# Sympathetic Vasoconstrictor Response to Lower Body Negative Pressure in Young Obese Adults: The Preliminary Finding

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## ABSTRACT

**Background:** Elevations in muscle sympathetic nerve activity (MSNA) and sympathetic vasoconstrictor responsiveness to sympathoexcitation are associated with increased cardiovascular risks, which affect hemodynamics, and have been reported in obese adults with metabolic syndrome (1-3). It remains unclear whether this observation may also be present in young metabolically healthy obese adults. **Purpose:** To compare sympathetic vasoconstrictor and hemodynamic responsiveness to lower body negative pressure (LBNP, -20 mmHg) in young normal-weight (NW) vs. obese (OB) adults. **Method:** Eleven NW (female=6; 25±2 yrs; 22.4±0.6 kg/m2) and 13 OB adults (female=6; 27±1 yrs; 32.7±0.6 kg/m2) underwent 2-min of LBNP in the supine position. Ultrasonography [brachial diameter, forearm blood flow (FBF), forearm vascular conductance (FVC)], MSNA [burst frequency, total MSNA, sympathetic vascular transduction], and beat-to-beat hemodynamics [heart rate (HR), mean arterial pressure (MAP), total peripheral resistance (TPR), cardiac output (CO), stroke volume (SV), systemic compliance (SC)] were reported. FBF and FVC were normalized to lean forearm mass, and TPR, CO, SV, and SC to body surface area. **Results:** Baseline MAP was lower in OB ($P<0.05$). In response to LBNP, normalized FBF, FVC, SV, CO, and SC decreased whereas TPR increased similarly in both groups ($P<0.05$). Brachial diameter and HR did not change in both groups. MAP decreased similarly by ~2-4 mmHg, but the values were lower in the OB group ($P<0.05$). Burst frequency, total MSNA, and sympathetic vascular transduction increased similarly in both groups ($P<0.05$). **Conclusion:** Young metabolically healthy obese adults did not exhibit altered sympathetic vasoconstrictor responsiveness under resting condition.

## INTRODUCTION

- Augmented sympathetic nerve activity and sympathetic vasoconstrictor responsiveness are associated with increased cardiovascular risks.
- These conditions have been reported in obese adults with metabolic syndrome.
- It remains unclear whether this observation may also be present in young metabolically healthy obese adults.
- Early detection of vascular dysfunction may offer physiologic insight and potential therapeutic target to help reduce/prevent the cardiovascular risk associated with obesity.

## PURPOSE

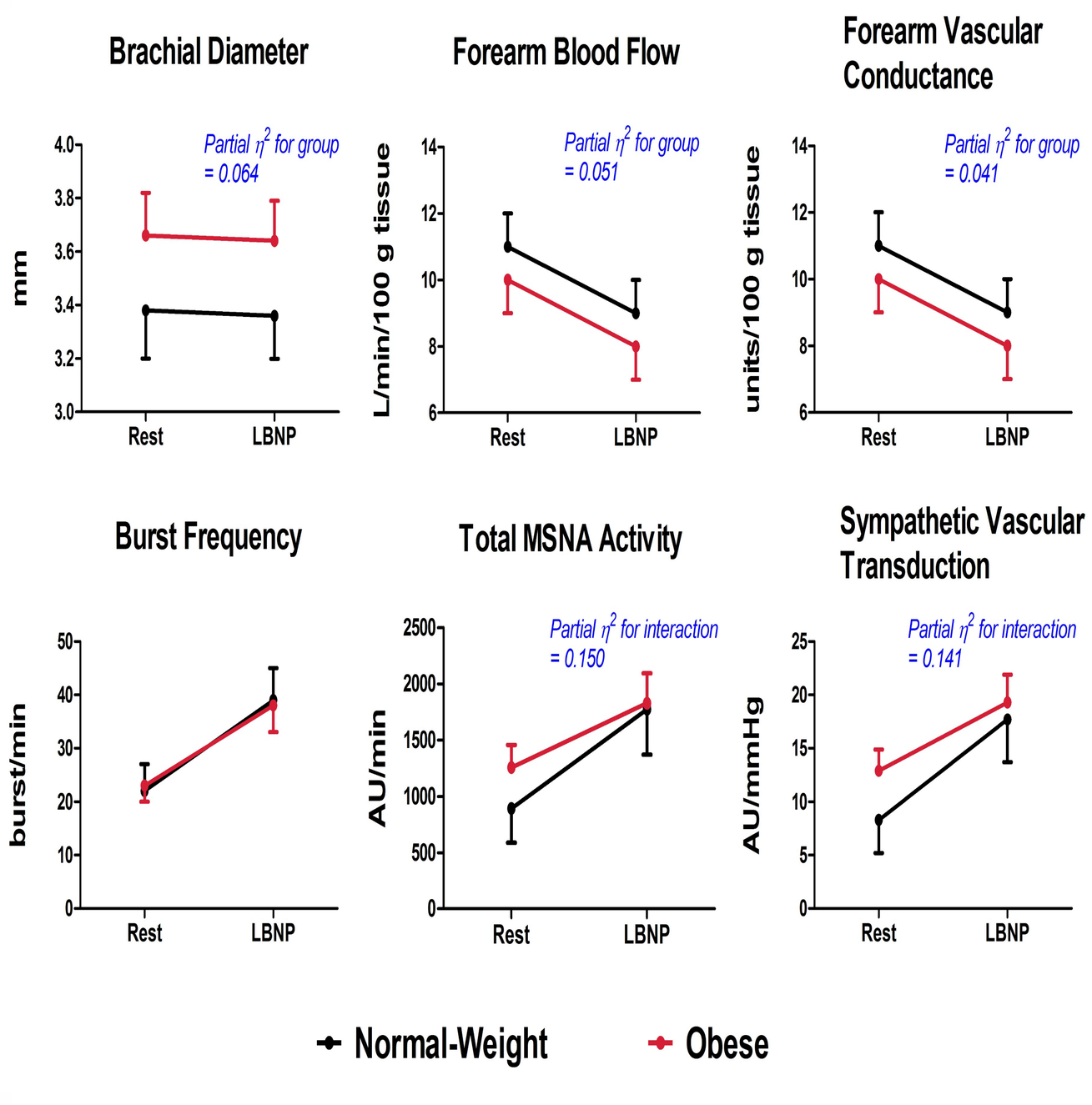
- To compare sympathetic vasoconstrictor and hemodynamic responsiveness to lower body negative pressure (LBNP, -20 mmHg) in young normal-weight vs. obese adults

## RESULTS

| | Normal-Weight (n=11) | Obese (n=13) |
|---|---|---|
| Age (years) | 25±2 | 27±1 |
| Sex (m/f) | 5/6 | 7/6 |
| Body mass index (kg/m2) | 22.4±0.6 | **32.7±0.6*** |
| Percent body fat (%) | 31.1±1.7 | **41.9±1.7*** |
| Total cholesterol | 180±14 | 176±11 |
| High density lipoprotein (mg/dL) | 62±3 | 51±5 |
| Low density lipoprotein (mg/dL) | 103±14 | 110±12 |
| Triglycerides (mg/dL) | 100±19 | 85±11 |
| Glucose (mg/dL) | 96±4 | 98±5 |
| Seated Brachial SBP (mmHg) | 109±1 | 109±3 |
| Seated Brachial DBP (mmHg) | 70±2 | 73±2 |

| | Normal-Weight (n=11) | | Obese (n=13) | |
|---|---|---|---|---|
| | Rest | LBNP | Rest | LBNP |
| Heart rate (bpm) | 62±2 | 61±2 | 64±2 | 65±2 |
| Mean arterial pressure (mmHg) | 104±2 | 100±2 | **97±2*** | 94±2 |
| Stroke volume index (mL/m$^2$/beat) | 55±4 | 44±4 | 48±3 | 42±4 |
| Cardiac index (L/min/m$^2$) | 3.41±0.24 | 2.69±0.28 | 3.04±0.22 | 2.74±0.25 |
| Total peripheral resistance index (L/min/mmHg/m$^2$) | 31.6±2.3 | 46.2±7.2 | 33.94±2.12 | 36.6±6.6 |
| Systemic arterial compliance (mL/mmHg/m$^2$) | 0.95±0.05 | 0.80±0.07 | 0.92±0.05 | 0.85±0.06 |

Data are mean±SE. *Group difference at rest ($P<0.05$).




## METHODS

**Study Design**

- Women tested in early follicular phase (or during placebo phase of oral contraceptive).
- Overnight fast and abstained from caffeine and alcohol 24 h.

**Measurements**

- Brachial artery diameter and flow velocity of the non-dominant arm were measured using ultrasonography (Hitachi Aloka, Alpha 7, Japan).
- Forearm blood flow was normalized to lean forearm mass.
- Postganglionic muscle sympathetic nerve activity (MSNA) was recorded from the radial nerve of the non-dominant arm.
- Beat-to-beat hemodynamics were recorded using finger plethysmography on the non-dominant arm (Finometer, The Netherlands) and were normalized to body surface area.
- Beat-to-beat heart rate was recorded using ECG (Biopac Systems, CA).
- Percent body fat (%) was determined by DXA.

## CONCLUSIONS

- Young obese adults did not exhibit altered sympathetic vasoconstrictor responsiveness under resting condition.
- However, the effect sizes of our comparisons suggest that obese individuals exhibit a tendency towards reduced vascular conductance and increased resting sympathetic vascular transduction.
- Importantly, the reduced vascular conductance and increased sympathetic vascular conductance may possibly contribute to exercise intolerance associated with obesity.

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