Relationship of Prison Life Style to Blood Pressure, Serum Lipids and Obesity in Women Prisoners in Japan

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Abstract: This prospective study of female prison inmates assessed the effects of prison labour life style on the blood pressure (BP), serum lipids, and body mass index of pre- and postmenopausal female prisoners. This study was carried out in the largest women’s prison, located in a town in the North East of Japan. The prison serves a reasonably large community. Three hundred and twelve premenopausal female prisoners and 88 postmenopausal female prisoners in a women’s prison participated in this study. Weight and height were measured to calculate the body mass index, and systolic and diastolic blood pressure were measured with a sphygmomanometer. Serum samples were collected for serum lipid estimations. Base-line data of two groups were compared by unpaired t-test, and changes in these data from the initial values were tested by paired t-test. From our limited data, both the pre- and postmenopausal female prisoners showed decreases in systolic and diastolic pressure, total cholesterol, triglycerides, LDL-cholesterol, and body mass index. Both also showed increases in HDL-cholesterol. Given that almost all the women in this prison had the same labour life style, the findings of this study suggest that BP, the serum lipids concentration and obesity can be changed effectively by prison labour life, but are less readily changed in postmenopausal than in premenopausal women.

Key words: Serum lipids, Blood pressure, Body mass index, Prison, Menopause

Introduction

The main focus of this study was the effect of a prison labour life style on women prisoners working within the same physical environment and with the same nutrition without access to cigarettes, alcohol, and ‘hard’ drugs in terms of variations in BP, lipids and body mass index within a period of 1 year. As this survey was carried out in a women’s prison, and previous studies revealed that menopause give rise to an increase in serum lipid levels, we divided all participants into two groups, pre- and post-menopausal. Premenopausal female prisoners were compared with postmenopausal. Data for pre- and postmenopausal female prisoners were examined individually and were then combined for an overall analysis.

The influence of prison labour life style on blood pressure (BP), serum lipids and body mass index was examined longitudinally at 12-month intervals in a women’s prison in Japan. BP, serum lipids and body mass index were also examined at admission and 12 months later in pre- and post-menopausal women. The results for 400 women are reported here.

Epidemiologic evidence indicates that increased physical activity is negatively related to the risk of hyperlipidemia1-9. To the extent that physical activity does have a protective effect against hyperlipidemia, it is important to understand
how activity exerts lower beneficial effects. It has been hypothesised that physical activity leads to a less atherogenic risk factor profile. While sample support for this hypothesis exists among men, few studies have investigated this hypothesis among women\textsuperscript{5-7}.

Several factors other than exercise may have an influence on plasma lipids and obesity. Cigarette smoking is an important risk factor for hyperlipidemia and other coronary heart disease\textsuperscript{8-10}. Serum lipids and obesity vary with diet, and alcohol consumption\textsuperscript{11-13}, but all previous reports have examined the general population. The prisoners investigated in this study lived in detained conditions, and were prohibited from smoking cigarettes, consuming alcohol and using ‘hard’ drugs, and their nutrition was restricted to 1,800 kcal per day. And they had to work every day at the factory in the prison. In addition, there has been no research conducted on the association of prison labour life style with BP, serum lipids and obesity.

This study tested the hypothesis that physical activity under a prison labour life style with restricted nutrition, abstinence from smoking and drinking alcohol, would enhance change in serum lipids and obesity in both pre- and postmenopausal female prisoners.

**Subjects and Methods**

The present survey was carried out between April, 1995 and April, 1996. The study was undertaken on 400 female prisoners residing in a women’s prison in Japan and who were aged 20 to 79 years. Following permission from the local prison authorities, informed consent was obtained from the inmates after adequate explanation of the study. All were asymptomatic and none was taking exogenous hormones or any other medication known to influence lipid and lipoprotein metabolism. The women were categorized into two groups: premenopausal women who still regularly menstruated, and postmenopausal women who had ceased menstruating for 12 months or more. All the premenopausal women had a history of regular menstrual bleeding. The postmenopausal women had not had a hysterectomy and were not pregnant. All the women were examined at the time of admission to prison and 12 months later.

A standard medical questionnaire was completed for each of the inmates, addressing issues such as medical history, alcohol consumption, smoking and the use of ‘hard’ drugs. Arterial blood pressure was measured on the right arm by the auscultation method with a standard mercury sphygmomanometer. A cuff was selected that was wider than the diameter of the arm. An adult cuff was available to the examiners. Measurements were taken after resting for 15 min. The systolic blood pressure was read at the first pulse sound while diastolic pressure was taken at the fifth Korotkoff sound. The blood pressure of each subject was measured three times by the same physician at intervals of five minutes during the course of the examination.

Height and weight were measured without shoes and with light clothing. The obesity index used in this study was the body mass index and was calculated as weight (kg)/(height × height) (m²). Total caloric intake per day was calculated from three-day food logs and was an indirect assessment of caloric expenditure.

Blood samples were taken from the cubital vein 12 hr after eating dinner between 7.00 and 8.00 am the next morning. The samples were incubated in an ice bath for 30 min and precipitated plasma lipoproteins were removed by centrifugation at 1,500 g for 30 min at 4°C. Total serum cholesterol and high density lipoprotein cholesterol were measured by the enzymic method\textsuperscript{14} and triglyceride by the acetylaceetone colorimetric method\textsuperscript{15}. Low-density lipoprotein was computed with the Friedewald formula\textsuperscript{16}.

**Statistical methods**

The 400 female prisoners who completed the study were divided into pre- and postmenopausal groups. Three hundred and twelve female prisoners were premenopausal and 88 postmenopausal. The values were calculated as means ± standard deviation (SD). Unpaired t-test was used to compare the initial values and main characteristics of the two groups. The average changes in BP, serum lipids, serum lipoproteins and body mass index of both groups from the initial values were tested by the paired t-test. To compare average changes in BP, serum lipids, serum lipoproteins and body mass index in the pre- and postmenopausal groups, we used the unpaired t-test.

**Results**

The age distribution of the female prisoners in this study is shown in Figure 1. The main characteristics of the female prisoners according to their menopausal status are shown in Table 1. The age range of the prisoners was 20–79 years with about 92% below 40 years. The mean age of premenopausal female prisoners was 33.2 ± 7.7 years while that of the postmenopausal groups was 58.7 ± 4.6 years. The percentage of premenopausal prisoners who had been smokers was 78% while that of the postmenopausal group
was 45%. The percentage of premenopausal prisoners who had been drug abusers was 33% while that of the postmenopausal group was 8%. The percent of premenopausal prisoners who had been alcohol consumers (more than 30 g/day) was 84% while that of the postmenopausal groups was 36%. The mean body weight of the premenopausal prisoners was 56.7 ± 9.1 while that of the postmenopausal group was 61.1 ± 6.1 kg. Premenopausal female prisoners had significantly more cigarette smoking, drug abuse and alcohol drinking habits. Postmenopausal female prisoners were significantly older and heavier than premenopausal prisoners. Moreover, there were more current smokers, previous drug abusers and higher alcohol consumers among the premenopausal than the postmenopausal prisoners.

Because there was great variability in BP, serum lipids and body mass index responses among both the pre- and post-menopausal female prisoners, analyses of variance were used to compare the differences as shown in Table 2. Pre- and postmenopausal groups differed in their initial BP, serum lipids and body mass index values. Initial values were higher in the postmenopausal groups than in the premenopausal groups for systolic pressure, diastolic pressure, total cholesterol, triglyceride, LDL cholesterol and body mass index, but were lower for HDL cholesterol.

Table 3 shows the average changes after 12 months in all prisoners in blood pressure, serum lipids and body mass index. All serum lipids, except for HDL-cholesterol, decreased after 12 months from the time of admission, but there were no statistical differences in HDL-cholesterol and systolic and diastolic pressure after 12 months.

The average changes from the initial values after 12 months for the 400 prisoners according to the menopausal status for BP, total cholesterol, HDL cholesterol, LDL cholesterol,
triglycerides and body mass index are shown in Table 4.

The 312 premenopausal prisoners showed a decrease of 5.3% in systolic pressure, 14% in diastolic pressure, 5.3% in total cholesterol, 5.8% in triglyceride, 12% in LDL cholesterol, 13% in body mass index and an increase of 3.1% in HDL cholesterol.

The BP, serum lipids, and lipoprotein changes in the postmenopausal prisoners were different from those in premenopausal prisoners. The group of 88 postmenopausal subjects showed a decrease of 0.9% in systolic pressure, 7.6% in diastolic pressure, 0.9% in total cholesterol, 3.6% in LDL cholesterol and a decrease of 2.3% in triglyceride, 6.4% in body mass index, and an increase of 3.0% in HDL cholesterol.

Premenopausal groups showed significantly greater percent changes in systolic pressure, diastolic pressure, total cholesterol, HDL cholesterol, triglyceride, LDL cholesterol and body mass index.

### Discussion

Many studies have reported that serum lipids are reduced by physical training\(^{17-19}\). Regular physical activity is associated with a decreased incidence of coronary heart disease\(^{20-23}\), and exercise may reduce coronary risk by altering plasma lipid and lipoprotein levels.

Prospective studies on exercise and lipid changes have yielded conflicting results. Studies of women have shown consistent increases in HDL cholesterol during programs of moderate or intensive exercise and have shown either a decrease or no significant change in LDL cholesterol\(^{24-29}\).

Other studies have found that smoking is an important risk factor for hyperlipidemia and other coronary heart disease. Women who smoke as little as half a pack a day may have a 50% increased risk of hyperlipidemia and other coronary heart disease\(^{5-9}\). Smoking may not be directly related to hypertension and hyperlipidemia, but it is nonetheless a major risk factor for cardiovascular disease.

‘Hard’ drugs, such as amphetamine are known to increase
catecholamine release and prevent neuronal re-uptake and induce cardiovascular disease, such as hypertension. As prisoners in Japan may not use ‘hard’ drugs in prison, their blood pressure may become stable within a short period when they live in detained conditions.

All previous research on blood pressure, serum lipids and obesity have examined the general labour population, consisting of subjects who do not live in the same environment, do not take the same nutrition, and can freely indulge in cigarettes, alcohol and ‘hard’ drugs, but the population in this study lived in the same restricted environment for 12 months, without cigarettes, alcohol or ‘hard’ drugs.

The findings of this study revealed that all the female prisoners showed a decrease in total cholesterol, triglycerides, LDL-cholesterol, body mass index and BP. In particular, premenopausal prisoners showed significantly greater changes in total cholesterol, triglyceride, LDL cholesterol and body mass index than the postmenopausal group living within the same labour environment and under the same nutrition.

Our survey confirmed the results of many previous studies, showing that menopause might give rise to increases in serum lipid levels. The incidence of atherosclerotic disease is generally much higher in men than in women until middle age, and the serum lipid level of women is known to exceed that of men after middle age. The role of menopause in the development of atherosclerotic disease remains controversial.

The prison labour life style in this study was different from the usual labour life style. The prisoners in this study lived in the same detained conditions, without access to cigarettes, alcohol or drugs. Their dietary intake was restricted to 1,800 kcal/day, and they had to do the same work 7 hr a day at the factory in a prison. They also had to do moderate exercise training for 30 min per day walking around the prison grounds.

As cigarette smoking, excessive alcohol intake and overeating are associated as major risk factors with hyperlipidemia and other cardiovascular diseases, and physical activity has been shown to be significantly negatively associated with these diseases, periods of exercise in daily prison life isolated from these risk factors may be of benefit in preventing the diseases.

It is important to note the limitations of this study. Since the population of this study was in a special labour environment, it might not be possible to generally apply the findings to other labour populations of women. Nevertheless, we have stressed the difference between pre- and postmenopausal women in the fall in blood pressure and serum lipids, but it was not clear whether the difference was really related to the menopausal or hormonal status. It may simply be a reflection of aging. And although we assumed the fall in blood pressure, serum lipids and obesity in all the prisoners might in part result of the effect of exercise or a psychological effect, we could not accurately calculate these factors.

Though there were more current smokers, previous drug abusers, and high alcohol consumers among the premenopausal than the postmenopausal prisoners, initial values for blood pressure, serum lipids, except for HDL-cholesterol, and body mass were higher in the postmenopausal groups. These results also might in part be a reflection of aging. It was not sure how much these previous habits had reflected the change in the blood pressure, serum lipids and body mass index of inmates.

Our intervention study was consistent for all of the subjects, and 99% of all prisoners in this women’s prison participated in the research program. In conclusion, from our limited data, it appears that BP, the serum lipid concentration and obesity can be altered effectively by strict labour life style intervention such as life in prison, but it remains more difficult to achieve these changes in postmenopausal than in premenopausal women.

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References


