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Urinary catecholamine excretion in men and women: Between- and within-subject variation

Maria C.P. Souza,* William V. Rumpler,* Larry W. Douglass,† and Juliette C. Howe*

**Diet and Human Performance Laboratory, Beltsville Human Nutrition Research Center, U.S. Department of Agriculture, Beltsville, MD USA; and †Animal Sciences Department, Biometrics Program, University of Maryland, College Park, MD USA*

Twenty-two women and 12 men collected 24-hr urine samples under free-living conditions. The study was conducted to determine the variation in urinary catecholamine excretion between and within subjects, as well as the impact of alcohol consumption on this variation. Subjects were fed controlled diets (20% or 40% of energy from fat) for two 8-week periods; within each dietary group, subjects consumed a carrier beverage with ethanol (5% of daily energy intake) during one 8-week period. Urine samples were collected during week 5 of each period for 4 consecutive days and analyzed for epinephrine, norepinephrine, and dopamine by HPLC with electrochemical detection. There was no significant effect due to dietary fat on catecholamines excretion; therefore, all subjects were combined. Coefficients of variation were determined separately for men and women and for alcohol consumption within sex. Daily excretion of epinephrine and norepinephrine was significantly greater ($P < 0.01$) in men than in women. Within- and between-subject variability presented large coefficients of variation for both men (28–48%) and women (22–47%). Although within-subject variation was similar for men and women, between-subject variation was consistently greater for women than for men regardless of alcohol consumption or abstention. Alcohol consumption did not significantly affect the levels of urinary catecholamine excretion within sex. However, both within- and between-subject variation decreased during alcohol consumption in all subjects. (J. Nutr. Biochem. 9:396–401, 1998) *Published by Elsevier Science Inc. 1998*

Keywords: urinary catecholamine excretion; alcohol consumption; humans; intra- and intersubject variation

Introduction

A decrease in sympathoadrenal system (SA) activity may lead to weight gain and finally to obesity. The SA, a unique neuroendocrine unit comprising the sympathetic nervous system and the adrenal glands, is involved in the control of energy expenditure and substrate mobilization from the various body stores.[1–3] Among the indirect methods currently used to assess SA activity, measurement of plasma catecholamine levels seems to be the most extensively used.[4] However, some drawbacks are associated with measurements of plasma catecholamines in human subjects: the technique is invasive, basal concentrations of epinephrine are low, and collection techniques and procedures vary widely.[5] Urinary catecholamine excretion provides an integrated measure of SA activity: the measurement is relatively easy to obtain, urinary concentrations are higher than those in human plasma, and collection procedures are well established and noninvasive.

Genetic and environmental factors, namely subject sex, cigarette smoking, caffeine intake, stress, menstrual cycle in women, dietary changes, and alcohol consumption,[6,7] can influence SA activity and hence affect subject variation in urinary catecholamine output. Information on the day-to-day and intersubject variability of 24-hour catecholamine excretion levels is very limited. The purpose of this study

Address correspondence and reprint requests to Juliette C. Howe, PhD, U.S. Department of Agriculture, Beltsville Human Nutrition Research Center, Nutrient Data Laboratory, 4700 River Rd., Riverdale, MD 20737; e-mail: <howe@rbhnrc.usda.gov>.

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Table 1 Pretreatment physical characteristics of subjects: means ± SEM (range)

Characteristic	Women (n = 22)	Men (n = 12)
Age (years)	52 ± 1.1 (41–59)	51 ± 2.6 (38–62)
Height (cm)	166 ± 1.2 (154–178)	180 ± 2.5 (166–194)
Weight (kg)	65 ± 2.2 (49–93)	84 ± 2.7 (72–105)
BMI[1] (kg/m^2)	23.8 ± 0.73 (19.2–31.1)	26.2 ± 0.62 (23.0–28.9)
LBM[2] (kg)	45.2 ± 0.86 (39.1–53.7)	64.8 ± 1.51 (54.7–72.0)
Body fat[3] (%)	29.7 ± 1.37 (19.1–42.3)	22.5 ± 1.75 (14.1–34.8)

[1]Body mass index = weight(kg)/height^2(m).
[2]Lean body mass determined by bioelectric impedence analysis using the sex-specific equation developed by Kushner and Schoeller (ref. 10).
[3]% Body fat = (weight − LBM)/weight × 100.

was to estimate the within- and between-subject variation in urinary epinephrine (EPI), norepinephrine (NE), and dopamine (DA) excretion in free-living adult men and women. The effect of sex and alcohol consumption on the within- and between-subject variation was also examined.

Methods and materials

Subjects

Twenty-two women (aged 41–59 years) and 12 men (aged 38–62 years) selected from subjects participating in a larger study (assessing energy expenditure associated with moderate alcohol consumption)[8] were asked to collect 24-hr urine samples for 4 consecutive days during each of the two experimental periods. Urine samples were collected during subjects' habitual daily activities without any major disturbance to their normal routine. Subject selection was based on body mass index, percentage body fat, and habitual alcohol consumption to optimize group homogeneity. Subjects' physical characteristics are shown in *Table 1*. All subjects were normotensive, nondiabetic nonsmokers and had normal blood chemistry values. A cooperating physician conducted physical evaluations on all subjects before selection and reviewed and monitored all procedures for possible medical implications and health hazards. Subjects were informed of the general purpose of the study and had all procedures explained to them. Expectations of the researchers for subjects were described in detail as written information or as consent forms. Informed consent was obtained and documented. All procedures were approved by the institutional review boards of Georgetown University and the U.S. Department of Agriculture (USDA).

The study was divided into two 8-week periods with an 8-week washout. Subjects were randomly assigned to receive either a high- or low-fat diet for the entire study. The diets were formulated to be isoenergetic using current values from USDA handbook No. 8.[9] The diets were designed to provide approximately 14% of dietary energy (%en) from protein and either 20 %en fat/66 %en carbohydrate (low-fat diet) or 40 %en fat/46 %en carbohydrate (high-fat diet). Foods used were those normally found in human diets and met known nutritional recommendations. No test chemicals or test additives were added other than those consistent with the objectives of the study. Energy intakes were adjusted to maintain body weight throughout the study. Subjects consumed breakfast and dinner at the Beltsville Human Nutrition Research Center's diet study facility under the supervision of a registered dietitian or a dietary technician. Lunches, snacks, and weekend meals were packed for off-site consumption.

Subjects within each dietary group (low or high fat) also consumed a carrier beverage, i.e., either a grape-colored, non-fruit-juice beverage (Gatorade Co., Chicago, IL USA) or a dealcoholized red wine (Cabernet Sauvignon, Ariel Vineyards, Napa, CA USA). During each of the 8-week treatment periods, the carrier beverage was supplemented (5% of daily energy intake) with either ethanol or polycose (Ross Lab., Columbus, OH USA) in a crossover pattern. The amount of ethanol consumed fell within the range of moderate alcohol consumption. Subjects received from 14.3 g of ethanol/day (1.2 drinks/day) to 28.6 g ethanol/day (2.4 drinks/day) depending on their total daily energy intake. The standard drink contained 12 g ethanol. Subjects were given the beverage for consumption at home with a small amount of food saved from the evening meal.

Measurements and analyses

Anthropometry. Measurements of height, weight, and percentage body fat were taken during the initial screening. Body weights of fasted subjects were determined using a Type E 1200 balance (August Sauter, Ebingen, Germany). Heights were measured with a stadiometer (Perspective Enterprises, Inc., Kalamazoo, MI USA). Body mass index (BMI) was calculated as weight (kg) divided by height squared (m^2). Lean body mass (LBM) was determined from the measurement of total body water by bioelectric impedance analysis (model BIA-101, RJL Systems Inc., Detroit, MI USA) using the sex-specific equations developed by Kushner and Schoeller.[10]

Urine collections. During week 5 of each treatment period, subjects were asked to collect 24-hr urine samples for 4 consecutive days. A cooler, collection supplies, and written instructions were provided for each subject. Daily urine samples were collected in plastic jugs containing 20 mL of 6 M hydrochloric acid, kept cool throughout the collection period, and brought to the laboratory on the following morning. Urine volumes were recorded. Some urine was collected from various subjects to make up a urine pool (approximately 500 mL). To protect the catecholamines from oxidation, the final pH for all urine collections (samples and pool) was checked and set between 1 and 3 with 6 M sodium hydroxide, if necessary. Eighteen milliliters of each urine sample or urine pool was placed in glass scintillation vials containing 150 μL of 5% EDTA and 150 μL of 1% reduced glutathione as the stabilizing solutions. Vials were stored at −80°C before analysis.

Catecholamine analysis. Free catecholamines were determined by HPLC with dual electrochemical detectors (Bioanalytical Systems [BAS], Inc., West Lafayette, IN USA). The chromatographic system included the CMA/200 refrigerated microsampler, the BAS 200A chromatographic analyzer with a dual glassy carbon working electrode, and the BAScontrol and ChromoGraph™ software for data collection and processing, respectively.

Catecholamines were isolated from human urine by ion exchange followed by adsorption on activated alumina and then eluted with perchloric acid. Sample preparation was based on the BAS procedure for analysis of urinary catecholamines by liquid chromatography with electrochemical detection[11] with some modifications. Frozen samples were thawed and vortex-mixed. Five milliliters of urine was pipetted into polypropylene conical tubes and kept on ice; 15 mL of 0.1 M phosphate buffer (pH 7.0) was added, and the pH was adjusted to 6.5 ± 0.2 with 3 M NaOH. The internal standard, dihydroxybenzylamine hydrobromide (35 μL; DHBA, 10 μg/mL 0.1 mol/L perchloric acid), was also added, and

the final mixture was transferred onto an isolation column packed with approximately 2 g of BIO-REX 70 Resin (BIO-RAD Lab., Richmond, CA USA), which had been previously washed with successive volumes of approximately 150 mL of 3 M HCl, 3 M NaOH, 3 M acetic acid, and 0.1 M phosphate buffer (pH 6.5). The final resin pH was checked and adjusted to 6.5 whenever needed. The urine was completely drained from the column, and 10 mL of deionized, distilled water was used to wash the column and resin. A volume of 1.3 mL of 0.7 M H_2SO_4 was added to each column and allowed to drain. A 15-mL disposable conical test tube was placed under each column, and the catecholamines were then eluted with 4.0 mL of 2 M $(NH_4)_2SO_4$.

The eluent was collected and kept on ice. Approximately 50 mg of acid-washed alumina was added to each test tube, followed by 0.5 mL of 3 M Tris/EDTA buffer (pH 8.6). Tubes were shaken vigorously for approximately 5 min, then set aside to allow the alumina to settle. The supernatant was removed by aspiration. The alumina was washed with approximately 1 mL of deionized, distilled water and again left to settle. The supernatant was removed once more and the resulting slurry was transferred into a disposable Centrex microfilter loaded with a 0.2-μm nylon membrane (Schleicher & Schuell, Inc., Keene, NH USA). Microfilters were centrifuged at 1000 *g* for 3.5 min; receiver tubes were discarded and replaced, and 200 μL of 0.2 M $HClO_4$ was added to the microfilter sample compartment. Microfilters were vigorously shaken and centrifuged again. The acidic extract containing the catecholamines was transferred to microvials and 20 μL of the extract was injected into the HPLC system with a flow rate of 0.8 mL/min. The oxidation potential of the electrochemical detectors was set at +650 mV.

Duplicate samples were run for each subject. Samples from each treatment period were processed in the same run to minimize the effects of between-assay variation. The urine pool was used to calibrate the response of the two detectors and was run along with every group of six samples. Peak height ratios (i.e., peak height of each catecholamine divided by peak height of the internal standard) were used to calculate urinary catecholamine concentration. Mean coefficients of variation (intra- and interassay, respectively) were 5.6% and 5.9% for EPI, 5.5% and 5.4% for NE, and 5.2% and 5.1% for DA. Mean analytical recovery, which was determined by additions of standards, was approximately 99% for all three catecholamines.

Creatinine analysis. Twenty-four-hour creatinine excretion was determined to check on the completeness of 24-hr urine collections. Fifty milliliters of urine was placed in plastic bottles and stored at −15°C for creatinine analysis. Urinary creatinine was measured with a commercially available kinetic assay kit (Trace Scientific Pty. Ltd., Baulkham Hills, N.S.W.) in an automated spectrophotometric system (Centrifichem, Baker Instruments Corp., Allentown, PA USA).

Statistical analysis

Data were analyzed using the mixed procedure of SAS (SAS Institute Inc., Cary, NC USA, Release 6.11). The model contained the fixed sources of variation for beverage, diet, and their interaction and the random effects of subject within diet and beverage, which generated the estimate of the variance component for between-subject variance. The residual variance for this model provided the estimate of the within-subject variance component for the four consecutive days of sampling. The coefficients of variation (*CV*) for urinary catecholamine excretion were calculated by using the variance components generated by the mixed procedure that were determined separately for all four combinations of sex (men and women) and alcohol (consumption and abstention). The *CV* within-subjects (CV_W) measures variation among consecutive 24-hr collection periods and was calculated as follows:

$$CV_W = \frac{\sqrt{\hat{\sigma}_W^2}}{\bar{X}} * 100$$

The *CV* calculated for between-subjects (CV_B) variation also included one unit of the variance component for within subjects. This *CV* is an estimate of the variation among subjects for one 24-hr collection and was calculated as follows:

$$CV_B = \frac{\sqrt{\hat{\sigma}_B^2 + \hat{\sigma}_W^2}}{\bar{X}} * 100$$

The alcohol effect was tested separately for each sex by adding the alcohol source into the model as a fixed factor. Differences among the means for sex and alcohol combinations were tested using the MIXED procedure with the following fixed sources of variation in the model: beverage, diet, alcohol, sex, and their interactions. The random portion of model contained the following sources: (1) period; (2) subject within sex, diet, and beverage; (3) interaction of alcohol*subject within sex, diet, and beverage; and (4) residual variance. Contrasts were used to compare differences between alcohol means within sex and to compare differences between sex means within alcohol. Pearson product-moment correlation coefficients were calculated between the mean daily excretion of each catecholamine and subjects' characteristics (age, weight, height, BMI, LBM, and body fat mass) for each sex separately. The critical level of significance was set at $P < 0.05$. Mean daily catecholamine excretion levels (μg/day) were converted into SI units (nmol/day) by using the following conversion factors for EPI, NE, and DA: 5.458, 5.911, and 6.536, respectively.[12]

Results

The subjects' characteristics are given in *Table 1*. Average BMI values for men and women were 23.8 and 26.2, respectively. Three women and four men had BMI values greater than 27.3 and 27.8, respectively, and therefore could be classified as overweight.[13] Because there were no significant effects due to dietary fat on catecholamines excretion, all subjects were combined.

Mean daily excretion of EPI, NE, and DA is presented in *Figure 1*. Mean daily excretion was significantly greater for EPI ($P < 0.001$) and NE ($P < 0.01$) in men than in women, whereas no significant difference in dopamine excretion was observed between the sexes. When data were evaluated for alcohol consumption within sex, no significant differences were found between periods of alcohol consumption and abstention for all three catecholamines.

Table 2 also shows urinary mean daily creatinine excretion and mean urine volume for men and women during alcohol consumption and abstention. Moderate alcohol consumption did not affect creatinine excretion. However, a significant sex effect ($P < 0.01$) was detected on urinary creatinine excretion, with men showing greater excretion levels than women (i.e., 16.6 vs. 12.2 mmol/day, respectively). No alcohol effect was observed within sex. The CV_Ws for urinary creatinine excretion for women were 28.8% and 42.2% during alcohol consumption and abstention, whereas the between-subject CVs were 32.4% and 46.8%, respectively. For men, CV_W was 39.4% during alcohol consumption and 35.1% during alcohol abstention

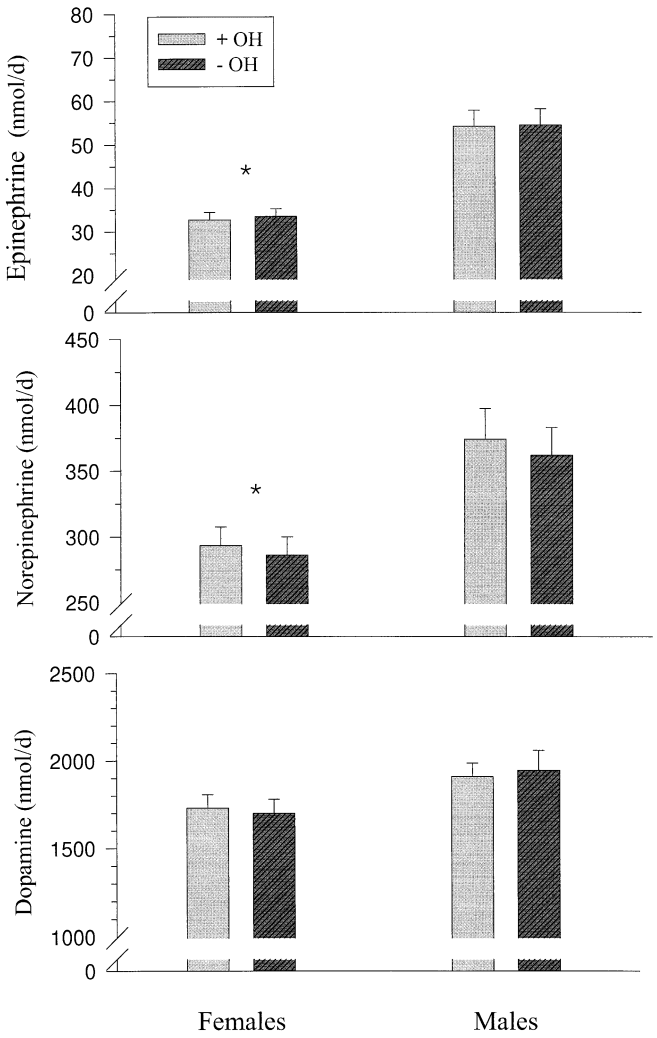

Figure 1 Total 24-hr catecholamine excretion in women and men during periods of alcohol consumption (+OH) or abstention (−OH). Data were analyzed by analysis of variance (mixed procedure of SAS). Contrasts were used to compare differences between alcohol means within sex and to compare differences between sex means within alcohol. Values represent mean ± SEM of 24-hr excretions collected over 4 consecutive days. *Within alcohol treatment, female means were significantly lower than the male means ($P < 0.05$).

and CV_B was 36.5% during both alcohol consumption and abstention.

Mean urine volume was significantly ($P < 0.01$) affected by alcohol consumption but not by sex. A significant decrease in urine volume (11.5% for men and 5% for women) was observed during alcohol consumption, and the overall mean daily urine volume was 1851 and 2026 mL/day during alcohol consumption and abstention, respectively.

Table 3 shows the results of within- and between-subject variation in urinary catecholamine excretion. Within-subject CVs were similar between men and women for all catecholamines during both alcohol consumption and abstention. Between-subject variation was consistently greater for women than for men. Comparisons of habitual alcohol consumption within sex revealed that both men and women had smaller within- and between-subject variation for all catecholamines during alcohol consumption.

Results on the Pearson product-moment correlations showed that in women a significant negative relationship with age was observed for DA ($r = -0.48$, $P < 0.05$) during alcohol consumption and for NE ($r = -0.48$, $P < 0.05$) during alcohol abstention. In men, however, a significant positive relationship was detected for NE ($r = +0.59$, $P < 0.05$) during alcohol consumption. In addition, of all the anthropometric variables tested, BMI was positively correlated with DA during alcohol abstention ($r = +0.73$, $P < 0.01$). EPI was negatively correlated with weight and height ($r = -0.69$, $P < 0.05$ and $r = -0.63$, $P = 0.28$, respectively) during alcohol abstention.

Discussion

Data on within- and between-subject variation in 24-hr urinary catecholamine under free-living conditions are not currently available despite the increased use of urinary catecholamines as a marker for SA activity. In a review article of the assessment of sympathetic nervous system function, it was mentioned that one can expect a large between-subject variability on urinary catecholamine excretion and also that intraindividual variation seems to stay relatively constant.[6] Nonetheless, no data were presented to substantiate that statement. The CV is an extensively used statistical tool that allows comparison of the relative amount of variation of two populations independent of the magnitude of their means.[14] Because each subject collected 24-hr urine samples for two periods, each consisting of 4 consecutive collection days, we were able to look at both within- and between-subject variation. Our results showed a broad within- and between-subject variation in urinary catecholamine excretion levels, even with a relatively small sample size of 22 women and 12 men. Broad variation in urinary catecholamine excretion could be due to incomplete 24-hr collection. Results of the creatinine analysis showed that creatinine levels from only four urine collections (three different women) were lower than 4.42 mmol/day (0.5 g/day), which might indicate incomplete 24-hr collections.[12] However, other investigators have questioned the validity of using creatinine excretion as an index of a complete 24-hr urine collection because of the high intra- and intersubject variability.[15–17] Furthermore, age, sex, and body weight have been shown to affect urinary creatinine output. Because no significant changes in the results were found when data from those subjects were left out of the data set, the CVs (both within and between) presented in this paper include all subjects.

For men, mean daily values for EPI, NE, and DA (*Table 2*) during alcohol abstention were generally similar to reported values.[12,18–21] Fewer data have been reported for women.[12,22] Our mean values for women for EPI, NE, and DA (*Table 2*) during alcohol abstention also agreed with reported values.[12,22] When compared with reported values for urinary catecholamines analyzed by the same technique used in this study, our overall range (*Table 2*) falls within the published normal ranges for all three catecholamines.[15]

Urinary catecholamine excretion was not affected by a moderate consumption of alcohol, i.e., 5% of daily energy

Table 2 Urinary volume, catecholamine, and creatinine excretion of free-living healthy men and women during periods of alcohol consumption (+) or abstention (−): mean ± SEM (range)

	Women (n = 22)		Men (n = 12)	
	(−)	(+)	(−)	(+)
Epinephrine* (nmol/day)	34.0 ± 3.57 (7.8–100.1)	33.6 ± 3.55 (10.5–85.0)	55.1 ± 4.76 (20.7–125.1)	54.3 ± 4.76 (15.4–117.7)
Norepinephrine* (nmol/day)	287 ± 21.2 (76–675)	296 ± 20.9 (102–686)	364 ± 27.6 (122–899)	370 ± 27.7 (158–809)
Dopamine (nmol/day)	1682 ± 115.4 (508–3621)	1756 ± 114.7 (649–4150)	1944 ± 153.5 (961–5256)	1911 ± 154.4 (1077–3287)
Creatinine* (mmol/day)	12.6 ± 1.40 (3.2–35.8)	11.8 ± 1.47 (3.8–22.4)	16.7 ± 1.89 (5.9–41.5)	16.5 ± 1.92 (4.9–39.8)
Urine volume** (mL/day)	1922 ± 96.8 (549–3418)	1816 ± 96.0 (751–3204)	2129 ± 129.7 (801–3394)	1886 ± 129.7 (799–3500)

Contrasts were used to compare differences between alcohol means within sex and to compare differences between sex means within alcohol.
*Within alcohol treatment, female means were significantly lower than the male means ($P < 0.05$).
**Within sex, means for subjects consuming alcohol were significantly lower than for subjects not consuming alcohol ($P < 0.01$).

intake or approximately two drinks per day. Other investigators did not find a significant effect of moderate alcohol consumption in a sample of nonalcoholic subjects (41 men and 53 women) with an age range of 25 to 75 years.[23] Perhaps a higher alcohol intake is needed to significantly alter SA activity. A significant alcohol effect was observed only on daily urinary volume (*Table 2*), where men and women had higher urine volumes during alcohol abstention.

In general, the within-subject variation was similar for both men and women but was affected by sex response to alcohol consumption. Between-subject variation was consistently greater for women than for men. Contributory factors to the greater between-subject variation observed for female subjects could include the known effect of the ovulatory cycle on catecholamine excretion,[7] menopausal status, and use of birth control pills or hormone replacement therapy (HRT). In this study, seven women were premenopausal, with five taking birth control pills; the remaining 15 claimed to be postmenopausal, with four on HRT. The urine collection periods were not scheduled in relation to the menstrual cycle or to the HRT pattern. When we examined the effect of habitual alcohol intake consumption on the variation of catecholamine excretion, both the within- and between-variation in men and women was generally reduced during alcohol consumption. A substantial decrease in urine volume (11.5% for men and 5% for women) also observed in these subjects during alcohol consumption may account for some of the changes observed in catecholamine excretion.

Table 3 Within-subject coefficient of variation (CV_W) and between-subject coefficient of variation (CV_B) in the daily urinary catecholamine excretion of healthy men and women collected over 4 consecutive days during periods of alcohol consumption (+) or abstention (−)

	Women (n = 22)		Men (n = 12)	
CV	(−)	(+)	(−)	(+)
Within-subject CV (%)				
Epinephrine	43 ± 6.5[1]	32 ± 4.8	38 ± 7.6	34 ± 6.9
Norepinephrine	34 ± 5.1	33 ± 5.0	37 ± 9.6	30 ± 6.3
Dopamine	31 ± 4.7	28 ± 4.2	39 ± 8.0	22 ± 4.5
Between-subject CV (%)				
Epinephrine	61 ± 9.2[1]	52 ± 7.8	53 ± 10.8	40 ± 8.2
Norepinephrine	44 ± 6.8	42 ± 6.3	40 ± 8.2	36 ± 7.4
Dopamine	42 ± 6.3	41 ± 6.2	39 ± 8.0	25 ± 5.1

[1]CV ± SEM.

Alcohol intake can also stimulate the adrenal glands, which could ultimately lead to an increased urinary excretion of the circulating hormone epinephrine.[24] Curiously, the greatest CV_B was for EPI, particularly in women. However, the higher values were observed during alcohol abstention. Alcohol has been considered to be a factor with a potential effect on SA activity and, therefore, catecholamine excretion. Our results showed that chronic consumption of alcohol during an 8-week period diminished both within- and between-subject variation. SA activity is also influenced by changes in dietary intake, which does not apply to this study because all subjects were kept on their diets throughout both study periods. However, our subjects had unrestricted use of noncaloric beverages such as coffee, tea, and sodas, which could have substantial amounts of caffeine and could affect catecholamine urinary output. Caffeine intake of approximately 4 mg/kg of body weight (equivalent to 5 cups of coffee per day) has been reported to increase urinary excretion of EPI in both lean and obese women.[25]

Contribution of such factors as age, body size, and body composition to the between-subject variation are still not completely clear. Published reports reflect values from highly divergent populations and environmental conditions, making comparisons very difficult. Several studies have looked at the relationship between age and urinary catecholamine excretion. Jenner et al.[26] and Ross et al.[15] failed to observe a relationship between catecholamine excretion and age across a number of different population groups. Gerlo et al.[12] determined urinary catecholamine excretion in a reference population (age range 17 to 88 years) consisting of 497 women and 459 men and found that urinary EPI significantly decreased with age in men whereas urinary DA decreased with age in both sexes. Urinary NE excretion was not age dependent for either men or women. In addition, men had significantly higher excretion rates for EPI, NE,

and DA than did women. Other studies also noticed significant decreases in urinary EPI and DA with age in men.[15,16] Goldstein et al.[16] detected a significant negative relationship between urinary DA and age in both sexes. Our study showed a significant decrease in urinary DA with age in women during alcohol consumption and also a significant decrease of urinary NE with age during alcohol abstention. Conversely, urinary NE was the only catecholamine showing a significant positive correlation with age in men, but only during alcohol consumption.

Catecholamines, particularly EPI and NE, are the chief lipolytic hormones in human adipocytes leading to a rapid mobilization of stored triacylglycerols during SA stimulation. Therefore, a decrease in SA activity has been related to body weight gain. In our sample groups, there were three women and four men whose BMI values indicate some degree of overweight, ranging between moderate and mild obesity. We found no correlation between daily urinary catecholamine excretion and any anthropometric variables that were measured in the 22 women. In men, however, a significant positive relationship was detected between DA excretion during alcohol abstention and BMI (an index of overall adiposity), and significant negative relationships were detected between urinary EPI excretion and measurements of height and weight during alcohol abstention.

In summary, this study determined 24-hr urinary catecholamine excretion in a group of free-living men and women. Within- and between-subject variability presented large coefficients of variation for both men and women. The analysis of variance did not detect a significant alcohol effect for all three catecholamines within each sex. However, both within- and between-subject variation decreased during alcohol consumption in all subjects. The CVs determined from this relatively small group of men and women were surprisingly high despite reasonably low intra- and interassay variation (5.1–5.9%). Further studies are needed to examine sources of variation in urinary catecholamine excretion to better use this assay as a reliable, indirect method for assessing SA activity, particularly in free-living populations.

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