

This article was downloaded by: [185.55.64.226]

On: 13 March 2015, At: 22:58

Publisher: Taylor & Francis

Informa Ltd Registered in England and Wales Registered Number: 1072954

Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



International Journal of Occupational Safety and Ergonomics

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/tose20>

Influence of Exercise-Focused Group Activities on the Physical Activity, Functional Capacity, and Work Ability of Female Farmers—A Three-Year Follow-Up

Merja Perkiö-Mäkelä^a

^a Kuopio Regional Institute of Occupational Health, Finland

Published online: 08 Jan 2015.

To cite this article: Merja Perkiö-Mäkelä (1999) Influence of Exercise-Focused Group Activities on the Physical Activity, Functional Capacity, and Work Ability of Female Farmers—A Three-Year Follow-Up, *International Journal of Occupational Safety and Ergonomics*, 5:3, 381-394

To link to this article: <http://dx.doi.org/10.1080/10803548.1999.11076427>

PLEASE SCROLL DOWN FOR ARTICLE

Taylor & Francis makes every effort to ensure the accuracy of all the information (the "Content") contained in the publications on our platform. However, Taylor & Francis, our agents, and our licensors make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions and views expressed in this publication are the opinions and views of the authors, and are not the views of or endorsed by Taylor & Francis. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Taylor and Francis shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to or arising out of the use of the Content.

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden. Terms

& Conditions of access and use can be found at <http://www.tandfonline.com/page/terms-and-conditions>

Influence of Exercise-Focused Group Activities on the Physical Activity, Functional Capacity, and Work Ability of Female Farmers—A Three-Year Follow-Up

Merja Perkiö-Mäkelä

Kuopio Regional Institute of Occupational Health, Finland

The objective of this randomised study was to evaluate the influence of exercise-focused group activities on female farmers' physical activity, functional capacity, and work ability over a period of 3 years. Physical activity increased more in the intervention group ($n = 62$) than in the control group ($n = 64$) during the first year. By the third year physical activity had almost returned to the pre-intervention level. In the 3-year follow-up examination muscular endurance and cardio-respiratory fitness had improved in the intervention group, and musculoskeletal symptoms had decreased more often in the intervention group than in the control group. The index used to measure perceived work ability showed no changes over the 3-year period. It can be concluded that group activities focused on leisure-time physical activity and work habits can be recommended as health promotion measures for farmers' occupational health services.

health promotion intervention musculoskeletal symptoms
occupational health

1. INTRODUCTION

In 1994 there were 96,000 farms in Finland. The average farm consisted of about 19 ha of arable land and 47 ha of forest. The most important operation was dairy farming, which was the main operation on 40,000 farms. Out of 89,000 male and 61,000 female farmers, two thirds worked full-time. Seven percent of the Finnish labour force works in agricultural production (Farmer's Social Insurance Institution, 1995).

Farming is a high-risk occupation for musculoskeletal disorders and

Correspondence and requests for reprints should be sent to Merja Perkiö-Mäkelä, Kuopio Regional Institute of Occupational Health, P.O.B. 93, FIN-70701 Kuopio, Finland. E-mail: <Merja.Perkio-Makela@occuphealth.fi>.

related disabilities (Notkola et al., 1990). Seventy-seven percent of the medical certificates used to apply for a disability pension include at least one musculoskeletal diagnosis, whereas only 38% include a cardiovascular disease, and only 11% list a mental disorder (Manninen, 1996).

Farm work is still physically strenuous, although it has changed somewhat during the last 2 decades as farm work has become more mechanical, farm size has increased, and the number of crop husbandry farms has increased. In order to avoid physical overstrain, farmers should be in a moderate or good physical fitness. However, farmers perceive their work ability as lower than other occupational groups in Finland, and their physical activity is lower than the rest of the Finnish population (Notkola, Perkiö, Koivisto, & Husman, 1991; Perkiö & Notkola, 1994). Especially female farmers have more long-standing illnesses than the rest of the Finnish population. Female farmers working in dairy farming are considered a health risk group (Susitaival & Husman, 1994).

Maintaining work ability involves work demands (e.g., ergonomics), work place or unit organisation (developmental, psychosocial and management issues), and an individual worker (health promotion and physical exercise; Louhevaara & Ilmarinen, 1995).

Almost every other full-time farmer (44%) is now covered by farmers' occupational health services in Finland. These services consist of basic preventive measures for maintaining work ability directed at work conditions (checked either in a walkthrough survey or in an interview at the health care centre every 2 years) and the health promotion of farmers (health check done by the occupational health nurse in the municipal health care centre). After the basic measures, the occupational health physician evaluates the need for occupational hygienic measurements on the farm, a more extensive examination of the health of the farmer, or rehabilitation (Susitaival & Husman, 1994).

At the Finnish Institute of Occupational Health, effects of worksite physical exercise interventions on physical fitness, work ability, and various work-related characteristics have been studied for ageing cleaners, nurses, home care personnel, metal workers, fire fighters, and police officers during the past 10 years. After the interventions, lasting 2–12 months, musculoskeletal and cardiorespiratory capacity were improved, on average, by 7–136% and 4–10%, respectively. Positive effects were observed on the work ability index, subjective health, musculoskeletal symptoms, absenteeism, strain at work, risk factors for ischemic heart

disease, tolerance of shiftwork, and on the control of work. It was concluded that physical exercise is an efficient and feasible measure to promote work ability (Louhevaara & Ilmarinen, 1995).

Studies of workplace fitness programs have found correlation between life-style changes and decreased absenteeism, fewer job-related injuries, improved job productivity or efficiency, increased morale, and decreased employee turnover. Furthermore, studies indicate that health care costs to the individual person, the employer, the health insurance industry, and the government are lower in an active versus inactive society. Not only do people live longer, they are also less likely to develop chronic disease, more likely to recover faster from an acute disease, more likely to remain functionally independent, and, even if living in a chronic care facility, may require less intense and less costly care (Kamar & Patton, 1994; MsPherson, 1994; Shephard, 1989, 1992).

Dishman, Oldenburg, O'Neal, and Shephard (1998) have recently made a quantitative synthesis of the literature that has examined the effectiveness of worksite interventions intended to increase physical activity or physical fitness. They used meta-analytic methods. They concluded that typical worksite intervention has yet to demonstrate a significant increase in physical activity or fitness. Simons-Morton, Calfas, Oldenburg, and Burton (1998) reviewed studies testing interventions to promote physical activity in health care settings for primary prevention (patients without disease) and secondary prevention (patients with cardiovascular disease). They concluded that such interventions can increase physical activity for both primary and secondary prevention. Long-term effects are more likely with continuing intervention and multiple intervention components such as supervised exercise, provision of equipment, and behavioural approaches.

Farmers perceive their work ability and physical activity lower than those of other occupational groups in Finland. Farmers' occupational health services traditionally consists of preventive measures for maintaining work ability directed at work conditions and the individual health promotion of farmers. Group activity is a new subject to farmers' occupational health services. The objective of this study was to evaluate the influence of exercise-focused group activities on female farmers' physical activity, functional capacity, and work ability over a period of 3 years.

2. MATERIALS AND METHODS

2.1. Participants

The study was carried out in 5 municipal health centres. The occupational health nurse from each municipal health centre selected the participants according to the following criteria: female farmer, work on a dairy farm, 25–45 years of age, and moderate musculoskeletal symptoms that had not yet affected work ability. Altogether 150 female farmers fulfilled the criteria. Twenty-four did not take part in the study because they lacked interest or forgot ($n = 14$), they lacked transportation ($n = 4$), had trouble with child care ($n = 4$), or were too busy ($n = 2$). According to the selection criteria, those who did not take part in the study were similar to those who participated in the study.

Altogether 126 female farmers participated in the study. In each municipal health centre, the participants were divided into 2 groups according to age, low-back symptoms, leisure-time physical activity, and the use of arable land. The groups were randomly assigned to an intervention group or a control group. There were 6 intervention groups and 6 control groups. The intervention and control groups did not differ significantly with respect to the background information (Table 1).

TABLE 1. Background Information About the Participants and Their Farms, $M \pm SD$, original, $n = 126$ (62 + 64), and Those Who Attended All Four Tests, $n = 106$ (52 + 54)

Variable	Intervention Group		Control Group	
	$n = 62$	$n = 52$	$n = 64$	$n = 54$
Female farmers				
Age (years)	38 ± 5	38 ± 5	38 ± 5	37 ± 5
Physical exercise ^a	31%	27%	28%	24%
Low-back symptoms ^b	76%	73%	73%	72%
Farms				
Arable farming land (ha)	24 ± 18	23 ± 10	22 ± 10	23 ± 10
Number of dairy cows	14 ± 5	14 ± 5	13 ± 5	13 ± 4

Notes. a—leisure time physical exercise at least twice a week; b—have had low-back symptoms during the last 12 months.

At the time of the 3-year follow-up examination, 19 participants were no longer doing farm work, 1 did not return the questionnaire, 24 did

not come to the tests measuring musculoskeletal capacity, and 34 did not attend the cardio-respiratory fitness tests. Those who were still farmers did not differ significantly with respect to the background information compared to those who had quit farming (Table 1).

2.2. Intervention

The group activities were designed to support and increase the functional capacity and work ability of the farmers. The aims were to motivate farmers to increase physical activity and to decrease strain to the musculoskeletal system in farm work. The instructors of group activities were a physiotherapist, an occupational health nurse, an occupational physician, a psychologist, and an agricultural advisor. The intervention included mainly physical exercise (aerobic training: walking, jogging, skiing, swimming; gymnastics: muscular strength, stretching, and relaxation) and training of work and particularly lifting techniques. Lectures of work conditions, work methods, personal protective equipment, nutrition, weight-reduction, musculoskeletal disorders, and control of life, were also involved. The groups met at the municipal health centre once or twice a week for 1–3 hrs at a time over a period of 2.5 months, the total duration of the meetings being 12–20 hrs.

2.3. Methods

A questionnaire and functional capacity tests were used to gather the data. The first measurements were done before the group activity began. The participants were measured a second time after the completion of the group activity. A third and fourth set of measurements followed 12 and 36 months, respectively, after the first measurements.

Subjective work ability was assessed with the work ability index, (WAI; Tuomi, Ilmarinen, Eskelinen, Järvinen, Toikkanen, & Klockars, 1991). The WAI is a sum variable that includes subjective estimations of work ability in relation to diseases, job demands, absenteeism, and psychological resources (score 7–49). Musculoskeletal symptoms were determined with the use of the standardised Nordic questionnaire. The question used in this study was “Have you had trouble (pain, ache, discomfort) during the last 12 months in the following parts of your

body: neck (no-yes), shoulders (no-yes), upper back (no-yes), elbows (no-yes), wrist or hands (no-yes), lower back (no-yes), hips or thighs (no-yes), knees (no-yes), ankles or feet (no-yes)?" (Kuorinka, Jonsson, Vinterberg, Biering-Sodersen, Andersson, & Jorgensen, 1987). Two indices concerning the upper (neck, shoulders, upper back, elbows, wrist and hands) and lower (lower back, hips and thighs, knees, ankles and feet) regions of the body were formed. Information gathered on habitual physical exercise concerned leisure-time physical activity (Berg, Peltoniemi, & Puska, 1990) and recovery pause-exercise. The physiotherapist of each municipal health centre measured the musculoskeletal capacity of the participants with tests by Alaranta, Soukka, Harju, and Heliövaara (1990). Muscle endurance of the legs (squatting) and of the trunk flexors was assessed by repetitive muscle tests. Muscle endurance of the trunk extensors was evaluated by a static muscle test. Back mobility was assessed from measurements of the side flexion of the back. Static balance was measured with the participant standing on one leg, eyes closed. The farmers' cardio-respiratory fitness was determined with a 2-km walking test (Laukkanen, 1993).

2.4. Statistics

The statistical analyses were done by SAS software. Means, standard deviations, medians, 95% confidence intervals, and the *t*-test were used in the analyses. The CATMOD procedure was used in the analyses of the categorical variables (SAS Institute, 1989, 1990).

3. RESULTS

3.1. Physical Activity

The leisure-time physical activity increased during the 2.5 month period of group activity both in the intervention ($p = .000$) and the control ($p = .007$) group but the increment was larger in the intervention group ($p = .001$). At the time of the 1-year follow-up, the intervention group was also more active ($p = .001$) in their leisure time than before the intervention (Figure 1). Both home gymnastics and recovery-pause exercise increased during the group activity ($p = .000$) and was still higher than the pre-intervention level at the time of 1-year follow-up

($p = .000$ and $p = .009$, respectively) in the intervention group, but not in the control group. The difference between the groups was significant after the group activity ($p = .000$ and $p = .011$) and also at the time of the 1-year follow-up ($p = .003$ and $p = .004$). By the time of the 3-year follow-up, the leisure-time physical activity and the routines for home gymnastics and recovery-pause exercise had decreased to the pre-intervention level.

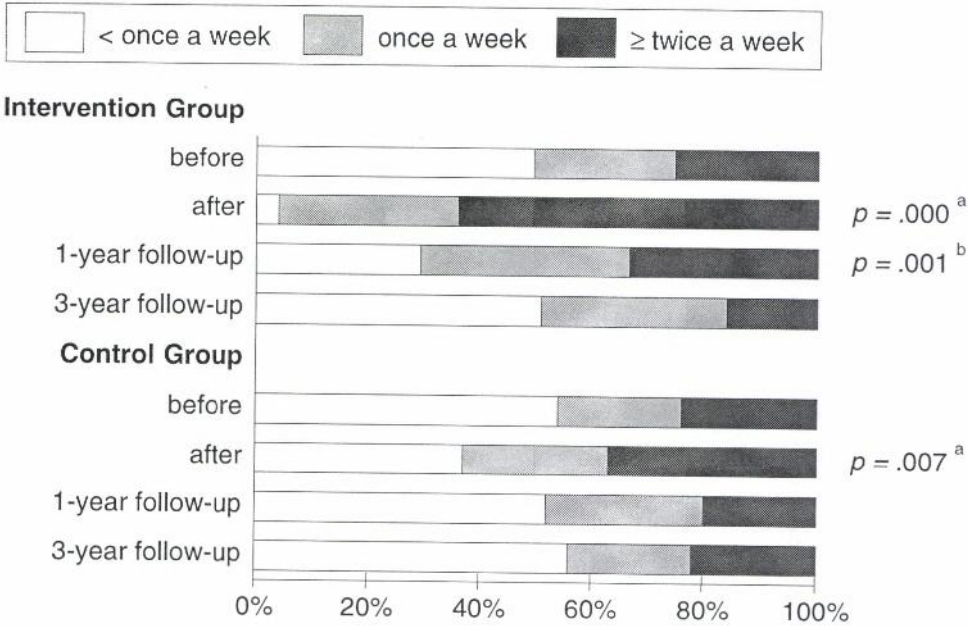


Figure 1. Leisure time physical activity before and after group activity and in the 1-year and 3-year follow-up examinations, $n = 105$. Notes. a—significance between situation before and after group activity, b—significance between situation before group activity and in 1-year follow-up.

3.2. Functional Capacity

The participants' muscle endurance improved during the follow-up in both the intervention and the control group, but more so in the intervention group than in the control group, even though the difference was not significant. Static balance improved in the intervention group but not in the control group during the first year of follow-up. Lateral flexion of the back improved more in the intervention group than in the control group during the same period ($p = .001$). Cardio-respiratory

TABLE 2. Physical Capacity Before and After Group Activity and in the 1-Year and 3-Year Follow-Up Examinations in the Intervention Group. Means (Median), Means of the Change, and 95% Confidence Interval (CI) of the Change, $n = 43$

Test Item	Before	After	Change ^a (95% CI)	<i>P</i>	1-Year Follow-Up	Change ^b (95% CI)	<i>P</i>	3-Year Follow-Up	Change ^c (95% CI)	<i>P</i>
Body mass, kg	70 (67)	69 (66)	-1 (-2-0)		70 (68)	0 (-1-1)		71 (69)	1 (-0-2)	
Trunk flexion strength, dynamic (maximum 50 repetitions)	23(20)	29 (26)	6 (3-8)	.000	28 (27)	5 (1-9)	.008	28 (25)	5 (2-7)	.003
Trunk extension strength, static (maximum 240 s)	157(175)	175 (190)	18 (5-31)	.007	181 (200)	25 (6-43)	.011	173 (185)	16 (-1-33)	
Squatting (maximum 50 repetitions)	29 (28)	35 (36)	7 (4-10)	.000	32 (33)	4 (1-7)	.005	34 (35)	6 (3-9)	.001
Lateral flexion of the back (mm)	390 (370)	400 (398)	11 (-1-23)		398 (395)	8 (-3-20)		385 (380)	-5 (-21-12)	
Static balance (maximum 40 s)	18 (13)	22 (18)	4 (0-7)	.039	24 (17)	5 (1-10)	.016	25 (14)	7 (-2-16)	
2-km walking test (score)	97 (101)				100 (102)	2 (-0-5)		100 (103)	2 (0-5)	.037
	$n = 42$									

Notes. a—change in after-before group activity, b—change in 1-year follow-up-before group activity, c—change in 3-year follow-up-before group activity.

TABLE 3. Physical Capacity Before and After Group Activity and in the 1-Year and 3-Year Follow-Up Examinations in the Intervention Group. Means (Median), Means of the Change, and 95% Confidence Interval (CI) of the Change, $n = 29-34$

Test Item	Before	After	Change ^a (95% CI)	<i>p</i>	1-Year Follow-Up	Change ^b (95% CI)	<i>p</i>	3-Year Follow-Up	Change ^c (95% CI)	<i>p</i>
Body mass, kg	68 (66)	68 (66)	-0 (-1-1)		68 (67)	1 (-0-1)		69 (68)	1 (0-3)	.039
Trunk flexion strength, dynamic (maximum 50 repetitions)	26 (23) $n = 33$	28 (26)	2 (-1-5)		31 (27)	5 (1-8)	.010	28 (25)	2 (-1-5)	
Trunk extension strength, static (maximum 240 s)	171 (185) $n = 33$	182 (225)	10 (-8-28)		185 (196)	14 (-1-29)		182 (193)	11 (-9-30)	
Squatting (maximum 50 repetitions)	33 (32) $n = 33$	36 (33)	3 (-0-7)		35 (40)	3 (-1-7)		36 (40)	5 (0-9)	.048
Lateral flexion of the back (mm)	417 (410)	416 (388)	-0 (-9-9)		382 (375)	-34 (-51-17)	.000	393 (397)	-24 (-40-7)	.006
Static balance (maximum 40 s)	18 (13)	20 (15)	1 (-3-6)		22 (14)	4 (-2-10)		18 (16)	0 (-4-4)	
2-km walking test (score)	100 (99) $n = 29$				103 (101)	3 (-1-6)		103 (104)	3 (-1-6)	

Notes. a—change in after-before group activity, b—change in 1-year follow-up-before group activity, c—change in 3-year follow-up-before group activity.

fitness improved in the intervention group by the time of 3-year follow-up (Tables 2 and 3).

3.3. Musculoskeletal Symptoms and Perceived Work Ability

The musculoskeletal symptoms of the lower part of the body had diminished in the intervention group but not in the control group at the time of the 1-year ($p = .001$) and 3-year ($p = .028$) follow-up examinations. The difference between the groups was significant at the time of both the 1-year ($p = .004$) and 3-year ($p = .021$) follow-ups. Perceived work ability (score 0–10) improved ($p = .030$) during the first year of follow-up in the intervention group, but not in the control group. The difference between the groups was significant ($p = .039$). The mean ranged from 7.7 ($SD = 1.8$) to 8.4 ($SD = 1.2$). The work ability index (score 7–49) did not change during the 3-year follow-up. The mean ranged from 39 ($SD = 7$) to 42 ($SD = 4$).

4. DISCUSSION

4.1. Methodological Considerations

In the study, a model for group activity was tested for the farmers' occupational health services. The participation rate was good. After receiving information about the study, 84% of the female farmers approached were willing to participate. In worksite fitness programs often only those who are already physically active take part (Verhoeven, 1997). In this study, physically inactive women were also involved. The sample represented 25- to 45-year-old women from dairy farms. The participants took part actively in the groups (90%) and no one dropped out of the group activity. They also expressed the wish that this kind of activity would be continued as part of their occupational health services. The health care personnel were also pleased with the activity. They felt that it gave new content to their work, and they planned to continue to use group activity as a part of the services offered if resources were available.

Nineteen participants were no longer doing farm work in the 3-year follow-up and they were excluded from the study. Economic reasons were most common reason for giving up farm work. This is a usual trend in Finland. Twenty-four participants did not come to the tests measuring

musculoskeletal capacity, and 34 did not attend the cardio-respiratory fitness tests. Those participants who attended all musculoskeletal capacity tests did not differ significantly with respect to muscular endurance compared to those who did not attend all tests. Those participants who attended all cardio-respiratory fitness tests got better results in the beginning of the study compared to those who did not attend all tests (mean of the score $\pm SD = 98 \pm 14$ vs. 91 ± 14 , $p = .0493$). This may have influenced the results. Maybe only those participants who considered that their cardio-respiratory fitness was improved attended the test. On the other hand, improvement in results is easier to achieve if the baseline result is lower.

The validity and reliability of the questions of the questionnaire (Kuorinka et al., 1987; Normand & Gaston, 1989; Tuomi et al., 1991) and the functional capacity tests used (Alaranta et al., 1990; Laukkanen, 1993) have proved to be good. The questions and tests were selected so that they would be easy to use as part of occupational health services also after the study. The same physiotherapist tested the functional capacity of the participants in each municipal health centre except one. The municipal health centres where the intervention was carried out represented the average of such centres in Finland.

The baseline musculoskeletal capacity of the participants was close to the average for Finnish women in same age group, except for the static endurance of the back muscles, which was better than average (Alaranta et al., 1990). The participants' cardio-respiratory fitness was average (Laukkanen, 1993). Their leisure-time physical activity was lower than average, but it was nevertheless on the same level as that of other farmer groups (Notkola et al., 1991; Perkiö & Notkola, 1994). The work ability index showed that the participants had above average work ability (Tuomi et al., 1991).

4.2. Effects of Intervention

Group activity had a positive influence on the participants' musculoskeletal capacity, cardio-respiratory fitness, musculoskeletal symptoms, and leisure-time physical activity, but it had only minor effects on perceived work ability.

Increases in leisure-time physical activity with the intervention were diminished as follow-up time increased. This result supports the general findings of Dishman and Sallis (1994). At the time of the 1-year

follow-up, participants did not know whether there would be 3-year follow-up, or not. Regular feedback and information on future part of the program might have increased activity.

Anyhow the participants' functional capacity was improved. The physical exercise of the groups stressed musculoskeletal capacity, but also training of cardio-respiratory fitness was involved. The training in work techniques that was initiated in the group activity helped decrease the number of musculoskeletal symptoms. These results support those of previous studies (Hopsu, Louhevaara, & Korhonen, 1997; Louhevaara & Ilmarinen, 1995; Pohjonen, Punakallio, & Louhevaara, 1997), according to which exercise programs arranged on worksites improved muscular capacity, cardio-respiratory fitness, and reduced musculoskeletal symptoms.

Farm work is physically strenuous. Better functional capacity should lead to decreased work load and strain, and better work ability. Decreased work strain was seen in this study as decreased musculoskeletal symptoms. Perceived work ability (score 0–10) improved during the first year of follow-up in the intervention group but not in the 3-year follow-up. Health-related interventions should be continually and intensively provided to attain long-term effects (Simons-Morton et al., 1998; Verhoeven, 1997). In this study, continuity was provided with occupational health services. The occupational health nurse meets a farmer on average every 2 years in a municipal health care centre in association with a health check. During these meetings the occupational health nurse should also discuss habits of physical activity and work techniques. A practical model of counselling on health-related physical activity recently published by Laitakari and Asikainen (1998) could be of great help. The model has been built around five steps of the counselling process: assessment of current situation, planning, definition of the target, implementation and monitoring, evaluation and reformulation. The model has shown to incorporate central behavioural strategies shown useful in promoting adherence to physical activity.

4.3. Conclusions

Group activity had a positive influence on the farmers' musculoskeletal capacity, cardio-respiratory fitness, and musculoskeletal symptoms. Group activities focused on work habits and leisure-time exercise are recommended as health promotion measures for farmers' occupational health services.

REFERENCES

- Alaranta, H., Soukka, A., Harju, R., & Heliövaara, M. (1990). *Tuki- ja liikuntaelin-sairauksien diagnostiikan kehittäminen. Selän ja niska-hartiaseudun suorituskyvyn mittaaminen työterveyshuollossa* [Developing the techniques used for diagnosing musculoskeletal diseases] (Työsuojelurahaston julkaisuja A7). Helsinki, Finland: Finnish Work Environment Fund. (With a summary in English).
- Berg, M.A., Peltoniemi, J., & Puska, P. (1990). *Suomalaisen aikuisväestön terveyskäyttäytyminen kevät 1990* [Health behavior among the Finnish adult population, Spring 1990] (Kansanterveyslaitoksen julkaisuja B3). Helsinki, Finland: National Public Health Institute. (With a summary in English).
- Dishman, R.K., Oldenburg, B., O'Neal, H., & Shephard, R.J. (1998). Worksite physical activity interventions. *American Journal of Preventive Medicine*, 15, 344–361.
- Dishman, R.K., & Sallis, J.F. (1994). Determinants and interventions for physical activity and exercise. In C. Bouchart, R.J. Shephard, & T. Stephens (Eds.), *Physical activity, fitness, and health: International proceedings and consensus statement* (pp. 214–238). Champaign, IL: Human Kinetics.
- Farmer's Social Insurance Institution. (1995). *Tilastovuosi 1994* [Statics for 1994]. Espoo, Finland: Author.
- Hopsu, L., Louhevaara, V., & Korhonen, O. (1997). Effects of a work-site physical exercise intervention on the physical fitness and well-being of professional cleaners. In P. Seppälä, T. Luopajarvi, C.H. Nygård, & M. Mattila (Eds.), *Proceedings of the 13th Triennial Congress of the International Ergonomics Association, Tampere, Finland, 1997* (Vol. 5, pp. 439–441). Helsinki, Finland: Finnish Institute of Occupational Health.
- Kamar, R., & Patton, R. (1994). Costs and benefits of an active versus an inactive society. In C. Bouchart, R.J. Shephard, & T. Stephens (Eds.), *Physical activity, fitness, and health: International proceedings and consensus statement* (pp. 134–144). Champaign, IL: Human Kinetics.
- Kuorinka, I., Jonsson, B., Vinterberg, H., Biering-Sodersen, F., Andersson, G.B.J., & Jorgensen, K. (1987). Standardised Nordic questionnaires for the analysis musculoskeletal symptoms. *Applied Ergonomics*, 3, 233–237.
- Laitakari, J., & Asikainen, T. (1998). How to promote physical activity through individual counseling—A proposal for a practical model of counseling on health-related physical activity. *Patient Education and Counseling*, 33, 13–24.
- Laukkanen, R. (1993). *Development and evaluation of a 2-km walking test for assessing maximal aerobic power of adults in field conditions* (Kuopio University Publications D. Medical Sciences 23). Kuopio, Finland: University of Kuopio.
- Louhevaara, V., & Ilmarinen, J. (1995). Physical exercise as a measure for maintaining work ability during aging. In M. Kumashiro (Ed.), *The paths to productive aging* (pp. 289–293). London: Taylor & Francis.
- Manninen, P. (1996). *Risk factors of musculoskeletal disorders and work disability among Finnish farmers* (Studies in Social Security and Health 14). Helsinki, Finland: Social Insurance Institution.
- MsPherson, B.D. (1994). Sociocultural perspectives on aging and physical activity. *Journal of Aging and Physical Activity*, 2, 329–353.

- Normand, I.G., & Gaston, G. (1989). Self-reported exercise behaviour of employees: A validity study. *Journal of Occupational Medicine*, 12, 969-973.
- Notkola, V., Perkiö, M., Koivisto, T., & Husman, K. (1991). *Päätoimisten maatalosyrittäjien koettu terveydentila, pitkäaikaissairastavuus, koettu työ- ja toimintakyky, liikuntakäyttäytyminen ja kuntoutuspalveluiden käyttö* [Self-reported health, functional and working capacities, habits of physical exercise and use of rehabilitation services among farmers]. *Työ ja ihminen*, 4, 397-428. (With a summary in English).
- Notkola, V., Virolainen, R., Tupi, K., Louhelainen, K., Husman, K., Nuutinen, J., Raitasalo, R., Terho, E.O., Penttinen, J., Kalimo, E., & Kankaanpää, E. (1990). *Viljelijöiden työterveyshuollon seuranta- ja kehittämistutkimus 1985-1987* [Farmers' occupational health programme in Finland, 1985-1987; a follow-up study based on experiment] (Kansaneläkelaitoksen julkaisuja A:25). Helsinki, Finland: Social Insurance Institution. (With a summary in English).
- Perkiö, M., & Notkola, V. (1994). Maatalosyrittäjien koettu terveydentila, pitkäaikaissairastavuus, työkyky, sairauspoissaolot, lääkärissä käynnit ja terveystyökyttäytyminen Suomessa vuonna 1992 [Self-reported health, chronic diseases, work ability, sick leaves, visits to physician and health behaviour among farmers in Finland 1992]. In P. Susitaival (Ed.), *Työterveys ja maatalous Suomessa 1992. Tutkimus maatalousyrittäjien työterveyshuollosta, terveydentilasta ja työssä viihtymisestä* (Kansaneläkelaitoksen julkaisuja ML:133, pp. 70-90). Helsinki, Finland: Social Insurance Institution. (With a summary in English).
- Pohjonen, T., Punakallio, A., & Louhevaara, V. (1997). Exercise and health promotion among home care personnel. In P. Seppälä, T. Luopajarvi, C.H. Nygård, & M. Mattila (Eds.), *Proceedings of the 13th Triennial Congress of the International Ergonomics Association, Tampere, Finland, 1997* (Vol. 5, pp. 510-512). Helsinki, Finland: Finnish Institute of Occupational Health.
- SAS Institute. (1989). *SAS/STAT users guide. Version 6* (4th ed., Vol. 1). Cary, NC: Author.
- SAS Institute. (1990). *SAS procedures guide. Version 6* (3rd ed.). Cary, NC: Author.
- Shephard, R.J. (1989). Current perspectives on the economics of fitness and sport with particular reference to worksite programmes. *Sports Medicine*, 7, 286-309.
- Shephard, R.J. (1992). A critical analysis of work-site fitness programs and their postulated economic benefits. *Medicine and Science in Sports and Exercise*, 24, 354-370.
- Simons-Morton, D.G., Calfas, K.J., Oldenburg, B., & Burton, N.W. (1998). Effects of interventions in health care settings on physical activity or cardiorespiratory fitness. *American Journal of Preventive Medicine*, 15, 413-430.
- Susitaival, P., & Husman, K. (1994). Farming and occupational health in Finland in 1992. In P. Susitaival (Ed.), *Työterveys ja maatalous Suomessa 1992. Tutkimus maatalosyrittäjien työterveyshuollosta, terveydentilasta ja työssä viihtymisestä* (Kansaneläkelaitoksen julkaisuja ML:133, pp. 222-232). Helsinki, Finland: Social Insurance Institution.
- Tuomi, K., Ilmarinen, J., Eskelinen, L., Järvinen, E., Toikkanen, J., & Klockars, M. (1991). Prevalence and incidence rates of diseases and work ability in different work categories of municipal occupations. *Scandinavian Journal of Work, Environment & Health*, 17(Suppl. 1), 67-74.
- Verhoeven, C.J.M. (1997). *Wellness effects of a worksite health promotion program* (Doctoral dissertation, Leiden University). Enschede, The Netherlands: PrintPartners Ipskamp.