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Association of Leisure Time Physical Activity with the Risk of Coronary Heart Disease, Hypertension and Diabetes in Middle-Aged Men and Women

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Background. The association of physical activity and the risk of coronary heart disease (CHD), hypertension and diabetes has previously been studied mostly in separate follow-up studies. The present analysis focuses on the association between physical activity and these three metabolic diseases in a representative adult cohort.

Methods. The effect of the total amount and intensity of leisure time physical activity on the risk of the three diseases was studied in a cohort of 1340 men and 1500 women aged 35–63 years.

Results. During the 10 years of follow-up the incidence rates per 1000 person-years for CHD, hypertension and diabetes were 108, 142 and 64 for men and 75, 117 and 54 for women, respectively. In the Cox proportional hazards model the men's total amount of activity was inversely associated with the risk of CHD and hypertension. An age- and smoking-adjusted relative risk of 1.98 (95% confidence interval [CI] : 1.22–3.23) for CHD and age-adjusted risk of 1.73 (95% CI : 1.13–2.65) for hypertension were found for the lowest third total activity group compared with the highest third of total activity. Vigorous activity once or more often a week was inversely associated with the risk of hypertension. For the women both a higher total amount of activity and weekly vigorous activity had an inverse association with the risk of diabetes. An age-adjusted relative risk of 2.64 (95% CI : 1.28–5.44) for diabetes was found for the lowest third activity group compared with the highest third.

Conclusions. The results suggest a preventive effect of leisure time physical activity on CHD, hypertension and diabetes. This effect may differ among middle-aged men and women and the relative importance of the total amount and the intensity may vary depending on the outcome measure.

Keywords: coronary heart disease, diabetes, energy expenditure, hypertension, intensity, leisure time activities

The role of physical activity in the prevention of coronary heart disease (CHD) has been studied extensively.[1–3] In most studies regular physical activity was found to be associated with a reduced risk of CHD, especially among middle-aged men.[4–18] The association between physical activity and the development of hypertension has been reported in only a few investigations. The evidence for the association has been weak, especially for older populations and women.[19,20] Even more limited data are available on the relation between physical activity and maturity onset diabetes (MOD). A few recent prospective studies have suggested that physical activity may be protective against maturity onset diabetes.[21–25] Despite the growing evidence suggesting that physical activity has a protective effect against several metabolic diseases, the published data yield somewhat conflicting results about the nature of physical activity needed to achieve these effects. It is uncertain whether the total amount of energy expenditure or the intensity of activity is more important in reducing the risk.[3,26] Some studies indicate that regular and vigorous exercise is needed,[5,16] whereas others[7,15] suggest that the total amount of energy expenditure, including that of moderate duration and intensity, is enough to reduce the risk.

Using prospective cohort material designed to reveal the interrelationships between physical activity and various health outcomes, we have studied the associations

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between leisure time physical activity and incidence of fatal and non-fatal CHD, hypertension and diabetes. Of special interest was the study of both the effect of the total amount of physical activity, estimated as weekly energy expenditure, and the intensity of leisure time physical activity in affecting the risk of the diseases of interest. The associations were investigated among healthy middle-aged men and women during a follow-up time of 10 years.

MATERIALS AND METHODS

Subjects

A systematic representative sample (n = 6787) of residents aged between 19 and 63 years was drawn from the census data of a medium-size industrial town and two rural municipalities in northeastern Finland. The sample represented about 20% of the working-age population of the target area in 1980.

A self-administered questionnaire including structured questions concerning living habits and health behaviour, health status and functional capacity, and socio-demographic background factors was sent to the subjects at the beginning of 1980. The final response rate, after two reminders, was 77.5% (n = 5259).

Follow-up questionnaires requesting similar information were sent to the respondents 5 and 10 years later. The response rates for these surveys were 84 and 85%, respectively.

Due to the very low incidence of the outcome diseases among those under 35 years of age at the beginning of the follow-up period these young adults were excluded from the analysis. Among the cohort aged 35–63 years, there were 1139–1182 men and 1358–1363 women who had outcome information on the diseases in 1985 and/or 1990 (Figure 1). Of those, subjects who reported the outcome disease in the first survey were excluded from the analyses concerning that specific disease. In order to reduce any selective bias towards low-level activity as a result of a disease, all those who reported that they were totally unable to participate in physical activity due to their health status were also excluded. In addition, the respondents who failed to respond to 5 or more of the 13 questions that were used to assess the weekly energy expenditure in physical activity were excluded. After all the exclusions, 865 men and 965 women aged 35–63 years were included in the CHD analysis. Similarly, 731 men and 796 women were included in the hypertension analysis and 891 men and 973 women qualified for the analyses regarding diabetes. The smaller number of subjects in the analyses concerning hypertension was due to the higher prevalence of hypertension at the beginning of the study.

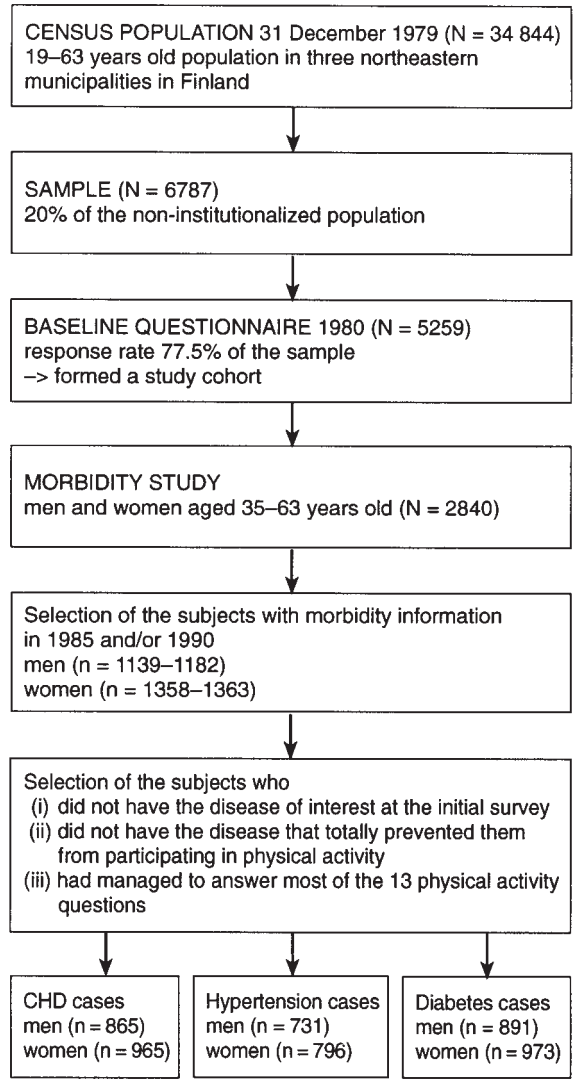

FIGURE 1 *Study design of the prospective follow-up study carried out in northeastern Finland in 1980–1990 and the selection criteria for the current analysis*

Assessment of Follow-up Events

Mortality from CHD, hypertension and diabetes was monitored using national census data from the Central Statistical Office of Finland until the year 1990. The follow-up period was thus 10 years. Information on the incidence of non-fatal CHD, hypertension and diabetes was obtained from self-administered questionnaires. The information on different medical conditions was asked by the following structured question 'Do you have or have you had any of the following diseases?'

People who reported angina pectoris or other CHD or myocardial infarction in follow-up surveys and the deceased for whom CHD was registered in the death certificate were considered as CHD cases. The hypertension and diabetes cases comprised those who in self-administered questionnaires reported having hypertension or high blood pressure or diabetes or high blood glucose level, and the deceased for whom hypertension or diabetes was registered in the death certificate, respectively. The new cases of diabetes were considered as maturity onset diabetes mellitus.

The validity of the questionnaire data regarding CHD, hypertension and diabetes was assessed by estimating the sensitivity and specificity and using a Kappa coefficient to determine the overall agreement with the data obtained from medical records for a random sample of 600 men and women aged 35–63 years at the onset of the study. The agreement of these two information sources was good for CHD (Kappa 0.73–0.80), hypertension (Kappa 0.74–0.80) and diabetes (Kappa 0.71–0.79) for both men and women.[27] In other words, 78–94% of those who reported having hypertension in the questionnaire also had it according to their medical records and 73–88% of those having hypertension according to the medical records also had it according to the self-administered questionnaire information.

Assessment of Physical Activity

Total leisure time physical activity was assessed primarily from the data obtained with 23 individual questions concerning conditioning exercise, sports, physical recreation, different leisure time and household chores, and commuting to and from work. An index for total leisure time physical activity was expressed as the weekly net energy expended during physical activity (kcal/week). It was calculated by multiplying the weekly frequency and average duration of each type of physical activity reported and a coefficient estimating the rate of the energy cost and the seasonal duration of each activity. The rate of the energy cost of each activity was derived from the compendium of the energy cost of physical activities presented by Ainsworth *et al.*[28] The net energy expenditure was calculated for each activity by subtracting the value 1.0 from the given MET value.[29]

When no information was available on the duration of a physical activity session, the estimated average time was derived from the Finnish time-budget study.[30] The seasonal coefficient was assigned a value of 1.0 if the physical activity could be done all year round. For the seasonal activities like gardening, the value was scaled to the estimated length of the active season, and thus the range for the seasonal coefficients was 0.1–1.0.

The constructed index was used to divide the subjects into high, moderate and low physical activity groups according to the total amount of weekly energy expended during leisure time physical activity. For men the index was categorized as 0–1100 kcal per week, 1101–1900 kcal per week and $>$1900 kcal per week, respectively. For women the weekly energy expenditure for leisure time physical activity was lower than for men and the classification was 0–900 kcal per week, 901–1500 kcal per week and $>$1500 kcal per week, respectively.

The measure for the intensity of the leisure time physical activity was based on the MET values of the self-reported activities. According to previous studies exercise with a MET value of $\geqslant$6 represents vigorous activity.[31,32] The weekly frequency needed to participate in vigorous activity has varied between studies from once a week to more often. Therefore, in this study the intensity of the activity was classified as vigorous if the respondents engaged once or more often a week in an activity for which the MET value was $\geqslant$6. The rest of the subjects were considered to have engaged in non-vigorous activities.

Assessment of Confounding Factors

In this study hypertension and diabetes were first considered as possible independent outcomes of physical inactivity. However, several studies have shown that hypertension, diabetes, smoking and overweight are strong risk factors for the development of CHD. Therefore, these conditions as well as alcohol consumption and socioeconomic status were considered potential confounding factors when the association between leisure time physical activity and CHD was analysed. Smoking status was considered on the scale 'never smoked or past smoker' and 'current smoker'. Socioeconomic status was categorized as follows: 'manual workers', 'lower-level employees', 'upper-level employees' and 'others'. Initial hypertension and diabetes were considered on the scale 'yes' and 'no'. In addition to those who had the disease initially, the cases of diabetes that appeared during the 1980s were considered confounding factors due to the strong genetic determination of the disease. Age and total alcohol consumption were considered to be continuous variables. Body mass index was used as a continuous variable apart from for graphic purposes where it was divided into two categories, one being $\leqslant$27 kg /m^2 and the other being $>$27 kg/m^2. Possible differences in response rates in 1990 among initially physically active and inactive subjects were also checked in order to control the potential bias related to this. There were no statistically significant differences in response rates among vigorously and non-vigorously active men and women.

TABLE 1 *Age-adjusted incidence rates and relative risks for coronary heart disease (CHD), hypertension and diabetes over 10 years of follow-up according to the level of leisure time physical activity among initially healthy northeastern Finnish men, 1980–1990*

Measure (no. of subjects)	CHD (n = 842)				Hypertension (n = 731)				Diabetes (n = 891)			
	New cases	Age-adjusted[a] rates per 1000 person-years	RR[b,c]	95% CI[c]	New cases	Age-adjusted rates per 1000 person-years	RR	95% CI	New cases	Age-adjusted rates per 1000 person-years	RR	95% CI
Total energy expenditure												
High (n = 258–309)	24	8.1	1.00		34	12.7	1.00		17	5.3	1.00	
Moderate (n = 221–282)	31	11.1	1.33	0.78–2.27	50	20.8	1.66	1.07–2.57	20	6.4	1.21	0.63–2.31
Low (n = 252–300)	53	16.6	1.98	1.22–3.23	58	20.8	1.73	1.13–2.65	27	8.1	1.54	0.83–2.84
			LR[b] = 8.5, d.f. = 2, P = 0.014				LR = 7.8, d.f. = 2, P = 0.021				LR = 2.0, d.f. = 2, P = 0.374	
Intensity												
Vigorous activity at least once a week (n = 269–327)	30	9.4	1.00		38	14.0	1.00		16	4.7	1.00	
less than once a week (n = 426–564)	78	13.8	1.42	0.92–2.17	104	20.9	1.56	1.07–2.28	48	7.8	1.63	0.92–2.88
			LR = 2.7, d.f. = 1, P = 0.102				LR = 5.8, d.f. = 1, P = 0.016				LR = 3.0, d.f. = 1, P = 0.082	

[a] Incidence rates age-adjusted by the direct method using the total population as the standard.
[b] Adjusted also for smoking.
[c] RR, relative risk; CI, confidence interval; LR, likelihood ratio (Cox proportional hazards model).

Statistical Analysis

Age-adjusted incidence rates per 1000 person-years of follow-up were computed for each of the three levels of total leisure-time physical activity and the two categories of intensity among those initially free of the disease of interest. The incidence rates for different diseases were age-adjusted by the direct method using the total population as the standard. The following age groups were designated: 35–44, 45–54 and 55–63 years.

A multivariate analysis for estimating the relative risk of CHD, hypertension and diabetes with respect to person-years was computed using the Cox proportional hazards model.[33] The basic analysis for different metabolic diseases included adjustment for age and in the case of CHD also for smoking. The further analysis for hypertension included adjustment for age and body mass index and among the men also for diabetes. For diabetes the confounders that arose from the regression model were age, body mass index and hypertension among the men and age, body mass index and alcohol consumption among the women. The models for CHD also included several other confounders. The age-adjusted incidence rates and relative risks of CHD were assessed for main confounders at different levels of total leisure time physical activity, as well.

RESULTS

Leisure Time Physical Activity and Coronary Heart Disease

Tables 1 and 2 show age-adjusted incidence rates and age- and smoking-adjusted relative risks of CHD during the 10-year follow-up period according to the three levels of total energy expenditure and the two levels of intensity for men and women, respectively. Age- and smoking-adjusted relative risks for CHD showed that an increase in the total amount of leisure time physical activity was statistically significantly associated with a reduced risk of CHD among men but not among women. For men in the low total activity group the risk of CHD was twice the risk of CHD in the high activity group. The intensity of leisure time physical activity was not statistically significantly associated with the risk of CHD either for men or for women.

Leisure Time Physical Activity and Hypertension

As with CHD, the age-adjusted incidence rates of hypertension were highest for the least active men (Table 1) and women (Table 2). The age-adjusted relative risk of hypertension was 60–70% higher for the sedentary men than for the most active people (Table 1). After further adjustment for body mass index and diabetes the

TABLE 2 *Age-adjusted incidence rates and relative risks for coronary heart disease (CHD), hypertension and diabetes over 10 years of follow-up according to the level of leisure time physical activity among initially healthy northeastern Finnish women, 1980–1990*

Measure (no. of subjects)	CHD (n = 953)				Hypertension (n = 796)				Diabetes (n = 973)			
	New cases	Age-adjusted[a] rates per 1000 person-years	RR[b,c]	95% CI[c]	New cases	Age-adjusted rates per 1000 person-years	RR	95% CI	New cases	Age-adjusted rates per 1000 person-years	RR	95% CI
Total Energy Expenditure												
High (n = 275–319)	21	6.4	1.00		39	13.1	1.00		10	2.6	1.00	
Moderate (n = 250–310)	17	5.3	0.73	0.38–1.39	33	12.3	0.94	0.59–1.50	12	3.6	1.17	0.50–2.70
Low (n = 271–344)	37	8.8	1.25	0.72–2.15	45	15.4	1.16	0.75–1.79	32	7.7	2.64	1.28–5.44
			LR[b] = 3.5, d.f. = 2, P = 0.178				LR = 0.9, d.f. = 2, P = 0.648				LR = 10.2, d.f. = 2, P = 0.006	
Intensity												
Vigorous activity at least once a week (n = 196–228)	13	6.5	1.00		26	12.7	1.00		6	2.7	1.00	
less than once a week (n = 600–745)	62	7.5	1.13	0.62–2.07	91	14.1	1.15	0.74–1.78	48	5.8	2.23	0.95–5.23
			LR = 0.2, d.f. = 1, P = 0.694				LR = 0.4, d.f. = 1, P = 0.537				LR = 4.1, d.f. = 1, P = 0.043	

[a] Incidence rates age-adjusted by the direct method using the total population as the standard.
[b] Adjusted also for smoking.
[c] RR, relative risk compared to reference category; CI, confidence interval; LR, likelihood ratio statistics (Cox proportional hazards model).

association between total amount (P = 0.076) and intensity of leisure time physical activity (P = 0.083) and the risk of hypertension remained statistically suggestively significant among men. For women neither of these leisure time physical activity measures were significantly associated with risk of hypertension. However, after adjustment for both age and total amount of activity, the intensity of activity was not associated with the risk of hypertension for men either.

Leisure Time Physical Activity and Diabetes

The age-adjusted incidence rate and relative risk of diabetes decreased fairly steadily as the energy expended increased and as activity changed from non-vigorous to vigorous among both men and women (Tables 1 and 2). For men an increased intensity of leisure time physical activity was suggestively significantly (P = 0.08) associated with an age-adjusted relative risk of diabetes (Table 1). However, after further adjustment for body mass index and hypertension the association weakened further. For women in the low total activity group the age-adjusted relative risk of diabetes was more than two and half times that of the women in the high activity group (Table 2). According to the intensity measure the risk of diabetes among non-vigorously active women was slightly more than twice the risk for vigorously active women. The associations of both total amount (P = 0.019) and intensity of leisure time physical activity (P = 0.055) with the risk of diabetes remained statistically significant even after further adjustment for body mass index and alcohol consumption. After adjustment also for total amount of activity the intensity of activity was not associated with risk of diabetes either among men or women.

Leisure Time Physical Activity in Relation to the Risk Factors for Coronary Heart Disease

Figure 2 presents the association between total amount of leisure time physical activity and diabetes in the 1980s (panel A), initial hypertension (panel B), smoking status (panel C), and body mass index (panel D), and the risk of CHD. Panel A shows that there was a steady decline in the risk of CHD with increasing levels of energy expenditure, whether or not the men had diabetes during the 1980s. Both the energy expenditure index for leisure time physical activity and diabetes status contributed independently to the incidence of CHD.

In panel B of Figure 2 both the level of energy expenditure for leisure time physical activity and the initial hypertension status were statistically significantly associated with the risk of CHD. There was a suggestive interaction effect (P = 0.09) between hypertension and

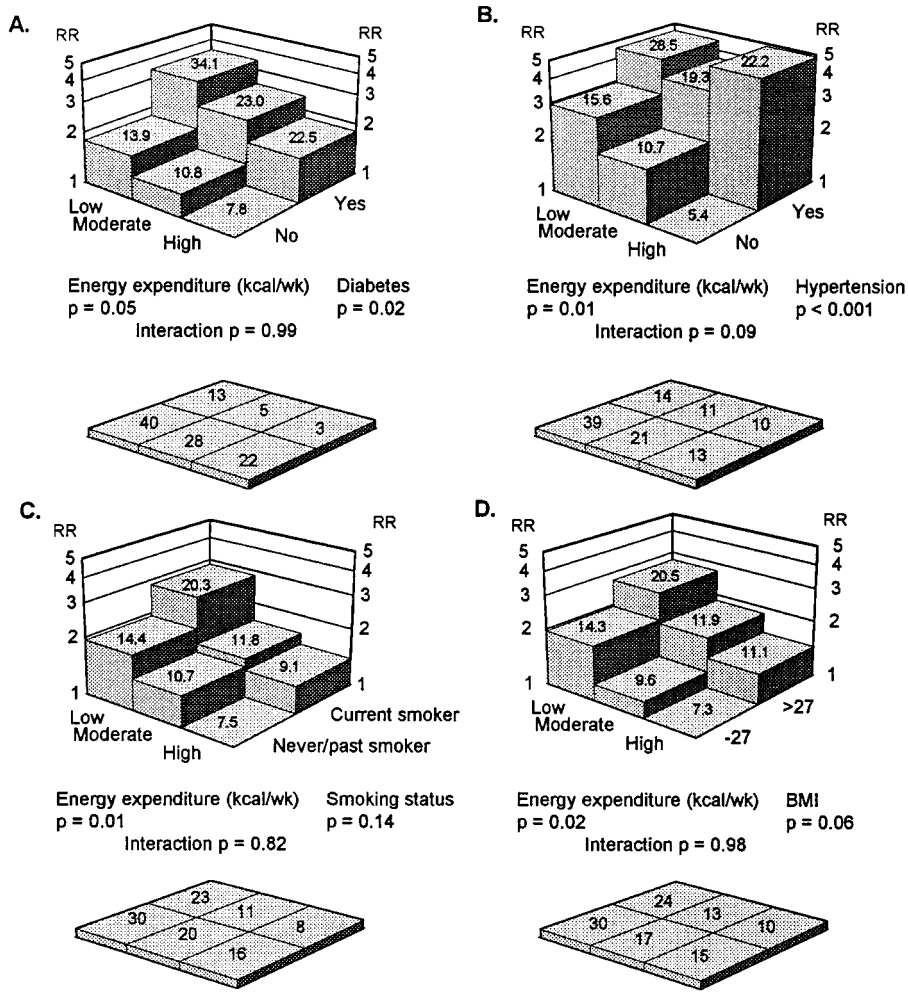

FIGURE 2 *Age-adjusted incidence rates and relative risks for coronary heart disease over 10 years of follow-up according to the data for the total amount of energy expended in leisure time physical activity (LTPA) in relation to the diabetes status (A), hypertension status (B), smoking status (C) and body mass index (BMI) (D) of initially healthy northeastern Finnish men, 1980–1990*

Numbers at top of the blocks designate age-adjusted coronary heart disease rates per 1000 person-years. The number of cases of coronary heart disease are given in the corresponding grid. *P*-values for each characteristic are based on the adjustment for age and the paired characteristic.

the total amount of leisure time physical activity which suggested that the effect of activity may differ for normotensive and hypertensive men. In fact, panel B suggests that, among initially hypertensive men, leisure time physical activity had no protective effect against CHD.

Panel C shows that the risk of CHD declined almost steadily among smokers and non-smokers as the energy expenditure of the leisure time physical activity increased. After adjustment for age and the total amount of activity, smoking status was not statistically significantly associated with the risk of CHD, however.

Panel D indicates that among both the overweight and normal weight men the incidence and the risk of CHD declined as the levels of energy expenditure increased. The protective effect of the total amount of leisure time physical activity in lowering the risk of CHD was statistically significant and that of body mass index was almost significant.

TABLE 3 *Relative risks for coronary heart disease over 10 years of follow-up according to the energy expenditure index for the level of leisure time physical activity among initially healthy northeastern Finnish men (n = 754), 1980–1990*

Total energy expenditure	n	RR[a,b]	95% CI[b]
High	267	1.00	
Moderate	226	1.22	0.69–2.15
Low	261	1.93	1.16–3.22
		LR[b] = 7.6, d.f. = 2, $P = 0.022$	

[a] Adjusted for age, smoking, body mass index and hypertension status at the beginning and for diabetes status until the end of follow-up period.
[b] RR, relative risk; CI, confidence interval; LR, likelihood ratio statistics.

Table 3 shows the relative risks for CHD according to the level of energy expenditure when age, smoking, body mass index, diabetes status and hypertension status were simultaneously included in the model. After adjustment for all these potential confounders, the protective effect of an increased level of energy expenditure against CHD remained statistically significant ($P = 0.022$).

DISCUSSION

The main purpose of this study was to explore the association in the same material between leisure time physical activity and CHD, hypertension and maturity onset diabetes. Since there were no differences in follow-up response rates among initially active and inactive subjects this supports the validity of the data used in this study. We found that the total amount of energy expenditure had an inverse and independent association with the risk of CHD among middle-aged Finnish men but not among women initially free of the disease. According to the incremental analysis there were no differences in the results when the categorical smoking variable was replaced by the duration of smoking. In this respect our finding concerning the preventive effect of leisure time physical activity is consistent with those of several authors[7,11,17] who have used a physical activity index in their studies. As well as the earlier findings from these data[29] this observation supports the validity of the index used in this study.

A corresponding association was not found for increased leisure time physical activity intensity, however. Therefore, our results conflict to some extent with those of the British Civil Servant Study[5] and with the Kuopio Ischemic Heart Disease Risk Factor Study in Finland,[16] in which vigorous physical activity was usually associated with a decreased risk of CHD. One reason for this discrepancy may be that, in our study, activity was considered vigorous if the subject engaged in it at least once a week which is less than in the studies mentioned above.

In this study we were not able to exclude the possibility of a sub-clinical effect. Therefore, in a sample analysis we further tightened the inclusion criteria. As a consequence, we assessed the association of leisure time physical activity and the risk of CHD among middle-aged men after those who had the disease or symptoms which substantially prevented them from participating in leisure time physical activity were excluded from the analysis. As a result, after adjustment for age, smoking, hypertension, diabetes and body mass index the association between the total amount of physical activity and the risk of CHD attenuated but still remained as suggestively significant ($P = 0.064$).

Both an increased total amount of energy expenditure during leisure time physical activity and an increased intensity of these activities, without adjustment for total amount of activity, were statistically significantly associated with reduced risk of hypertension among men but not among women. Our results for men are consistent with the findings of Paffenbarger *et al.*[34] who found that middle-aged and older men who did not participate in vigorous activity had a 35% higher incidence of hypertension than those who were more active. Less is known of the association between the level of leisure time physical activity and hypertension among women.[19,35] There is some evidence that increased intensity of leisure time physical activity could be protective against hypertension among women as well,[19] but this finding was not confirmed in the present study.

There are several possible reasons for the weak associations between leisure time physical activity and CHD, and hypertension among the women in our study. Compared with the men, both the intensity of leisure time physical activity and the total amount of energy expended were lower. Another reason for the lack of association between leisure time physical activity and CHD may be that, for women, the possible preventive effect of leisure time physical activity occurs later in life as a result of the later appearance of CHD.

Even after adjustment for the main confounding factors, a decreased risk of diabetes was found with both an increasing level of expenditure and a change from non-vigorous to vigorous intensity of leisure time physical activity among women. For men there was a weak association with increased intensity of activity. These results agree, for the most part, with those of the few

prospective cohort studies in which the independent effect of physical activity on the risk of developing diabetes has been assessed.[22–24] For both genders the association between intensity of activity and the risk of diabetes disappeared after adjustment for total amount of activity, however.

Leisure time physical activity may also affect morbidity through its effect on risk factors. Physical activity has been associated with a variety of CHD risk factors, including diabetes, hypertension, smoking status and body mass index.[4,36] Interestingly, however, the protective effect of leisure time physical activity against CHD was not found in people with hypertension. One reason for this finding may be that, in 1980, the criteria for clinical hypertension were higher than they are nowadays. In 1980 the Finnish Hypertension Committee[37] stated that medication for increased blood pressure should be prescribed if the diastolic pressure frequently exceeds the value of 110 mmHg and medication should be individually considered if the pressure is frequently 95–109 mmHg. During the 1980s and beginning of the 1990s, the recommended borderline values for increased blood pressure have progressively been lowered. Thus, according to current criteria, the initially normotensive subjects in our sample may have been mildly hypertensive and those initially regarded as having high blood pressure may mostly be strongly hypertensive.

Some disagreement with earlier findings may be related to validity and reliability aspects of subject recall for hypertension. In Finland, however, it is well known that due to, for example, age-related physical examinations and various community programmes, the population is well aware of their hypertension levels e.g.[38] In agreement with this, a good correlation was found between the questionnaire data and medical record information on hypertension in this study.[27]

Both body mass index and diabetes status were associated with the risk of CHD when age and energy expenditure of leisure time physical activity were controlled for. The strength of the body mass index as a risk factor for CHD in this study may have been lessened by the fact that, of those initially with a body mass index $\leqslant 27$, 28% gained at least 5 kg while only 20% of those initially with a body mass index of >27 gained 5 kg during the 10-year follow-up. Thus, as a consequence of the changes in weight during the follow-up, overlapping between the body mass index groups occurred.

Though the relative risk of CHD among smokers was high, the association between smoking status and CHD was not statistically significant. The relatively small differences in the risk of CHD between smokers and non-smokers may partly be because 30% of those who initially smoked had stopped smoking during the 10-year follow-up. Of those who were past smokers, 10% had begun to smoke again during that time. Thus the original exposure criterion in the follow-up study was not stable, and overlapping between the groups occurred as a consequence of transfers from one category to another.

In summary, this 10-year follow-up study on a representative adult cohort in northeastern Finland supports the hypothesis that, for men, a low level of energy expenditure during leisure time physical activity is a significant independent risk factor for both CHD and hypertension. The total amount of leisure time physical activity remained significantly and inversely related to the risk of CHD, even though the association was attenuated by the inclusion of other CHD risk factors in the model. Thus our results agree with recent statements[39,40] suggesting that the total amount of activity is important for cardiovascular health. For middle-aged women a sedentary lifestyle was found to be a risk factor for diabetes but not for CHD or hypertension. Therefore, our results suggest that the preventive effect of leisure time physical activity on CHD, hypertension and diabetes may differ for men and women, although this difference may be partly due to the differences in the amount of leisure time physical activity performed by the two genders. Furthermore, the relative importance of the total amount of leisure time physical activity and the intensity of the activity may vary depending on the outcome measure. Thus conclusive evidence to determine the relative contributions of the amount and intensity of leisure time physical activity must wait for studies in which more detailed and accurate methods are used to assess leisure time physical activity in a larger sample and/or with a longer follow-up period than in the investigations published so far.

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