A LETTER TO THE EDITOR

Self-judged Work Activity Level and Lipid Metabolism in Young Male Adults.

Key words: Physical activity at work—Serum total—Cholesterol—Serum HDL—Cholesterol—Serum triglycerides—Skinfold thickness—Body mass index—Coronary heart disease

In developed countries, coronary heart disease (CHD) is one of the most common causes of death after middle age, especially in males. Hypercholesterolemia and total-cholesterol/high-density-lipoprotein-cholesterol ratio are risk factors for CHD, the former is a major one for CHD. However, hyper-high-density-lipoprotein-cholesterolemia is a negative risk factor for CHD. Lipid metabolism probably affects the pathogenesis of CHD. Physical inactivity and the incidence of CHD positively correlated. Physical activity and habitual exercise decreased serum total cholesterol and triglycerides, and increased serum high-density-lipoprotein cholesterol. These effects of physical activity on lipid metabolism seem to prevent CHD. We have various types of "physical activity", work, walking, sports, leisure, and so on. Since Japanese workers work long times daily, physical activity at regular work is the most regular and the most time-consuming physical activity in their daily lives. Thus, to determine whether the physical activity at work (work activity: WA) influences the lipid metabolism of Japanese workers, the serum lipids (total cholesterol (T-C), high-density-lipoprotein cholesterol (HDL-C) and triglycerides (TG)), skinfold thicknesses (ST), body mass index (BMI) and self-judged WA level were surveyed in young male full-time workers.

Subjects and their WA levels: The subjects were 364 thirty-year-old males living in Gifu-city who had visited the Gifu-city central public health center for 'health check for 30-year-olds' from April 1987 to March 1988. Individuals with a medical history of hepatic, renal or diabetic disease were excluded from the subjects. All the subjects were apparently healthy and had full-time jobs. A self-administered questionnaire 'Your physical activity level at work is (low, moderate, high or very high)' was used to classify WA levels, since the correct measurement of energy consumption of each subject at work is almost impossible to measure for many subjects. The subjects themselves chose one of the four classes. Since only one subject chose 'very high', the 'high' and 'very high' groups were combined. Finally, the WA levels of the subjects were simply
classified and coded into three groups (0 = low WA, n = 178; 1 = moderate WA, n = 133; and 2 = high WA, n = 53).

Drinking and smoking habits: The two habits of the subjects were also surveyed, because lipid metabolism could be influenced by these habits. The data on these habits were based on personal interviews with public health nurses. Drinking habits was classified and coded into four groups by the number of days having a drink per week (0 = non-drinker, n = 92; 1 = 1–3 days/week-drinker, n = 106; 2 = 4–6 days/week-drinker, n = 38; 3 = everyday-drinker, n = 128). The mean alcohol intake for the everyday-drinkers was about 40 g per day. The heaviest drinker had drunk about 130 g alcohol every day, but had no apparent medical problem. Smoking habits was classed into four groups by the number of cigarettes smoked per day (0 = non-smoker, n = 149; 1 = 1–19 cigarettes/day, n = 87; 2 = 20–39 cigarettes/day, n = 93; 3 = 40 or more cigarettes/day, n = 35).

Indicators for lipid metabolism: Venous blood was taken from each subject at 9–10 a.m. before breakfast. After collection of serum by centrifugation, serum T–C, HDL–C and TG (as triolein) were determined by a clinical-biochemical autoanalyzer (CL–7000, Shimadzu Seisakusyo, Kyoto) within 3 hours of the sampling. Serum T–C and TG were analyzed by enzymatic methods, and serum HDL–C by an enzymatic method with a phosphotungstate/magnesium chloride precipitation method. The ST (triceps + subscapular) of each subject was determined using a skinfold caliper, and the BMI (kg/m²) of each subject was calculated from body weight and body height.

All the data on the subjects were taken from medical records in the Gifu-city central public health center.

Statistical analysis: Student’s t-test was used to compare mean values. Multiple regression of the six indicators for lipid metabolism on the WA level, smoking and drinking habits were analyzed to detect the effects of WA on the six indicators independently from the effects of drinking and smoking habits. A commercial software for personal computers (Lotus 1–2–3, Lotus Development Corporation) was used in the multiple regression analysis. The statistical significance of the regression coefficients was tested. The statistical significance denotes p < 0.05 in all the tests.

Six indicators for the lipid metabolism of the 364 subjects by WA groups are presented in Table 1 (means ± s.d.). The high WA group had a significant higher mean HDL–C, a significant lower mean T–C/HDL–C ratio and a significant lower mean ST than the low and the moderate WA groups. The high WA group also had a significant lower mean TG than the low WA group. The differences in the mean T–C or the mean BMI among the three groups were not significant.

The multiple regression analysis of the six indicators on WA, drinking and smoking habits are summarized in Table 2.

Serum T–C: Neither of the three variables was a significant predictor for
SELF-JUDGED WORK ACTIVITY LEVEL AND LIPID METABOLISM

Table 1. Six indicators for lipid metabolism in 364 subjects by self-judged work activity groups. (means ± s. d.)

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Self-judged work activity groups</th>
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<tbody>
<tr>
<td></td>
<td>Low (n=178) Moderate (n=133) High (n=53)</td>
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<tr>
<td>T–C (mmol/l)</td>
<td>4.76±0.83  4.73±0.80  4.58±0.73</td>
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<tr>
<td>HDL–C (mmol/l)</td>
<td>1.28±0.29  1.33±0.28  1.44±0.32&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>T–C/HDL–C ratio</td>
<td>3.87±0.99  3.70±1.00  3.36±1.00&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>TG (mmol/l)</td>
<td>1.36±0.94  1.25±1.31  1.08±0.54&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>ST (mm)</td>
<td>25.3±10.1  24.0±10.0  20.0±9.6&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>BMI (kg/m&lt;sup&gt;2&lt;/sup&gt;)</td>
<td>22.1±2.6  22.1±2.6  21.4±2.8</td>
</tr>
</tbody>
</table>

<sup>a</sup>: The mean is significantly different from the mean for the low WA group.
<sup>b</sup>: The mean is significantly different from the mean for the moderate WA group.

All the subjects were 30-year-old males.

Serum T–C:

Serum HDL–C: The WA level and drinking habits were significant positive predictors for serum HDL–C, and smoking habits was a significant negative one. The highest multiple correlation coefficient in the six models was 0.333.

Serum T–C/HDL–C ratio: The WA level and drinking habits were significant negative predictors for serum T–C/HDL–C ratio, and smoking habits was a significant positive one.

Serum TG: The WA level was a significant negative predictor for serum TG, and smoking habits was a positive one, but drinking habits was not significant.

ST: The WA level was a significant negative predictor for ST, but neither of the other two variables was significant.

BMI: None of the three variables was a significant predictor for BMI.

It is well known that human lipid metabolism is influenced by drinking and smoking habits. The results in this survey suggest that WA is as effective on human lipid metabolism as the two habits, especially on serum HDL–C. High physical activity improved lipid metabolism,<sup>5-7</sup> and decreased the incidence of CHD.<sup>5-4</sup> Higher WA also decreased the incidence of the death from CHD.<sup>5-10</sup>

Our results are consistent with the results from these previous epidemiological studies. The correct energy consumption of each subject at work was not calculated in this study. Although the WA of the subjects were simply classified by their self-judgements, higher WA significantly influenced their lipid metabolism. The self-judged WA level, which is very easy and simple, is probably a useful indicator for physical activity in fieldwork for many subjects. Habitual exercise and leisure activity, not given here, may be a confounding factor in this study. We are planning to investigate the interactive effects of WA and habitual exercise on lipid metabolism in the next study.

The mean alcohol consumption was about 40 g/day even for the everyday-
Table 2. Multiple regression coefficients of the six indicators on self-judged work activity level, drinking, and smoking habits in 364 subjects.

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>T-C (mmol/l)</th>
<th>HDL-C (mmol/l)</th>
<th>T-C/HDL-C</th>
<th>TG (mmol/l)</th>
<th>ST (mm)</th>
<th>BMI (kg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-judged work activity (0, 1, 2)¹</td>
<td>-0.087 NS</td>
<td>0.069**</td>
<td>-0.242***</td>
<td>-0.158*</td>
<td>-2.147**</td>
<td>-0.236 NS</td>
</tr>
<tr>
<td>Drinking habits (0, 1, 2, 3)¹</td>
<td>0.004 NS</td>
<td>0.069***</td>
<td>-0.182***</td>
<td>0.050 NS</td>
<td>-0.552 NS</td>
<td>-0.099 NS</td>
</tr>
<tr>
<td>Smoking habits (0, 1, 2, 3)¹</td>
<td>0.071 NS</td>
<td>-0.032*</td>
<td>0.154**</td>
<td>0.120*</td>
<td>-0.791 NS</td>
<td>-0.124 NS</td>
</tr>
<tr>
<td>constant</td>
<td>4.703</td>
<td>1.205</td>
<td>4.018</td>
<td>1.180</td>
<td>27.118</td>
<td>22.476</td>
</tr>
<tr>
<td>R</td>
<td>0.113 NS</td>
<td>0.333***</td>
<td>0.300***</td>
<td>0.165*</td>
<td>0.198**</td>
<td>0.100 NS</td>
</tr>
</tbody>
</table>

¹: See 'text'.
R: multiple correlation coefficient.
NS: not significant (p > 0.05), *: p < 0.05, **: p < 0.01, ***: p < 0.001.
All the subjects were 30-year-old males.
drinkers. Most of the drinkers were moderate- and light-drinkers. Moderate alcohol intake increased serum HDL–C. But smoking, even light-smoking decreased serum HDL–C. These effects of the two habits on serum HDL–C were confirmed in this study. Both drinking and smoking habits have influenced body composition, especially in older males. In this study, neither drinking nor smoking habits had any significant effects on the ST or BMI. These conflicting results were probably because the subjects in this study, aged 30 years, were exposed to alcohol and tobacco smoke at most for 12 years. Much longer exposure may influence body composition.

CHD is one of the major causes of death in Japan as elsewhere, and the incidence of death from CHD is increasing year by year. The mean WA level for Japanese workers gradually decreases year by year, although their work-time has not changed in the last several years. The low WA and the long work-time may influence lipid metabolism and the incidence of CHD. Full-time workers should increase physical activity on their own time to improve lipid metabolism and to prevent CHD.

REFERENCES

13) Williamson DF, Forman MR, Binkin NJ, Gentry EM, Remington PL, Trowbridge FL. Alcohol

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