Physical activity, fitness and body composition of Finnish police officers: a 15-year follow-up study

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This study evaluated changes in the physical activity, fitness and body composition of 103 police officers during a 15-year follow-up. The absolute aerobic capacity was similar in 1981 and 1996, muscular performance had declined, and body weight had increased approximately 0.5 kg/year. More than half the subjects (53%) had increased their leisure-time physical activity in 1996. The correlation was significant between physical activity in 1981 and physical fitness in 1996, but weak between physical activity in 1996 and fitness in 1996. It was also significant between waist circumference and waist/hip ratio in 1996 and physical activity during the previous 5 and 15 years. No significant correlations were found between physical activity and work ability or perceived physical or mental job stress. The physical fitness of middle-aged police officers seems to be predicted strongly by physical activity in early adulthood. Therefore health and fitness promotion measures should start at that time. This, together with regular systematic training, should help to sustain work ability of middle-aged police officers.

Key words: obesity; physical activity; physical fitness; police officers; work ability index.

INTRODUCTION

The work of police officers primarily includes mentally demanding, but sedentary, tasks, with occasional periods of maximum physical exertion. Soininen reported that approximately one-quarter of policemen aged 40–54 years must work at maximal or near maximal physical capacity at least five times a year. The most common extremely strenuous time is during an arrest that involves a struggle with a resisting subject.

In the 1960s the health status and physical fitness of Finnish policemen were thoroughly investigated. According to Lehtovirta, policemen were not physically active during their leisure-time, they were often heavy smokers, and many of them were overweight, especially after the age of 35 years. Smolander et al. investigated the physical fitness characteristics of officer students (mean age 34 years, range 27–46 years) in the Finnish Police Academy. The results indicated that the selection of heavier and taller men for police training guaranteed a satisfactory absolute level of physical work capacity, although more than half (57%) of the students were physically inactive. The habitual work of policemen seemed to be insufficient to maintain an adequate level of physical fitness for demanding tasks.

The effect of physical activity and ageing on cardiovascular responses and cardiovascular diseases has been clearly shown by many studies. Soininen found that an 8-month worksite exercise programme was feasible and that it improved the health and physical work capacity of middle-aged police officers. In his...
study, at baseline, approximately one-third (34%) of the policemen aged 50–54 years had a reduced work ability index. This rate was almost twice as high as that of other age-matched male occupational groups in Finland. The work ability index has been shown to predict work disability among 50-year-old workers; one-third of the persons in the group with poor work ability, according to the index, was granted a work disability pension during the 4-year follow-up. Most of the studies on physical activity, physical work capacity or work ability of policemen or police officers have been cross-sectional. A few follow-up or intervention studies have been conducted within a short time span, but no information is available about the changes in the physical activity and fitness of police officers over a period of several years. Consequently, the purpose of this study was to investigate: (1) changes in the physical activity, physical fitness and body composition of police officers during a 15-year follow-up period without active intervention (observational follow-up); (2) relationships between physical activity, fitness and body composition of middle-aged police officers; and (3) the perceived changes in physical and mental job stress among the officers during the follow-up period of 15 years, their perceived work ability, and how these factors are associated with physical activity and fitness.

SUBJECTS AND METHODS

Subjects

The subjects were either current or former male police officers studied by Smolander et al., whilst they were at the Police Academy in 1981 (n=103). In 1996, when our study was carried out, five of the subjects had retired, three had died, and two had changed their profession. The retired subjects participated in the tests for assessing physical fitness were performed in nine different locations by the same researchers, using the same equipment as in 1981. The assessment of physical fitness started with an examination by a physician for cardiorespiratory and musculoskeletal symptoms and signs. At this stage of the study the physician decided which tests each subject could perform safely. During the physician's examination the subjects were asked to rate the physical and psychological strain of their jobs during the past 15 years on a visual analogue scale. They were also asked about regular medication and smoking habits. These questions had not been a part of the questionnaire used in 1981. On the scales, minimal strain was considered 0% (no strain at all), and maximal possible strain was 100% (as much strain as one can stand). The rating was carried out for each year.

The height and weight were measured with standard scales, and the body mass index (BMI) was calculated as weight/height² (kg/m²). The skinfold thickness of the biceps, triceps, subscapular and supra-iliac regions were measured with a Harpenden skinfold caliper, as in 1981.

The circumsference of the waist and hips was measured with a flexible tape measure and the waist/hip ratio was calculated. The circumference measurements had not been obtained in 1981.

Maximal aerobic power (ml/min/kg) was estimated by a submaximal incremental exercise test (4 min at each stage until a steady-state heart rate of 150–160 beats/min was achieved at the highest load) on a mechanically braked bicycle ergometer (Monark, Sweden) with the use of the WHO extrapolation method, as carried out in 1981. The linearity of the heart rate response to incremental work loads was checked graphically for each subject. Blood pressure was measured with the conventional auscultatory method of Riva-Rocci with the subject in a sitting position, and a 12-lead electrocardiogram (ECG) was recorded with the subject in a supine position before the exercise test and 3–5 min afterwards. A three-lead ECG was continuously monitored by a physician during the exercise test. Furthermore, a 15-s sample of a 12-lead ECG recording was taken during the last minute, and blood pressure was measured during the third minute of each work load.

After a 20-min rest, followed by the ergometer test, the following three tests of muscular performance were performed as in 1981: (1) the push-up test (number of repetitions in 30 s); (2) the bent knee sit-up test (number

activity scale consisted of the following five categories: (1) no regular physical exercise; (2) physical exercise less than once a week; (3) physical exercise once a week; (4) physical exercise twice a week; and (5) physical exercise three times or more per week. The work ability index consisted of the following seven items: (1) current work ability compared with the lifetime best; (2) work ability in relation to the demands of the job; (3) number of current diseases diagnosed by a physician; (4) estimated work impairment due to disease; (5) sick leave during the past year; (6) own prognosis of work ability after 2 years; and (7) mental resources.

The subjects lived in different parts of Finland, and the tests for assessing physical fitness were performed in nine different locations by the same researchers, using the same equipment as in 1981. The assessment of physical fitness started with an examination by a physician for cardiorespiratory and musculoskeletal symptoms and signs. At this stage of the study the physician decided which tests each subject could perform safely. During the physician's examination the subjects were asked to rate the physical and psychological strain of their jobs during the past 15 years on a visual analogue scale. They were also asked about regular medication and smoking habits. These questions had not been a part of the questionnaire used in 1981. On the scales, minimal strain was considered 0% (no strain at all), and maximal possible strain was 100% (as much strain as one can stand). The rating was carried out for each year.

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of repetitions in 30 s); and (3) the pull-up test (maximum number of repetitions).

The edited and coded data from the questionnaires and tests were entered and processed by the SAS Microsoft statistical analysis system (SAS Institute Inc., USA). Means and standard deviations were calculated for the anthropometric and physical fitness measurements. Student’s t-test for paired observations was used to compare the results of 1981 and 1996. The correlation between different variables was calculated with Pearson’s correlation coefficient, and the differences were considered statistically significant when \( P<0.05 \).

RESULTS

Physical activity

More than half the subjects (53%) had increased their leisure-time physical activity in 1996 compared with that in 1981. Almost every fourth (23%) person had the same level of leisure-time physical activity in 1996 as in 1981, whereas 25% of the subjects had less leisure-time physical activity in 1996 than in 1981. Three-quarters of those (76%) who were physically active (physical exercise twice a week or more in leisure-time) in 1981 were still active in 1996. About half of those (52%) who were physically passive (physical exercise once a week or less in leisure-time) in 1981 had become active in 1996.

In 1996 the leisure-time physical activity was mostly in the form of an endurance type of training (e.g. walking, running, bicycling, skiing, orienteering). Altogether, 26% of the physically active subjects performed muscular training exercises (e.g. weight lifting, gym training).

Physical fitness

The results of the tests on aerobic power (ml/min/kg) and muscular performance obtained in 1996 were significantly lower than those in 1981. Only the absolute \( V_{O_2 \text{max}} \) in litres per minute did not change significantly (Table 1). About three-quarters (73%) of the subjects had the same \( V_{O_2 \text{max}} \) fitness category in 1981 and 1996 when compared with the reference values of Finnish men in different age groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of subjects</th>
<th>1981</th>
<th>1996</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{O_2 \text{max}} ) (l/min)</td>
<td>75</td>
<td>3.4 (0.8)</td>
<td>3.3 (0.7)</td>
<td>-0.1</td>
</tr>
<tr>
<td>( V_{O_2 \text{max}} ) (ml/min/kg)</td>
<td>74</td>
<td>42.8 (10.1)</td>
<td>38.4 (8.3)</td>
<td>-4.4**</td>
</tr>
<tr>
<td>Sit-up test (repetitions/30 s)</td>
<td>79</td>
<td>20.9 (3.4)</td>
<td>17.5 (5.6)</td>
<td>-3.4**</td>
</tr>
<tr>
<td>Push-up test (repetitions/30 s)</td>
<td>77</td>
<td>25.5 (7.5)</td>
<td>18.6 (9.9)</td>
<td>-6.9***</td>
</tr>
<tr>
<td>Pull-up (maximum repetitions)</td>
<td>71</td>
<td>5.0 (3.4)</td>
<td>4.0 (4.0)</td>
<td>-1.0**</td>
</tr>
</tbody>
</table>

\( \ast P<0.05, \ast\ast P<0.01, \ast\ast\ast P<0.001. \)

Correlation between leisure-time physical activity and fitness

The results on \( V_{O_2 \text{max}} \) (ml/min/kg) and muscular performance obtained in 1996 correlated the most strongly \( (P<0.001 \text{ or } P<0.01) \) with the leisure-time physical activity level assessed in 1981 (Table 2). The leisure-time physical activity during the past 15 years, investigated in 1996, had a positive correlation \((r=0.26 \text{ and } 0.27, P<0.05)\) with the results of the pull-up and push-up tests in 1996. There were no significant correlations between physical fitness in 1996 and the leisure-time physical activity of the previous 12 months.

Table 2. Correlation between physical fitness in 1996 and past leisure-time physical activity in 1981 and 1996

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{O_2 \text{max}} ) (ml/min/kg)</td>
<td>0.46***</td>
<td>0.11</td>
<td>0.11</td>
<td>0.15</td>
<td></td>
</tr>
<tr>
<td>Sit-ups (repetitions/30 s)</td>
<td>0.40**</td>
<td>0.11</td>
<td>0.20</td>
<td>0.16</td>
<td></td>
</tr>
<tr>
<td>Push-ups (repetitions/30 s)</td>
<td>0.41***</td>
<td>0.19</td>
<td>0.22</td>
<td>0.27*</td>
<td></td>
</tr>
<tr>
<td>Pull-ups (maximal repetitions)</td>
<td>0.34***</td>
<td>0.13</td>
<td>0.20</td>
<td>0.26*</td>
<td></td>
</tr>
</tbody>
</table>

\( V_{O_2 \text{max}}=\text{maximal oxygen consumption.} \; *P<0.05, \; **P<0.01, \; ***P<0.001. \)
Table 3. Correlation between leisure-time physical activity and anthropometric characteristics measured in 1996

<table>
<thead>
<tr>
<th>Variables in 1996</th>
<th>1981/past 12 months</th>
<th>1996/past 12 months</th>
<th>1996/past 5 years</th>
<th>1996/past 15 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg)</td>
<td>-0.21</td>
<td>-0.07</td>
<td>-0.18</td>
<td>-0.18</td>
</tr>
<tr>
<td>Biceps(a) (mm)</td>
<td>-0.21</td>
<td>-0.08</td>
<td>-0.17</td>
<td>-0.14</td>
</tr>
<tr>
<td>Triceps(a) (mm)</td>
<td>-0.20</td>
<td>-0.02</td>
<td>-0.16</td>
<td>-0.16</td>
</tr>
<tr>
<td>Subscapular(a) (mm)</td>
<td>-0.19</td>
<td>-0.17</td>
<td>-0.23*</td>
<td>-0.21</td>
</tr>
<tr>
<td>Suprailiac(a) (mm)</td>
<td>-0.16</td>
<td>-0.05</td>
<td>-0.15</td>
<td>-0.19</td>
</tr>
<tr>
<td>BMI (kg/m(^2))</td>
<td>-0.17</td>
<td>-0.08</td>
<td>-0.18</td>
<td>-0.17</td>
</tr>
<tr>
<td>Waist (cm)</td>
<td>-0.30**</td>
<td>-0.12</td>
<td>-0.24*</td>
<td>-0.25*</td>
</tr>
<tr>
<td>Waist/hip (cm/cm)</td>
<td>-0.20</td>
<td>-0.20</td>
<td>-0.33**</td>
<td>-0.23*</td>
</tr>
</tbody>
</table>

BMI=body mass index. \(^a\)Skinfold thickness. \(^*\)P<0.05, \(^**\)P<0.01

The leisure-time physical activity during the past 5 years and past 15 years had significant negative correlations (\(r=-0.33\) and \(-0.23, \ r<0.01\) and 0.05) to the waist/hip ratio and (\(r=-0.24\) and \(-0.25, \ P<0.05\)) to waist circumference measured in 1996. Leisure-time physical activity during the past 12 months in 1996 had no significant correlation with the anthropometric characteristics measured in 1996 (Table 3).

The body weight measured in 1996 had a significant negative correlation with \(\dot{V}O_{2\max}\) (ml/min/kg) in relation to body mass in both 1981 and 1996 (\(r=-0.31, \ P<0.01\) and \(r=-0.39, \ P<0.001\), respectively). The waist circumference had a significant negative correlation to \(\dot{V}O_{2\max}\) (ml/min/kg) in relation to the body mass measured in 1981 and 1996 (\(r=-0.39, \ P<0.001\); and \(r=-0.49, \ P<0.001\), respectively) (Table 4).

Table 4. The correlation between maximal oxygen consumption (ml/min/kg) in 1981 and 1996 and anthropometric characteristics measured in 1996

<table>
<thead>
<tr>
<th>Variables in 1996</th>
<th>1981</th>
<th>1996</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>-0.307**</td>
<td>-0.391***</td>
</tr>
<tr>
<td>Waist circumference</td>
<td>-0.391***</td>
<td>-0.487***</td>
</tr>
</tbody>
</table>

\(^*\)P<0.01, \(^**\)P<0.001.

Figure 2. Physical and psychological strain of policework on a visual analogue scale (0%=minimal possible strain level, 100%=maximal possible strain).

Perceived physical and psychological strain of the work and work ability index

The perceived physical strain of the work was 43% of maximum between 1981 and 1985, and 34% between 1991 and 1996 (\(P<0.0001\)). The psychological strain of the work increased from 51% of maximum between 1981 and 1985, to 64% between 1991 and 1996 (\(P<0.0001\); and \(r=-0.49, \ P<0.001\), respectively) (Fig. 2).

In 1996 the work ability index was poor (7–27) for 7%, moderate (28–36) for 21%, good (37–43) for 57%, and excellent (44–49 points) for 15% of the subjects still employed as police officers. The association between the work ability index and age is shown in Fig. 3.

Correlations of leisure-time physical activity and fitness with the perceived physical and mental strain of the job and work ability index

The perceived physical job strain between 1991 and 1996 had a significant positive correlation (\(r=0.29, \ P<0.05\)) with \(\dot{V}O_{2\max}\) (ml/min/kg). The perceived mental job strain between 1991 and 1996 had a negative correlation (\(P<0.05\)) with the results of the pull-up test. The work ability index had a significant positive correlation (\(r=0.31, \ P<0.01\)) with the results of the sit-up test (Table 5).

Anthropometric characteristics and health

The average body weight and skinfold thicknesses (except for the triceps muscle) were significantly higher in 1996 than in 1981 (Table 6). The waist circumference was 98.7 cm (SD 10.0 cm) in 1996.
The waist circumference exceeded 94 cm for about two-thirds of the subjects (64%) and 102 cm for 38% of the subjects. The proportion of overweight subjects according to the BMI (>27 kg/m²) was 29% in 1981 and 51% in 1996 (Fig. 4).

In 1996, about one-quarter of the subjects had a cardiovascular disease (27%). About every fifth (21%) person was on medication for high blood pressure, high cholesterol level, coronary heart disease or diabetes. The subjects had smoked for an average of 12 years (range, 0–53 years), with an average of 20 cigarettes per day. Altogether, 27% of the policemen were still smoking on a regular basis, 37% of the previously regular smokers had stopped smoking, and 36% had never smoked regularly.

DISCUSSION

Methodological considerations

In 1996, the number of tested subjects was smaller than in 1981 (76–89 vs 90–95 in different tests), mainly because of the disorders and diseases suffered by some subjects, which made it impossible to carry out some of the tests. The anthropometric characteristics of 89 subjects were measured, aerobic power of 76, sit-ups of 82, pull-ups of 76, and push-ups of 80. A few subjects (n=6) did not participate in the study. Sepulveda et al. found that the proportion of obese and physically less active subjects was higher among those who dropped out of the study than among those tested. Thus our results may have somewhat overestimated the level of physical activity and physical fitness of middle-aged police officers. The number of subjects was low, but they lived in all parts of Finland, so it can be assumed that the results represented serving middle-aged Finnish police officers reasonably well. The police officers in the study had been admitted to the Police Academy in 1981. Therefore, by 1996, most had reached a high rank. Consequently, the results of this study do not represent all Finnish policemen. There may also be a variable bias in trying to recall physical activity 12 months, 5 years or 15 years previously, but in the case of 12 months and 5 years.

Table 6. Mean (SD) age, weight, body mass index (BMI) and skinfold thickness in 1981 and 1996

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of subjects</th>
<th>1981</th>
<th>1996</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>91</td>
<td>33.6 (4.1)</td>
<td>48.7 (4.1)</td>
<td>+15.1</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>86</td>
<td>83.1 (7.7)</td>
<td>90.3 (13.0)</td>
<td>+7.2***</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>81</td>
<td>25.2 (2.7)</td>
<td>27.3 (3.7)</td>
<td>+2.1***</td>
</tr>
<tr>
<td>Triceps (mm)</td>
<td>86</td>
<td>10.8 (4.2)</td>
<td>11.4 (4.6)</td>
<td>+0.8</td>
</tr>
<tr>
<td>Biceps (mm)</td>
<td>86</td>
<td>6.2 (2.7)</td>
<td>7.5 (4.0)</td>
<td>+2.3***</td>
</tr>
<tr>
<td>Subscapular (mm)</td>
<td>86</td>
<td>13.8 (5.7)</td>
<td>18.5 (10.1)</td>
<td>+4.7***</td>
</tr>
<tr>
<td>Suprailiac (mm)</td>
<td>83</td>
<td>10.5 (4.9)</td>
<td>12.2 (5.9)</td>
<td>+1.7**</td>
</tr>
</tbody>
</table>

*Skinfold thickness. *P<0.05, **P<0.01, ***P<0.001.
Physical activity

According to the questionnaire, the leisure-time physical activity of those police officers studied had markedly increased between 1981 and 1996, whereas the cardiorespiratory and muscular fitness parameters showed a decline. Smolander et al. reported that leisure-time physical activity had a significant and high correlation with the results of physical fitness in 1981. The leisure-time physical activity in 1981 also had a much stronger correlation with physical fitness in 1996 than the leisure-time physical activity in 1996. The intensity of the leisure-time physical activity of the police officers was probably lower in 1996 than in 1981. Walking was very popular among those police officers studied in 1996. The current type of leisure-time physical activity seemed to reduce the waist circumference, but it had no effect on the \( V_{O_{2}\text{max}} \) (ml/min/kg) in relation to body mass. If the aerobic power of the subjects had been measured directly, the measurements would have been more precise and the correlations between their leisure-time physical activity and aerobic power might have been stronger.

Physical fitness

In 1981 and 1996 the results of the \( V_{O_{2}\text{max}} \) (ml/min/kg) and sit-up tests were better, while those of the pull-up test were slightly worse when compared with age-specific reference values. This finding supports the conclusion of Smolander et al. that the selection of heavier and taller men for police training guarantees a certain level of physical capacity which is not strongly determined by body mass.

According to this study the police officers’ absolute \( V_{O_{2}\text{max}} \) (l/min) was about equal in 1981 and 1996 (3.41 vs 3.31 l). Although this is a positive result, it may also have overestimated the cardiorespiratory capacity of the police officers since the proportion of inactive policemen was presumably greater among those who did not participate in this study or could not undertake the ergometer test because of disease or other disorder. Muscular performance declined more than aerobic power because only 26% of the physically active police officers had carried out physical exercises that were estimated to have had some beneficial effect on muscular performance. Some of the decline in muscular performance can also be explained by the weight gain (approximately 0.5 kg/year). It seems probable that, at 35–50 years of age, physical fitness can be maintained at a stable level if moderate, regular and diverse physical activity is conducted and chronic diseases are avoided.

Perceived physical and psychological strain of the work, and work ability index

The physical strain that resulted from their jobs, as perceived by these police officers, had lessened during the 15-year follow-up. During the same time the perceived psychological strain had increased. The police officers who participated in the study had made progress in their career so that, for example, physically strenuous night shifts had become rare, but they worked in high ranking and responsible positions.

The mean work ability index (39 points) of the police officers was similar to that of Finnish male municipal workers at the age of 50 years. Seven per cent of the police officers had a poor index value, and therefore they had an increased risk of work disability. Altogether, 21% of the police officers had a moderate work ability index. Therefore, nearly one-third of the police officers had an index lower than good or excellent (<36 points), and needed efficient measures to promote their work ability. Successful retention of work ability requires action in the following areas: (1) the psycho-social working environment; (2) the physical working environment; (3) individual working ability; and (4) the professional skills of the workers. Work ability seemed to decline more rapidly after the age of 45 years (Fig. 3). Thus measures for retaining work ability should be commenced early, preferably before chronic health impairment occurs.

In the Finnish follow-up study of ageing municipal workers there was a positive correlation between the work ability index, trunk muscle forces and grip forces. An improved work ability index also correlated with vigorous leisure-time physical exercise. In this study we also found a correlation between the work ability index and the sit-up test, but there was no correlation between the index, physical activity or the other fitness parameters.

Anthropometric characteristics

The proportion of overweight (BMI <27) subjects was considerably smaller in 1981 than in 1996 (29% and
The waist/hip ratio. Only leisure-time physical activity main-
tained for several years seemed to be able to prevent the
men from gaining harmful intra-abdominal fat. There-
fore the promotion of leisure-time physical activity must
start no later than early adulthood.

CONCLUDING REMARKS

During our 15-year follow-up police officers had
experienced some positive changes in their life-style
(i.e. increased leisure-time physical activity and reduced
smoking). Negative changes were also observed, for
example, an increased number of chronic diseases,
reduced physical fitness in most of the tests and
significant weight gain. Leisure-time physical activity in
1981 correlated most strongly with fitness in 1996. This
result emphasizes the importance of adopting a physi-
cally active life-style early in a career. Such a life-style
should be supported by the police organization and
occupational health services.

ACKNOWLEDGEMENTS

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REFERENCES

1. Soininen H. The Feasibility of Worksite Fitness Programs and
Their Effects on the Health, Physical Capacity and Work Ability
of Aging Police Officers. Kuopio University Publications D.
Medical Sciences 68. Kuopio: University of Kuopio; 1995.
2. Lehtovirta E. Obesity in relation to glucose tolerance: a cross-
sectional anthropometric and retrospective study on Hel-
3. Pyorälä K, Savolainen E, Lehtovirta E, Punsar S, Siltanen P.
Glucose tolerance and coronary heart disease: Helsinki
4. Vanhala K. Psychological Risk Factors Related to Coronary
Heart Disease: Prospective Study on Psychological Factors
Predicting Coronary Heart Disease Morbidity of Helsinki
Policemen. (Monographs of Psychiatrca Fennica 9.) Hel-
5. Smolander J, Louhevaara V, Oja P. Policemen’s physical
fitness in relation to the frequency of leisure-time physical
6. Ogawa T, Spina R, Martin W, et al. Effects of aging, sex and
physical training on cardiovascular responses to exercise.
7. Lakka T, Venäläinen J, Rauramäki R, Salonen R, Tuomi-
lehto J, Salonen J. Relation of leisure-time physical activity
cardiorespiratory fitness to the risk of acute myocardial
8. Tuomi K, Ilmarinen J, Eskelinen L, Järvinen E, Toikkanen
J, Klockars M. Prevalence and incidence rates of diseases
and work ability in different work categories of municipal
9. Lean M, Han T, Morrison C. Waist circumference as a
measure for indicating need for weight management. Br Med J


