Alcohol & Alcoholism Vol. 33, No. 5, pp. 528-532, 1998

CARDIOPROTECTIVE EFFECT OF MODERATE DRINKING: POSSIBLE MEDIATION BY VITAL EXHAUSTION

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(Received 19 January 1998; in revised form 14 April 1998; accepted 19 April 1998)

Abstract — A curvilinear relationship between alcohol consumption and heart disease risk has often been demonstrated. A similar relationship was found between vital exhaustion (VE) and alcohol intake in 62 Japanese and 53 British healthy males. Vital exhaustion is a prodromal state for cardiac events. A possible connection between moderate social drinking, VE and heart disease is suggested.

INTRODUCTION

Alcohol consumption has repeatedly been shown to have a curvilinear relation to coronary heart disease (CHD). Non-drinkers and heavy drinkers both seem to have higher risk of myocardial infarction (MI) and cardiac death than moderate drinkers. The mediating protective influences remain obscure. Most discussion has focused on biological properties of alcohol, such as its effect on lipoproteins or oxidation. Alcohol is used recreationally to achieve preferred mood states, so it is also possible that psychosocial factors such as avoidant hostility, exhaustion, and social support may be mediators.

Vital exhaustion (VE) has been shown to be a risk factor for cardiac events in the next year (Appels, 1980; Appels and Otten, 1992; Kop et al., 1994). The term was introduced in the late 1970s to describe a mental state which often precedes myocardial infarction. The concepts of exhaustion and depression share futility and lack of energy, but exhaustion does not seem to include sadness. VE also has much in common with burn-out, but tiredness on waking is more important than loss of motivation. Exhaustion is independent of effort, and does not show any simple relationship to subclinical ischaemic changes. Its relationship to physiological variables is not known at present. It is now emerging as a likely mediator for psychological influences on heart disease.

VE was included with CHD risk factors in a health check of male Rotterdam civil servants which started in 1979. A total of 3877 men were followed up for an average of 4.2 years (Appels, 1980). In the first year the relative risk was 10.05 for a fatal or non-fatal MI after controls for age, cholesterol, smoking and blood pressure. The relative risk for the subsequent 3 years was 2.23, 3.04 and 0.68, respectively, for coronary events in the next year. In another group of Rotterdam males (Appels and Otten, 1992) in the early 1970s, answers to the statement ‘I am completely exhausted, both mentally and physically at the end of the day’ were found to predict cardiac death. Exhausted coping, including disproportionate irritability and inability to withdraw from work obligations, substantially increased the risk of MI in the next 6.5 years (Siegrist et al., 1990).

Case–control methods, for example by Falger and Schouten (1992), have found that VE discriminates MI survivors from healthy controls, and applies equally to women. Most studies of VE have been undertaken in The Netherlands, but one report from Texas (Appels and Mendes de Leon, 1989) also shows the same trend. When 22 angina patients were compared with 44 orthopaedic patients, the odds ratio was found to be 2.36.

The concept of karoshi or overwork death may be related to exhaustion. Karoshi includes a variety of vascular events, linked only by a history of overwork. Pathologies include cerebral haem-
orrage, subarachnoidal haemorrhage, cerebral infarction, acute heart failure and myocardial infarction. Uehata (1991) studied 203 karoshi cases, and reported that the key issue was long working hours.

Hostility is an important construct for CHD, as it has independent predictive value for cardiac events. This may be because of unhealthy habits such as smoking, or through increasing the risk of vital exhaustion. Methods for assessing it remain underdeveloped. A detailed consideration is beyond the scope of this article, so the reader is referred to Barefoot (1992). The Cook-Medley scale is another widely-used questionnaire for CHD research. However, its declared construct of cynicism may also measure social withdrawal, paranoid ideation, and rigidity of moral standards. The main alternatives to self-report questionnaires are behavioural ratings. The Hostility Facet Scoring System is a development of the Structured Interview for Type A Behaviour. Behavioural observations may have slightly higher validity, but administration is much more exacting.

The scale of Buss and Durkee (1957) remains a good candidate for the assessment of hostility. The original factor analysis grouped seven clinical subscales into two major factors, and the eighth subscale, guilt, was kept separate. Assault, indirect hostility, irritability, negativism, and verbal hostility loaded on an expressive factor. Resentment and suspicion loaded on an experiential factor. The original authors have not published much standardization data since then. In Dutch translation (Lange et al., 1995), the two-factor structure was also found, while the eight clinical subscales retained clinical usefulness without achieving statistical independence. A seven-response version was compared with the two-response Buss-Durkee scale by Velicer et al. (1985). This had better stability between administrations, but the statistical structure was less closely related to the clinical definitions.

In the present paper, the possible involvement of hostility and the concept of VE in the relationship between alcohol consumption and cardiovascular disease were explored.

SUBJECTS AND METHODS

The present cross-sectional study compared VE and hostility among Japanese men living in Britain and native-born men. Subjects were engineers or managers in five corporations with Japanese connections. Valid responses were received from 62 Japanese and 53 Britons. The questionnaire measured VE, hostility, alcohol and socialization, work values, and CHD risk factors. Parallel forms in English and Japanese were constructed.

Assessment of vital exhaustion

VE was assessed with Form B of the Maastricht questionnaire (Appels, 1989). The 21 questions are reproduced here as Appendix 1. ‘Yes’ responses are scored 2, and ‘Don’t know’ as 1. Items 9 and 14 are reverse scored. The maximum possible is 42. Form B has good internal consistency. Cronbach’s alpha was found to be 0.85 and test–retest reliability was 0.85 in the Rotterdam study (Appels et al., 1987). Form A of the Maastricht questionnaire had 37 items, some of which were eliminated because of low predictive validity in the Rotterdam study (Appels, 1980).

Assessment of hostility and CHD risk factors

The hostility scale published by Buss and Durkee (1957) was used. This has 75 items, which are answered ‘Yes’, ‘No’, or ‘Don’t know’. Answers are scored into eight clinical subscales, and then into an experiential and expressive factor. CHD questions concerned smoking, dietary fat intake, exercise, heredity, height and weight, and recall of a diagnosis of high cholesterol or high blood pressure.

Assessment of drinking

Drinking was assessed by three questions. The first asked respondents to estimate their weekly intake of alcohol units. A table of the alcohol equivalents of wine, beer, and spirits was attached. The English version used familiar examples such as the pint and pub double, and the Japanese version used wine and whisky bottles and the standard large beer bottle. The respondent had six range choices. The ranges were: (1) I do not drink; (2) ≤5 units; (3) 6–12 units; (4) 13–20 units; (5) 20–30 units; (6) ≥30 units; (7) Cannot say. Self-report would be expected to underestimate true consumption. The second question concerned social drinking with work colleagues, for which four frequency choices were offered. The third question attempted to elicit status diversity in
socialization outside work. This choice of questions is derived from a hypothesis about after-work socialization as a hostility-reducing factor in Japanese men.

RESULTS

VE was used as the end-point. A score of 14 was used as a cut-off for VE, as this was the median value in previous questionnaire studies. The relationship between reported alcohol intake and VE was found to be curvilinear. The curve was definitely J-shaped in Japanese, and somewhat flatter for Britons. As differences between nationalities were small, data for 115 subjects were combined for the analysis of exhaustion and alcohol use. The data are summarized in Fig. 1.

Frequency of social drinking with colleagues had a negative correlation ($r = -0.1$) with exhaustion, which did not quite reach significance. Suspicious/resentful hostility had univariate correlations of $\sim 0.5$ with VE. Most of the Japanese expatriates did not report the stereotypical pattern of after-work socialization with colleagues. Some Japanese are intolerant of acetaldehyde, and would therefore be expected to report themselves as non-drinkers or occasional drinkers of alcohol. In fact the proportion drinking between 0 and 12 units (the bottom three points) was lower in Britons (68%) than in Japanese (61%), so acetaldehyde intolerance has not skewed the samples.

One-way analysis of variance was undertaken with Scheffé's method to compare means of several groups. VE was entered as a continuous variable with six levels of alcohol use as the independent factor. The seven heavy (≥30 units) drinkers were all in the exhausted range. This group was significantly ($P < 0.05$) different from the groups drinking <5, 6–12 and 13–20 units. There was no overlap in the 95% confidence intervals for exhaustion between the heavy drinkers and the occasional and moderate groups. (The confidence interval does not imply that no individual was extreme: the person with the maximum VE of 42 was actually in the group drinking 6–12 units.)

DISCUSSION

Alcohol intake showed a curvilinear relation with exhaustion, which is remarkably similar to that between alcohol intake and CHD risk. The analogy warrants further enquiry. A cardioprotective effect of moderate alcohol intake was first reported in association with red wine, and was often referred to as the 'French paradox'. More recent studies seem to show equal benefit from wine, beer or spirits. In a review of ecological,
case-control and cohort studies (Rimm et al., 1996), four studies of beer and four of spirit drinking showed a significant inverse association with CHD risk, equal to that of the four wine studies.

The search for biological mediators between alcohol and CHD has revealed high density lipoprotein (HDL) cholesterol as the strongest candidate. Kannel and Ellison (1996) calculated that 50% of the protective value of alcohol in the Framingham study was statistically associated with its correlation with HDL. This correlation between alcohol and a serum factor does not preclude psychobiological mediation, since lipoprotein fractions are also associated with hostility. Low total cholesterol is the best-documented, and has been associated with suicide, depression, and reduced impulse control. Death from injury has been found to be 1.4-fold higher in men with serum cholesterol <4.14 mmol/l (Cummings and Psaty, 1996). Suspicious/resentful hostility has an inverse relationship with aggression, and HDL has an inverse relationship with low density lipoprotein, so research to separate these issues is likely to be difficult.

Another possible mediator between moderate drinking, VE and low MI risk is via decreased platelet aggregability. Kop et al. (1993) studied coagulation factors in healthy volunteers. A chronically stressed group with a mean Maastricht score of 23.8 was compared with a non-stressed group with mean score of 3.5. Plasminogen activator inhibitor was found to be 13.0 au/l in the chronically stressed, significantly higher than the level of 6.0 au/l in the non-stressed group. There was no difference in fibrinogen or t-PA antigen. Chronic stress was found to be associated with plasminogen activator inhibitor by Raikkonen et al. (1996). The same Finnish team have shown that VE is related to elevated levels of the hormones of the hypothalamic-pituitary-adrenal axis (Keltikangas-Jarvinen et al., 1996). These results suggest that fibrinolysis is less efficient in exhausted subjects.

VE was shown in this study to be predisposed by suspicious/resentful hostility, and slightly offset by social support. Social isolation has been shown to be an independent predictor of cardiac death (Berkman, 1984). The following hypothesis is suggested by the results reported here: moderate drinking is often associated with social support, which in turn reduces suspicious/resentful hostility and prevents VE. French evening meals, English pub habits, or Japanese karaoke bars may be significant contexts for social support. Heavy drinkers and non-drinkers may both be more isolated than moderate drinkers. The association between heavy drinking and aggression might be seen as a failure to achieve reduction of hostility through social support while drinking moderately. Research on drinking situations as social support is indicated.

**REFERENCES**


APPENDIX 1: FORM B OF THE MAASTRICHT QUESTIONNAIRE FOR VITAL EXHAUSTION

Medical research is constantly trying to track down the causes of disease. You would help this research by answering the following questions about how you have been feeling lately. Please mark the answers that are true for you. If you do not know or cannot decide, circle the ? There are no ‘right’ or ‘wrong’ answers

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes ? No</th>
</tr>
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<tbody>
<tr>
<td>1. Do you often feel tired?</td>
<td>yes ? no</td>
</tr>
<tr>
<td>2. Do you often have trouble falling asleep?</td>
<td>yes ? no</td>
</tr>
<tr>
<td>3. Do you wake up repeatedly during the night?</td>
<td>yes ? no</td>
</tr>
<tr>
<td>4. Do you feel weak all over?</td>
<td>yes ? no</td>
</tr>
<tr>
<td>5. Do you have the feeling that you have not been accomplishing much lately?</td>
<td>yes ? no</td>
</tr>
<tr>
<td>6. Do you have the feeling that you cannot cope with everyday problems as well as you used to?</td>
<td>yes ? no</td>
</tr>
<tr>
<td>7. Do you believe that you have come to a ‘dead end’</td>
<td>yes ? no</td>
</tr>
<tr>
<td>8. Do you lately feel more listless than before?</td>
<td>yes ? no</td>
</tr>
<tr>
<td>9. I enjoy sex as much as ever</td>
<td>yes ? no</td>
</tr>
<tr>
<td>10. Have you experienced a feeling of hopelessness recently?</td>
<td>yes ? no</td>
</tr>
<tr>
<td>11. Does it take more time to grasp a difficult problem than it did a year ago?</td>
<td>yes ? no</td>
</tr>
<tr>
<td>12. Do little things irritate you more than they used to?</td>
<td>yes ? no</td>
</tr>
<tr>
<td>13. Do you feel you want to give up trying?</td>
<td>yes ? no</td>
</tr>
<tr>
<td>14. I feel fine</td>
<td>yes ? no</td>
</tr>
<tr>
<td>15. Do you sometimes feel that your body is like a battery that is losing its power?</td>
<td>yes ? no</td>
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<td>16. Would you want to be dead at times?</td>
<td>yes ? no</td>
</tr>
<tr>
<td>17. Do you have the feeling these days that you just do not have what it takes any more?</td>
<td>yes ? no</td>
</tr>
<tr>
<td>18. Do you feel dejected?</td>
<td>yes ? no</td>
</tr>
<tr>
<td>19. Do you feel like crying sometimes?</td>
<td>yes ? no</td>
</tr>
<tr>
<td>20. Do you ever wake up with a feeling of exhaustion and fatigue?</td>
<td>yes ? no</td>
</tr>
<tr>
<td>21. Do you have increasing difficulty in concentrating on a single subject for long?</td>
<td>yes ? no</td>
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