INTERNATIONAL JOURNAL OF BEHAVIORAL MEDICINE, *7*(2), 111–126


# Social Support and Stress: Influences on Lipid Reactivity

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Social support protects individuals from cardiovascular morbidity and mortality, possibly by attenuating physiological stress responses. The presence of supportive individuals during acute psychological stress has been shown to influence cardiovascular functioning, but in inconsistent directions. The purpose of this study was to test the notion that the presence of a supportive friend during an acute stressor would influence lipid reactivity. Forty healthy women participated in the study. One half engaged in a speech task while a friend was present; the other half participated in a speech task without a friend present. The speech stressor elicited elevations in total cholesterol and triglycerides under both conditions. Those with a friend present had greater total cholesterol reactivity to stress, relative to those without a friend present. These findings are similar to some studies in the cardiovascular literature, and may be due to increased threat appraisal among those with a friend present.

Key words: lipids, reactivity, social support, affiliation, appraisal

The positive impact of social support on health has been well-documented (Cohen & Syme, 1985; Hazuda, 1994; Shumaker & Czajkowski, 1994). Many of these studies have provided cross-sectional evidence for the impact of social ties on all-cause morbidity and mortality. For example, the first prospective study on the impact of social ties on mortality (Berkman & Syme, 1979) reported that individu-

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This study was supported in part by National Institutes of Health grants HL–48363 and HL–48411, and by MO1–RR0034 to The Ohio State University General Research Clinical Research Center.

We gratefully acknowledge the expert assistance of Karen Cook. The assays were performed in the laboratory of Dr. Linda Bausserman of the Division of Cardiology in the School of Medicine at Brown University.

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als with few contacts with family and friends were 1.9 to 3.1 times more likely to die within a 9-year follow-up period than were those individuals with more social contacts. These early findings have been replicated in more recent prospective studies. Although the particular elements of support that are protective may be somewhat different for men and women, overall, data consistently indicate that both men and women who are socially isolated have increased all-cause morbidity and mortality, and those with strong support networks are particularly protected from early mortality (Avlund, Damsgaard, & Holstein, 1998; Broadhead et al., 1983; Cohen, 1988; Ruberman, Weinblatt, Goldberg, & Chaudhary, 1984).

Social ties are also specifically and inversely related to cardiovascular mortality and morbidity (Orth-Gomér, 1994; Seeman & Syme, 1987), even after controlling for established coronary heart disease (CHD) risk factors and health behaviors (House, Landis, & Umberson, 1988; Orth-Gomér et al., 1998). As with the aforementioned studies of all-cause mortality, most investigations of cardiovascular-specific morbidity and mortality have studied primarily men. Recently, however, the cardioprotective effects of social support and social networks have also been demonstrated for women (Orth-Gomér et al., 1998; Shye, Mullooly, Freeborn, & Pope, 1995). Although the manner in which social support is defined differs from study to study, taken together there is compelling evidence that aspects of social support are significant factors in determining cardiovascular risk for both men and women.

The mechanisms by which social support affect cardiovascular health are still unknown, but several viable hypotheses have been proposed (Knox & Uvnäs-Moberg, 1998). For example, supportive individuals might encourage CHD health-promoting behaviors and health-care seeking behaviors (Cohen, 1988). Data from more recent investigations, however, strongly suggest that the increased health-promoting behaviors among those with high levels of social support cannot fully account for the positive impact that social support has on cardiovascular disease (Cohen, Kaplan, & Manuck, 1994).

Currently, studies are testing the hypothesis that social support influences cardiovascular health through the psychophysiologic consequences of social interactions and social presence. For example, individuals who report high levels of social support have lower blood pressure at rest and during psychological stress (Knox, 1993). Similar findings have been reported in the context of ambulatory blood pressure and social support among women (Linden, Chambers, Maurice, & Lenz, 1993). Thus, it is possible that social integration affects cardiovascular health by influencing blood pressure throughout the day.

To understand this relation more fully, subsequent investigations have used the presence of supportive individuals during acute psychological stress as a laboratory model for the physiological consequences of support. More specifically, these studies have investigated whether the simple presence of a supportive individual modifies cardiovascular responses to acute laboratory stressors (Allen,

Blascovich, Tomaka, & Kelsey, 1991; Edens, Larkin, & Avel, 1992; Gerin, Milner, Chawla, & Pickering, 1995; Kamarck, Annunziato, & Amateau, 1995; Kamarck, Manuck, & Jennings, 1990; Kors, Linden, & Gerin, 1997; Lepore, 1995; Sheffield & Carroll, 1994). Some of these investigations have found that the presence of a friend reduces cardiovascular responsivity to psychological challenges (Gerin et al., 1995; Kamarck et al., 1990). For example, in one of the first investigations of this type, Kamarck et al. (1990) examined female university students while they performed a mental arithmetic and concept formation task alone or in the presence of a friend. The friend was encouraged to be silently supportive and to touch the participants on the wrist during the experiment. Results of this study indicated that the presence of a supportive friend induced smaller increases in heart rate (HR) and systolic blood pressure (SBP) during the math task, relative to those who performed the tasks alone.

In contrast, other investigations have failed to find that the supportive presence of an individual reduces cardiovascular reactivity to stress (Allen et al., 1991; Sheffield & Carroll, 1994), and others have noted that the presence of a supportive partner results in enhanced cardiovascular reactivity to stress (Edens et al., 1992). In sum, although some investigations of cardiovascular functioning during acute psychological stress find that the presence of a supportive individual can attenuate the response to stress, others do not. The discrepancies in this literature are currently an active area of investigation.

The literature on the psychophysiological effects of this model of social support has primarily focused on blood pressure and HR reactivity to stress. However, other physiological variables are associated with risk for CHD and are also associated with social support. With regard to risk factors, blood lipid concentrations are well known to be consistent and potent physiological risk factors for CHD (Lipid Research Clinics Program, 1984; Schaefer et al., 1994). With regard to factors associated with social support, blood lipid concentrations also have been cross-sectionally associated with social support. One investigation demonstrated that a high degree of social integration among a large group of healthy elderly individuals was associated with significantly lower levels of serum cholesterol (Thomas, Goodwin, & Goodwin, 1985); these investigators postulate that social support may mitigate the negative physiological consequences of stress. More recent studies have reported significantly lower high-density lipoprotein–cholesterol (HDL–c) concentrations among elderly men living alone (Gliksman, Lazarus, Wilson, & Leeder, 1995), and higher levels of the atherogenic lipids were found in young men, but not young women, with low levels of social support (Unden, Krakau, Hogbom, & Romanus-Egerborg, 1995). Taken together, these data suggest that social support may exert part of its protection through its association with blood lipid concentrations. Thus, it may be fruitful to expand the investigation of physiological parameters outside of the traditional measures of cardiovascular reactivity.

The data linking social support and blood lipid concentrations are particularly intriguing in light of the literature that has examined the impact of psychological stress and blood lipid concentrations. Stress reliably increases the concentrations of the atherogenic lipids in both men and women (Brindley, McCann, Niaura, Stoney, & Suarez, 1993; McCann et al., 1996; Niaura, Stoney, & Herbert, 1992; Stoney, Niaura, Bausserman, & Matacin, 1999). Although the etiologic significance of such changes is not known, individuals at increased risk of cardiovascular diseases have larger atherogenic lipid reactivity to acute stressors, relative to those who are not at elevated risk (Stoney & Hughes, 1999). Because social support is related in some studies to blood lipid concentrations as described earlier (Gliksman et al., 1995; Thomas et al., 1985), an examination of the interaction of psychological stress, blood lipids, and social support is warranted. The purpose of this study was to examine the effects of an acute stressor and the influence of a supportive presence on lipid reactivity in healthy young women.

## METHOD

### Participants

Forty healthy women with a mean age of 19.30 years (*SD* = 2.09, range = 18–29 years) participated in this study. Female participants were chosen because women may be more responsive to the effects of social support than are men (Linden et al., 1993). The women were recruited through introductory psychology classes at The Ohio State University and through campus-wide advertisements. To control for possible effects of health status on the lipid parameters, only nonsmokers and individuals who were not on medications were eligible to participate. In addition, women who were pregnant, nursing, or taking oral contraceptives were excluded from participating in this study because there is evidence to suggest that fluctuations in reproductive hormones that occur in these situations influence lipid concentrations (Davis & Matthews, 1990; Stoney, Matthews, McDonald, & Johnson, 1988).

Each woman (Target) was asked to recruit a female friend (Friend) to accompany them to the laboratory. We asked the participants to recruit same-sex friends because such pairings reduce the possible variability associated with the interactions of opposite-sex pairings (Kamarck et al., 1990). Each target–friend pair was randomly assigned to one of two conditions: the "Alone" condition or the "Friend" condition. In the Alone condition, friends were asked to remain in the hallway while the target participant took part in the study. In the Friend condition, friends were asked to directly participate in the study with the target participant.

All participants received monetary compensation for taking part in the study, and target participants also received partial course credit for their involvement.

Table 1 shows the relevant sample characteristics of the participants, by experimental condition.

## Physiological Measures

Blood lipid measures in this study included total cholesterol, HDL–c, and triglycerides. These measures were assessed from blood samples drawn over a 2-min interval at the end of the baseline, stressor, and recovery periods.

Total cholesterol was determined enzymatically on a Beckman CX4 analyzer (Allain, Poon, Chan, Richmond, & Fu, 1974). Triglycerides were first corrected for free glycerol, and concentrations were then determined using Beckman reagent (Buccolo & David, 1973); all triglyceride values were log-transformed because of nonnormal distributions. HDL–c was determined following sequential precipitation with heparin–$MnCl_2$ and dextran sulfate (Gidez, Miller, Gurnstein, Slagle, & Eder, 1982). The laboratory responsible for assays participates in the national survey for clinical laboratories sponsored by the College of American Pathologists and has participated in the Centers for Disease Control Lipid Standardization program since 1977. The coefficients of variation for total cholesterol, triglycerides, and HDL–c are 0.8, 1.5, and 2.0%, respectively.

Hematocrit and hemoglobin were measured in each blood sample to estimate changes in plasma volume during the stressor (Dill & Costill, 1974). Analysis of each of the lipid measures was accomplished after correction for stress-associated plasma volume shifts (Patterson, Gottdiener, Hecht, Vargot, & Krantz, 1993; Stoney & West, 1997).

TABLE 1
Sample Characteristics by Condition

| | *Alone Condition*[a] | | *Friend*[a] | |
|---|---|---|---|---|
| *Characteristic* | *M* | *SD* | *M* | *SD* |
| Age (years) | 18.53 | .72 | 19.95 | 2.63 |
| Height (in.) | 64.92 | 5.37 | 63.74 | 6.67 |
| Weight (lbs.) | 140.26 | 11.49 | 138.72 | 12.96 |
| Cook–Medley Hostility | 20.3 | 7.9 | 19.1 | 7.8 |
| ISEL total score | 34.6 | 4.0 | 33.3 | 6.2 |
| Tangible support | 9.1 | 1.6 | 9.0 | 1.6 |
| Appraisal support | 9.1 | 1.1 | 8.4 | 1.9 |
| Self-esteem support | 8.3 | 2.0 | 8.3 | 1.8 |
| Belonging support | 8.2 | 1.2 | 7.8 | 1.8 |

*Note.* ISEL = Interpersonal Support Evaluation List.
[a]$n = 20$.

## Psychological Measures

In addition to testing the primary question of whether the social support manipulation would influence lipid reactivity, we also wished to test two secondary questions. Some investigations have reported that hostility moderates the relation between social support and cardiovascular reactivity. We included a standard measure of hostility to test a similar question with regard to lipid reactivity. The only published investigations to date to investigate social support and lipid concentrations have examined self-report measures of social support. To replicate these findings in a laboratory manipulation of social support, we included a measure of perceived social support in this study.

The Cook–Medley Hostility Scale (Cook & Medley, 1954) is a 50-item true–false scale derived from the Minnesota Multiphasic Personality Inventory that has been associated with cardiovascular disease morbidity and mortality (Barefoot, Dahlstrom, & Williams, 1983; Shekelle, Gale, Ostfeld, & Paul, 1983; Williams et al., 1980). Responses to these 50 items are summed to yield a total hostility score. Test–retest reliability of the Cook–Medley Hostility Scale is good and ranges between .85 and .89 over 1–4 years (Shekelle et al., 1983).

The Interpersonal Support Evaluation List (ISEL; Cohen, Mermelstein, Kamarck, & Hoberman, 1985) contains 40 true–false statements about the perceived availability of social resources. We tested the relations between the overall score of perceived social support, as well as the four subscales on this questionnaire. These subscales include tangible support, appraisal support, self-esteem support, and belonging support (Cohen et al., 1985). The ISEL has high internal consistency (alphas range from .77 to .86), and the test–retest reliability over a 4-week interval is high (Cohen et al., 1985).

## Stressor

A videotaped speech task was used in this study because it reliably elicits increases in lipid parameters (Stoney et al., 1988). Target women were given 2 min to construct and 3 min to deliver a speech about how they would respond to a hypothetical situation. They were asked to suppose that after careful preparation for their best friend's wedding, a measurement mistake by the seamstress caused major faults in their maid of honor dress just 1 week prior to the wedding. They were asked how they would confront the store manager about the situation and asked to talk about potential solutions to the problem. A video camera was placed approximately 5 feet away, and target participants were asked to speak into the camera for the entire 3-min period. Target participants were also informed that their speeches would be evaluated for organization, clarity, and delivery. Individuals were prompted to continue speaking if they completed their speech before the end of the 3-min period.

## Manipulation

The social support manipulation was based on the procedure used by Kamarck et al. (1990). For those participants randomized to the Friend condition, the friend received support training during the time the target participant was being instrumented. Specifically, friends were instructed how to demonstrate support by lightly touching the target participant on the wrist. This study involved the presence of a friend and touching in the social support manipulation because these have been shown to influence the effects of social presence on cardiovascular reactivity (Christenfeld et al., 1997). The friends were specifically asked not to speak during the protocol or to try and distract the target participant in any way.

For those participants who had been randomized to the Alone condition, the friend remained in the hallway during the entire time that the target participant completed the protocol.

## Manipulation Checks

We employed four types of measures to check our stressor manipulation both with and without the presence of a friend. First, we wished to assess the quality of the relationship between the target participant and the recruited friend. We used a short friendship assessment questionnaire that has been previously reported (Kamarck et al., 1995) to assess overall perceived trustworthiness and loyalty of the friend who was brought to the experimental session. Second, we wished to assess the importance of having a friend present during the experimental manipulation. We used 5-point Likert-type scales to assess this during both tasks.

Third, we wished to assess how helpful and supportive the target participant felt during the experiment. We used two, previously reported true–false questions (Kamarck et al., 1995) for this assessment. Finally, perceptions of the tasks themselves were assessed using 5-point Likert scales regarding perceived competency, stress, confidence, amount of anger elicited, and task-difficulty.

## Procedure

Target participants were asked to fast for 12 hr prior to coming to the laboratory, and an interview confirmed that participants had complied with this requirement. All participants were asked to have their same-sex friend accompany them to the laboratory. Upon their arrival, the experimenter reviewed each of the respective consent forms with the target participant and the friend. Once the consent forms were read and signed by both participants, the target participant and friend were separated; the target participant entered the laboratory where testing took place.

The target participant's height and weight were obtained. Once this was completed, an indwelling catheter was inserted into the antecubical space of the dominant arm.

For those participants randomized to the Friend condition, the following procedure was followed. After instructions were administered to the friend, she was brought into the laboratory, where the target participant was already instrumented, and the experiment began. During the initial 30-min acclimation period, the target participant was asked to relax in a comfortable chair and listen to relaxing music. The friend was instructed to begin showing active support as she had been instructed.

A 10-min baseline period followed the acclimation period, during which relaxing music was played. Two minutes before the end of baseline, a blood sample was taken. Once the baseline period had been completed, instructions for the speech task were given, and the video camera was turned on. Following a 2-min preparation period, participants were verbally prompted to begin speaking for 3 min. Another blood sample was taken 2 min before the end of the speech. Finally, target participants completed a 10-min recovery period, during which time relaxing music was again provided. A final blood sample was taken 2 min before the end of the recovery period. Once the protocol was completed, the participants were asked to complete the set of questionnaires and were then debriefed and excused.

For those participants randomized to the Alone condition, the target participant completed the experiment while her friend remained in the hallway. Once the target participant had completed the experiment, the friend was brought in to the laboratory for debriefing and to receive payment.

## Data Reduction and Analysis

Demographic characteristics of the women in the Friend and Alone conditions were compared with a series of one-way analyses of variance (ANOVAs) for each of the relevant variables and for the baseline lipid parameters. Each of the variables regarding perceptions of the stressor and support conditions was compared in a similar manner. A series of one-way ANOVAs examining Time (Baseline vs. Speech Stressor vs. Recovery) were performed for each of the lipid variables, to determine which were significantly elevated during stress, relative to baseline. Change scores were calculated by subtracting the baseline values from the corresponding values during the stressor. A separate series of one-way ANOVAs on change scores compared those in the Alone and Friend conditions on lipid reactivity. High- and low-hostile groups were formed by median splits on the total Cook–Medley scores. Two (Condition: Alone vs. Friend) × 2 (Hostility: High vs. Low) ANOVAs were performed on each of the lipid change scores, separately. Finally, a series of one-way ANOVAs on the changes from baseline to stress compared those scoring high and low on the ISEL on lipid reactivity.

Triglyceride values were log transformed prior to analyses; nontransformed data are displayed in all tables for easier interpretation. All other parameters were normally distributed. Post-hoc tests were accomplished using Tukey's HSD test statistic (Kirk, 1968). For all analyses involving a repeated factor with more than two levels, the Greenhouse–Geiser epsilon correction was applied to the error degrees of freedom.

## RESULTS

### Demographic Characteristics

The age of the participants in the two groups was slightly, but significantly, different, $F(1, 35) = 4.66$, $p = .04$. Subsequent inspection of the means indicated that women in the Alone condition ($M = 18.5$ years) were somewhat younger than were women in the Friend condition ($M = 19.9$ years). However, women in the two groups did not differ significantly with respect to height, $F(1, 38) = 2.45$, $p = .13$, or weight, $F(1,38) = .03$, $p = .86$. There were no group differences in any of the psychosocial variables measured (see Table 1).

### Manipulation Checks

Women in the Friend and Alone conditions rated their friends equally important in their lives. Thus, the overall perceived quality of the relationship prior to task exposure was the same in both groups. As expected, participants in the Friend condition rated the presence of their friend significantly more helpful during the session than did participants in the Alone condition, $F(1, 37) = 13.86$, $p = .001$. Participants in the Friend condition were also more likely to report that it is important to have a friend present in order to do well on the task, relative to those in the Alone condition, $F(1, 37) = 5.54$, $p = .024$. The analysis of perceived stress ratings during the tasks also indicated Group differences, but in the opposite direction. Specifically, women in the Friend condition reported significantly more anger, $F(1, 37) = 5.61$, $p = .023$, and slightly more stress, $F(1, 37) = 2.87$, $p = .09$, during the speech task, relative to those in the Alone condition. No other task impressions or friendship-related variables differentiated the groups.

### Baseline Measures

The one-way ANOVAs on baseline lipid values indicated that participants in both groups had similar baseline concentrations of total cholesterol (all $p$s $> .05$).

## Effects of Stress on Lipid Parameters

The mean values for each of the lipid and hematologic parameters during baseline, stress, and recovery periods by condition are presented in Table 2. The ANOVAs and subsequent post-hoc tests indicated that total cholesterol, $F(2, 46) = 3.84$, $p = .029$, and triglycerides, $F(2, 46) = 4.50$, $p = .016$, were significantly elevated during the stress period, relative to baseline, $p$s $< .05$. There was no significant stressor effect for HDL–c ($p = .09$).

## Effects of the Presence of a Friend on Lipid Reactivity

Subsequent analyses compared women in the Alone and Friend conditions on the changes in each of the lipid parameters during stress. Women in the Friend condition had higher total cholesterol reactivity during stress, $F(1, 29) = 3.97$, $p = .056$, relative to women in the Alone condition (see Figure 1). No other significant condition main effects emerged in these analyses.

Hostility did not interact with the social support condition for any of the lipid parameters, as reflected in the nonsignificant interaction terms for these analyses (all $p$s $> .20$).

When comparing those scoring high and low on the ISEL and each of the subscales, no group differences were apparent for lipid reactivity, all $p$s $> .11$.

TABLE 2
Means and Standard Deviations of Lipids During Baseline, Stress, and Recovery by Condition

| | *Baseline* | | *Speech Task* | | *Recovery* | |
|---|---|---|---|---|---|---|
| *Condition* | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| Alone | | | | | | |
| Total cholesterol (mg/dl) | 145.60 | 29.52 | 147.69 | 30.90 | 146.21 | 31.55 |
| Triglycerides (mg/dl) | 53.50 | 22.02 | 53.67 | 20.38 | 50.61 | 22.78 |
| HDL–c (mg/dl) | 43.80 | 8.94 | 44.14 | 8.23 | 43.48 | 8.26 |
| Friend | | | | | | |
| Total cholesterol (mg/dl) | 145.80 | 29.96 | 153.10 | 30.77 | 150.45 | 27.69 |
| Triglycerides (mg/dl) | 49.47 | 25.92 | 50.80 | 25.95 | 48.62 | 26.74 |
| HDL–c (mg/dl) | 50.33 | 10.21 | 52.33 | 12.31 | 52.97 | 12.65 |

*Note.* HDL–c = high-density lipoprotein–cholesterol.

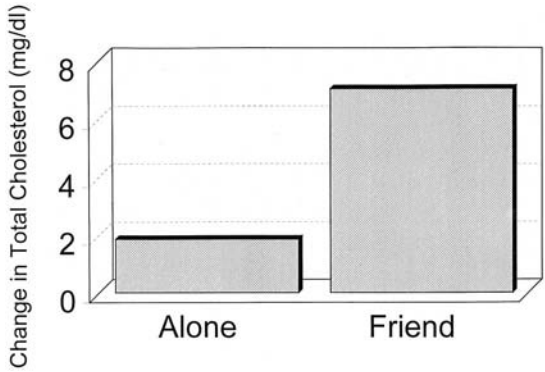


FIGURE 1 Comparison of total cholesterol (mg/dl) reactivity during a speech stressor between participants in the Alone condition and those in the Friend condition.

## DISCUSSION

Acute psychological stress was associated with reliable increases in the blood concentrations of total cholesterol and triglycerides in this sample of young, healthy women. The magnitude of this increase is similar to what has been previously reported (Niaura et al., 1992; Stoney et al., 1988) and was apparent after correction for stress-induced plasma volume shifts. Although the physiological importance of short-term lipid elevations is not yet known, indirect evidence suggests that they may play a role in risk for CHD. For example, cross-sectional studies have demonstrated larger magnitude elevations in the atherogenic lipids during acute stress among healthy individuals at risk for the future development of CHD, relative to those at lower risk (Davis & Matthews, 1990; Groover, Jernigan, & Martin, 1960; Stoney & Hughes, 1999). The current data replicate previous findings that blood lipid concentrations are transiently and mildly elevated during acute psychological stress in healthy young individuals.

The main thrust of this study was to investigate whether the presence of a supportive friend would alter lipid reactivity to an acute stressor. The results indicate that the social manipulation induced significantly greater increases in total cholesterol in the women with a friend present during the stressor, relative to the women who were alone during the stressor. To our knowledge, no other published study has tested lipid reactivity using this model. These findings suggest that the presence of a supportive friend during a challenging task actually increases physiologic responsivity to psychological stress. These findings are similar to the results of some studies testing the effects of the presence of a supportive other on the cardiovascular system (Lepore, Allen, & Evans, 1993; Snydersmith & Cacioppo, 1992). For example, one investigation reported that the presence of a supportive friend enhances cardiovascular and skin conductance reactivity to psychological

stressors (Allen et al., 1991). Another recent investigation reported increased cardiovascular reactivity as a function of increased perceived social support (Roy, Steptoe, & Kirschbaum, 1998). This latter study did not utilize the presence of a friend as a model for social support, but the results call into question the ecological validity of such a model.

One possible explanation for the increased lipid reactivity noted in this study is that the presence of a supportive friend increases the threat appraisal by the participant. In his review of the cardiovascular literature reporting increased autonomic reactivity to stress in the presence of a partner, Kamarck et al. (1995) noted that each of these studies included conditions where partners viewed task performance but did not provide verbal feedback regarding that performance. Thus, the absence of a specific condition to reduce the threat associated with social evaluation may have resulted in the enhanced cardiovascular reactivity. In this study, there was no explicit, verbal condition by which the supportive friend could reduce appraisals of threat. Additionally, there was a tendency for those with a friend present to report more stress during the speech task. Thus, it is possible that participants in this study appraised the presence of their friends as potential social threats, resulting in enhanced lipid reactivity to stress. Future studies could explicitly test this notion by manipulating the degree of social threat and evaluation.

The increased lipid reactivity in this study may be a function of the touch manipulation that we used. A previous study demonstrated that the presence of a friend or other who showed support using touch resulted in larger HR and blood pressure reactivity, relative to a condition not utilizing touch (Edens et al., 1992). However, touch has also been reported to reduce subjective stress (Lynch, Thomas, Paskewitz, Katcher, & Weir, 1977), and other studies of cardiovascular reactivity have not demonstrated enhanced stress reactivity during a touch manipulation (Kamarck et al., 1990). Future investigations including both a touch and no-touch condition using this paradigm will be necessary to determine the extent to which the touch manipulation is relevant to lipid responsivity to stressors.

Although the bulk of the cardiovascular reports are in contrast to the findings reported here for lipid reactivity, there is considerable variability in the existing literature (Uchino, Cacioppo, & Kiecolt-Glaser, 1996). Although several investigations of cardiovascular reactivity have found that the presence of a friend or stranger attenuates cardiovascular reactivity to stress (Gerin et al., 1995; Kamarck et al., 1995; Kamarck et al., 1990), others have failed to find an effect (Sheffield & Carroll, 1994; Spitzer, Llabre, Ironson, Gellman, & Schneiderman, 1992). When social presence has been shown to attenuate reactivity, the finding does not appear to be uniform for men and women or for all response systems measured (Kirschbaum, Klauer, Filipp, & Hellhammer, 1995; Linden et al., 1993). For example, the Linden et al. (Linden et al., 1993) study found that ambulatory SBP was associated with self-reported high social support in women but not in men. No effects of social support were apparent for ambulatory diastolic blood pressure or

HR for either men or women. Other studies suggest that the physiological effects of this type of manipulation may be dependent on individual differences in psychological variables. For example, one study showed that the presence of a supportive friend resulted in diminished blood pressure reactivity only among individuals low in cynicism; no effects of the presence of a friend were apparent among those high in cynicism (Lepore, 1995). In this study of women only, we did not find any evidence for an interaction between the presence of a friend and hostility. However, there may be other important individual differences in psychological factors, particularly for women, that may interact to result in differential lipid reactivity to stressors.

One potential limitation of this study is that the baseline physiological measures were assessed after the manipulation (presence or absence of the friend) occurred. Although this was necessary for pragmatic reasons, it does not appear to explain the reactivity differences noted, because there were no baseline differences between the two groups for any of the physiological measures assessed. Thus, it appears that the presence of the friend had effects on lipids during the stressor only but not during baseline. Another potential limitation of this study concerns the exclusive investigation of young, healthy, educated women. Given the gender differences in cardiovascular disease progression and in some investigations of social support and lipid concentrations, studies in our laboratory are further investigating the extent to which the current findings are generalizable to men and other populations. Several previous investigations have reported a significant and negative association between social support and blood lipid concentrations at rest (Gliksman et al., 1995; Thomas et al., 1985). However, two of the three studies were investigating a healthy elderly population. In contrast, a recent investigation of older African Americans reported opposite findings (Waldstein, Toth, & Poehlman, 1998). These investigators reported that those with more social support had higher total cholesterol and low density lipoprotein–cholesterol (LDL–c) concentrations, relative to those with lower levels of social support. Investigation of similar relationships among a healthy young adult population has resulted in finding either no association for social support and blood concentrations of cholesterol (Knox, Jacobs, Chesney, Raczynski, & McGreath, 1996; Terborg, Hibbard, & Glasgow, 1995) or only limited support for a positive association (Unden et al., 1995). In this study, we found no evidence for an association between overall social support, as measured by the ISEL, and lipids either at rest or during the stressor. No previous study has investigated the impact of social presence on lipids at rest and during stress. This study suggests that the presence of a friend may, in some circumstances, actually increase cholesterol stress responses.

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