

# Physical Exercise and Psychological Well-Being: A Population Study in Finland

Peter Hassmén, Ph.D.,\*†<sup>1</sup> Nathalie Koivula, Ph.D.,\* and Antti Uutela, Ph.D.‡

\*Department of Psychology, Stockholm University, S-106 91 Stockholm, Sweden; †Stockholm University College of Physical Education and Sport, Sweden; and ‡Department of Epidemiology and Health Promotion, National Public Health Institute (KTL), Finland

**Background.** Regular physical exercise has been characterized as a positive health behavior having physiological benefits. It may also yield psychological benefits. The purpose of the present study was therefore to explore the association between physical exercise frequency and a number of measures of psychological well-being in a large population-based sample.

**Methods.** A total of 3403 participants (1856 women and 1547 men) of the Finnish cardiovascular risk factor survey, ranging in age between 25 and 64, completed questionnaires. Besides answering questions concerning their exercise habits and perceived health and fitness, the participants also completed the Beck Depression Inventory, the State-Trait Anger Scale, the Cynical Distrust Scale, and the Sense of Coherence inventory.

**Results.** The results of this cross-sectional study suggest that individuals who exercised at least two to three times a week experienced significantly less depression, anger, cynical distrust, and stress than those exercising less frequently or not at all. Furthermore, regular exercisers perceived their health and fitness to be better than less frequent exercisers did. Finally, those who exercised at least twice a week reported higher levels of sense of coherence and a stronger feeling of social integration than their less frequently exercising counterparts.

**Conclusions.** The results indicate a consistent association between enhanced psychological well-being, as measured using a variety of psychological inventories, and regular physical exercise. © 2000 American Health Foundation and Academic Press

**Key Words:** exercise; psychological well-being; health; mood.

## INTRODUCTION

Apart from physiological benefits associated with regularly performed physical exercise, a number of psychological benefits have also been reported in the literature. These benefits include reduced depression [1–3], anxiety [4], and anger [5], as well as generally improved mood [6–8].

Furthermore, a reduction of coronary-prone (i.e., Type A) behavior has also been associated with physical exercise [9]. Since anger and hostility, both subcomponents of the global Type A behavior pattern, have been related to coronary heart disease [10], the potential significance of exercise in reducing these unhealthy characteristics is appealing. In a study by Buchman et al. [5] investigating the relationship between exercise and anger expression in adults, the strongest and most consistent finding was a negative association of suppression of anger with exercise. This was taken to indicate that physical exercise may reduce the risk of coronary heart disease by altering the style of anger expression.

The potential alleviating effect of physical exercise on negative moods is of course also highly attractive, considering the large number of people in modern society who suffer from physical problems having some type of psychological origin [11]. The prevalence of depression alone is noteworthy—6.8% of men and 12.1% of women reported high rates of depressive symptoms when a sample of the Finnish 55-year-old population was investigated [12]. Depression scores were also found to be higher among those with a sedentary lifestyle than among those exercising moderately. Even higher percentages have been reported for the American population, where the lifetime prevalence of anxiety and depression has been estimated to reach 20–30% among adults [13,14]. The importance of lifestyle is further highlighted by a report from the U.S. Department of Health and Human Services [15] in which physical exercise and fitness are considered vital to general

<sup>1</sup> To whom correspondence and reprint requests should be addressed. Fax: +46-8-15 93 42. E-mail: [phn@psychology.su.se](mailto:phn@psychology.su.se).

health improvement and also a specific means to promote mental health in the population. The fact that depression alone has been estimated to cost American society \$43.7 billion annually [16] may be a clear enough cue for authorities to act.

Previous research investigating the potential effect of physical exercise on various psychological characteristics has, however, presented equivocal results [1]. This can be explained, at least to some degree, by differences in research designs and the fact that small sample sizes have often been used [17]. Dishman therefore calls for population-based studies to allow an appraisal of the possible dose–response relationship between physical exercise and mental health. The present study is an effort in this direction. Additionally, the diversity of operational definitions pertaining to the term “physical exercise” and, to a greater extent, to the definitions of the terms “psychological well-being,” “psychological health,” and “mental health,” may also be responsible for the ambiguous results presented in the literature.

The definition of physical exercise subscribed to in the present study is the definition proposed by the American College of Sports Medicine [18], whereby exercise involves planned, repetitive, and structured activity, presumably with the goal of improving cardiopulmonary fitness. To reach this goal, exercise should be performed at least two or three times a week, for at least 15–20 minutes on each occasion, and with an intensity that results in increased breathing and perspiration.

To define psychological well-being operationally is somewhat more difficult than to define exercise. As stated by Brown [19], “well-being could be related to the quality of life, however defined, or to life satisfaction, however defined” (p. 186). Brown continues, “. . . psychological well-being may be related to self-esteem, cognitive functioning, personality, and mood, including positive affects such as happiness, vigor, and morale, and negative affects such as anxiety and depression” (pp. 186–187). This led Brown, in his 1992 review, to acknowledge psychological well-being as whatever the investigator identified as the dependent psychological measures. Clearly, no study can include the entire spectrum of this multifaceted concept.

Consequently, the present study focused on measures pertaining to negative affect (depression, anger, hostility, and perceived stress) commonly found in the general population and with important health consequences. In addition, feelings of social integration, perceived health, and perceived fitness were measured and also related to the sense of coherence [20] and health locus of control. Psychological well-being is therefore operationalized in the present study not only as the absence of negative affect—which is the case in most other studies—but also in regard to the presence of positive affect.

Following the reasoning above, we aim to investigate

whether differences exist in a number of psychological variables when the exercise frequency of the individuals is used as a between-subjects factor. We expect that exercise frequency will be negatively associated with depression, anger, hostility, and the perceived level of stress, whereas positive associations are expected to exist between exercise frequency and the individual's sense of coherence, health locus of control, perceived health, and perceived fitness.

## METHOD

### *Participants*

A total of 3403 participants, ranging in age between 25 and 64 years, were included in the study; 1856 were women (mean age 45.4, SD 11.3 years) and 1547 were men (mean age 46.0, SD 10.9 years). The participants belonged to one of four different age groups: (1) 25–34 years (406 women, 304 men); (2) 35–44 years (463 women, 372 men); (3) 45–54 years (495 women, 437 men); and (4) 55–64 years (492 women, 434 men).

### *Material*

Questionnaire data for the study were gathered from participants in the Finnish cardiovascular risk factor survey in 1992 by the National Public Health Institute. Exercise frequency was determined according to answers to the question “How often do you exercise physically in your spare time for at least 20–30 minutes to the extent that you at least slightly lose your breath and perspire?” Alternatives included: (1) daily; (2) two to three times a week; (3) once a week; (4) two to three times a month; (5) a few times a year; and (6) cannot perform exercise due to illness or handicap. The psychological inventories included in the present study, as described below, were chosen because they measure both positive and negative affect commonly found in the general population, as described in the Introduction [1–8, 11–15]. Furthermore, the majority of the chosen inventories have been used in previous studies, and both their reliability and their validity have been found to be satisfactory.

*Beck Depression Inventory (BDI)* [21,22]. The BDI is a 21-item scale measuring symptoms related to different components of depression such as cognitive, behavioral, affective, and somatic elements. An index value was subsequently calculated from the obtained raw scores for each individual [23].

*Anger.* This variable was assessed with the State–Trait Anger Scale [24], on which the participants are asked to rate how they generally feel when they are angry or furious. As suggested by Spielberger et al., three factors were computed: (1) anger-in, which reflects a style of suppressing anger and hostility; (2)

anger-out, reflecting the individual's tendency to express angry feelings outwardly; and (3) anger-control, which reflects the extent to which the individual considers it possible to retain control over anger and hostile impulses.

*Cynical Distrust Scale* [25]. This measure is a subscale of the Minnesota Multiphasic Personality Inventory. The Cynical Distrust Scale measures the degree to which people feel distrustful toward other people; this is also frequently referred to as hostility.

*Perceived stress*. This measure is a single item inquiring about experience of stress over the past 30 days, a higher score indicating a higher stress level. The respondent chooses one of four alternatives ranging from "almost unbearable" to "none at all." The question relates to the psychological stress concept of Lazarus [26] involving the psychological reaction to situations where demands exceed resources. The same item has been used for more than 25 years in the North Karelia project [27], but no published study has explicitly investigated the reliability or validity of this single item.

*Locus of control-luck* [28]. This measures when health is considered to be being affected or controlled by fate or luck rather than by human agents, a higher score indicating a stronger belief in an external source of control of health, which is normally thought to be counterproductive to health.

*Locus of control-self* [28]. This measures an individual's belief in her/his own responsibility for personal health, higher scores indicating a stronger belief in internal control of the individual's own health. Personal control of health is considered to promote health.

*Sense of Coherence (SOC)*. The SOC concept was assessed on Antonovsky's [20,29] short 13-item scale. This instrument aims at measuring the extent to which an individual has a pervasive and enduring, yet dynamic, feeling of confidence that life in general is comprehensible, manageable, and meaningful.

*Social integration* [30]. This measures feelings of integration in collectives, such as one's own family and neighborhood, municipality, parish, or association. Higher scores indicate higher levels of integration in the system of these collectives.

*Perceived health and perceived fitness* [31]. The respondents were asked to rate their health/fitness status by marking one of five possible alternatives ranging from "very poor" to "very good," higher values corresponding to higher levels of perceived health/fitness. A question regarding perceived health has been found to be a reliable measure of overall health [31] and a good predictor of subsequent mortality [32].

## Procedure

Age-stratified random samples of 2000 individuals each, 25–64 years of age, were drawn from four different regions. The participants came from two eastern provinces (North Karelia and Kuopio), two areas in southwest Finland (Loimaa and surrounding municipalities and Turku), and the Helsinki metropolitan area (Helsinki, Vantaa). The participants received (1) the initial questionnaire with sociodemographic and health-related questions, including those pertaining to physical exercise. After they answered these questions, (2) a medical examination was performed at their local health care center. After the clinical measurements, two-thirds of the participants (3) were asked to respond to a questionnaire containing the psychosocial measures used here. The remaining one-third took part instead in a nutrition study in which they were asked to keep a diary listing their daily food/drink intake during a specified period of time (to be reported elsewhere). Random selection was employed to determine which ones were to take part in the present study and which ones were to take part in the nutrition study. Hence, the individuals in this study underwent all three study phases (referred to as 1, 2, and 3 above). The final response rate was 67%, corresponding to 3403 individuals.

## Statistical Analyses

To evaluate the overall effect of exercise frequency, a multivariate analysis of covariance (MANCOVA) was performed. In this analysis, exercise frequency (six levels) was used as the independent variable, scores on the psychological inventories were the dependent variables, and age and gender were used as covariates. Subsequently, univariate analyses of variance were performed to investigate specific differences including the following factors: exercise frequency (six levels), age (four levels), and gender (two levels). Post hoc tests were performed where appropriate using the Scheffé method.

## RESULTS

Table 1 shows a breakdown of the number of participants in the study according to exercise frequency, gender, and age. The greatest proportion of both women and men exercised two to three times a week (38%), followed by those who exercised once a week (21%).

The initial MANCOVA proved to be significant (Pillai Bartlett trace  $V = 0.184$ ,  $F_{60,16335} = 10.4$ ,  $P < 0.001$ ), indicating that the scores on the various psychological inventories differed in relation to exercise frequency. Below follows a description of the results pertaining to the univariate analyses of variance in which exercise frequency, age, and gender were used as independent

**TABLE 1**  
Number of Participants in Each Subgroup

Exercise frequency	Women					Men					Total <i>n</i> = 3397 <sup>a</sup>
	Age group				Total <i>n</i> = 1852 <sup>a</sup>	Age group				Total <i>n</i> = 1545 <sup>a</sup>	
	25–34 ( <i>n</i> = 405)	35–44 ( <i>n</i> = 462)	45–54 ( <i>n</i> = 494)	55–64 ( <i>n</i> = 491)		25–34 ( <i>n</i> = 305)	35–44 ( <i>n</i> = 370)	45–54 ( <i>n</i> = 436)	55–64 ( <i>n</i> = 434)		
Daily	43	37	45	67	192	41	20	35	84	180	372
Two or three times a week	153	197	187	174	711	123	166	141	152	582	1293
Once a week	101	95	102	89	387	60	80	107	72	319	706
Two or three times a month	59	74	66	52	251	43	46	68	38	195	446
Once a month	47	54	77	83	261	36	53	71	60	220	481
Unable to exercise	2	5	17	26	50	2	5	14	28	49	99

<sup>a</sup> The total number of participants was 3403 (1856 women and 1547 men). However, 6 of these did not quantify their exercise habits.

factors. Corresponding *F* and *P* values are compiled in Table 2.

*Depression*

Statistically significant main effects for exercise frequency and age were detected (*PS* < 0.001). However, neither the gender main effect nor any of the interaction effects reached conventional levels of significance. Pair-wise comparisons (Scheffé) showed that the BDI scores increased when exercise frequency decreased and that older individuals scored higher than younger individuals. The group exercising the most frequently (i.e., daily) scored somewhat higher, however, than those exercising two to three times a week and once a week, respectively. It is also noteworthy that the highest depression scores were observed for individuals who could not exercise at all due to illness or handicap.

*Anger*

In regard to anger-in (i.e., the tendency to suppress anger and hostility), the main effect of exercise frequency reached significance (*P* < 0.01). The lowest anger scores were associated with exercise daily or two-three times a week. Also the two-way interaction between exercise frequency and gender was significant (*P* < 0.02), the latter indicating that women who exercised infrequently scored higher on anger-in than did men following the same exercise pattern.

Neither the anger-out score nor the anger-control score differed in regard to the exercise frequency factor. Women, however, considered themselves to express more anger outwardly than did the men (*P* < 0.01); and younger individuals expressed more anger than older ones (*P* < 0.001). This was particularly noticeable in the younger women, and this finding accounted for the

significant interaction effect between gender and age (*P* < 0.01).

Men considered themselves to control their anger to a greater extent than women and older individuals felt they controlled their anger to a greater extent than their younger counterparts (*PS* < 0.001). The interaction between gender and age (*P* < 0.001) indicates that older men in particular considered themselves to control their anger to a great extent.

*Cynical Distrust Scale*

Individuals who exercised moderately, i.e., a few times a week, had the lowest scores on this scale compared to those who exercised daily or infrequently; this resulted in a significant main effect of exercise frequency. In addition, older persons scored higher than younger ones, making the main effect of age significant (*PS* < 0.001). None of the other effects reached significance.

*Perceived Stress*

The main effect of exercise frequency was significant (*P* < 0.01). Post hoc tests confirmed that those who exercised daily perceived significantly less stress than those who could not exercise at all, with the other groups in between. Age was also related to stress, older persons perceiving less stress than younger ones (*P* < 0.001). Again, none of the other effects were statistically significant.

*Locus of Control: Luck and Self*

Persons who exercised the least perceived their health to be affected by luck to a greater extent than those who exercised more frequently; the main effect

**TABLE 2**

Analyses of Variance Results (*F* and *P* Values) for the Three Main Effects, Exercise Frequency (EF), Age (A), and Gender (G), and the Interaction Effects for the 12 Dependent Variables

Dependent variable	EF		A		G		EF × A		EF × G		A × G		EF × A × G	
	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>	<i>F</i>	<i>P</i>
Depression	8.5	<0.001	8.3	<0.001	1.8	NS	0.9	NS	1.0	NS	1.4	NS	0.7	NS
Anger-in	3.5	<0.01	1.8	NS	2.2	NS	1.1	NS	3.0	<0.02	2.3	NS	0.6	NS
Anger-out	1.4	NS	7.2	<0.001	6.6	<0.01	0.9	NS	0.9	NS	6.2	<0.01	1.9	<0.02
Anger-control	0.7	NS	5.0	<0.001	31.0	<0.001	1.1	NS	1.1	NS	11.4	<0.001	1.5	NS
Cynical Distrust	7.6	<0.001	7.5	<0.001	1.2	NS	1.5	NS	1.5	NS	1.1	NS	0.9	NS
Perceived stress	3.8	<0.01	9.4	<0.001	0.1	NS	0.7	NS	0.5	NS	0.7	NS	1.1	NS
Locus-luck	11.5	<0.001	26.9	<0.001	1.5	NS	1.1	NS	2.0	NS	1.1	NS	0.9	NS
Locus-self	6.0	<0.001	2.8	<0.04	4.6	<0.04	0.8	NS	1.2	NS	0.3	NS	1.2	NS
Sense of Coherence	6.2	<0.001	2.8	<0.05	1.2	NS	1.0	NS	0.6	NS	1.0	NS	0.6	NS
Social integration	4.5	<0.001	0.6	NS	1.5	NS	0.8	NS	0.4	NS	0.8	NS	1.1	NS
Perceived health	23.2	<0.001	38.7	<0.001	12.6	<0.001	1.9	NS	4.6	<0.001	0.4	NS	1.3	NS
Perceived fitness	72.6	<0.001	10.1	<0.001	0.3	NS	3.1	<0.001	3.1	<0.001	1.1	NS	1.2	NS

Note. NS indicates a nonsignificant effect.

of exercise frequency reached significance. Older individuals also considered their health to be determined by luck to a greater extent than younger ones ( $PS < 0.001$ ).

Consequently, individuals who exercised more frequently considered their health to be dependent on themselves to a higher degree than those who exercised infrequently ( $P < 0.001$ ). Men felt to a greater extent than women that health was determined by themselves; this was also true for younger individuals compared to older ones ( $PS < 0.04$ ).

### *Sense of Coherence*

Individuals who exercised more frequently perceived their sense of coherence to be significantly higher than those exercising less frequently, as evidenced by their scores on Antonovsky's Sense of Coherence scale ( $P < 0.001$ ). In general, younger persons reported their sense of coherence to be higher than older individuals ( $P < 0.05$ ). No other effects were significant.

### *Social Integration*

The only statistically significant effect detected was exercise frequency ( $P < 0.001$ ). Those exercising regularly felt more socially integrated than those exercising infrequently or never.

### *Perceived Health*

Frequent exercisers perceived their health to be better to a greater extent than those who exercised less frequently, women perceived their health to be better than did the men, and younger individuals perceived their health to be better than did the older individuals. In addition, a significant interaction effect between exercise frequency and gender showed that the women in particular perceived their health to be related to regular physical exercise (all  $PS < 0.001$ ).

### *Perceived Fitness*

In accordance with the results pertaining to perceived health, individuals who exercised the most also perceived their fitness to be significantly better than did those who did not exercise as frequently. Younger people also perceived their fitness to be better in comparison to older people. This was more evident in the men which resulted in an interaction effect between exercise frequency and gender on perceived fitness ( $PS < 0.001$ ).

## DISCUSSION

The present study evaluated the relationship between physical exercise and a number of psychological factors in a large sample of Finnish adults. The primary findings show that the more physically active participants experienced less depression, less suppressed

anger, less cynical distrust, and less perceived stress in comparison to those who exercised less frequently. In addition, frequent exercisers seem to possess a stronger sense of coherence and a stronger feeling of social integration than their inactive counterparts. They also perceived their health and fitness to be better than those who exercised less frequently.

Clearly, the interpretation of the present results must take into account the fact that self-reports were the sole criteria used to assess the psychological variables as well as the exercise frequency of the respondents. Furthermore, the research design, incorporating self-reports and comparing individuals with different exercise patterns is, as all cross-sectional designs, subject to possible errors with confounding variables affecting the results and their interpretation. An important issue therefore relates to whether regular physical exercise really produces the many positive effects described in this study or whether the statistically significant differences only reflect something that is different from the very beginning in those who exercise and those who do not. Hence, the question of causality is central. Given the cross-sectional design of the present study, the results presented relating psychological well-being to exercise frequency should be regarded as signs of association, not necessarily reflecting causal relationships. Previous studies nevertheless seem to support the antidepressant and mood-enhancing effects associated with exercise programs as exemplified in the review by Byrne and Byrne [1]. Longitudinal studies may conclude with greater certainty that regular physical exercise is indeed related to better physical and mental health. Unfortunately, few projects allow follow-ups over periods of at least 10–15 years, and preferably longer, which would be necessary. On the other hand, Dishman [17] states that “there are too few population-based studies of physical activity and mental health to draw conclusions” (p. 362). Hence, the results of the present study may add some valuable information to our knowledge base even without being longitudinal in design.

As might be expected, the numbers of participants were not equal in the various subgroups (Table 1). However, the distribution between very active, moderately active, and sedentary individuals is similar to that in previous studies where exercise frequency has been investigated in large samples from the general population [e.g., 33]. Nevertheless, one should keep this in mind when the statistical analyses are interpreted, especially since the interaction effects might suffer from the relatively small number of individuals in certain cells. Only a few of these were also, in fact, statistically significant. Apart from this, analysis of variance is considered to be a robust method in regard to unequal  $n$ 's [34].

In line with the findings reported by Rajala et al. [12], depression scores in the present study were higher among the individuals in the three subgroups who only

exercised two–three times a month or less than in the groups exercising two–three times a week or more. An interesting observation, corroborating previous findings [e.g., 35], was the somewhat higher depression score in the group that exercised the most, i.e., daily. Hence, from a mental health point of view, regular, but not daily, exercise seems to be associated with the lowest depression scores. Since vigorous, daily exercise is often associated with competitive sports, mental health aspects may be secondary for the individual to performance aspects. A whole new area is thereby involved as discussed at length by Kenttä and Hassmén [35].

However, only a weak tendency ( $P < 0.18$ ) to a difference was noted between men and women. This was somewhat unexpected since previous research has shown that women often report higher rates of depressive symptoms than men [12,36]. The age difference, with higher scores appearing in the older groups, did, however, conform to expectations [37]. The absence of any interaction effects prohibits the same conclusion as reached in other studies, i.e., that exercise should be particularly beneficial to elderly women since this group is known to score higher than men of the same age [38]. Based on the present results, a more tenable conclusion would be that more frequent exercise in general is associated with lower depression, as long as it is not too frequent or excessive [cf. 35]. It should be noted, however, that the oldest group in the present study (55–64 years) would not even qualify as “young old” in the aging literature since that group typically consists of those 65–74 years of age [19,39]. Hence, the association between physical exercise and depression in women over 65 years of age could not be determined from our data.

Consistent with the present results is the conclusion reached in a review by McAuley and Rudolph [40], who stated, “There is little evidence that exercise has differential psychological effects on men and women or on individuals of differing ages” (p. 67). The results of the 38 studies reviewed were judged as being “overwhelmingly positive, with the majority reporting positive associations between physical activity and psychological well-being” (p. 67). The gist of these somewhat disparate results is that elderly women may indeed benefit more than elderly men from regular physical exercise, *provided* that they are more depressed than the men to begin with, a proposition which is also consistent with previous research findings [41]. Regardless of age, the key issue is most likely to be whether depression is present or not. The exact mechanisms for the alleged anxiolytic and antidepressant effects of exercise are, however, still not known. Hypotheses suggested have included mastery, self-efficacy, self-perceptions of control, distraction, and social interactions [17,41,42].

Of the three factors calculated from the State–Trait

Anger Scale [24], only anger-in covaried with exercise frequency. Specifically, individuals who exercised more frequently reported being less inclined to suppress their anger and hostility in comparison to those who exercised less frequently. Since anger, particularly in combination with hostility, has been associated with coronary heart disease [10], this finding is compelling. It also corroborates the results presented by Buchman et al. [5], who suggested that exercise may help reduce the risk of coronary heart disease also by changing the individuals’ style of expressing anger. The mechanism behind this is not clearly understood, however. Alternatives presented by Buchman et al. included the suggestion that exercise simply reduces the amount of angry feelings that are suppressed or, alternatively, people who normally suppress anger tend to increase their exercise frequency in order to reduce anger-in. The fact that no relation was detected between exercise frequency and the other two subscales (anger-out and anger-control) also conforms to previous findings [5].

Besides measuring the degree to which people feel distrustful toward other people, the Cynical Distrust Scale also includes a component of hostility [25]. Consistent with the results pertaining to anger-in, as described above, this may be why participants in the present study who exercised more frequently also scored lower on the Cynical Distrust Scale than those who exercised less frequently. The cited stress-reducing effect of physical exercise has been discussed in many reports. In a meta-analysis by Crews and Landers [43], it was demonstrated that aerobically fit subjects frequently showed a reduced psychosocial stress response compared to less fit subjects. Several explanations for this effect have been offered, including the distraction hypothesis [44]. Other explanations focus on the possibility that exercise may act as either a coping strategy that reduces the physiological response to stress or an inoculator that fosters a more effective response to stress [37]. If regular physical exercise leads to lower stress levels, such an association should presumably also be detectable in the present study. Indeed, a significant main effect of exercise frequency was found, progressively lower scores appearing as exercise frequency increased. Consequently, the present results do not contradict the positive effect that regular exercise might have on reducing the perceived level of stress.

If exercise is seen as a health-related behavior [45,46] that can actually influence one’s health in a positive direction, then regular exercisers can be expected to consider luck to be of less importance for their health. Similarly, if exercise is engaged in primarily for health reasons, health should be considered an outcome that regular exercisers can influence to a greater extent than those who do not exercise as frequently. The present results strengthen these assumptions: frequent exercisers perceived health to be less dependent on luck than

less frequent exercisers do. Regular exercisers also considered themselves to be responsible for their own health to a significantly greater extent than less active individuals. As shown by, among others, Carlson and Petti [47], individuals with an internal health locus of control tend to engage in high caloric expenditure activities, whereas external individuals engage instead in low caloric expenditure activities. This finding may explain why those who exercise the most frequently also score above those showing a less regular exercise pattern when it comes to the amount of control they experience over their own health.

The concept of sense of coherence has been described as being related to the extent to which an individual considers life in general to be comprehensible, manageable, and meaningful [20]. Persons with a strong sense of coherence are thought to be able to manage the stresses of life better and maintain their health. In contrast, persons with a weak sense of coherence tend to be more vulnerable to ill health [29]. In the present study, those exercising more frequently displayed a significantly stronger sense of coherence than those who exercised less frequently. The same applied to the social integration subscale: frequent exercisers perceived themselves to be socially integrated to a greater extent than those performing less frequent exercise. The concepts of health locus of control, sense of coherence, and social integration, if viewed together, have some common properties. The sense of coherence construct refers to [29] "a global orientation to one's inner and outer environments which is hypothesized to be a significant determinant of location and movement on the health ease/dis-ease continuum" (p. 731). Similarly, both the health locus of control and the feeling of social integration comprise aspects which refer to a person's feeling of being in control, being responsible for health consequences, and being connected to others. A correlational analysis also confirms that these variables were significantly related ( $PS < 0.001$ ) in the present sample.

### CONCLUSION

A number of significant differences in psychological factors were found between more and less active Finnish adults. The majority of these differences were related to exercise frequency: persons exercising more frequently displayed lower scores on the inventories measuring negative affect, whereas they displayed higher scores on the measures of positive affect. The findings may provide potent arguments for the health practitioner by indicating a number of positive consequences that stem from regularly performed physical exercise. However, the cross-sectional design of the present study precludes the drawing of definite causal inferences. The consistent pattern of the results is, however, compelling and certainly warrants further research.

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