Published in final edited form as:

J Wine Res. 2011 ; 22(2): 113–117. doi:10.1080/09571264.2011.603217.

Moderate Wine Consumption Inhibits the Development of the Metabolic Syndrome: The Study of Women's Health Across the Nation (SWAN)

I. JANSSEN,

Department of Preventive Medicine, Rush University Medical Center, 1700 W Van Buren, Suite 470, Chicago, IL 60612, USA (imke_janssen@rush.edu).

L. H. POWELL, and R. P. WILDMAN

Abstract

We investigated the relationship between wine consumption and the metabolic syndrome (MetS) in a longitudinal, eight-year study of the natural history of the menopause transition at seven geographical sites in the United States. Although similar in age, the 527 African American women had a worse metabolic profile than 1057 Caucasian women. Moderate wine consumption (one glass/day) was less common among African American women but was associated with a better lipid profile in both ethnic groups. Compared to women who drank one glass of wine per day, those who consumed no wine had twice the risk of developing the MetS.

Introduction

The metabolic syndrome (MetS) is associated with an increased risk of developing cardiovascular disease (CVD) (Lloyd-Jones, 2009). We have shown previously that the incidence of the MetS increases through the menopausal transition, primarily due to the increasing predominance of testosterone in the hormonal milieu (Janssen *et al.*, 2008). Lifestyle factors associated with MetS include low physical activity, smoking, and high fat diet. A meta-analysis (Alkerwi *et al.*, 2009) showed that moderate alcohol intake is associated with lower incidence of MetS; in general, alcohol intake is associated with elevated blood pressure, lower triglycerides, and higher HDL (Baer *et al.*, 2002; Opie and Lecour, 2007). Because alcohol has opposite effects on certain MetS components, separate examination of components is warranted. One longitudinal study of MetS components (Sonnenberg *et al.*, 2005) found no association between average three-year alcohol intake, or change in alcohol intake, and any of the five metabolic syndrome components in women. There are no data to date on the link between wine consumption and the development of the MetS, or its components, in women.

Methods

This was a longitudinal, eight-year study of 1057 Caucasian and 527 African American women in SWAN, a study of the natural history of the menopause transition (Sowers *et al.*, 2000). Women aged 42 to 52 who were either pre- or early peri-menopausal were recruited in 1996/97 at seven geographical sites across the US. Participants for the current study were eligible if they identified themselves as African American or Caucasian, did not have MetS or diabetes at baseline, and if they had baseline and at least one follow-up assessment of wine consumption. Wine consumption was assessed by questionnaire with nine possible responses: none or less than 1 per month, 1–3 per month, 1 per week, 2–4 per week, 5–6 per week, 1 per day, 2–3 per day, 4 per day, 5 or more per day; these were condensed into categories of none, <1 glass/day, 1 glass/day, or >1 glass/day. Since wine consumption was

stable over time for the women with repeat assessment (Powell *et al.*, 2007), we took the maximum reported wine consumption over the time of follow-up as the wine measure in this analysis. The presence of health conditions (heart disease, arthritis, hypertension, osteoporosis) was assessed by questionnaire at baseline. Physical activity was assessed at baseline using an adaptation of the Kaiser Physical Activity Survey, a self-administered questionnaire (Sternfeld *et al.*, 2004). Summary data are presented as mean (SD) or %, as appropriate, unless indicated otherwise. Bioavailable testosterone was calculated as $T \text{ (mg/dL)} * 100 / [28.84 * \text{SHBG (nM)}]$. Testosterone values were transformed by logarithm before analysis to ensure that the distributions of the residuals were close to normal. The association between wine consumption and the MetS was analyzed using generalized estimating equations (GEE). Associations between wine consumption and the components of MetS, that is, waist circumference, HDL, glucose, triglycerides, and systolic blood pressure, were analyzed as repeated measures mixed models with a random intercept. Each of the six analyses started by examining a race by wine interaction in a minimally adjusted model with age and education. This interaction was significant for waist circumference only and led to race-specific analyses for this variable. For all other analyses, the ethnic groups were combined. All models included age, study site, education, smoking, self-assessed health, percentage calorie intake from fat, physical activity, total number of alcohol servings, and testosterone, as well as ethnicity in the overall models.

Results

Table 1 shows that African American women were similar to Caucasian women in age, but differed significantly in most lifestyle and cardiovascular risk parameters. The overall relation between the amount of wine consumption and MetS is shown in Table 2. Figure 1 plots the rates of MetS by wine consumption using the raw data. Women who consume one glass of wine per day had the lowest risk of MetS and a significantly lower risk than women who consumed no wine ($p = 0.031$).

Figure 2 plots the means of the MetS components by wine consumption from the raw data. The strongest association was between wine consumption and HDL cholesterol; the higher the wine consumption, the higher the HDL, with all pairwise comparisons being highly significant ($p < 0.001$). Triglycerides were significantly lower for moderate wine consumers than abstinent women ($p < 0.001$).

Glucose levels were unrelated to wine consumption. Women who consumed >1 glass/day had higher blood pressure than all other groups. Despite higher blood pressure for black women, the pattern was the same in both racial groups. Therefore, the graph presents averages across race. Figure 3 portrays the statistically significant interaction between wine consumption and ethnicity for waist circumference. Caucasian moderate wine drinkers had the lowest waist circumference, and this was significantly different from those who drank no or <1 glass/day (both $p < 0.01$). African American women who drank >1 glass/day had the largest waist circumference, but none of the group comparisons was statistically significant.

Conclusions

In this longitudinal study, moderate wine consumption (1 glass/day) was associated with lower odds of developing the MetS in midlife women, mainly through the beneficial association between wine consumption and HDL cholesterol and triglycerides, consistent with the literature (Baer *et al.*, 2002; Opie and Lecour, 2007). Our findings of no relationship of wine consumption with glucose levels are similar to results from large cross-sectional studies (Djoussé *et al.*, 2004). Blood pressure was higher only in women who consumed more than 1 glass of wine per day, consistent with findings from intervention

studies (Leighton and Urquiaga, 2007). The finding that waist circumference was higher in African American women but lower in Caucasian women who drank 1 glass of wine per day may indicate different drinking patterns in the two groups. Using a rigorous longitudinal design, the current study supports the hypothesis that moderate wine consumption has a beneficial effect on the risk of MetS.

Acknowledgments

The Study of Women's Health Across the Nation (SWAN) has grant support from the National Institutes of Health, DHHS, through the National Institute on Aging, the National Institute of Nursing Research and the NIH Office of Research on Women's Health (Grants NR004061; AG012505, AG012535, AG012531, AG012539, AG012546, AG012553, AG012554, AG012495). The content of this paper is solely the responsibility of the authors and does not necessarily represent the official views of the NIA, NINR, ORWH or the NIH.

References

- ALKERWI A, BOUTSEN M, VAILLANT M, et al. Alcohol consumption and the prevalence of metabolic syndrome: a meta-analysis of observational studies. *Atherosclerosis*. 2009; 204(2):624–635. [PubMed: 19084839]
- BAER DJ, JUDD JT, CLEVIDENCE BA, et al. Moderate alcohol consumption lowers risk factors for cardiovascular disease in postmenopausal women fed a controlled diet. *Am. J. Clin. Nutr.* 2002; 75(3):593–599. [PubMed: 11864868]
- DJOUSSE L, ARNETT DK, ECKFELDT JH, PROVINCE MA, SINGER MR, ELLISON RC. Alcohol consumption and metabolic syndrome: does the type of beverage matter? *Obesity Research*. 2004; 12:1375–1385. [PubMed: 15483202]
- JANSSEN I, POWELL LH, CRAWFORD S, LASLEY B, SUTTON-TYRRELL K. Menopause and the metabolic syndrome. *Arch. Intern. Med.* 2008; 168:1568–1575. [PubMed: 18663170]
- LEIGHTON F, URQUIAGA I. Changes in cardiovascular risk factors associated with wine consumption in intervention studies in humans. *Annals of Epidemiology*. 2007; 17(5)(Supplement 1):S32–S36.
- LLOYD-JONES D, ADAMS R, CARNETHON M, et al. Heart disease and stroke statistics—2009 update: a report from the American Heart Association statistics committee and stroke statistics subcommittee. *Circulation*. 2009; 119(3):e21–181. [PubMed: 19075105]
- OPIE LH, LECOUR S. The red wine hypothesis: from concepts to protective signalling molecules. *Eur. Heart J.* 2007; 28(14):1683–1693. [PubMed: 17561496]
- POWELL, LH.; JANSSEN, I.; WESLEY, D. Stability of moderate wine consumption over seven years in middle-aged women. In: DROUET, L.; TIESSEDRE, P-L., editors. *Proceedings of the 3rd International Congress on Wine and Health 2007, Winehealth 2007*; Bordeaux: Vigne et Vin Publications Internationales; 2007. p. 34-35. www.vigne-vin.com
- SONNENBERG L, PENCINA M, KIMOKOTI R, et al. Dietary patterns and the metabolic syndrome in obese and non-obese Framingham women. *Obes. Res.* 2005; 13(1):153–162. [PubMed: 15761175]
- SOWERS, MF.; CRAWFORD, S.; STERNFELD, B. SWAN: a multicenter, multiethnic, community-based cohort study of women and the menopausal transition. In: LOBO, RA.; KELSEY, J.; MARCUS, R., editors. *Menopause: Biology and Pathobiology*. Academic; San Diego, CA and London: 2000. p. 175-188.
- STERNFELD B, WANG H, QUESENBERRY CP, et al. Physical activity and changes in weight and waist circumference in midlife women: findings from the study of women's health across the nation. *Am. J. Epidemiol.* 2004; 160(9):912–922. [PubMed: 15496544]

Figure 1.
Development of the metabolic syndrome by year of visit and by glasses of wine per day

Figure 2.
Components of MetS by glasses of wine per day.

Figure 3.
Waist Circumference by glasses of wine per day for each ethnic group

Table 1

Characteristics of the study population at baseline overall and by race

		African American	Caucasian
Demographics	<i>N</i>	527	1057
	Age (years), $\bar{x}$ (SD)	46.1 (2.6)	46.3 (2.7)
	College education, %	35.7	57.4 ***
	Family income median, %	60.9	82.5 ***
CV risk factors	alcohol servings, $\bar{x}$ (SD)	0.2 (0.4)	0.4 (0.6)
	% Kcal from fat, $\bar{x}$ (SD)	33.7 (7.2)	32.6 (7.4) **
	physical activity, $\bar{x}$ (SD)	7.4 (1.7)	8.3 (1.7) ***
	smoker, %	22.7	13.5 ***
	any health condition, %	54.3	36.0 ***
	bioavailable testosterone *	3.2 (1–12.9)	3.4 (1–11.4)
MetS variables	Waist (cm), $\bar{x}$ (SD)	87.3 (14.0)	80.8 (12.3) ***
	SBP (mm Hg), $\bar{x}$ (SD)	121.9 (19.6)	111.2 (12.7) ***
	HDL (mg/dL), $\bar{x}$ (SD)	60.1 (14.9)	59.5 (13.5)
	Glucose (mg/dL), $\bar{x}$ (SD)	90.8 (8.6)	89.0 (7.8) ***
	Triglycerides (mg/dL), $\bar{x}$ (SD)	81.1 (32.9)	90.1 (39.1) ***

*
geometric mean and 95% CI***
 $p < .001$,**
 $p < .01$.

Table 2

Wine and the metabolic syndrome

	RR (95 % CI)
Time	1.20 (1.17–1.23) ***
Wine consumption	
>1 glass/day	1.76 (0.96–3.21)
= 1 glass/day	Reference
<1 glass/day	1.59 (0.71–3.60)
None	2.10 (1.07–4.12) *

 $p < .001$,

*
 $p < .05$.