Mental stress-induced hemoconcentration: Sex differences and mechanism

Jet J.C. S. Veldhuijzen Van Zanten, Christopher Ring, Victoria E. Burns, Kate M. Edwards, Mark Drayson, and Douglas Carroll.

Psychophysiology, 41 (2004), 541-551

Given the possible role of hemoconcentration in myocardial infarction and apparent sex differences in susceptibility, three studies examined sex differences in mental stress-induced hemoconcentration, and explored possible underlying mechanisms. Blood pressure, heart rate, and hematocrit were monitored at rest and in response to a mental stress task that was contrived to be increasingly provocative across the three studies. This was confirmed by self-report, performance, and cardiovascular reactivity data. The most convincing evidence for hemoconcentration effects and sex differences in hemoconcentration emerged from exposure to the more provocative of the stress tasks, with men also showing greater hemoconcentration than women. Blood pressure reactivity was a strong and consistent predictor of stress-induced hemoconcentration. These findings may help to explain sex differences in susceptibility to myocardial infarction.

Allen & Patterson, 1995 (1). Blood pressure (hemoconcentration)

Bachen, et al., 2003 (2). Blood pressure (hemoconcentration) with blood pressure

Lowe, 1994 (3). Blood pressure (hemoconcentration) with blood pressure

Protease, tryptase

Birmingham (2002) 20

BMI (2002) 20

Oz (2002) 20

These findings may help to explain sex differences in susceptibility to myocardial infarction.

Mental stress-induced hemoconcentration: Sex differences and mechanism

Jet J.C. S. Veldhuijzen Van Zanten, Christopher Ring, Victoria E. Burns, Kate M. Edwards, Mark Drayson, and Douglas Carroll.

Psychophysiology, 41 (2004), 541-551

Given the possible role of hemoconcentration in myocardial infarction and apparent sex differences in susceptibility, three studies examined sex differences in mental stress-induced hemoconcentration, and explored possible underlying mechanisms. Blood pressure, heart rate, and hematocrit were monitored at rest and in response to a mental stress task that was contrived to be increasingly provocative across the three studies. This was confirmed by self-report, performance, and cardiovascular reactivity data. The most convincing evidence for hemoconcentration effects and sex differences in hemoconcentration emerged from exposure to the more provocative of the stress tasks, with men also showing greater hemoconcentration than women. Blood pressure reactivity was a strong and consistent predictor of stress-induced hemoconcentration. These findings may help to explain sex differences in susceptibility to myocardial infarction.

Allen & Patterson, 1995 (1). Blood pressure (hemoconcentration)

Bachen, et al., 2003 (2). Blood pressure (hemoconcentration) with blood pressure

Lowe, 1994 (3). Blood pressure (hemoconcentration) with blood pressure

Protease, tryptase
研究一：壓力作業影響心縮壓、心舒壓與心跳率；血球容積的增加與血漿量的減少並不顯著，進一步分析證實壓力誘發男性血液濃度改變，女性心縮壓反應與血漿量成負相關。研究二：增加的壓力作業不僅引發心血管活動的改變，也產生顯著血液濃度的變化。證實壓力下的血液濃度效應男性大於女性。而壓力誘發 tryptase 的變化與血漿量有關，且女性較男性更具關連性。研究三：壓力作業實質上引發心跳、血壓與血液濃度的反應，後者的效應男性比女性大；心血管的反應，tryptase 的變化與血漿量成負相關，再次驗證女性較男性更具關連性。在多元迴歸模式心縮壓可預測血漿量，而且女性比男性有更強的傾向。三個研究的比較：作業等級與表現，研究二、三比研究一難度高，自評表現男性自認比例性好，實際上並無顯著。在表現上研究一優於研究三與二。

討論與結論

整體而言：1. 短期心理壓力與血液濃度有關，如血球容積增加與血漿量減少。較強的壓力作業也更強化血液濃度效應，而且男性比女性更被證實。2. 在實驗室裡心理壓力作業越強烈則心縮壓反應越大，血液濃度效應越強；此結論強調血液濃度的主要機制：動脈壓增高使靜脈壓增加。當然心理壓力持續時間的長短也是值得探討的問題。3. 先前研究無法證實男性在壓力下產生血液濃度效應比女性顯著，可能原因是所設計的壓力不足之故。4. 血壓反應與血液濃度有關，微血管過濾增加使動脈壓增高引發較高的靜脈壓；也有可能血壓反應與血液濃度並無因果關係，是受到交感神經的影響。5. 心理壓力使內皮組織開口使血管可透性增加，有如發炎的機制，研究三以 tryptase 來作為探討血管可透性增加的結構，卻無顯著性，無法作為與血液濃度關聯的機制，或許另有其他介質。結論：短期心理壓力誘發血液濃度效應，而且男性比女性顯著，也說明男性有較高的 MI 罹患率。

評論及心得

本研究以年青男女性為參與者，而女性在停經前可受到 estrogen 的保護，其血壓、膽固醇等會有變化。因此在性別差異的研究上較不易掌控。