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# The effect of post-meal walking on daytime blood pressure in young adult women

By
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A senior thesis submitted to the Faculty of the University of New Hampshire in partial fulfillment of the requirements for the Honors in Biomedical Science.

Spring 2022

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# The effect of post-meal walking on 24-hour central blood pressure in young women with and without excess adiposity

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## ABSTRACT

Post-meal walking (PMW) performed after breakfast, lunch, and dinner has been demonstrated to reduce blood glucose. However, no studies have examined the potential additive benefits of post-meal walking exercise on daytime central blood pressure (BP) in young women. **METHODS:** Thirteen physically inactive, non-hypertensive women (Age: 20±1 years; percent body fat: 28.2±13%) completed the study during the early follicular or placebo phase of their contraceptive cycle. Participants completed a control day (CON; no exercise/excess physical activity) and PMW day (3 bouts x 15 minutes of brisk walking) over five days in random order. Daytime ambulatory BP and accelerometry data (to estimate METs) were measured and compared. **RESULTS:** PMW increased metabolic expenditure (PMW= 35.8±1.44 vs. CON= 33.7±0.94 METs, $p<0.05$). Daytime central BP trended to increase or was increased on the PMW day compared to the control day (Central Systolic BP: PWM= 104±8 vs. CON= 101±9 mmHg, $p=0.054$; Central Diastolic BP: PWM= 73±6.5 vs. CON= 70±7 mmHg, $p<0.05$; Central Mean BP: PWM= 88±8 vs. CON= 85±8 mmHg, $p<0.05$). PMW also increased daytime heart rate (PWM= 85±7. vs. CON= 80±5 bpm, $p<0.05$). Further, a median split based on adiposity did not lead to any meaningful reductions in daytime central BP ($p>0.05$ for all). **CONCLUSION:** PMW does not lead to reductions in central BP in young, physically inactive women.

## INTRODUCTION

Excess adiposity, tobacco use, physical inactivity, and unhealthy diets are all risk factors for the development of hypertension (Artham et al., 2009). Hypertension is defined as a systolic blood pressure (BP) of 129 mmHg or higher and/or a diastolic BP of 79 mmHg or higher. Hypertension has been linked to an increased risk of cardiovascular disease (Fuchs & Whelton, 2020) and is more prevalent in sedentary obese participants compared to their normotensive counterparts (Wildman et al., 2003). Therefore, interventions have been developed to improve modifiable risk factors to reduce adiposity, increase exercise, and dietary interventions to reduce the risk of hypertension and cardiovascular disease in our sedentary obese population.

Exercise has been demonstrated to help lower the risk of CVD independent of body weight and hypertension status (Lunde et al., 2012). As little as 10 minutes of acute moderate-intensity exercise has been demonstrated to acutely lower BP in a normotensive adults directly after exercise (MacDonald et al., 2000). The transient decrease in BP is known as post-exercise hypotension. Further, any decrease in post-exercise BP in normotensive participants are generally greater in overweight and hypertensive participants (Kenney & Seals, 1993). Importantly, the benefits of acute BP reductions may be beneficial in reducing daytime BP. A study by Quinn (2000) found that exercising at moderate (50% $VO_{2max}$) and vigorous (75% $VO_{2max}$) intensity exercise decreased BP over a 24-hour period in hypertensive participants (Quinn, 2000). Although high-intensity exercise is recommended to meet exercise guidelines with benefits of acutely lowering BP (Angadi et al., 2015; Eicher et al., 2010), low-intensity exercise has similarly been demonstrated to reduce BP (Gomes et al., 2010). Therefore, low to moderate-intensity exercise may be a preferred low-risk exercise intervention for sedentary and obese adults.

The acute known reduction in BP following exercise might offer additional benefits following a meal, as previous studies have highlighted the benefit for reducing BP and blood glucose (Lunde et al., 2012; Nygaard et al., 2009). The post-meal effects of exercise provides a novel intervention mechanism, as insulin is known to promote smooth muscle vasodilation and reduce peripheral resistance. Previous research by Stevens and colleagues (2011) demonstrated that post-meal walking lowered blood glucose concentration over a 24-hour period following a single 45 minute bout of exercise in the morning or the afternoon in older individuals (Stevens et al., 2011). New ambulatory BP technology offers an enhanced ability to measure central BP, which has not been studied in an ecological setting. To this point, central BP provides a better prognostic assessment of cardiovascular health compared to brachial BP (Kollias et al., 2016). Central BP is pressure measured at the aorta, which nearby target organs receive (Kollias et al., 2016). As central BP increases, nearby target organs experience increased pressure leading to target organ damage (Mensah, 2016). A paucity of data exists assessing central BP and arterial stiffness following acute exercise. However, available data suggests that resistance exercise and maximal aerobic exercise does not affect central BP and arterial stiffness when measured in a laboratory-based setting (5-30 minutes post-exercise) (Bunsawat et al., 2017; Thiebaud et al., 2016). Acute reductions in central BP remains unknown beyond a laboratory setting.

In addition to understanding the daytime benefits to central BP, there are limited studies assessing the post-exercise hypotension response in women (Bonsu & Terblanche, 2016; Brito et al., 2015; Pescatello et al., 2003; Tibana et al., 2014) and the specific response to post-meal exercise remains unknown in physically inactive young women. Therefore, the purpose of the following study was to determine if three bouts of post-meal walking reduces daytime BP in women. We hypothesized post-meal walking would reduce daytime central BP compared to the control day. Additionally, we examined if the magnitude of the central BP response was greater in young women with excess adiposity.

## METHODS

All experimental procedures were approved by the Institutional Review Board at the University of New Hampshire and were in compliance with the guidelines set forth by the Declaration of Helsinki. Healthy women (age 18-25) with no previous health conditions that were physically inactive were recruited in the study. Participants did not have diabetes, hypertension, cardiovascular disease, stroke, chronic kidney disease, cancer, neurological disease, asthma, chronic obstructive pulmonary disease, and blood clotting diseases. They were also free of injury that prevented completing the post-meal walking regimen.

*Basic Health Profile & Familiarization*

Prior to entry into the study, all participants provided both verbal and written informed consent. All participants first completed a basic health assessment and familiarization session. Each participant was asked to fast and abstain from caffeine, physical exercise, and alcohol for 24 hours before the basic health assessment. Upon arrival, each participant completed a brief health history questionnaire. Next, resting BP, heart rate, and a fasting blood sample were measured. Resting BP (Spot Vital Signs LXi, WelchAllyn; Skaneateles Falls, New York, USA) and heart rate were measured following 5-minutes of quiet rest in a seated position. Fasting blood glucose and lipid were measured from the fasting blood sample (Cholestech LDX Analyzer,Abbott; Chicago, Illinois, USA). Participants were excluded if they had resting hypertension (systolic BP >129 mmHg; diastolic BP > 79 mmHg) or if their fasting blood glucose was greater than or equal to 126 mg/dL. Height, weight, waist circumference, and body fat percentage were completed for Anthropometric measurements. Weight and body fat percentage were measured using bioelectrical impedance analysis (InBody770; Cerritos, California, USA). After completing the basic health profile, we reviewed and familiarized participants to the post-meal walking regimen. During the familiarization, participants completed a walking bout at a Borg (6-20 scale) rating of perceived exertion at 13-14.

### *Control & Post-Meal Walking Day*

Over a 5-day period, participants completed a control day and post-meal walking day in random order. Participants wore a 24-hour BP monitor and the physical activity monitor during both the control and the post-meal walking day. On the control day, participants completed normal daily activities and avoided strenuous physical activity. On the post-meal walking day, participants maintained normal daily activities except for completing three 15-minute bouts of post-meal walking, one after each meal (breakfast, lunch, and dinner). The participant walked for 15 minutes at a walking pace equal to 13-14 on the Borg rating of perceived exertion scale 30 minutes after their meal.

### *Physical Activity Monitoring & Blood Pressure Instrumentation*

An ActivPal Physical Monitor (PAL Technologies Ltd; Glasgow, Scotland) was placed on the right thigh of the participant, 1/3 of the way down from the inguinal crease at their hip. Participants wore the physical activity monitor for each day of the 5-day study. A 24-hour ambulatory BP cuff was placed on the upper arm of the non-dominant arm. We reviewed the proper fitting of the BP cuff to allow the participant to remove for showering and place it again on their arm. The participant wore the BP cuff and the activity monitor for both days. The participant removed the BP cuff before the exercise bout and replaced it immediately after exercise, and immediately began BP measurements again. Daytime BP measurements were taken every 20 minutes. The participant recorded their sleep and wake times to determine daytime and nighttime periods. The participant recorded food intake and mealtime in a diet log on both the control and post-meal walking day. Participants were instructed to consume the same meals and timing of meals as best as possible on the two study days.

### *Data & Statistical Analysis*

All data was presented as mean ± standard deviation. Two-tail paired t-tests compared daytime brachial BP, central BP, heart rate, steps, metabolic equivalents, and arterial stiffness measures between control and post-meal walking days. In a sub-analysis, a median split was performed between women based on adiposity levels. A two-way ANOVA compared average daytime central BP measurements between the two groups and trials (Group x Time).

## RESULTS

A total of 14 women participated in the study. One dropped out due to a non-study related illness and 13 women completed the study. Demographic and anthropometric data are presented in Table 1. Based on the basic health assessment, twelve of the thirteen participants were classified as normotensive and one participant was classified with elevated BP (systolic BP = 124 mmHg). All participants were inactive healthy women with no previous history of diagnosed hypertension, cardiovascular disease, diabetes, or chronic illness.

### *Daytime Central BP Responses to Post-Meal Walking*

Figure 1 displays the difference in activity when comparing the post-meal walking and control day. Post-meal walking increased steps per day and metabolic equivalents compared to control day ($p<0.05$). Figure 2 displays the daytime brachial systolic, diastolic, and mean arterial pressure responses between control and post-meal walking. Both brachial systolic BP and mean arterial pressure trended to increase ($p=0.057$, $p=0.063$ respectively) on the post-meal walking day. Diastolic BP was not different between control and post-meal walking ($p>0.05$). Daytime central BP are provided in Figure 3. Central systolic BP trended towards significance on the post-meal walking day ($p=0.052$). Central diastolic BP was greater on the post-meal walking day compared to the control day. Central mean arterial pressure was higher on the post-meal walking day compared to the control. Daytime heart rate, central pulse pressure, and augmentation pressure are provided in Figure 4. Daytime heart rate was augmented on the post-meal walking day compared to the control day ($p<0.05$), but central pulse pressure and central augmentation pressure were not different ($p>0.05$).

### *Central BP Responses in Adiposity Groups*

Demographic and anthropometric data are presented in Table 2 after a median split was performed on the participants. The participants in the excess adiposity group had a body fat percentage greater than a 30%. Figure 5 displays the daytime central BP and heart rate comparisons between the normal adiposity group and the excess adiposity group. No difference was seen in either group when comparing the post-meal walking and control day for central systolic, diastolic BP, and mean arterial pressure. There was a significant increase in heart rate on the post-meal walking day compared to the control day in both groups.

## DISCUSSION

The novel findings of our study found that post-meal walking did not reduce daytime brachial BP in physically inactive young women. Instead of reducing daytime BP, post-meal walking increased heart rate, central diastolic BP, and mean arterial pressure. Contrary to our hypothesis, post-meal walking did not have a meaningful reduction in daytime BP in physically inactive young women. Additionally, a sub-analysis of young women with excess adiposity revealed no effect of PMW walking to reduce brachial and central BP.

We found no change in daytime brachial BP in physically inactive young women, however, the literature has found decreases in brachial BP. Vriz et al (2002) found that in those who were consistent, heavy (3+ days) exercisers, had a decrease in lab measured and 24-hour BP after 3 months in men with mild hypertension compared to those with less or no exercise. Guimaraes et al (2014) found that in inactive individuals between 40-65 with resistant hypertension, after completing 12 weeks of 3 times a week 60 minute exercise, a significant reduction in 24-hour SBP and DBP overall, including day and night periods. Brachial BP reductions have also been found in normotensive populations. Badrov et al (2016) found that isometric exercise training lowers resting brachial BP in normotensive men and women. Brachial BP reductions have been seen in middle-aged and older populations of women. Lunde et al (2012) found slow walking helps to reduce post-meal acute BP in middle-aged physically inactive women. Harvey et al (2005) found that in healthy postmenopausal women, exercise was found to decrease systolic and diastolic BP, but this was not found in premenopausal women. Brachial BP has been found to be reduced in multiple populations regardless of hypertension status, with most of the studies extending past a single week. It could be hypothesized that if our study was extended for a longer period of time, that we would see a similar reduction in brachial BP.

We found a significant increase in central BP measures in physically inactive young adult women. Central BP assesses the pressor load experienced by nearby target organs. Multiple studies have found a reduction in central BP following exercise in various populations of men. Heffernan et al (2009) found that resistance training led to reductions in central BP in young African American and white men. Croymans et al (2014) found that after high-intensity resistance training, there was a decrease in central systolic and diastolic BP in overweight and obese young men. Goeder et al (2019) found central systolic BP to be decreased up to five hours after a maximum effort of exercise in young, healthy males. There was also a study conducted including women and central BP. Tomschi et al (2018) compared upper and lower body resistance exercise in young adult women. In central systolic BP, they found a decrease in BP 10 minutes following upper body resistance. When looking at central diastolic BP, they found a decrease in BP 10 minutes following exercise in both upper and lower body resistance, however, there was no difference in either central systolic or diastolic BP 60 minutes after the exercise bout. The studies with men saw a longer decrease in central BP than those women and with less studies including women, therefore, this suggests a sex difference response in central BP between sexes. The difference BP response might be due to altered cardiovascular responses to exercise between men and women. Women have been found to have a greater cardiac mediated exercise response than men (Samora et al., 2019).

Contrary to our hypothesis, we found no difference in daytime BP when comparing women with and without excess adiposity. Although obesity is linked to increases in BP and arterial stiffness, we found no meaningful differences in arterial stiffness measures. Mertens & Van Gaal (2000) found that a 5-10% decrease in body weight in obese hypertensive patients can help to normalize BP to normal weight patients. Hu et al (2005) discussed that both weight and physical activity are important claiming that a high level of physical activity did not counteract the mortality associated with obesity and, in turn, that being lean does not eliminate mortality risk that is associated with inactivity. Our excess adiposity group contains women with percentage body fat greater than 30%, with the greatest percent body fat being 41.4%. The BMI range of our excessive adiposity group cohort was 22.4-30, placing them between normal BMI to one being classified as obese. Even though our study found no difference between adiposity levels and BP reduction, most of our cohort was of a lower BMI than the average American, so Americans within the overweight and/or obese category may see a difference in BP and should utilize exercise and healthy diet to decrease their weight.

The study had a few limitations. We tried to control for the menstrual cycle by having each of the participants complete the study during their early follicular phase or placebo phase of their oral contraceptive cycle, however, we do not know how other phases would affect these results. Although several control measures were in place, we only collected data from a small sample of physically inactive women, therefore further studies with larger sample sizes are needed to confirm the effects of PMW on daytime brachial and central BP. Lastly, the effects of diet were not explicitly controlled for therefore, we are unable to determine if participant to participant variations in diet affected our results.

## CONCLUSION

Contrary to our hypothesis, post-meal walking led to increases in central diastolic and mean arterial pressure in physically inactive women. These central blood pressure responses appear to be cardiac driven blood pressure responses as heart rate was elevated, and arterial stiffness measures were not different between control and post-meal walking days. These data suggest the role of potential sex differences between men and women.

## REFERENCES

Angadi, S. I. S. A., Hammar, D. H. M. B., & Aesser, G. L. A. G. (2015). Post-Exercise Hypotension After Continuous, Aerobic Interval, and Sprint Interval Exercise. *Journal of Strength and Conditioning Research*, *29*(10), 2888–2893.

Artham, S. M., Lavie, C. J., Milani, R. V., & Ventura, H. O. (2009). Obesity and hypertension, heart failure, and coronary heart disease - Risk factor, paradox, and recommendations for weight loss. *Ochsner Journal*, *9*(3), 124–132.

Badrov, M. B., Freeman, S. R., Zokvic, M. A., Millar, P. J., & McGowan, C. L. (2016). Isometric exercise training lowers resting blood pressure and improves local brachial artery flow-mediated dilation equally in men and women. *European Journal of Applied Physiology*, *116*(7), 1289–1296. https://doi.org/10.1007/s00421-016-3366-2

Bonsu, B., & Terblanche, E. (2016). The training and detraining effect of high - intensity interval training on post - exercise hypotension in young overweight / obese women. *European Journal of Applied Physiology*, *116*(1), 77–84. https://doi.org/10.1007/s00421-015-3224-7

Brito, A. D. F., Brasileiro-Santos, M. D. S., Oliveira, C. V. V. De, Nobrega, T. K. S. Da, Forjaz, C. L. de M., & Santos, A. D. C. (2015). High-Intensity Resistance Exercise Promotes Post-Exercise Hypotension Greater Than Moderate Intensity and Affects Cardiac Autonomic Responses In Women Who Are Hypertensive. *Journal of Strength and Conditioning Research*, *29*(12), 3486–3493.

Bunsawat, K., Ranadive, S. M., Lane-Cordova, A. D., Yan, H., Kappus, R. M., Fernhall, B., & Baynard, T. (2017). The effect of acute maximal exercise on postexercise hemodynamics and central arterial stiffness in obese and normal-weight individuals. *Physiological Reports*, *5*(7), 1–9. https://doi.org/10.14814/phy2.13226

Croymans, D. M., Krell, S. L., Oh, C. S., Katiraie, M., Lam, C. Y., Harris, R. A., & Roberts, C. K. (2014). Effects of resistance training on central blood pressure and wave reflection in obese adults with prehypertension. *Journal of Human Hypertension*, *28*(3), 143–144. https://doi.org/10.1038/jhh.2013.83

Eicher, J. D., Maresh, C. M., Tsongalis, G. J., & Thompson, P. D. (2010). The additive blood pressure lowering effects of exercise intensity on post-exercise hypotension. *American Heart Journal*, *160*(3), 513–520. https://doi.org/10.1016/j.ahj.2010.06.005

Fuchs, F. D., & Whelton, P. K. (2020). High Blood Pressure and Cardiovascular Disease. *Hypertension*, *75*, 285–292. https://doi.org/10.1161/HYPERTENSIONAHA.119.14240

Goeder, D., Böhm, B., Oberhoffer, R., & Müller, J. (2019). Postexercise changes in peripheral and central blood pressure during a 24-hour ambulatory blood pressure monitoring in healthy young men. *Journal of Sports Medicine and Physical Fitness*, *59*(9), 1593–1598. https://doi.org/10.23736/S0022-4707.19.09448-9

Gomes, C., Jr, C., Gomides, I. R. S., & Cristiane, I. A. (2010). Acute and Chronic Effects of Aerobic and Resistance Exercise on Ambulatory Blood Pressure. *Clinics*, *65*(3), 317–325. https://doi.org/10.1590/S1807-59322010000300013

Guimaraes, G. V., Galvani de Barros Cruz, L., Fernandes-silva, M. M., Lima, E., & Alcides, E. (2014). Heated water-based exercise training reduces 24-hour ambulatory blood pressure levels in resistant hypertensive patients : A randomized. *International Journal of Cardiology*, *172*(2), 434–441. https://doi.org/10.1016/j.ijcard.2014.01.100

Harvey, P. J., Morris, B. L., Kubo, T., Picton, P. E., Su, W. S., Notarius, C. F., & Floras, J. S. (2005). Hemodynamic after-effects of acute dynamic exercise in sedentary normotensive postmenopausal women. *Journal of Hypertension*, *23*(2), 285–292. https://doi.org/10.1097/00004872-200502000-00010

Heffernan, K. S., Fahs, C. A., Iwamoto, G. A., Jae, S. Y., Wilund, K. R., Woods, J. A., & Fernhall, B. (2009). Resistance exercise training reduces central blood pressure and improves microvascular function in African American and white men. *Atherosclerosis*, *207*(1), 220–226. https://doi.org/10.1016/j.atherosclerosis.2009.03.043

Hu, F. B., Willett, W. C., Li, T., Stampfer, M. J., Colditz, G. A., & Manson, J. E. (2005). Adiposity as compared with physical activity in predicting mortality among women: Editor's comments. *American Journal of Health Promotion*, *20*(2), 155–156.

Kenney, M. J., & Seals, D. R. (1993). Postexercise Hypotension - Key Features, Mechanims, and Clinical Significance. *American Heart Journal*, *22*(5).

Kollias, A., Lagou, S., Zeniodi, M. E., Boubouchairopoulou, N., & Stergiou, G. S. (2016). Central Blood Pressure Association of Central Versus Brachial Blood Pressure Systematic Review and Meta-Analysis. *Hypertension*, 183–190. https://doi.org/10.1161/HYPERTENSIONAHA.115.06066

Lunde, M. S. H., Hjellset, V. T., & Høstmark, A. T. (2012). Slow post meal walking reduces the blood glucose response: An exploratory study in female Pakistani immigrants. *Journal of Immigrant and Minority Health*, *14*(5), 816–822. https://doi.org/10.1007/s10903-012-9574-x

MacDonald, J. R., MaDdougall, J. D., & Hogben, C. D. (2000). The effects of exercise duration on post- exercise hypotension. *Journal of Hu*, *14*, 125–129.

Mensah, G. A. (2016). *O rgan D amage : D on ' t B elieve E verything Y ou T hink ! 26*(3), 275–278. https://doi.org/10.18865/ed.26.3.275

Mertens, I. L., & Van Gaal, L. F. (2000). Overweight, obesity, and blood pressure: the effects of modest weight reduction. *Obesity Research*, *8*(3), 270–278. https://doi.org/10.1038/oby.2000.32

Nygaard, H., Tomten, S. E., & Høstmark, A. T. (2009). Slow postmeal walking reduces postprandial glycemia in middle-aged women. *Applied Physiology, Nutrition and Metabolism*, *34*(6), 1087–1092. https://doi.org/10.1139/H09-110

Pescatello, L. S., Bairos, L., VanHeest, J. L., Maresh, C. M., Rodriguez, N. R., Moyna, N. M., DiPasquale, C., Collins, V., Meckes, C. L., Krueger, L., & Thompson, P. D. (2003). Postexercise hypotension differs between white and black women. *American Heart Journal*, *145*(2), 364–370. https://doi.org/10.1067/mhj.2003.107

Quinn, T. J. (2000). Twenty-four hour , ambulatory blood pressure responses following acute exercise : impact of exercise intensity. *Journal of Human Hypertension*, *14*, 547–553.

Samora, M., Incognito, A. V., & Vianna, L. C. (2019). Sex differences in blood pressure regulation during ischemic isometric exercise: The role of the β-adrenergic receptors. *Journal of Applied Physiology*, *127*(2), 408–414. https://doi.org/10.1152/japplphysiol.00270.2019

Stevens, M. M., Gribok, A., Rumpler, W., & DiPetro, L. (2011). Post-meal Exercise And 24-h Glycemic Control In Older People Glycemic Control Strategies In A Distance Runner With Type 1 Diabetes Training For A Marathon. *American College of Sports Medicine*, 18138.

Thiebaud, R. S., Fahs, C. A., Rossow, L. M., Loenneke, J. P., Kim, D., Mouser, J. G., Beck, T. W., Bemben, D. A., Larson, R. D., & Bemben, M. G. (2016). Effects of age on arterial stiffness and central blood pressure after an acute bout of resistance exercise. *European Journal of Applied Physiology*, *116*(1), 39–48. https://doi.org/10.1007/s00421-015-3242-5

Tibana, R. A., Manoel, N., Sousa, F. De, Vieira, A., Almeida, J. A. De, & Prestes, J. (2014). Effects of Resistance Exercise Versus Combined Training On Post-Exercise Hypotension in Women with Metabolic Syndrome. *RBCDH*, *March*.

Tomschi, F., Köster, P., Predel, H. G., Lay, D., Bloch, W., & Grau, M. (2018). Acute effects of lower and upper body-resistance training on arterial stiffness, peripheral, and central blood pressure in young normotensive women. *Sport Sciences for Health*, *14*(2), 357–363. https://doi.org/10.1007/s11332-018-0440-7

Vriz, O., Mos, L., Frigo, G., Sanigi, C., Zanata, G., Pegoraro, F., & Palatini, P. (2002). *Effects of physical exercise on clinic and 24-hour ambulatory blood ...*

Wildman, R. P., Mackey, R. H., Bostom, A., Thompson, T., & Sutton-tyrrell, K. (2003). *Measures of Obesity Are Associated With Vascular Stiffness in Young and Older Adults*. 468–473. https://doi.org/10.1161/01.HYP.0000090360.78539.CD

## FIGURE LEGENDS

**Figure 1.**

Post-meal walking increased step count and energy expenditure (METs) compared to the control day. PMW, post-meal walking. *$p<0.05$ vs. control.

**Figure 2.**

Daytime brachial blood pressure did not decrease with PMW. However, there were trends for an increase in daytime systolic and mean arterial pressure. PMW, post-meal walking.

**Figure 3.**

Post-meal walking increased day time central diastolic blood pressure and mean arterial pressure compared to the control day. PMW did not increase daytime central systolic blood pressure. PMW, post-meal walking. *$p<0.05$ vs. control.

**Figure 4.**

Post-meal exercise increased daytime heart rate but had no effect on measures of arterial stiffness measures (central pulse pressure & central augmentation pressure). PMW, post-meal walking; HR, heart rate; PP, pulse pressure. *$p<0.05$ vs. control.

**Figure 5.**

A median split based on adiposity found no difference in central BP responses to post-meal walking between normal and excess adiposity groups. However, both groups did have an elevated daytime heart rate on the post-meal walking day. PMW, post-meal walking; HR, heart rate; SBP, systolic blood pressure; DBP, diastolic blood pressure; MAP, mean arterial pressure. *$p<0.05$ vs. control.

Table 1

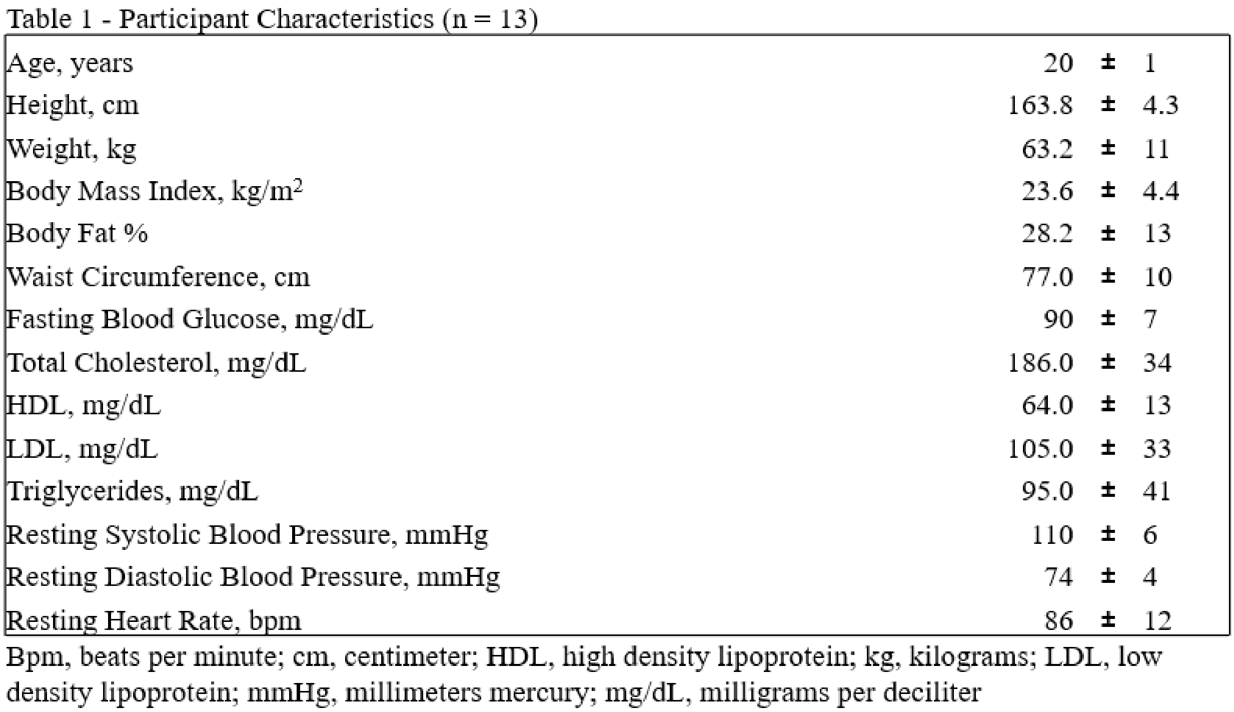


Table 1 - Participant Characteristics (n = 13)

| | | | |
|---|---|---|---|
| Age, years | 20 | ± | 1 |
| Height, cm | 163.8 | ± | 4.3 |
| Weight, kg | 63.2 | ± | 11 |
| Body Mass Index, kg/m$^2$ | 23.6 | ± | 4.4 |
| Body Fat % | 28.2 | ± | 13 |
| Waist Circumference, cm | 77.0 | ± | 10 |
| Fasting Blood Glucose, mg/dL | 90 | ± | 7 |
| Total Cholesterol, mg/dL | 186.0 | ± | 34 |
| HDL, mg/dL | 64.0 | ± | 13 |
| LDL, mg/dL | 105.0 | ± | 33 |
| Triglycerides, mg/dL | 95.0 | ± | 41 |
| Resting Systolic Blood Pressure, mmHg | 110 | ± | 6 |
| Resting Diastolic Blood Pressure, mmHg | 74 | ± | 4 |
| Resting Heart Rate, bpm | 86 | ± | 12 |

Bpm, beats per minute; cm, centimeter; HDL, high density lipoprotein; kg, kilograms; LDL, low density lipoprotein; mmHg, millimeters mercury; mg/dL, milligrams per deciliter

Table 2

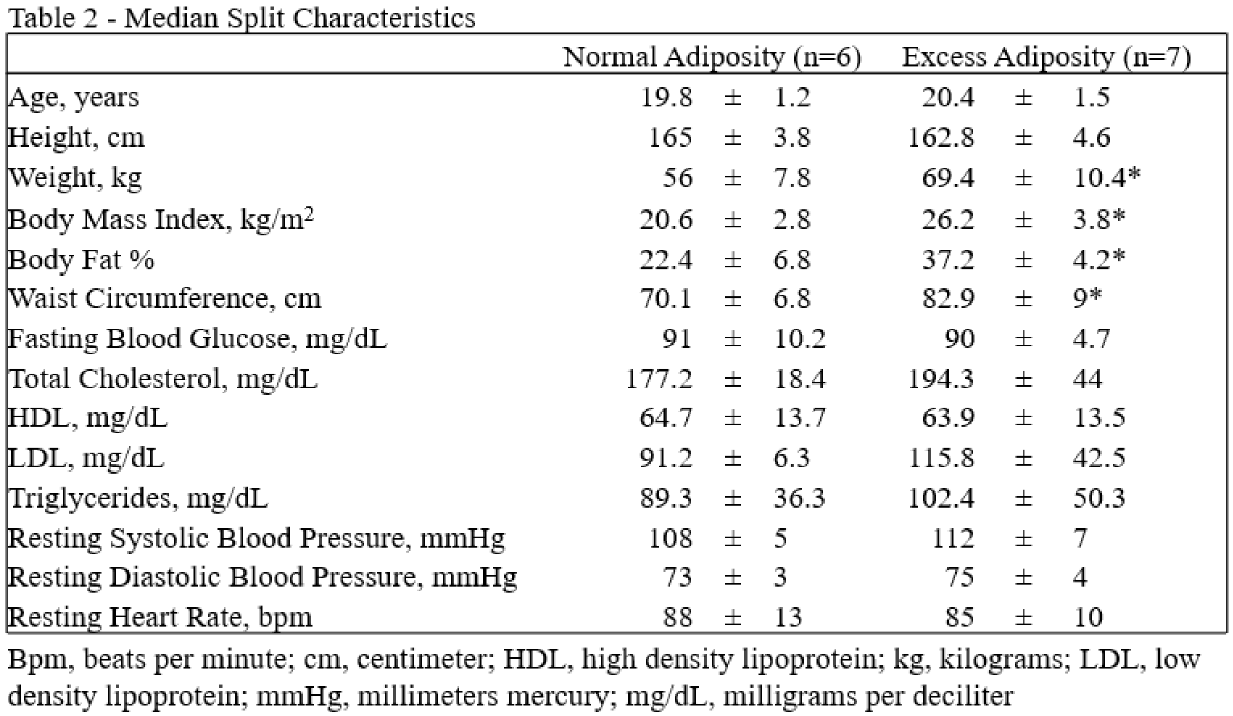


Table 2 - Median Split Characteristics

| | Normal Adiposity (n=6) | Excess Adiposity (n=7) |
|---|---|---|
| Age, years | 19.8 ± 1.2 | 20.4 ± 1.5 |
| Height, cm | 165 ± 3.8 | 162.8 ± 4.6 |
| Weight, kg | 56 ± 7.8 | 69.4 ± 10.4* |
| Body Mass Index, kg/m$^2$ | 20.6 ± 2.8 | 26.2 ± 3.8* |
| Body Fat % | 22.4 ± 6.8 | 37.2 ± 4.2* |
| Waist Circumference, cm | 70.1 ± 6.8 | 82.9 ± 9* |
| Fasting Blood Glucose, mg/dL | 91 ± 10.2 | 90 ± 4.7 |
| Total Cholesterol, mg/dL | 177.2 ± 18.4 | 194.3 ± 44 |
| HDL, mg/dL | 64.7 ± 13.7 | 63.9 ± 13.5 |
| LDL, mg/dL | 91.2 ± 6.3 | 115.8 ± 42.5 |
| Triglycerides, mg/dL | 89.3 ± 36.3 | 102.4 ± 50.3 |
| Resting Systolic Blood Pressure, mmHg | 108 ± 5 | 112 ± 7 |
| Resting Diastolic Blood Pressure, mmHg | 73 ± 3 | 75 ± 4 |
| Resting Heart Rate, bpm | 88 ± 13 | 85 ± 10 |

Bpm, beats per minute; cm, centimeter; HDL, high density lipoprotein; kg, kilograms; LDL, low density lipoprotein; mmHg, millimeters mercury; mg/dL, milligrams per deciliter

Figure 1.

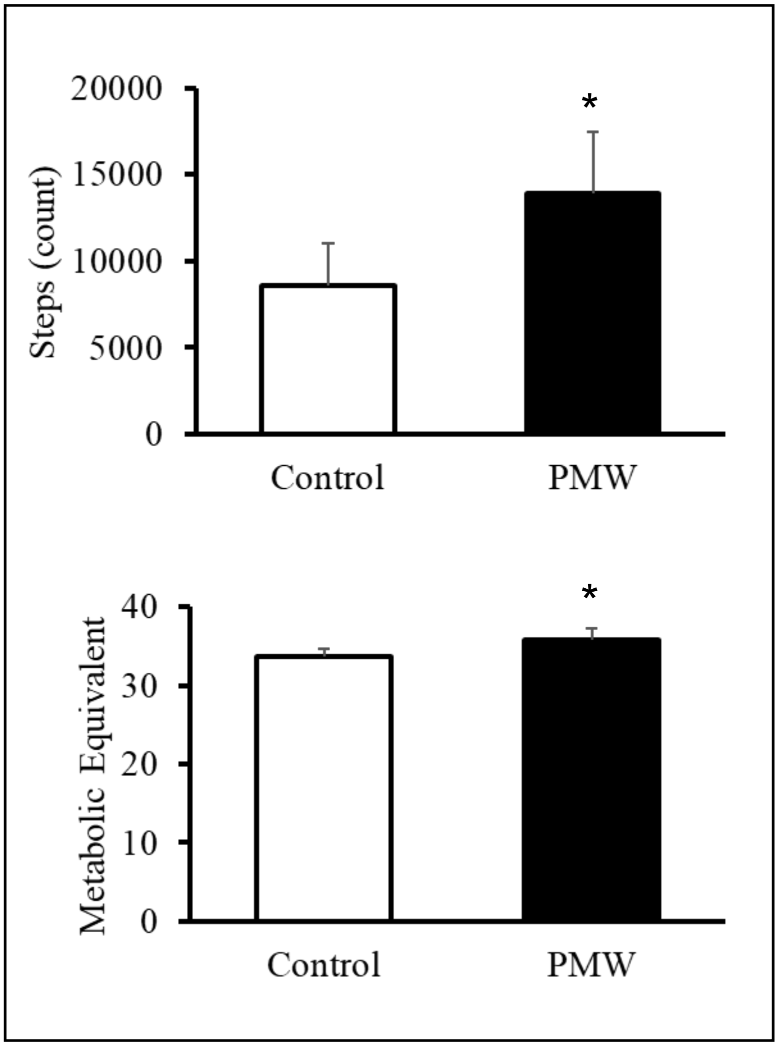

20000
15000
10000
5000
0
Steps (count)
*
Control
PMW
40
30
20
10
0
Metabolic Equivalent
*
Control
PMW

Figure 2.

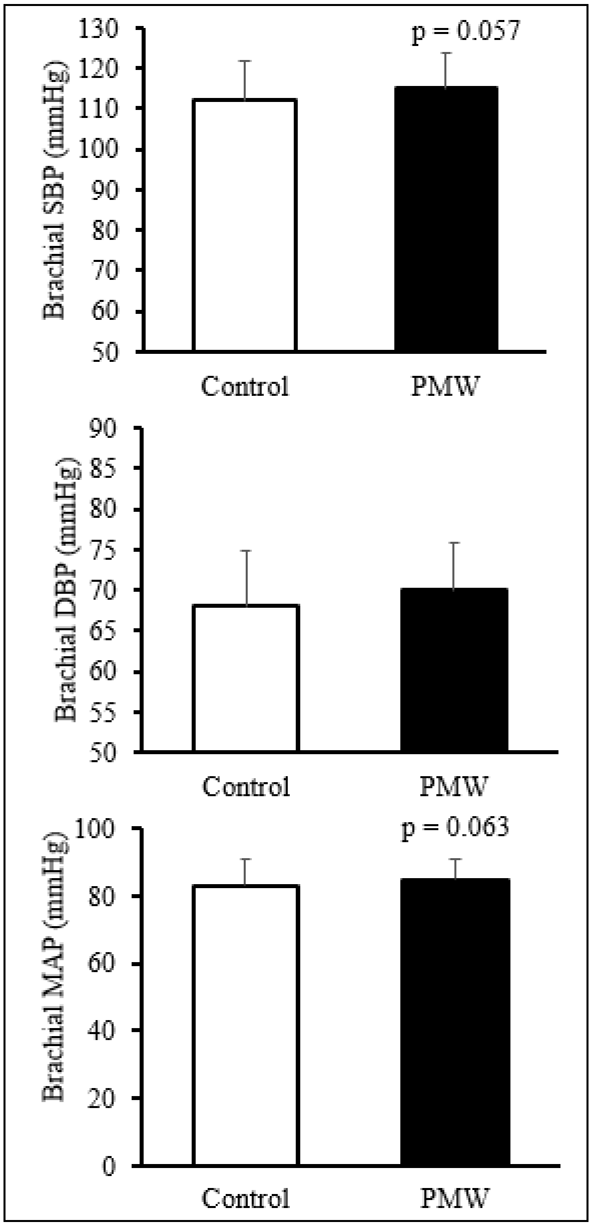

p = 0.057
Brachial SBP (mmHg)
130
120
110
100
90
80
70
60
50
Control
PMW
Brachial DBP (mmHg)
90
85
80
75
70
65
60
55
50
Control
PMW
p = 0.063
Brachial MAP (mmHg)
100
80
60
40
20
0
Control
PMW

Figure 3.

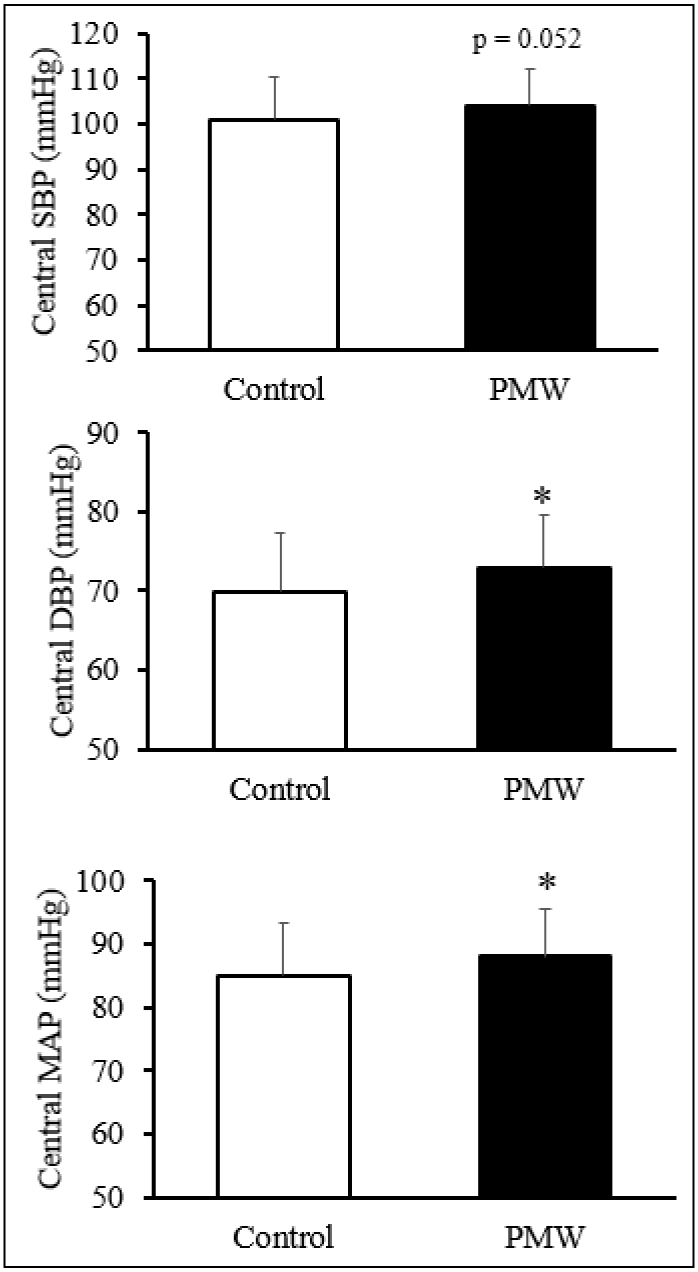

Central SBP (mmHg)
120
110
100
90
80
70
60
50
p = 0.052
Control
PMW
Central DBP (mmHg)
90
80
70
60
50
*
Control
PMW
Central MAP (mmHg)
100
90
80
70
60
50
*
Control
PMW

Figure 4.

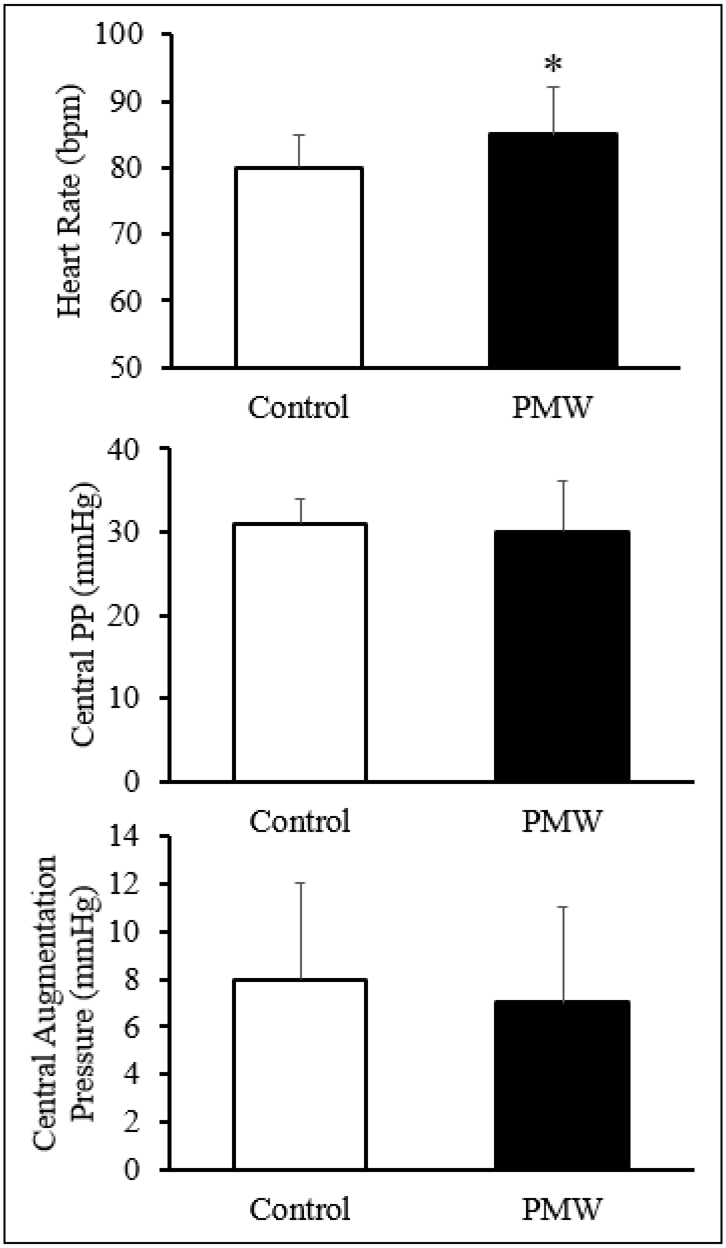
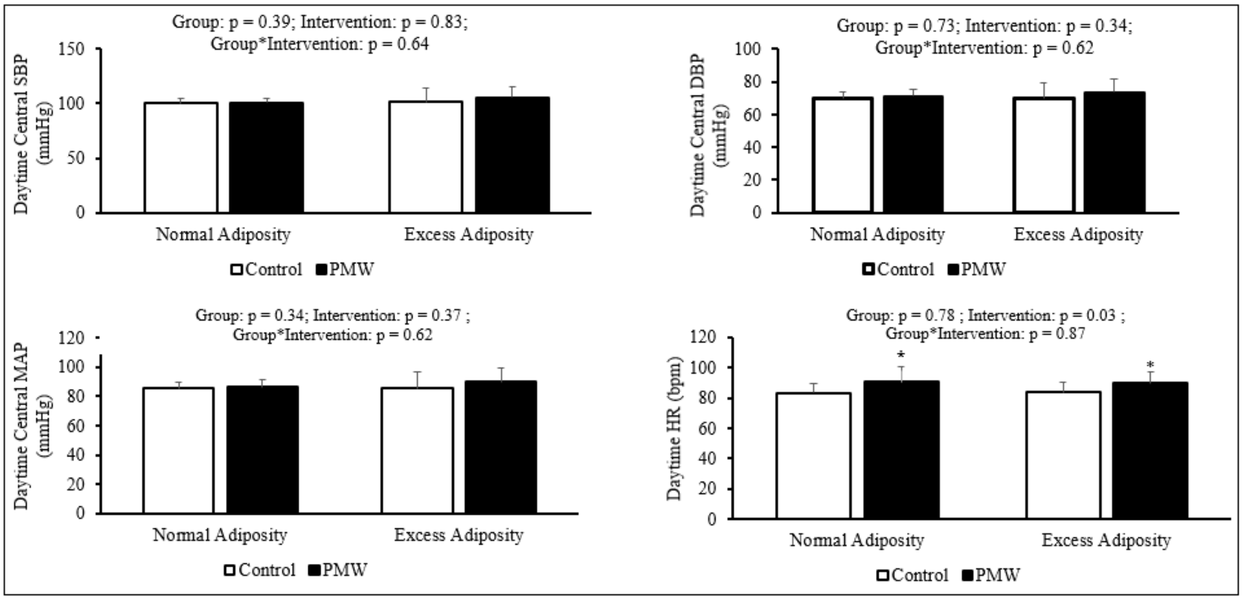

Heart Rate (bpm)
100
90
80
70
60
50
*
Control
PMW
Central PP (mmHg)
40
30
20
10
0
Control
PMW
Central Augmentation Pressure (mmHg)
14
12
10
8
6
4
2
0
Control
PMW

Figure 5.


Group: p = 0.39; Intervention: p = 0.83;
Group*Intervention: p = 0.64
Daytime Central SBP (mmHg)
150
100
50
0
Normal Adiposity
Excess Adiposity
☐Control ■PMW
Group: p = 0.73; Intervention: p = 0.34;
Group*Intervention: p = 0.62
Daytime Central DBP (mmHg)
100
80
60
40
20
0
Normal Adiposity
Excess Adiposity
☐Control ■PMW
Group: p = 0.34; Intervention: p = 0.37 ;
Group*Intervention: p = 0.62
Daytime Central MAP (mmHg)
120
100
80
60
40
20
0
Normal Adiposity
Excess Adiposity
☐Control ■PMW
Group: p = 0.78 ; Intervention: p = 0.03 ;
Group*Intervention: p = 0.87
Daytime HR (bpm)
120
100
80
60
40
20
0
*
*
Normal Adiposity
Excess Adiposity
☐Control ■PMW