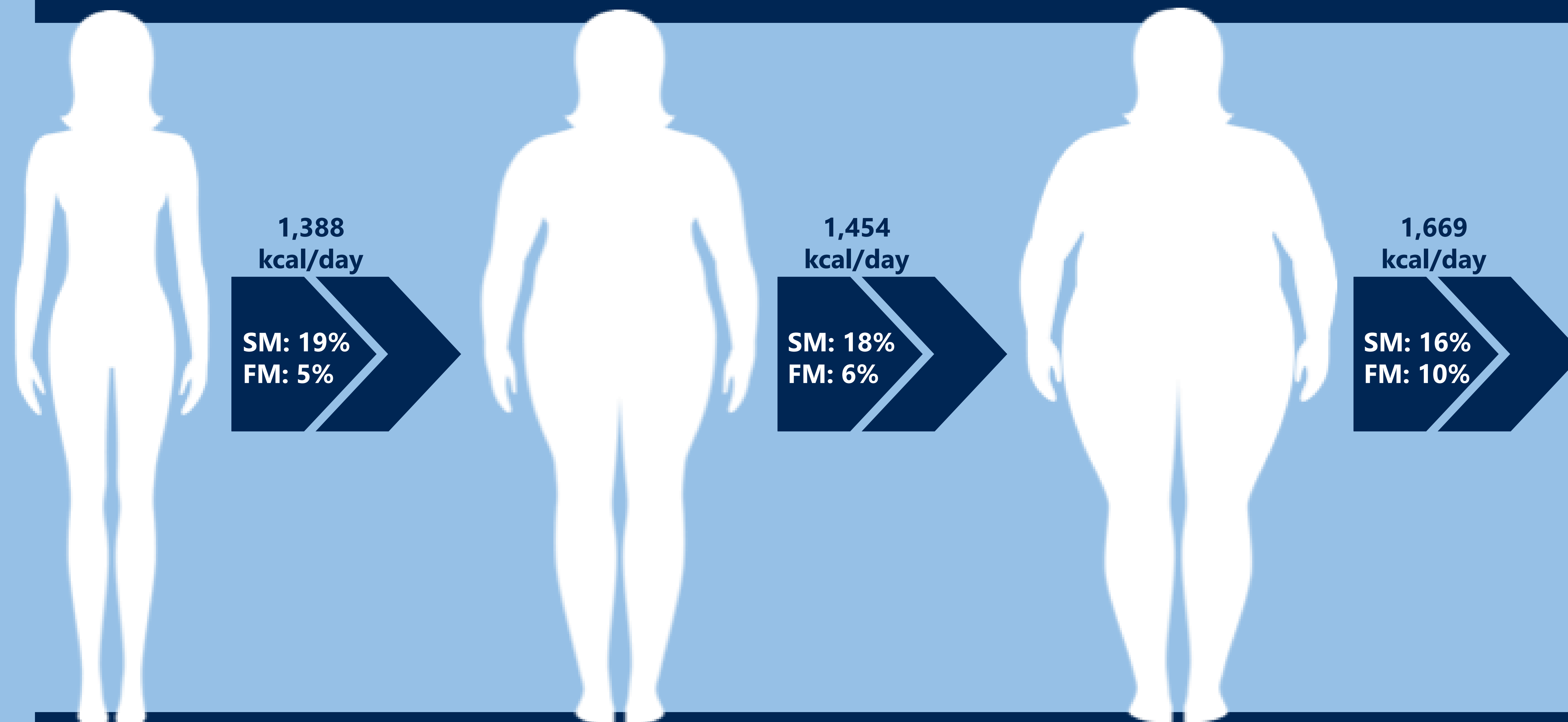
RESULTS

| Participants | Tertile 1 (T1); n=62 | Tertile 2 (T2); n=58 | Tertile 3 (T3); n=62 |
|---------------------------|----------------------|----------------------|----------------------|
| Age (yrs) | 21.1 ± 2.5 | 21.2 ± 2.8 | 30.1 ± 13.2 |
| Height (cm) | 165.1 ± 6.2 | 165.0 ± 6.2 | 165.0 ± 6.2 |
| Weight (kg) | 58.7 ± 5.9 | 63.4 ± 9.0 | 84.6 ± 31.7 |
| BMI (kg·m ⁻²) | 21.5 ± 1.7 | 23.3 ± 3.0 | 31.5 ± 11.7 |
| %fat | 18.5 – 28.4 | 28.5 – 33.8 | 34.0 – 61.0 |
| Fat Mass (kg) | 14.8 ± 2.3 | 19.6 ± 3.1 | 37.4 ± 21.1 |
| Fat-Free Mass (kg) | 43.8 ± 4.4 | 43.1 ± 6.4 | 46.3 ± 11.0 |
| Lean Mass (kg) | 41.3 ± 4.2 | 40.7 ± 6.1 | 43.9 ± 10.6 |
| Skeletal Lean Mass (kg) | 20.2 ± 2.8 | 19.6 ± 3.8 | 20.8 ± 5.5 |

Table 1. Descriptive demographic and body composition data per tertile (mean ± SD)

PRACTICAL APPLICATIONS

Resting energy expenditure **increases with increasing adiposity** in women, but fat mass contributes **up to 5% more** to REE_a in overweight and obese individuals compared to leaner women.

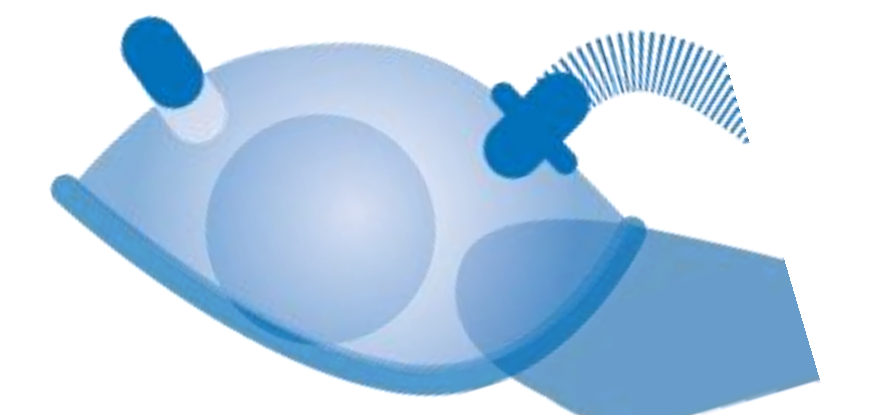


Resting energy expenditure may need to be **adjusted for both fat-free mass and fat mass** when comparing individuals with **high adiposity**.

METHODS

Measured Resting Energy Expenditure

Indirect Calorimetry; TrueOne 2400, Parvomedics, Inc., Sandy, UT, USA



Adjusted Resting Energy Expenditure

REE_m: measured REE via indirect calorimetry

REE_t: average REE_m per tertile; tertiles were determined by %fat.

REE_p: predicted REE calculated by linear regression derived from REE_m, FFM (kg), and age (yrs);
REE_p = 203.4 + (Age x 12.1) + (FFM x 22.7)

REE_a: REE_t + REE_m - REE_p
(Ravussin & Bogardus 1989)

A two-way ANOVA [REE (REE_m vs. REE_a) × Group (T1 vs. T2 vs. T3)] was employed.

CONCLUSION

The group with the highest adiposity had the highest REE, however, the energy expenditure attributed to adipose tissue was substantially greater than in the two leaner groups.

REE may need to be adjusted for fat mass in overweight and obese women.

Main Effect of Group on REE Across Tertiles

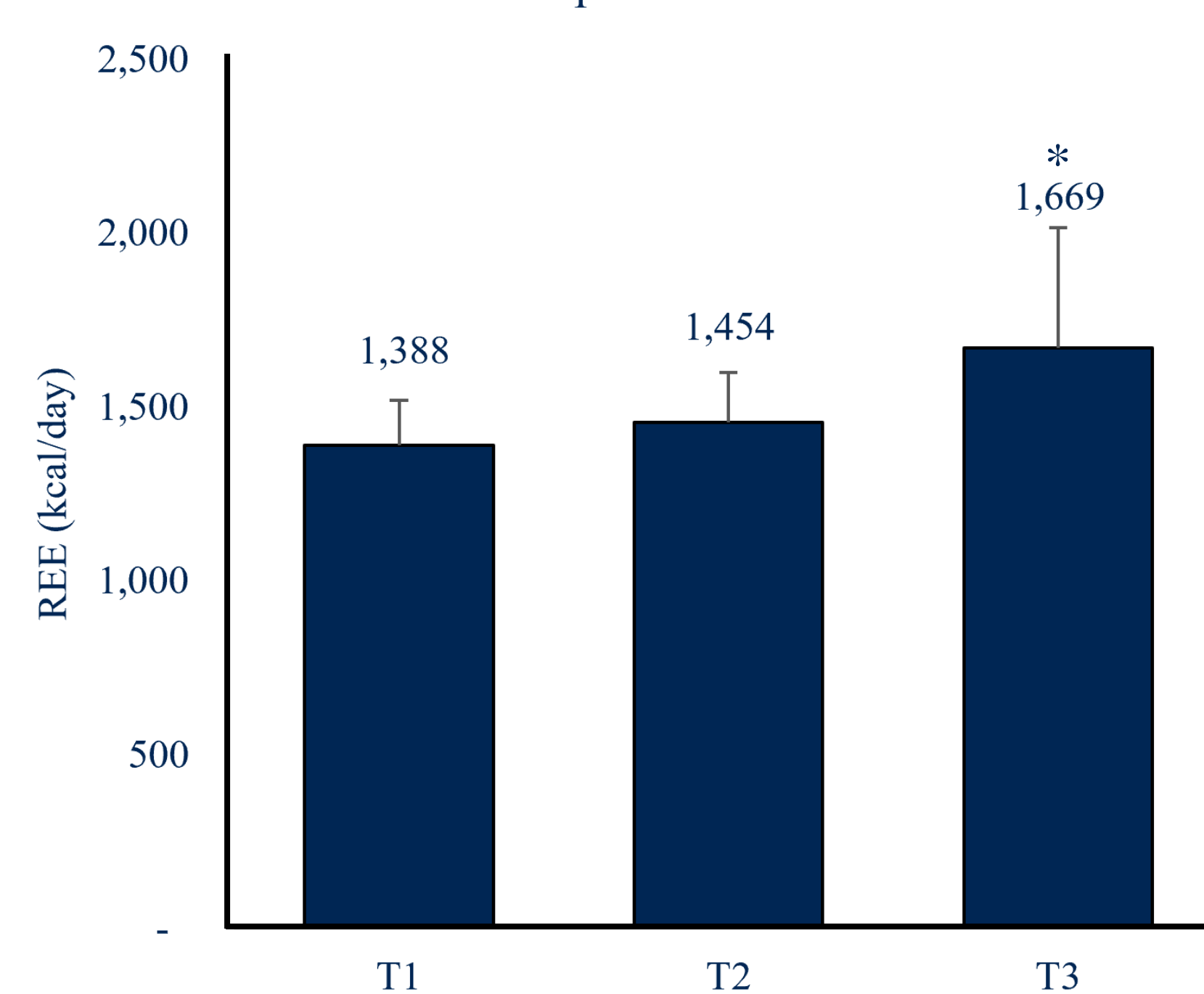


Figure 1. Mean REE_m and REE_a collapsed across tertiles (error bars = SD); *Significant difference between T3 & T1

SM and FM Contribution to REE_a Across Tertiles

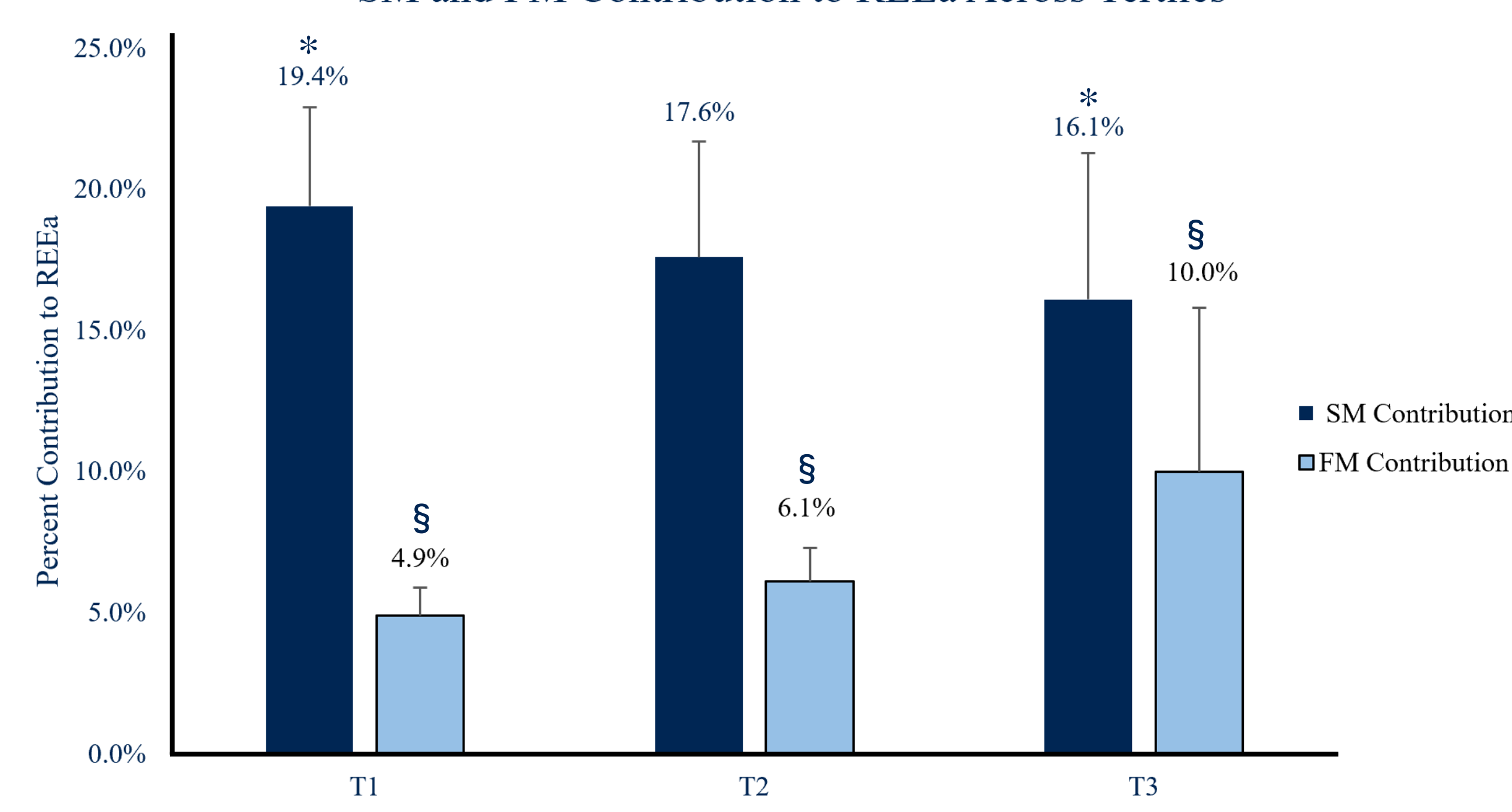


Figure 2. Contributions of SM and FM to REE_a across tertiles (error bars = SD). *Significant difference between T1 & T3 in SM contributions; § Significant differences in FM contribution from T3

| | Tertile 1 (T1) | Tertile 2 (T2) | Tertile 3 (T3) |
|-----------------------------|----------------|----------------|----------------|
| REE _m (kcal/day) | 1,409 ± 139 | 1,449 ± 162 | 1,653 ± 434 |
| REE _p (kcal/day) | 1,452 ± 107 | 1,438 ± 140 | 1,619 ± 366 |
| REE _a (kcal/day) | 1,367 ± 120 | 1,459 ± 124 | 1,685 ± 224 |
| SM Contribution (%) | 19.4 ± 3.5 | 17.6 ± 4.0 | 16.1 ± 5.1 |
| FM Contribution (%) | 4.9 ± 0.9 | 6.0 ± 1.1 | 10.0 ± 5.8 |
| | T1 vs T2 | T1 vs T3 | T2 vs T3 |
| Age | -0.1 ± 16.1 | -9.0 ± 16.0* | -9.0 ± 16.1* |
| %fat | -5.9 ± 9.7* | -17.0 ± 9.7* | -11.0 ± 10.9* |
| FM (kg) | -4.7 ± 25.0 | -22.6 ± 25.0* | -17.9 ± 25.0* |
| FFM (kg) | 0.7 ± 15.6 | -2.5 ± 15.5 | -3.2 ± 15.6 |
| LM (kg) | 0.7 ± 15.0 | -2.5 ± 15.0 | -3.2 ± 15.0 |
| SM (kg) | 0.5 ± 8.3 | -0.6 ± 8.3 | -1.2 ± 8.3 |

Table 2. Descriptive REE data per tertile (mean ± SD) and differences in body composition across tertiles. All data is presented as mean difference (MD) ± SD; statistical significance (p<0.05) is indicated by *.