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Exercise- and ergonomics-focused promotion of health and work ability in farmers' occupational health services

Doctoral dissertation

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ABSTRACT

The aims of this study were to identify farmers most in need of measures to promote health and work ability and to evaluate both the feasibility and the short- and long-term effects of group counselling intervention focusing on physical activity and ergonomics. Special emphasis was placed on female farmers' physical activity, physical fitness, musculoskeletal symptoms and work ability. The group counselling intervention was organised and carried out as part of the work of farmers' occupational health services.

The study included a telephone interview survey and randomised controlled intervention. The survey and intervention studies focused on 577 full-time farmers (296 men and 281 women) and 126 female farmers from dairy farms (an intervention group and a control group), respectively. The group counselling intervention was designed to support and increase the leisure-time physical activity, physical fitness and work ability of the subjects and to decrease their musculoskeletal symptoms. The data for the intervention study were obtained with questionnaires, and physical fitness tests that were carried out before and after the 2½month intervention and in the 1-, 3- and 6-year follow-ups.

According to a telephone interview survey, female farmers, farmers over 34 years of age, farmers having less than 10 years of education, farmers from small farms (area of cultivation <20 hectares), farmers who milk regularly, and depressed farmers had the greatest need for measures to promote their health and work ability. Group counselling intervention helped the subjects increase their leisure-time physical activity over the 1st year of follow-up, and musculoskeletal symptoms had decreased in the 1- and 6-year follow-ups more in the intervention than control groups. The subjects in the intervention group had made more changes in their work methods than those in the control group by the time of the 3-year follow-up. In the 6-year follow-up physical fitness was better in both groups than it was before the intervention. However, for both groups, the work ability index was lower in the 6-year follow-up than it had been in the beginning of the study.

Female farmers from small dairy farms are most in need of measures to promote their health and work ability. Exercise- and ergonomics-focused group counselling had positive short-term effects on physical activity and positive long-term effects on musculoskeletal symptoms. Therefore, such activities, when they are persistent and associated with habitual worktasks, can be recommended to occupational health services as measures for promoting the health and work ability of female farmers.

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To Meri, Visa and Pentti

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Kuopio, October 2000

Merja Perkiö-Mäkelä

LIST OF ORIGINAL PUBLICATIONS

This work is based on the following articles, referred in the text by their Roman numerals.

I. Perkiö-Mäkelä M. Finnish farmers' self-reported morbidity, work ability, and functional capacity. Annals of Agricultural and Environmental Medicine 2000 (7), 11-16.

II. Perkiö-Mäkelä M, Notkola V, Husman K. Activities supporting work ability as a part of farmers' occupational health services. Journal of Occupational Rehabilitation 1999 (9), 107-114.

III. Perkiö-Mäkelä M. Influence of exercise-focused group activities on the physical activity, functional capacity and work ability of female farmers - a three-year follow-up. Journal of Occupational Safety and Ergonomics 1999 (5), 381-394.

IV. Perkiö-Mäkelä M. Guided physical activity and instruction of ergonomics for promoting work ability of female farmers. Occupational Ergonomics (submitted)

In addition, some unpublished data are presented.

page

1. INTRODUCTION

In 1997, there were 90 000 active farms in Finland, and the average arable area was 24 hectares. Almost all of the farms (88%) were privately owned (1). Farm work is physically strenuous, even though the physical load factors have changed during the past 2 decades as farm work has become more mechanical (2). The number of farms is declining and their size is increasing.

Farming is a high-risk occupation with respect to musculoskeletal disorders and work-related disability (3-5). Farmers perceive their work ability to be lower, and they are less physically active than other occupational groups in Finland during their leisure time (6, 7).

The concept of promoting work ability, as adopted in Finland, involves measures targeted towards work demands (e.g., ergonomics), work organisation (development of psychosocial and management issues) and the worker (8). Together with individual health-promotion measures related to life-style, regular physical activity during leisure time seems to be an essential measure for promoting work ability. The best results can be attained if physical activity is carried out in conjunction with the development of ergonomics, work organisation and the professional competence of workers (9).

Farmers' occupational health services (FOHS) have been available since 1985 in Finland. Almost every 2nd full-time farmer (44%) is covered by these services. The activities consist of basic preventive measures to promote work ability. The measures are directed towards the work environment and the individual farmer. Services are subsidised from the tax revenues so that the farmers pays half of the costs of the medical examination (10). Group counselling intervention focusing on physical activity and ergonomics can promote work ability, but very limited information is available on the feasibility of such group activities.

The objectives of this study were to identify farmers most in need of measures to promote health and work ability and to assess both the feasibility and the short- and long-term effects of group counselling intervention focusing on physical activity and ergonomics. Special emphasis was placed on female farmers' physical activity, fitness, musculoskeletal symptoms and work ability. The intervention was carried out by FOHS.

2. REVIEW OF THE LITERATURE

2.1. Farming and farmers

2.1.1. Farms in Finland

In 1997, there were 90 000 active farms in Finland, and the average arable area was 24 hectares. Almost all of the farms (88%) were privately owned. The average age of active farmers was 47 years at that time. Finnish farms primarily raised crops (45%), cattle (40%), or pigs or poultry (8%). As of 1997 there were 30 800 farms with dairy cows, and the average size of the herds was 13 cows per farm (1). The size of farms is growing, and, according to the linear trend calculation, the mean number of cows will be about 15 by the year 2005. The structural change that started in agriculture in 1995 when Finland became a member of the European Union is still continuing. According to a radical reform scenario based on the assumption that national support will be abolished by the year 2005, as required by the European Union, the number of dairy farms will decrease to 14 000, and the mean number of cows will increase to about 25 per farm (11).

2.1.2. Physical load and strain in farming

Farm work is physically strenuous even though the physical load factors have changed during the past 2 decades as farm work has become more mechanised and automated (2).

Agricultural work involves potential risk factors for musculoskeletal disorders and injuries, including strenuous muscular exertion, prolonged static contractions, poor postures that include continuous forward bending and twisting of the trunk (especially while lifting), the handling of excessive or asymmetrical loads, and various harmful load factors with a repetitive nature (12). High static postural load is common in agriculture (13-16), and the load on the back is the highest in dairy farming, arable farming, beef production, mushroom production, outdoor vegetable growing, fruit growing, and arboriculture (16).

The work on dairy farms is characterised by a high work pace, long work hours and a considerable risk of injury. When milking cows in stanchion barns, a milker has to use a variety of work postures and movements that involve walking, sitting, rising, squatting, kneeling, stooping, bending, twisting and stretching. Often the milker needs to hold a load of 3-6 kg (cluster, teat cups) in one hand under the cow's udder at a relatively long distance from the body (17).

In most agricultural tasks, the cardiorespiratory strain is light or moderate according to the heart rate and moderate or hard according to the relative aerobic strain. Women have a higher level of strain in dairy work than men due to women's lower cardiorespiratory capacity (18). The aerobic capacity (VO_2 max) of female dairy farmers is below average, 26 (SD 3) $ml \cdot min^{-1} \cdot kg^{-1}$, and their work requires over 50% of VO_2 max during most of the tasks in dairy farming. The VO_2 max of male farmers is moderate, 32 (SD 10) $ml \cdot min^{-1} \cdot kg^{-1}$ and most tasks require below 50% of the worker's VO_2 max. The mean heart rate in dairy farming tasks has been reported to be 99 beats/min for men and 116 beats/min for women (18).

Dairy farmers, regardless of age or gender, consider the feeding of ensilage and milking to be the most physically demanding tasks (19). In the study of Ahonen et al. (18) both the male and female farmers rated delivering ensilage and removing manure as somewhat hard or hard, and female farmers gave milking the same ratings. According to Stål et al. (20) perceived physical exertion is the highest in milking during the carrying and lifting of 1 or 2 milking machines, pre-milking, the disconnection of the milking units, and the attaching of the cluster to the udder. Milking in parlours can be considered as light work for the cardiorespiratory and musculoskeletal system (21).

2.1.3. Farmers' health, musculoskeletal disorders and work ability

Farming is considered a high-risk occupation for musculoskeletal disorders, injuries and work-related disability (3-5, 22). According to a recent study on work disability among Finnish farmers aged 55 years or less, the incidence of new disability pensions has proportionally decreased among men but not among women when compared with other occupational groups (22). In addition, over three-fourths (77%) of the medical certificates for accepted disability pensions include at least one musculoskeletal diagnosis. The corresponding proportions were 38% and 11% for cardiovascular and mental diagnoses, respectively (23).

Farmers have been found to consider their work ability to be lower than that of other occupational groups in Finland (7). According to a telephone interview female farmers have more chronic diseases than the Finnish population in general, and, particularly, female farmers working on dairy farms are a high-risk group for poor health (24).

Finnish male farmers experience more low-back pain than other male blue-collar workers or male white-collar workers (25), but there is no difference in the occurrence of low-back pain among women in different occupational groups. The prevalence of back pain among farmers does not differ significantly from that of other occupations in the United States (26). In Sweden, farmers are granted more disability pensions due to low-back disorders than persons in other occupations (27), and in Finland farmers and industrial workers lead in this respect (28). In Finland, female blue-collar workers experience more neck-shoulder pain than female farmers (25), whereas male farmers have neck-shoulder pain as frequently as male white- and blue-collar workers. In Sweden, 82% of the men and 86% of the women working on dairy farms reported having some kind of musculoskeletal symptoms during a period of 12 months. Compared with reference data from other occupations, pain and discomfort among Swedish dairy farmers are especially frequent in the shoulders, elbows, lower back, hips and knees (17).

2.1.4. Farmers' physical activity during leisure time

Farmers' physical activity during leisure time is lower than that of the average Finnish population. In a telephone interview altogether 32% of male farmers and 40% of female farmers reported exercising at least twice a week for at least 30 minutes per time. The corresponding values for male and female blue-collar and white-collar workers were 51% and 62% and 55% and 56%, respectively. Male farmers were less physically active in their leisure time than female farmers, but there were no differences between the different age groups (7).

According to a work and health telephone interview, 35% of 25- to 64-year-old Finnish men and women, regardless of age, take part in intensive physical activity at least 30 minutes (causing increased breathing and sweating) three or more times a week during their leisure time. One-third of the Finnish population is physically active 1-2 times a week, while the rest are occasionally physically active or passive. The corresponding values for farmers are 28% and 25%, respectively (29).

The National Institute of Public Health in Finland annually produces a report on the health behaviour among the Finnish adult population. The study is based on a questionnaire. In the 1998 report, Helakorpi et al. (6) stated that 60% of Finnish men and 62% of Finnish women exercise for at least 30 minutes a minimum of twice a week. The corresponding values for male and female farmers were 41% and 49%, respectively.

2.2. Farmers' occupational health services in FInland

The main objective of occupational health and safety activities is "to promote and develop the health, safety and work ability of the worker, as well as to prevent occupational accidents and diseases. Particular areas of development are the prevention of work-related musculoskeletal diseases and the promotion of employees' mental well-being and work ability" (30).

In Finland the Occupational Health Care Act of 1979 provides farmers with the possibility of purchasing occupational health services. In 1979, the Kuopio Regional Institute of Occupational Health started a project funded by the Social Insurance Institution and the Farmer's Social Insurance Institution to study the condition of Finnish farmers and their work and to develop occupational health services for this group of workers in collaboration with the Social Insurance Institution, the Farmers' Social Insurance Institution, the Central Union of Agricultural Producers and Forest Owners, occupational health personnel in municipal health care centres, and also the farmers themselves (31). The main objective of the study was to develop a national model for the organisation of FOHS. The purpose was to promote farmers' health and work ability by improving their work conditions, providing health care for their chronic and work-related diseases and developing preventive measures. In order to gain baseline data for the occupational health services, a large (n=12 056) survey was carried out on farmers' work conditions, socio-economic status, health status, health behaviour and use of health services (31).

In 1985, the National Board of Health issued an ordinance initiating FOHS in municipal health care centres according to the recommendations of the research (31). They have been functioning in Finland since that time. An advisory group consisting of members from the municipal health care centres, local agricultural organisations and extension services, the Social Insurance Institution, and the Farmers' Social Insurance Institution support FOHS. The functioning of this group is to oversee the planning, operation, development, and awareness of FOHS locally. FOHS are subsidised from the tax revenues so that farm visits and surveys of work conditions are free for farmers, but they pay half of the costs of medical examinations made by an occupational health nurse, physician or physiotherapist (10).

Almost every 2nd full-time farmer (44%) was covered by FOHS in 1992. Dairy and hog farmers, and those with more than 20 hectares of cultivated land, have joined the services more often than other farmers. Other factors associated with joining the services are a basic education of more than 10 years and familylife (24).

FOHS consist of basic preventive measures to promote work ability. These measures are directed towards the work environment (checked either in a walk-through survey or in an interview every 2nd year) and the health of farmers (health check-up done by an occupational health nurse). After the basic assessments the occupational health physician evaluates the need for additional measures, such as occupational hygiene measurements, a more extensive health examination, or medical care or rehabilitation (24).

Most of those who have joined the services (82%) have been satisfied with them, even though one-fourth (25%) of them had received no services during the past 5 years. On average, 60% of the farms belonging to the FOHS were inspected within 5 years. These farms had acquired personal protective equipment, improved their work conditions, and increased their first-aid readiness more often than those not yet with access to FOHS. According to the farmers the functioning of the services suffers the most from their shortage and from the rapid turnover of health care personnel, since these characteristics result in the slow delivery of services and a lack of expertise (24).

The history of FOHS in Finland is a unique example of the use of health service research to develop and implement a national occupational health service system. The current protocol and the functioning of the services have resulted from a series of studies that include intervention and evaluations (4, 24, 31, 32) and also active surveillance training of occupational health personnel by the Finnish Institute of Occupational Health. The system has served as a model for the planning and launching of similar services in The Netherlands, Norway, the United States and Canada (24).

2.3. Promotion of health and work ability at worksites

The worksite health promotion programmes have progressed through 4 generations (33, 34). First-generation programmes were offered for a number of reasons, most unrelated to health. Second-generation programmes were characterised by a focus on a single intervention designed for a single risk factor or behaviour and targeted toward one population. Third-generation programmes were designed to offer a variety of interventions aimed at a variety of risk factors or behaviours for all employees. Fourth-generation programmes were described as encompassing a comprehensive approach incorporating all activities, policies, and decisions related to the health of employees, their families, the communities in which they reside, and the company's consumers (33, 34).

The World Health Organization (WHO) (35) has provided the basis for a global strategy on the application of health promotion to work settings. The following 4 principles serve as a basis for the global healthy work approach developed by WHO (35): i) health promotion, ii) occupational health and safety, iii) human resource management, and iv) sustainable development. The healthy work approach is defined as: "A continuous process for the enhancement of the quality of working life, health and well-being of all working populations through environmental (physical, psychosocial, organisational, economic) improvements, personal empowerment and personal growth". The goal of this approach is to improve the health and well-being in all sectors (formal and informal) of the workforce (35).

The Luxembourg declaration on workplace health promotion in the European Union (36) was the combined effort of employers, employees and society to improve the health and well-being of people at work. The European network for workplace health promotion co-ordinates the exchange of information and dissemination of examples of good practice in Europe. It regards the following priorities as a basis for future activities: i) increase in the awareness of workplace health promotion and promotion of the responsibility for health with regard to all stakeholders, ii) identification and dissemination of models of good practice, iii) development of guidelines for effective workplace health promotion, iv) commitment of the member states to incorporating respective policies, and v) attention to the specific challenges of working together with small-scale enterprises (36).

Work ability reflects the interaction between work and the worker. Individual resources and professional competence of the worker and issues pertaining to the work environment, the work organisation and also management, influence of the balance of this relationship. Therefore, promoting work ability involves measures targeted towards work demands (e.g., ergonomics), the work organisation (developmental, psychosocial and management issues) and the individual (health, functional capacities) (8).

In Finland, major labour market parties formed an agreement and recommendation on the promotion of work ability in 1989. In 1991 it became obligatory for occupational health services to participate in medical rehabilitation and activities to promote work ability at the worksite (37). In 1999, the concept of promoting of work ability was made more concrete and focused by the advisory board of occupational health services in the Ministry of Social Affairs and Health (30) in the following manner: "Workplace activities aiming at the promotion of work ability include all systematically planned and objectively oriented measures that the managers, the workers as well and co-operative organisations take at the workplace in a united effort to maintain and support the work ability and functional capacity of all persons active in worklife throughout their work careers. The essential measures for attaining the practical objectives of the promotion of work ability in the workplace are to develop the work and work environment, to improve the function of the work community and the work organisation, and to promote the health and professional competence of the worker. The promotion of work ability is based on active commitment, involvement and co-operation from the work community and workplace and on the resources to carry out occupational health and safety and other activities that aim at promoting work ability."

2.4. Physical activity interventions

2.4.1. Effects of physical activity on health

The benefits of physical activity were recognised very early from experience, but only in the 2nd half of the 20th century did scientific evidence begin to accumulate (38). *Physical Activity and Health - A Report of the Surgeon General* from the United States (38) states that "People of all ages, both male and female, benefit from regular physical activity and that significant health benefits can be obtained if a moderate amount of physical activity is included on most, if not all, days of a week. Physical activity reduces the risk of premature mortality in general, and that of coronary heart disease, hypertension, diabetes mellitus, and colon cancer, in particular. Physical activity also improves mental health and is important for the fitness of muscles, bones, and joints" (38).

There is no evidence that physical activity during leisure time, various specific sports, or other physical activities during leisure time reduce the risk of back pain (39).

Cardiorespiratory fitness gains are suggested to be similar when physical activity occurs in several short sessions (e.g., 10 minutes) as when the same total amount and intensity of activity occurs in one longer session (e.g., 30 minutes). It is assumed that most people can improve their health and quality of life through a modest increase in daily activity. Additional health benefits can be gained through greater amounts of physical activity (38).

2.4.2. Effects of intervention on physical activity during leisure time

Simons-Morton et al. (40) have reported that intervention that promotes physical activity in health-care settings for primary prevention (patients without a disease) and secondary prevention (patients with a cardiorespiratory disease) can increase physical activity. Consistent effects are more likely attained with long-term interventions and multidisciplinary interventions that includes elements such as supervised exercise, provision of equipment, and behavioural approaches.

The results of the quantitative meta-analysis of Dishman and Buckworth (41) showed that physical activity can be increased by intervention in community, worksite, school, home, and health-care settings.

Life-style intervention (integrating physical activity into daily routines) allows people to individualise their physical activity programmes to include a variety of activities that are at least of moderate intensity and to accumulate bouts of these activities in a manner befitting their life circumstances. According to Dunn et al. (42) life-style physical activity intervention effectively increases and maintains levels of physical activity that meet or exceed public health guidelines for physical activity in previously sedentary adults. The majority of these types of intervention are delivered by face-to-face contacts in small groups, and therefore their public health application is limited. A small number of studies has demonstrated that these interventions can be delivered by mail and telephone and these approaches enhance feasibility of life-style physical activity intervention. Interventions aimed at modifying the environment, such as signs posted to increase stair climbing, have also been shown to be effective over a short-period (42). Results from several studies have suggested that the life-style and home-based exercise approaches are feasible (43).

Dunn et al. (44) concluded that, for previously sedentary healthy adults, life-style physical activity intervention is as effective as a structured exercise programme in improving physical activity, cardiorespiratory fitness, and blood pressure. They also found life-style intervention to be significantly more cost-effective, with total costs of about one-fourth to one-third of that of structured exercise. The follow-up period was 24 months.

2.4.3. Physical activity intervention at worksites

Research quality and limitations

The worksite has been considered a favourable setting for the promotion of leisure-time exercise in sedentary populations because of the established channels of communication, existing support networks, and opportunities for developing corporate norms of behaviour (45).

Despite wide use, scientific evidence of the effectiveness of worksite physical exercise programmes is not unambiguous. Unfortunately the majority of published reports on worksite physical activity programmes suffer from serious design flaws: small, selected samples, weak measures of program effectiveness, inadequate observation time, and inadequate control of the effects of extraneous factors. The feasibility of large, randomised, double-blind, controlled experiments seems to be questionable in the context of worksite physical activity programmes (45).

Although worksites seem to allow various measures for effective health promotion and they seem to contribute to a generally desired healthier society, there are some potential complications. Several ethical dilemmas can arise when companies or organisations attempt to encourage changes believed to be conductive to health. According to Verhoeven (46) these dilemmas are associated with the following issues: i) blaming the victim, ii) enhancing the relatively healthy, iii) free choice, iv) privacy, and v) unethical screening.

European studies

On the basis of a meta-analysis of 23 health promotion studies completed in Europe in 1974-1994, Scholten (47) and Verhoeven (46) concluded that worksite health promotion programmes on physical activity can be profitable and efficient. They (46-48) developed and implemented a comprehensive, multi-factorial, multi-level program for a Dutch manufacturer of nonelectrical household products during 1989-1993. The programme entailed a combination of interventions in the field of health and life-styles (such as exercise, nutrition, alcohol consumption, and elevated blood pressure levels), and work conditions (changes in content and organisation of the work, training in social skills, leadership and work consultation meetings, and changes in the organisational structure).

Intervention was offered at the individual, environmental and organisational levels. As far as physical activity was concerned, a significant change over time was found in favour of experimental group activities, and it was concluded that the favourable changes in physical activity could be maintained over time, even up to 3 years (47).

At the Finnish Institute of Occupational Health, the effects of worksite physical activity intervention on physical fitness, work ability and various work-related characteristics have been studied among cleaners, nurses, home-care workers, metal workers, fire fighters and police officers during the past 10 years in the project FinnAge - Respect for the Ageing Program. After feasible intervention, lasting 2-12 months, musculoskeletal and cardiorespiratory fitness improved an average of 7-136% and 4-10%, respectively. Positive effects were observed for subjective health and work ability, musculoskeletal symptoms, strain at work, risk factors for ischemic heart disease, and the mastering of work (8, 9).

In her doctoral dissertation, Kaukiainen (49) reported the effects and feasibility of physical exercise intervention in small construction enterprises. Physical activity during leisure time increased, perceived work ability improved, musculoskeletal symptoms decreased and isometric and dynamic muscle strength (back and abdominal) and balance increased.

Nurminen (50), in her doctoral dissertation, considered the effectiveness of worksite exercises on physical activity, physical capacity, musculoskeletal symptoms, and perceived work ability among women aged 19-64 years and engaged in physically heavy work (n=260) in a cleaning company. The exercise sessions, led once a week by physiotherapist, resulted in a significant increase in muscle strength and endurance. The intervention also decreased musculoskeletal symptoms, especially in the neck and upper extremities.

On the basis of a systematic review Nurminen (50) concluded that there is much evidence indicating that physical activity intervention based on cognitive-behaviour modification techniques increases physical activity over short periods when individually tailored, motivationally matched intervention is used. There is also evidence that physical activity intervention increases cardiorespiratory capacity, as well as weak evidence that weekly muscle strength training effects some decrease in low-back pain (50).

In Finland, 59% of employers promote physical activity by offering exercise facilities, subsidising the costs of physical activities or taking part in the organisation of physical activity (29).

North American studies

Studies in the United States and Canada, on worksite fitness programmes have shown a correlation between life-style changes and decreased absenteeism, fewer work-related injuries, improved productivity or efficiency, and decreased turnover of workers. Furthermore, health-care costs of workers, employers, health insurance companies, and the government seem to be lower in active than in inactive enterprises (51-53).

Shephard (45) reviewed 52 published studies on worksite fitness and exercise programmes from 1972 to 1994. The programme participants showed small but favourable changes in body mass, skinfold thickness, aerobic power, muscle strength and flexibility, overall risk-taking behaviour, systemic blood pressure, serum cholesterol levels, and cigarette smoking. He concluded that participation in worksite fitness programmes can enhange health-related fitness ["Health-related fitness refers to those components of fitness that are affected favorably or unfavorably by habitual physical activity and relate to health status" (54)] and reduse risk-taking behaviour, but the population effect is limited by low participation rates.

On the other hand, a meta-analysis of 26 studies by Dishman et al. (55) from 1972 to 1997 did not demonstrate a significant increase in physical activity or fitness as a result of the worksite intervention typically used to increase physical activity and fitness. They stated that "the generally poor scientific quality of the literature on this topic precludes the judgement that interventions at worksite cannot increase physical activity or fitness, but such an increase remains to be demonstrated by studies using valid research designs and measures" (55).

2.4.4. Physical activity intervention in agriculture

Pekkarinen et al (56) studied the effects of increased, moderate leisure-time physical activity on farmers' aerobic fitness with a 1-year follow-up. The farmers participated in a 1-week exercise course in a rehabilitation centre in Finland. The programme included different kinds of exercise sessions and lectures on ergonomics. The study showed that farmers and their wives could be activated to increase leisure-time physical activity, and even a moderate increase in physical activity led to positive subjective and objective results. During the study 71% of the men and 68% of the women increased their physical activity during leisure time according their diaries. According direct measurements of oxygen consumption VO_2 max and maximal work load increased by 5-10% during the study (56).

Occupationally oriented medical rehabilitation courses were developed, organised and paid for the working age population by the Social Insurance Institution in Finland. Each occupational group had their own course, also farmers. The courses lasted 3 weeks in a rehabilitation institution and included a 1-year follow-up. The goals of the courses for the dairy farmers were to increase the subjects' physical and psychological capacities and to teach them work techniques that optimise the musculoskeletal load at work. The courses included mainly training in ergonomic work and lifting techniques in dairy tasks, physical exercise sessions and instruction in the structure and physiological strain responses of the musculoskeletal system. Perceived health and the results of several tests measuring muscle force, endurance and balance were significantly improved at the end of the 1-year follow-up than early in rehabilitation. No statistical changes occurred in aerobic fitness, while the frequency of physical exercise was greater during follow-up than before the rehabilitation began (57).

There is a shortage of studies outside rehabilitation centres. Agriculture is dynamic in terms of farm size, ownership, commodity, the wide range of hazards, community norms, working children, and owner autonomy, all of which differ significantly from the corresponding circumstance in other industries (58). Farmers live in scattered settlements and neighbourhood support is often lacking. Farmers' work days are long, and they usually have more than 1 work session per day. Furthermore every farm and farmer is unique. All these aspects require multidisciplinary approaches for promoting farmers' work ability.

2.4.5. Features of successful physical activity intervention at the worksites

Blue and Conrad (59) reviewed the literature regarding strategies to increase adherence to worksite exercise programmes. The results of 90% of the studies indicated that exercise adherence strategies were effective in improving the exercise behaviour of the participants. The best results were obtained in studies that used multiple types of intervention strategies and in studies conducted over short periods of time. Well-planned and executed intervention strategies appear to be successful in increasing the number of workers who exercise regularly.

According to Heaney and Goetzel (60), worksite health promotion programmes are likely to reduce the health risks of workers if individualised risk reduction counselling is provided in a personal and consistent manner to high-risk workers and the programmes have a sufficient operative duration (i.e., at least 1 year). The effects of the programmes can be maintained if the worksite continues to support and reinforce risk reduction. Ideally, worksite health promotion programmes should be supported by senior management so that they can become a part of the underlying fabric and culture of the organisation. When worksite health promotion programmes are related to the human resource strategy of an organisation and accepted as the "norm" for the organisation, the programmes will have a high probability of being well-implemented and effective (60).

In the review by Shephard (45) the rate of participation in exercise programmes was the greatest in studies in which exercise course attendance was a condition of employment, a massive attempt was made to change corporate culture, a counselling and buddy system was introduced, the requirements of the formal exercise class were light, or subjects were allowed to complete 80% or 100% of the exercise regime on their own.

Dishman et al. (55) offered the following recommendations for research on worksite physical activity intervention: i) base intervention on contemporary theories of behavioural change or organisational change, ii) emphasise the broad spectrum of physical activity, iii) examine linkages between intervention delivered at the worksite with that in other setting or groups, iv) describe behavioural intervention fully, specifying the presumed mechanisms for behavioural change and the outcome measures used in evaluating the impact, v) use fully randomised designs, vi) use validated measures of fitness and/or physical activity, vii) report complete information on samples, intervention, the worksite, and characteristics of the physical activity component of the intervention, viii) report means and standard deviations, or frequencies, before and after an intervention for both the experimental and control groups, ix) use the best design and measurements, x) assess and report the follow-up measures of outcomes after the intervention ends, and xi) develop intervention focused on hourly workers and other hard-to-reach populations.

The results and experiences of the FinnAge - Respect for the Ageing Program (9) emphasised the following necessary prerequisites for feasible physical exercise at the company level: i) commitment and support of top management, ii) commitment of the entire work unit, iii) implementation entirely or partly during workhours, iv) quick feedback on improvements in physical fitness, v) continuous provision and strengthening of motivation, vi) meaningful, versatile and positive experiences from the exercise, and vii) skilful instruction and guidance. Physical activity programmes should also remain strictly confidential, work on a voluntary basis, be available for evaluation, and not arouse feelings of guilt. Furthermore, all physical activity programmes should be carried out in conjunction with ergonomic and organisational measures for promoting work ability (9).

2.5. Ergonomic intervention

2.5.1. Ergonomic intervention in general

Ergonomics is a term for the practice of learning about human characteristics and using that understanding to improve people's interaction with the things they use and with the environments in which they use them (61). Probably the simplest definition is "Ergonomics is the scientific study of human work" (62). The *Encyclopaedia of Occupational Health and Safety* (63) states that "ergonomics is the systematic study of people at work with the objective of improving the work situation, the working conditions and the tasks performed". Ergonomics is a multidisciplinary field of science that is based on physiology, psychology, sociology and applications of technical science. It considers human capacities, needs and limitations in the interaction between a technical and organisational work system. The integrated knowledge of ergonomics is used to develop work contents and the environment through job design and redesign, to prevent work-related diseases and work disability through the integration of ergonomics with organisationally and individually oriented measures for the maintenance of work ability and health, and to improve the productivity and quality of work (64).

The National Institute for Occupational Safety and Health (NIOSH) in United States made a summary of studies on the effectiveness of ergonomic intervention (65). It included 24 studies demonstrating the effectiveness of engineering controls in reducing exposure to ergonomic risk factors and 27 studies of the effectiveness of various control strategies for reducing musculoskeletal injuries and discomfort. All except one had a positive outcome. Kemmlert (66) also stated, on the basis of 4 case studies, that improvements in ergonomics have proved to be highly profitable. Smith at al. (67) did an in-depth review and analysis of 43 articles and stated that ergonomic intervention appears to have positive effects on discomfort, accident incidence and body postures, but the outcomes must be interpreted with caution.

Within the FinnAge - Respect for the Ageing Program ergonomic intervention was initiated for professional cleaning, domestic work, vehicle inspection, and metal work (64). The purpose of the intervention programmes was to reduce the acute load and strain of the workers with technical and organisational redesign measures that aimed at optimising the load and strain of both the musculoskeletal and cardiorespiratory system of the workers. In each intervention programme the ergonomic measures were linked with other organisational and individual measures aiming at the promotion of work ability. The following results were obtained: i) harmful static postural load on the musculoskeletal system was reduced, ii) heart rate during work decreased, iii) the necessary occupational knowledge and skills increased, iv) the job satisfaction, appreciation and interest of the workers increased, v) better possibilities for regulating work rate were arranged, and vi) work pace decreased (64).

Wickström et al. (68) showed, that in the metal industry, it is possible to reduce sick leaves due to low-back disorders using interventive measures directed towards both the work (environment, equipment) and the workers (work techniques, fitness of back tissues). The management of the company appointed a work group consisting of an engineer, a foreman, two representatives of the workers, and a physiotherapist or nurse of the occupational health unit. These groups convened for 1-2 hours once a month during 1 year to determine the main causes of back problems in the occupation, to plan ways to abolish these causes and to carry out the measures considered worthwhile in practice (68).

Evanoff et al. (69) studied the effects of a participatory worker-management ergonomics team among hospital orderlies. The intervention was the formation of a participatory ergonomics team with 3 orderlies, 1 supervisor and technical advisors. This team designed and implemented changes in training and work practices. During the 2-year postintervention period there was a marked decrease in the risk of work injury, lost-time injury, and injury with 3 or more days of time loss. Total lost days declined from 136 to 23 annually per 100 full-time workers. Musculoskeletal symptoms declined, and there were significant improvements in job satisfaction, perceived psychosocial stress, and social support among the orderlies. In general, following the implementation of the participatory ergonomics program, substantial improvements in health and safety were observed (69).

2.5.2. Ergonomic intervention in agriculture

There is a short history for the application of ergonomics to agricultural worksites. Ergonomic job design involving the introduction of improved work methods and equipment is urgently needed in agriculture, mining and the building industry (2). The most successful approach emphasises ergonomic control of hazards that combines engineering, administrative, and behavioural approaches into a comprehensive programme of problem identification and problem-solving (12).

Stål et al. (20) reported that, with respect to elbow symptoms, there was a significant difference between female milkers who had received ergonomic instructions on the reduction of muscle strain (measured with the Borg-scale) in their work and those who did not receive such training. The age of the milkers varied from 20 to 71 years, and 84% had experienced pain in different parts of the musculoskeletal system at some time during the preceding 12 months.

Occupationally oriented medical rehabilitation courses that were organised in rehabilitation centres and lasted 3 weeks changed farmers' work techniques. The farmers worked with their back bent or twisted and their arms over their shoulders less often than before the rehabilitation. The musculoskeletal pain index had also decreased and the mean work ability index had increased at the time of the 1-year follow-up (70).

Kivikko (71) studied the effects of environmental improvements in dairy barns on farmers' worktime, perceived physical load, work conditions, and work postures. In the first part of the study 50 farmers who had recently built or renovated their barns were selected as targets of a telephone interview study. The daily worktime was about 30% shorter, and the perceived physical load was lower after environmental improvements when compared with the situation before the changes. In the second part of the study the work postures of 9 male and 6 female farmers were analysed on dairy farms before and after improvements were made in the milking and handling of fodder and manure. The frequency of bent and twisted back postures and postures with arms at or above shoulder level decreased after the improvements (71).

The results of the studies showed that there is a great need for improved ergonomics, particularly from the point of view of musculoskeletal system of female milkers. Lundqvist et al. (17) concluded that it is necessary to improve the ergonomic design of the milking system. Solutions that provide good safety and comfort levels and are economically possible to attain must be planned in advance and built into the design of constructions and equipment.

The development of health and safety programmes for farmers is important world-wide, but data on the efficiency and feasibility of current practices are lacking (72). According to Nevala-Puranen (70) occupationally oriented medical rehabilitation courses in rehabilitation centres and environmental measures proved to be feasible ways of developing ergonomic aspects of dairy farms.

2.6. Methodological aspects of intervention studies

2.6.1. General

Worksites seem to allow for effective interventions through promotion of health and work ability. For example, intervention with respect to physical activity, health risk appraisal, nutrition or cholesterol, weight control, hypertension, alcohol, smoking, stress management and ergonomics has been conducted on various worksites (34, 65, 73).

Many of the intervention studies conducted in the field of occupational health and safety have lacked a theoretical basis, used small samples, and studied intervention that has lacked the power to cause the desired change(s). Most studies have been either non-experimental or quasi-experimental (74).

The quality of worksite intervention research should be markedly enhanced. Appropriately designed studies based on sound theory should be the rule rather than the exception. Well-controlled longitudinal studies should be undertaken using multiple intervention periods and multiple worksites. This type of effort requires considerable co-operation between researchers, worksites, and funding organisations (34).

Smith et al. (67) presented the quality issues needed in the prevention of musculoskeletal disorders as follows: random assignment to groups, the use of control groups, clear differences between intervention groups and controls, the use of dependent variables sensitive to change, checks for between-group differences in a range of jobs, demographic and disorder-related variables, statistical control of differences and the use of multiple long-term assessment points to evaluate changes in intervention effectiveness over time.

Intervention studies that compare the same group before and after a period of intervention are at particular risk for confounding effects from a larger social context (75). A review of randomised clinical trials estimated that intervention based on inadequate randomisation or a lack of randomisation exaggerates the magnitude of the outcomes by 30% to 40% as compared with intervention that is adequately randomised (76). The lack of a placebo group admits ambiguity to an intervention study (75).

2.6.2. Assessment of work ability and perceived health

There is no absolute measure of work ability. A worker's own concept of his or her work ability is as important as the evaluations of experts. The work ability index was validated in Finland during the FinnAge - Respect for the Ageing Program and it is meant for practical use in occupational health services as an aid to help promote work ability (77-79). The work ability index depicts a worker's subjective assessment of his or her work ability on a scale from 0-10, one's own work ability in relation to work demands, the number of physician diagnosed diseases, impairment caused by the diseases, the amount of time absent from work because of illness, a prognosis of work ability, and psychological resources (78). Its agreement with a clinical health examination has proved to be good (77). The work ability index has predicted work disability, retirement on a disability pension and also mortality in the age group of 45 years and over in municipal occupations (79). The work ability index helps to determine workers who need the support of occupational health services. It is easy and quick to use, reproducible, and it can be used for follow-up at both the individual and group level (78). The index has been widely used in Finland (80), but also in other countries, for example, Austria (81) and China (82).

Perceived health has been found to be a valid and reliable measure of health (83). A single question on perceived general health (How would you assess your current health?) is an often used item in health surveys. It seems to summarise medically confirmed information on a person's health status and diagnosed chronic conditions as well as his or her functional limitations and disability (83-85). Perceived health may also be influenced by more subtle knowledge of family history of chronic disease, behavioural and life-style characteristics relevant for health and cognitive and affective psychosocial characteristics of the individual and personality. Perceived health has been found to predict health care use (86) and mortality (87).

2.6.3. Assessment of musculoskeletal disorders

The epidemiology of musculoskeletal disorders is problematic. Everyone who studies musculoskeletal disorders from the point of view of public health has to accept the vagueness of the syndromes and deal with symptoms (88). Pain is the major symptom of musculoskeletal disorders, and symptom data can be easily obtained. Self-administered questionnaires and telephone interviews have been used to assess the incidence and prevalence of musculoskeletal pain. Unfortunately, pain is subjective and is affected by many individual and cultural factors. Moreover, musculoskeletal pain is not a constant phenomenon. Recall bias is a matter of concern for retrospective symptom data. In order to minimise the bias short observation periods should be used (under 12 months), which, in turn, may lead to the misclassification of cases and noncases (89).

Comparisons of the results of different studies on the occurrence of musculoskeletal pain must be done with care. Indicators of morbidity differ because of different phrasing of the questions. Standardisation of questionnaires makes different studies more comparable unless such problems as cultural factors or conceptual differences due to dialects intervene. A rather widely (20, 90-94) utilised questionnaire on musculoskeletal symptoms, called the Nordic questionaire, was developed in the Nordic countries (95).

2.6.4. Assessment of physical activity and fitness

The survey approaches used to measure physical activity vary in their complexity, from self-administered, single-item questions to interviewer-administered surveys of lifetime physical activity (96). Leisure-time physical activity can be assessed with a question such as: "How often did you participate in one or more physical activities of 20 to 30 minutes' duration per session during your leisure time within the past 6 months?" This question has proved to be valid for assessing the exercise behaviour of workers in the power industry and the impact of an exercise promotion programme at the worksite (97). For more specific information on physical activity, such measures as the Minnesota leisure-time physical activity questionnaire (98) can be used. The validation results of the Minnesota leisure-time physical activity questionnaire has been found to be good (98, 99).

Alaranta et al. (100) determined the reliability of repetitive sit-ups, repetitive back tests, repetitive squatting, and back endurance tests. The 1-year intra-observer reproducibility of the muscle strength measurements showed fairly high correlation coefficient values: 0.87 for repetitive squatting, 0.84 for repetitive sit-up, 0.65 for repetitive arch-up, and 0.63 for static endurance of the trunk extensors. The tests showed no significant shifts between the 2 measurements. The inter-observer reproducibility was also fairly good or excellent: 0.95 for repetitive squatting, 0.91 for repetitive sit-up, 0.83 for repetitive arch-up, and 0.66 for static endurance of the trunk extensors. Only the endurance test for the trunk extensors showed a significant shift between the 2 measurements.

The endurance of trunk extensor muscles is the only musculoskeletal fitness factor that has been systematically associated with low-back disorders, and it was shown to have predictive value for first-time back pain among Danish men and Finnish men and women (101).

Suni (101) recommended the following tests for the practical assessment of health-related fitness among middle-aged adults: one-leg squat, vertical jump, trunk-side bending, one-leg standing and the UKK Walk Test. The developed test battery is a promising field-based method for the reliable, safe, feasible and valid assessment of health-related fitness among adult populations.

Maximal aerobic power is the best measurement of cardiorespiratory fitness. Direct measurement of maximal aerobic power requires laboratory procedures and equipment, and the maximality depends on the ability and willingness of an individual to exercise to the point of exhaustion. Since laboratory facilities are seldom available, and maximal effort may be a health risk for some people, simpler submaximal cardiovascular fitness tests have been developed. Walking is a useful exercise mode for cardiovascular fitness testing, especially for mass testing, due to its simplicity, physiological demands, safety and social acceptability. Laukkanen et al. (102-105) found that the UKK Walk Test (formerly called 2-km walking test) is a valid and feasible fitness test for the healthy adult population, and it is also suitable for field conditions. The UKK Walk test has been included in the European Fitness Test Battery for adults (106), and it is widely used in Finland also by occupational health services.

2.7. Summary of literature review and framework of the study

Farm work is physically strenuous and therefore farmers are a high-risk group for musculoskeletal disorders, injuries and work-related disability. Farmers consider their work ability to be lower than that of other occupational groups in Finland, and farmers' physical activity during leisure time is lower than that of the average Finnish population. FOHS, provided by municipal health care centres, have been available since 1985 in Finland. FOHS consist of basic preventive measures to promote work ability. There are no studies on the promotion of health and work ability by using more intensive approaches such as using group counselling carried out in FOHS.

The basic model for measures to promote health and work ability is the integration of 4 different lines of action. Actions targeted towards work concentrate on the contents of work and also on the physical work environment and the work community. Actions targeted towards an individual worker concentrate on strengthening the health status and functional resources of the worker and developing professional competence and skills (107). The framework of this study is presented in Figure 1.

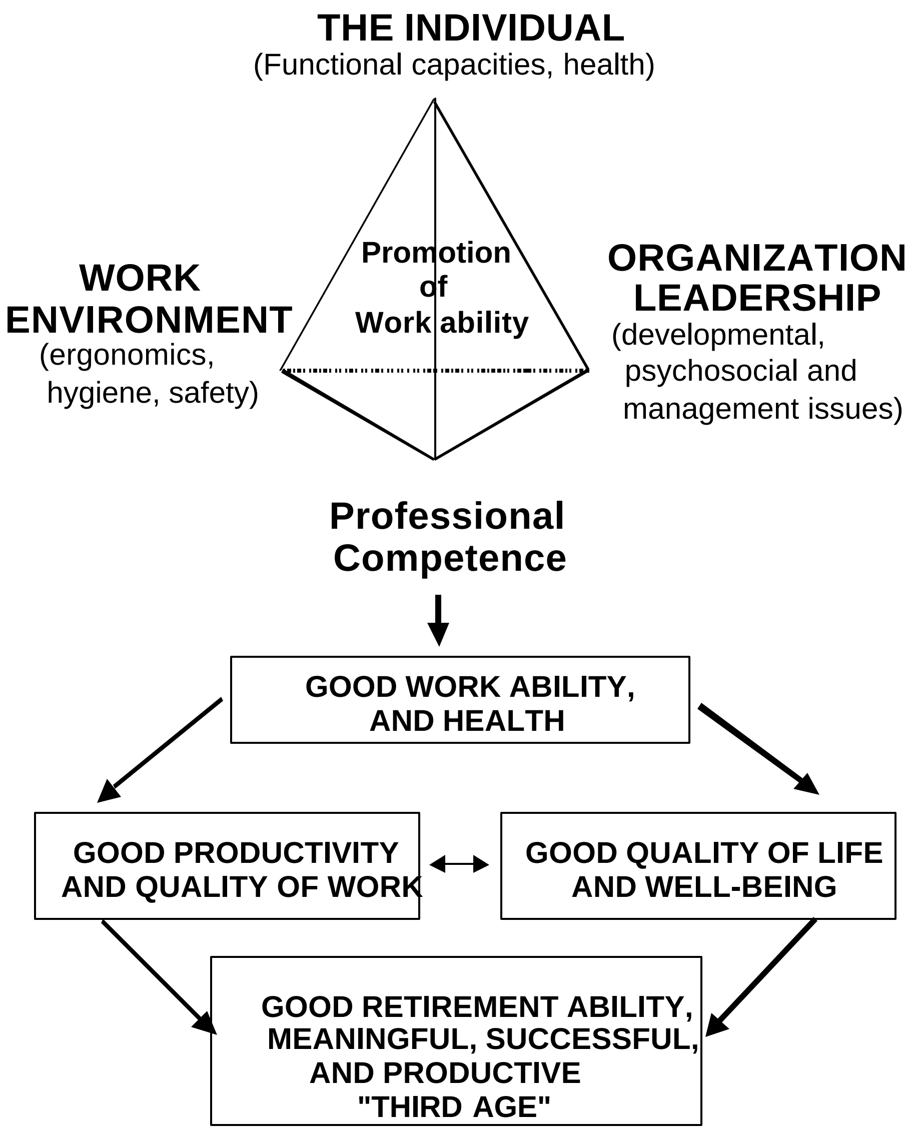


Figure 1. Basic model to improve work ability during ageing (107)

3. AIMS OF THE STUDY

The aims of this study were to identify the characteristics of farmers most in need of measures to promote health and work ability and to evaluate short- and long-term effects and the feasibility of group counselling intervention focusing on physical activity and ergonomics. Special emphasis was placed on female farmers' physical activity, physical fitness, musculoskeletal symptoms and work ability. Group counselling intervention was organised and carried out as part of the work of FOHS.

The specific questions were the following:

1. What is the self-reported morbidity of Finnish farmers, especially musculoskeletal diseases and disabilities, perceived work ability and physical fitness?
2. What group of farmers is most in need for measures to promote health and work ability?
3. What is the feasibility of exercise and ergonomic group counselling intervention completed within the scope of farmers' occupational health services?
4. What are the short-term effects of exercise and ergonomic group counselling intervention on female farmers' physical activity, physical fitness, musculoskeletal symptoms and work ability?
5. What are the long-term effects of exercise and ergonomic group counselling intervention on female farmers' physical activity, physical fitness, musculoskeletal symptoms and work ability?

4. SUBJECTS AND METHODS

4.1. General study design

In the first part of the study (study I), Finnish farmers' self-reported morbidity, especially musculoskeletal diseases and disabilities, work ability, physical fitness, and functional capacity were evaluated with a telephone interview. In the second part of the study (studies II-IV) an intervention was conducted. With the intervention study the short- and long-term effects and the feasibility of a group counselling programme focusing on physical exercise and ergonomics was evaluated. The study design with main variables is illustrated in Figure 2.

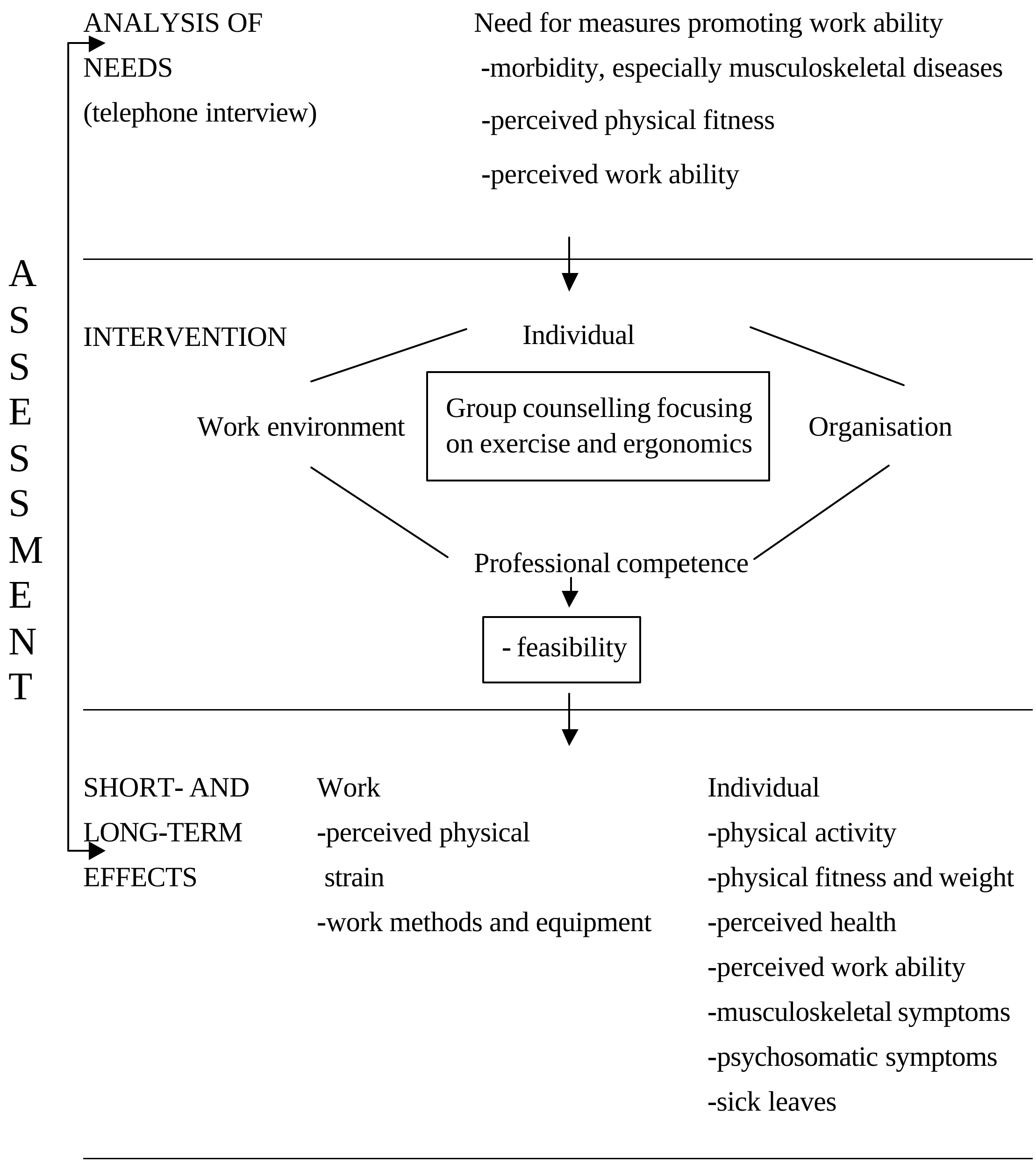


Figure 2. The study design and main variables of this study.

4.2. Subjects

4.2.1. Telephone interview (study I)

Finnish farmers who were insured by the Finnish Farmers' Social Insurance Institution were randomly sampled for a telephone interview. The sample size was 1200, of whom 936 were contacted by telephone. Of those contacted 67 refused to be interviewed, 115 no longer worked in agriculture, and 174 were part-time farmers. Three farmers were excluded due to missing data. The subjects in the final study group included 577 full-time farmers ($\geq$ 60% of their income coming from agriculture), 296 men and 281 women. The subjects' mean age was 44.8 (SD 12.0) years for the men and 44.9 (SD 11.1) years for the women. The age and gender distributions were equal to those of the total farming population in Finland (108), and the loss of subjects was equal across the age groups among the men and women.

Two-thirds of the farmers tended cattle (76% of them milking cows regularly), 7% raised pigs, 1% concentrated on chickens, and 2% raised other animals. About every tenth farmer (13%) cultivated various grains, 2% grew potatoes, 2% raised root plants, and 2% cultivated other plants. The average area of cultivation was 22.8 (SD 18.0) hectares. Forestry was the main work operation for 3% of the subjects.

4.2.2. Intervention (studies II-IV)

The intervention study was carried out in 5 municipal health care centres in 6 municipalities. The occupational health nurse from each centre selected the subjects according to the following criteria: female, working on a dairy farm, 25-45 years of age, and musculoskeletal symptoms which had not prevented working. Altogether 150 subjects were identified who fulfilled the criteria. In one municipal health care centre only 25 subjects fulfilled the criteria, otherwise the subjects were divided equally between the 4 municipal health care centres. About every sixth woman (n=24, 16%) refused to participate in the study because of a lack interest (n=14), no transportation (n=4), problems with child care (n=4) or a busy schedule (n=2). There were no differences between the municipal health care centres with respect to refusal. The study was approved by the ethical review committee of the Finnish Institute of Occupational Health and each subject signed an informed consent. Figure 3 shows each step of the intervention with the number of subjects.

In each municipal health centre the subjects from the respective area were divided into 2 groups matched by age, low-back symptoms, leisure-time physical activity, and the use of arable land. The groups were randomly assigned in each municipal to an intervention group or a control group using stratified randomisation. There were 6 intervention groups, 3 of which focused primarily on physical exercise and the ergonomics of work techniques [hereafter referred to as the physical exercise and ergonomics (EE group)], and 3 of which also included various forms of instruction [hereafter referred to as the physical exercise, ergonomics and instruction (EEI group)]. The personnel of the municipal health care centres chose which group counselling programme they wished to provide. One municipal health care centre organised EE group and EEI group in two municipalities. Each intervention group had its own control group. The subjects in the control groups convened at the beginning of the study and at the time of the follow-up examinations and feedback meetings after 1-, 3- and 6-year follow-ups. They also took part in basic occupational health care services during the follow-up. The intervention and control groups did not differ significantly with respect to the background variables (Table 1).

SELECTION OF THE SUBJECTS January 1991-September 1991

Municipal health care centres, n=5
Female farmers fulfilling the criteria, n=150

Did not participate, n=24

INSTRUCTION OF THE PERSONNEL IN THE MUNICIPAL HEALTH CARE CENTRES
August-September 1991

BASELINE ASSESSMENT BEFORE THE INTERVENTION
September-December 1991

Questionnaire (n=126)
Musculoskeletal fitness tests (n=126)
Cardiorespiratory fitness tests (n=126)

Randomisation

INTERVENTION November 1991-March 1992

3 physical exercise and ergonomics groups	3 control groups	3 physical exercise, ergonomics and instruction groups	3 control groups
n=32	n=33	n=30	n=31

ASSESSMENT AFTER THE INTERVENTION February-May 1992

Questionnaire, n=124 (98% of full-time farmers responded)
Musculoskeletal fitness tests, n=123 (98% participated)
Interview of the personnel of the municipal health care centres, n=19

- terminated farming, n=15
- did not return the questionnaire, n=1
- did not attend the musculoskeletal fitness tests, n=10
- did not attend the cardiorespiratory fitness tests, n=11

1-YEAR FOLLOW-UP September-December 1992

Questionnaire, n=110 (99% responded)
Musculoskeletal fitness tests, n=101 (91% participated)
Cardiorespiratory fitness tests, n=100 (90% participated)

- terminated farming, n=19
- did not return the questionnaire, n=1
- did not attend the musculoskeletal fitness tests, n=24
- did not attend the cardiorespiratory fitness tests, n=34

3-YEAR FOLLOW-UP September 1994

Questionnaire, n=106 (99% responded)
Musculoskeletal fitness tests, n=83 (91% participated)
Cardiorespiratory fitness tests, n=73 (90% participated)

- terminated farming, n=27
- did not return the questionnaire or refused to participate, n=8
- did not attend the musculoskeletal fitness tests, n=19
- did not attend the cardiorespiratory fitness tests, n=26

6-YEAR FOLLOW-UP September - October 1997

Questionnaire, n=91 (92% responded)
Musculoskeletal fitness tests, n=80 (81% participated)
Cardiorespiratory fitness tests, n=68 (69% participated)

Figure 3. Subjects and the main phases of the intervention.

Table 1
Background baseline data of the subjects and farms in the intervention [physical exercise and ergonomics (EE group) and physical exercise, ergonomics and instruction (EEI group)] and control groups, (n=99)

Groups	N	Age (year)		Arable farming land (ha)		Variable Dairy cows (number)		Physical exercise[a] (% of the subjects)	Low-back symptoms [b] (% of the subjects)	Walk test (index)		Work ability index (points)	
		Mean	SD	Mean	SD	Mean	SD			Mean	SD	Mean	SD
EE group	25	37	6	20	7	13	5	32	88	98	14	41	4
Control	27	38	5	20	5	13	4	30	85	96	14	40	4
EEI group	26	38	5	25	11	15	6	23	58	95	16	42	3
Control	21	37	5	25	12	15	5	14	52	100	14	43	4

[a]Leisure-time physical activity at least 30 minutes at least 2 times a week

[b]Low-back symptoms during the past 12 months

At the time of the 1-year follow-up measurements 15 subjects were no longer involved in farm work, the corresponding number being 19 subjects for the 3-year follow-up and 27 for the 6-year follow-up. The total number of dropouts was 27, the final number of subjects therefore being 99 full-time female farmers (Figure 3).

4.3. Intervention (studies II-IV)

The intervention study included two types of group counselling programmes [physical exercise and ergonomics (EE group) and physical exercise, ergonomics and instruction (EEI group)] under the management of the municipal health care centres. A researcher at the Kuopio Regional Institute of Occupational Health planned an outline for the programme but the farmers were encouraged to take part in the planning of the actual programme in the beginning of the activities. The implementation was followed-up after the group counselling programme came to an end.

The group counselling programme was designed to increase and support the leisure-time physical activity, physical fitness and work ability of the subjects and to decrease their musculoskeletal symptoms. The instructors of each EE group were a physiotherapist and an occupational health nurse. Physical exercise modes primarily included muscular fitness training (strength training, stretching and relaxation), but aerobic training (walking, jogging, cross-country skiing, indoor swimming) and training in ergonomic work techniques, particularly in lifting, were also involved. Muscular or aerobic training (or both) and training in ergonomic work techniques were given in each session. The EE groups met at the municipal health centres 8-10 times once or twice a week 1-2 hours at a time in the middle of the day over a period of 2.5 months. The cumulative duration of the meetings was 12-15 hours.

In each EEI group the instructors were a physiotherapist, an occupational health nurse, an occupational health physician, a psychologist and an agricultural advisor. The EEI groups were not only given muscular and aerobic training and training in ergonomic work techniques in each session, but also lectures on the work environment, work methods and personal protective equipment (altogether 2 hours), nutrition and weight control (altogether 1 hour), musculoskeletal disorders (1 hour) and coping with life (2 hours). The EEI groups met at the municipal health centres 10-11 times once or twice a week for 2-3 hours at a time in the middle of the day over a period of 2.5 months. The cumulative duration of the meetings was 21-23 hours for the EEI groups.

4.4. Methods

4.4.1. Telephone interview (study I)

A computer-assisted telephone interview was carried out in May-June 1990 by specially trained personnel at the Kuopio Regional Institute of Occupational Health.

The interview comprised questions on health, work ability, physical fitness, education, farmwork and depression. The following questions were used:

- Do you have some chronic disease or injury diagnosed by a physician? (no/yes)
- Does your disease cause you problems at work or in daily activities? (no/yes)
- Do you have any chronic respiratory, cardiovascular, skin, or musculoskeletal disease or injury that has been diagnosed by a physician? (no/yes)

- What is the musculoskeletal disease or injury? (back, neck, upper-limb, lower-limb disease or injury, rheumatoid arthritis or other musculoskeletal disease or injury)
- How do you perceive your work ability at the moment? Is it good, moderate or poor? Why do you feel that your work ability is not good at the moment?
- How do you perceive your physical fitness at the moment? Is it good, moderate or poor? Why do you feel that your physical fitness is not good at the moment?
- Can you climb stairs, run 100 meters, walk 1 kilometer, squat, sit at least 30 minutes and reach goods on high shelves without difficulty? (no/yes)
- How many years have you gone to school or studied full-time? Elementary and comprehensive school should be included.
- What is the area of cultivation of your farm, including your own and any leased area?
- What is the main operation of your farm? (cattle, swine, chicken, other animals, grains, potato, root plant, other plants, forestry). Those tending cattle were also asked: Do you milk cows regularly? (no/yes)
- Do you feel depressed at the moment? (no/yes)

4.4.2. Intervention (studies II-IV)

A questionnaire and cardiorespiratory and musculoskeletal fitness tests were used for obtaining the data in the baseline and follow-up measurements (Figure 3). The outcome variables are presented in Figure 2.

Physical activity was assessed with a questionnaire on habitual physical activity during leisure time (109), including pause gymnastics. The following questions were used: "How often do you exercise in your leisure time for at least half an hour so that you get at a least little out of breath and sweat?", "How often do you do gymnastics at home?" and "How often do you do pause gymnastics?" Farmers also kept daily diaries on their leisure-time physical activity (form of physical activity, duration) over the period of group counselling.

Data on changes in work methods, equipment and devices were gathered with the questions "Have you made any changes in your work methods (milking, using concentrate/fresh hay/dry hay/fertiliser, removing manure) during the last year (12 months)?" and "Have you obtained any equipment and devices for decreasing work load on your farm during the last year (12 months)?

Data on perceived physical strain was asked with the question "How much physical strain do you feel at work?" [alternatives 0 (not at all) - 4 (extreme strain)].

Perceived physical fitness was asked as "What alternative describes your physical fitness the best? 1) no problems with heavy execution (e.g., lifting or carrying heavy loads, felling trees, shovelling, running), 2) problems with heavy execution (e.g., lifting or carrying heavy loads, felling trees, shovelling, running), 3) problems with moderately heavy execution (e.g., more than 2 km of walking, more than 30 minutes of sitting or standing in place), 4) problems with light execution (e.g., light, short duration, varying sitting, standing and walking), 5) continuous problems even at rest". Data on perceived physical fitness was also gathered with the question "Is your current physical fitness: 1) good, 2) rather good, 3) moderate, 4) rather poor, 5) poor?"

Data on perceived health was gathered with the question "Is your current health: 1) good, 2) rather good, 3) moderate, 4) rather poor, 5) poor?"

Perceived work ability was assessed with the work ability index (110). The work ability index is a sum variable which includes subjective estimations of work ability in relation to diseases, job demands, absenteeism, and psychological resources. The index score ranges from 7 to 49.

A physiotherapist assessed musculoskeletal fitness with the test set of Alaranta et al. (100, 111). The researcher made a manual of tests and every test was practised during 1-day of instruction in the Kuopio Regional Institute of Occupational Health. Muscular strength and endurance of the leg muscles (squatting) and of the trunk flexors (sit-ups) was assessed by dynamic repetitive muscle tests. The muscular strength and endurance of the trunk extensors was evaluated by a static muscle test. Low-back mobility was assessed with the measurement of the lateral flexion of the back. Static balance was measured from the subject standing on one leg with her eyes closed.

Cardiorespiratory fitness was determined with the UKK Walk Test (103, 105). Before the test the subjects walked briskly about 500 meters in order to warm up and familiarise themselves with the test. The UKK Walk Test was done outside on a sports field or dirt road in late autumn. The heart rate was measured immediately at the finish with a heart rate monitor (Polar Sport Tester PE 3000, Polar Electro Oy, Kempele, Finland). In the baseline measurement 2 subjects used betablocker medication, which may have decreased the heart rate at rest and during exercise. However, they used the same medication also in the follow-up measurements, and therefore they were not eliminated from the analysis. The UKK Walk Test was done before the group counselling and in the 1-, 3- and 6-year follow-ups. After the tests the subjects received feedback on their physical fitness and also guidelines for increasing their physical fitness.

Musculoskeletal symptoms were determined with the use of the standardised Nordic questionnaire (95). The question used was "Have you had trouble (pain, ache, discomfort) during the past 12 months in the following parts of your body: neck (no/yes), shoulders (no/yes), upper back (no/yes), elbows (no/yes), wrist/hands (no/yes), lower back (no/yes), hips/thighs (no/yes), knees (no/yes), ankles/feet (no/yes)?" The symptoms concerning the upper (neck, shoulders, upper back, elbows, wrists or hands) and lower (lower back, hips or thighs, knees, ankles or feet) regions of the body were combined into 2 indexes. Points for the upper regions of the body ranged from 5 to 10, and those for the lower regions of the body ranged between 4 and 8. The Nordic questionnaire was administered before the group counselling and in the 1-, 3- and 6-year follow-ups.

Psychosomatic symptoms (headache, lack of memory, nervousness, depression, fatigue, insomnia, irritability, strain, anxiety, vertigo, overstrain and lack of ambition) were inquired about with 12 questions, the sum of which were combined into a sum variable (112).

The personnel of the municipal health care centres were interviewed with a structured questionnaire over the telephone after the intervention. The topics were the feasibility of the group counselling and physical fitness tests as a part of FOHS.

4.5. Statistical analyses

The statistical analysis of study I was done using software of the statistical analysis system (SAS) with logistic regression (proc genmode) analysis. The results were expressed as percentage distributions and as crude and mutually adjusted (age+gender+education+area of cultivation+operation+depression) odds ratios (OR) with their 95% confidence intervals (95% CI).

In the intervention study (studies II-IV) the MIXED SAS procedure was used in the analysis of the continuous variables, results being given as means and 95% confidence intervals. The CATMOD procedure was used in the analyses of the categorical variables (113, 114). The differences were considered significant when $P<0.05$.

5. RESULTS

5.1. Self-reported morbidity, work ability and physical fitness (study I)

5.1.1. Morbidity

More than one-third of the subjects (38%) had a chronic disease diagnosed by a physician, and 72% of those with a diagnosis had work problems caused by the disease. Musculoskeletal disease was the commonest chronic disease (prevalence 19%), followed by cardiovascular disease (prevalence 11%), respiratory disease (prevalence 9%) and skin disease (prevalence 5%). Almost all of those (90%) who had a musculoskeletal disease had problems at work because of the disease. The corresponding value was 78% for skin disease, 75% for respiratory disease and 58% for cardiovascular disease.

Older age, high degree of depression, little education and small area of cultivated land were associated with a high prevalence of chronic disease, problems at work because of a disease and musculoskeletal disease (Table 2). When the other independent variables were adjusted for, the prevalence of chronic disease, problems at work because of a disease and the prevalence of musculoskeletal disease increased with increasing age and depression. Problems at work because of a disease were more frequent among the subjects who cultivated less than 20 hectares than among those from larger farms (Table 2).

Table 2
Risk factors for chronic disease, problems at work caused by a disease and musculoskeletal disease - crude and mutually adjusted (age+gender+education+area of cultivation+operation+depression) odds ratios (OR) with 95% confidence intervals (95% CI) (n=577)

Independent variable		Chronic disease						Problems at work caused by a disease						Musculoskeletal disease					
		Crude			Mutually adjusted			Crude			Mutually adjusted			Crude			Mutually adjusted		
	n	OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI	
Age, years																			
18-34	139	1.0			1.0			1.0			1.0			1.0			1.0		
35-44	145	1.8	1.1-3.1	*	1.9	1.1-3.3	*	2.1	1.1-3.9	*	2.1	1.1-4.1	*	1.7	0.8-3.7		2.0	0.9-4.5	
45-54	142	2.2	1.3-3.7	**	2.2	1.2-4.0	**	2.7	1.5-5.1	**	2.6	1.3-5.3	**	3.1	1.5-6.5	**	3.6	1.7-8.4	**
55-65	151	4.5	2.7-7.6	***	4.4	2.4-8.3	***	4.6	2.6-8.5	***	4.4	2.2-8.9	***	4.6	2.4-9.6	***	5.6	2.5-12.9	***
Gender																			
Male	296	1.0			1.0			1.0			1.0			1.0			1.0		
Female	281	1.2	0.8-1.6		1.1	0.8-1.6		1.2	0.8-1.7		1.1	0.7-1.6		1.1	0.7-1.7		1.0	0.7-1.6	
Education, years																			
≥ 10	221	1.0			1.0			1.0			1.0			1.0			1.0		
0-9	356	1.8	1.3-2.6	**	1.0	0.6-1.5		2.0	1.3-3.0	***	1.0	0.6-1.6		1.6	1.1-2.6	*	0.7	0.4-1.2	
Area of cultivation, hectares																			
≥ 20	274	1.0			1.0			1.0			1.0			1.0.			1.0		
0 - 19.9	303	1.5	1.0-2.1	*	1.3	0.9-1.9		1.8	1.3-2.6	**	1.6	1.1-2.4	*	1.5	1.0-2.3	*	1.3	0.9-2.1	
Operation																			
Milking	295	1.1	0.8-1.6		1.1	0.8-1.6		1.1	0.8-1.6		1.1	0.7-1.6		1.2	0.8-1.8		1.2	0.8-1.9	
Other	282	1.0			1.0			1.0			1.0			1.0			1.0		
Depression																			
No	517	1.0			1.0			1.0			1.0			1.0			1.0		
Yes	60	2.3	1.3-4.0	**	2.1	1.2-3.7	**	3.1	1.8-5.4	***	2.9	1.6-5.1	***	3.6	2.1-6.4	***	3.4	1.9-6.1	***

* p<0.05
** p<0.01
*** p<0.001

Back disease was the common musculoskeletal disease (prevalence 10%), followed by lower-limb (4%), neck (3%) and upper-limb (2%) disease, rheumatoid arthritis (1%), and other musculoskeletal disease (2%). Back and lower-limb diseases were more frequent among the subjects over 44 years of age than among the younger ones (Table 3). The subjects from small farms more often reported back and neck diseases than those from large farms. The subjects who milked cows regularly had somewhat more often upper-limb disease than those with other types of farm tasks. The subjects who felt depressed at the time of the interview more often had neck and upper- and lower-limb disease than those who were not depressed (Table 3).

Table 3

Risk factors for back, neck, and upper- or lower-limb disease - crude and mutually adjusted (age+gender+education+area of cultivation+operation+depression) odds ratios (OR) with 95% confidence intervals (95% CI) (n=577)

	Diseases															
Independent variable	Back				Neck				Upper-limb				Lower-limb			
	Crude		Mutually adjusted		Crude		Mutually adjusted		Crude		Mutually adjusted		Crude		Mutually adjusted	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Age, years																
18-34	1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
35-44	2.0	0.8-5.5	2.3	0.9-6.7	1.0	0.2-5.3	0.7	0.1-4.5	1.4	0.2-11.1	0.9	0.1-7.5	3.9	0.6-77.0	3.1	0.4-64.1
45-54	2.7	1.1-7.2*	3.4	1.3-9.8*	1.7	0.4-8.2	1.0	0.2-6.1	0.5	0.0-5.1	0.2	0.0-3.1	7.2	1.2-134.7	4.6	0.7-94.4
55-65	3.0	1.3-8.0**	3.8	1.4-11.1**	2.9	0.8-13.2	1.7	0.4-9.7	2.3	0.5-16.6		0.2-11.5	11.9	2.3-218.4*	6.8	1.0-136.4
Gender																
Male	1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
Female	1.2	0.7-2.1	1.2	0.6-2.0	1.6	0.7-4.2	1.4	0.5-3.8	0.9	0.2-2.9	0.8	0.2-2.8	0.4	0.2-1.0	0.4	0.2-1.0
Education, years																
≥10	1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
0 - 9	1.3	0.7-2.3	0.6	0.3-1.3	2.6	0.9-9.0	1.5	0.4-6.9	2.8	0.7-18.7	3.1	0.5-25.9	4.6	1.5-19.4*	2.1	0.6-10.4
Area of cultivation, hectares																
≥20	1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
0 - 19.9	1.9	1.1-3.5*	1.8	1.0-3.4*	3.8	1.4-13.3*	3.0	1.0-10.9	0.5	0.1-1.7	0.4	0.1-1.4	1.3	0.6-3.0	1.0	0.4-2.5
Operation																
Milking	1.0	0.6-1.8	1.0	0.6-1.8	1.5	0.6-3.8	1.4	0.5-3.7	4.4	1.1-29.1	4.1	1.0-27.7	0.8	0.3-1.8	0.9	0.4-2.1
Other	1.0		1.0		1.0		1.0		1.0		1.0		1.0		1.0	
Depression																
No	1.0		1.0		1.0		1.0		1.0	0.7-18.7	1.0		1.0		1.0	
Yes	1.6	0.7-3.3	1.5	0.6-3.1	4.0	1.4-10.4**	3.0	1.0-8.2*	5.2	1.3-17.8*	4.6	1.1-16.7*	3.9	1.4-9.5**	3.5	1.2-8.8*

* $p<0.05$

** $p<0.01$

5.1.2. Perceived work ability

Less than half of the subjects (44%) perceived their work ability as good. The commonest reason for moderate or poor work ability was a somatic disease (45%) or factors associated with ageing (29%).

Ageing, female gender, little education, small area of cultivated land, milking and depression were associated with poor or moderate perceived work ability. When the other independent variables were adjusted for, age and depression were associated with poor or moderate work ability (Table 4)

Table 4
Risk factors for work ability, physical fitness and functional capacity[a] - odds ratios (OR) with 95% confidence intervals (95% CI) (n=577)

Independent variable	Work ability (poor or moderate)						Physical fitness (poor or moderate)						Restricted functional capacity[a]					
	Crude			Mutually adjusted			Crude			Mutually adjusted			Crude			Mutually adjusted		
	OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI	
Age, years																		
18-34	1.0			1.0			1.0			1.0			1.0			1.0		
35-44	3.1	1.8-5.2	***	2.6	1.5-4.7	***	2.0	1.3-3.3	**	1.9	1.1-3.1	*	1.9	1.1-3.3	*	1.4	0.8-2.5	
45-54	7.8	4.6-13.4	***	6.0	3.2-11.4	***	2.3	1.5-3.8	***	2.1	1.2-3.7	**	4.3	2.6-7.4	***	2.8	1.5-5.2	***
55-65	19.4	10.9-36.0	***	15.5	7.9-31.7	***	4.1	2.5-6.8	***	3.7	2.1-6.8	***	8.3	4.9-14.3	***	5.4	2.9-10.3	***
Gender																		
Male	1.0			1.0			1.0			1.0			1.0			1.0		
Female	1.5	1.1-2.1	*	1.5	1.0-2.2		1.7	1.2-2.4	**	1.7	1.2-2.5	**	1.9	1.3-2.6	***	2.0	1.4-2.9	***
Education, years																		
≥10	1.0			1.0			1.0			1.0			1.0			1.0		
0 - 9	4.3	3.0-6.2	***	1.5	1.0-2.4		1.9	1.3-2.7	***	1.1	0.7-1.7		3.6	2.5-5.2	***	1.8	1.1-2.9	**
Area of cultivation, hectare																		
≥20	1.0			1.0			1.0			1.0			1.0			1.0		
0 - 19.9	1.5	1.1-2.2	**	1.2	0.8-1.8		1.2	0.9-1.7		1.1	0.7-1.5		1.7	1.2-2.3	**	1.3	0.9-1.9	
Operation																		
Milking	1.4	1.0-2.0	*	1.4	1.0-2.1		1.2	0.8-1.6		1.0	0.7-1.5		1.3	0.9-1.8		1.2	0.8-1.7	
Other	1.0			1.0			1.0			1.0			1.0			1.0		
Depression																		
No	1.0			1.0			1.0			1.0			1.0			1.0		
Yes	4.4	2.3-9.4	***	4.7	2.2-10.8	***	1.5	0.9-2.8		1.4	0.8-2.6		2.3	1.3-4.0	**	2.0	1.1-3.6	*

[a] At least one perceived restriction of the following functions: climbing stairs/running 100 meters/walking 1 kilometer/squatting/sitting at least 30 minutes/reaching up for goods on high shelves.

* p<0.05
** p<0.01
*** p<0.001

5.1.3. Perceived physical fitness and functional capacity

Less than half of the subjects (41%) perceived their physical fitness to be good. The commonest reported reason for moderate or poor fitness was a disease (36%) or the lack of sufficient physical activity during leisure time (20%). Older subjects, female subjects and less-educated subjects perceived their physical fitness more often as moderate or poor than younger subjects, male subjects and subjects who had at least 10 years of education (Table 4). When the other independent variables were adjusted for, female subjects and subjects over 34 years of age perceived their physical fitness more often as moderate or poor than did the male subjects and the subjects between 18 and 34 years of age (Table 4).

Almost half of the subjects (44%) had restricted functional capacity. The commonest reasons for such restriction were back pain (12-70% depending on the type of task) and knee pain (0-56% depending on the type of task).

Ageing, female gender, little education, small area of cultivated land and depression were associated with poor functional capacity. When the other independent variables were adjusted for, age, gender, education and depression were associated with perceived functional capacity (Table 4).

5.1.4. High-risk groups for health and work ability problems

The subjects over 34 years of age (n=438), the female subjects (n=281), the subjects who had less than 10 years of education (n=356), the subjects from farms with less than 20 hectares to cultivate (n=303), those who milked regularly (n=295) and those who were depressed (n=60) were found to be the high-risk groups for chronic diseases and problems at work caused by diseases, or for decreased work ability and functional capacity. There were 12 farmers (2%) who fulfilled all these criteria and 85 (15%) female farmers aged 25-45 years who milked regularly. The high-risk groups or the group with a combination of these characteristics were considered to need the promotion of health and work ability the most.

5.2. Feasibility of group counselling intervention in farmers' occupational health services (studies II-IV)

The group counselling used in this study could be organised within the scope of FOHS. The programmes were carried out as planned in each municipal health care centre according logs made by the physiotherapists. The subjects and the personnel of the health care centres were pleased with the group activities. The functional capacity tests were also highly valued. The subjects actively participated in the groups (attendance being 90% of all group members), and no one quit the programme.

The costs of the group counselling programme ranged from FIM 0 to FIM 928 (USD 0-143) per subject, mean FIM 456 (USD 70), the musculoskeletal fitness tests costs FIM 0-123 (USD 0-19) per subject per measurement, and the cardiorespiratory fitness test fell into the costs range of FIM 0-126 (USD 19) per subject per measurement. One municipal health care centre did the tests and organised the group activities as public health services, but nevertheless as a part of FOHS also.

According to the farmers' answers to a questionnaire, the group counselling programme had a positive influence, particularly on mental alertness, physical activity, and knowledge about strain on the musculoskeletal system.

5.3. Effects of the group counselling intervention (studies II-IV)

5.3.1. Effects on physical activity

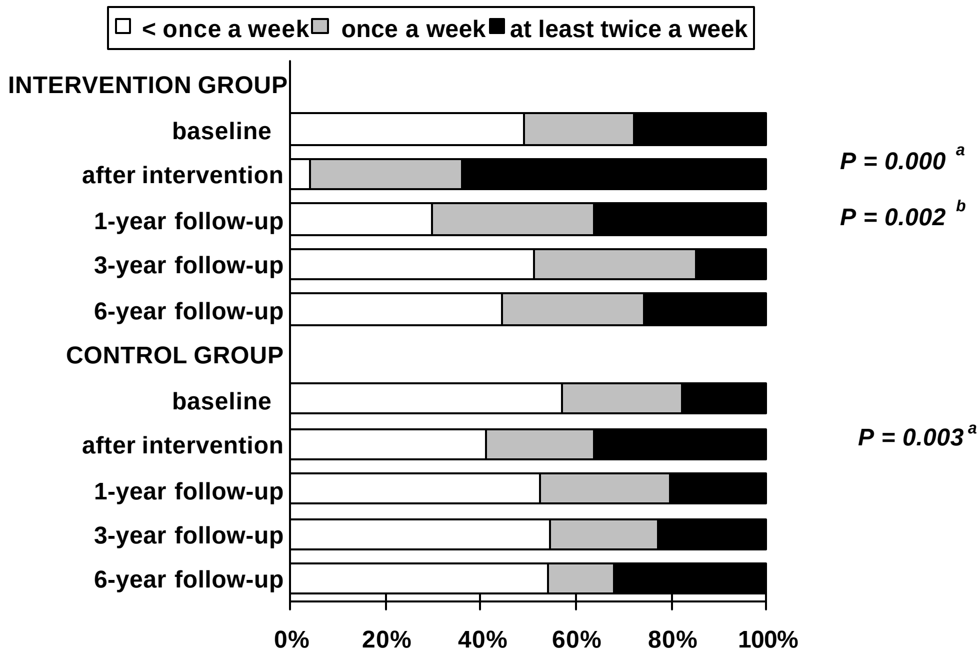
There was no significant differences between the EE and EEI groups in the effects of group counselling on physical activity; therefore the data of the EE and EEI groups, and also those of the control groups were combined in the analysis. For example, at the baseline 25% of the female farmers in the EE group and 30% in the EEI group exercised in their leisure time for at least half an hour to the point that they became at least somewhat breathless and sweaty at least 2 times a week. The corresponding figure in the 6-year follow up was 21% for the EE group and 28% for the EEI group.

At the baseline 28% of the female farmers in the intervention group and 18 % in the control group exercised in their leisure time for at least half an hour to the point that they became at least somewhat breathless and sweaty at least 2 times a week. The corresponding percentage for home gymnastics was 19%

for the intervention group and 14% for the control group, and for pause gymnastics the respective figures were 40% and 36%.

After the intervention leisure-time physical activity, home gymnastics and pause gymnastics were more frequent in the intervention group (EE group and EEI group) than in the control group (P=0.004, P=0.000 and P=0.004, respectively) according to the results of the questionnaires. Exercise sessions during counselling programme were excluded from the analysis. In the 1-year follow-up home gymnastics and pause gymnastics were more frequent in the intervention group than among in the control group (P=0.005 and P=0.014, respectively). In the 3-year follow-up, the intervention group carried out pause gymnastics more frequently than the control group (P=0.019). In the intervention groups the level of leisure-time physical activity, home gymnastics and pause gymnastics had increased after the intervention and in the 1-year follow-up as compared with the baseline level (Figures 4-6). In the control group home gymnastics had decreased at the time of the 6-year follow-up as compared with the baseline levels (Figures 4-6).

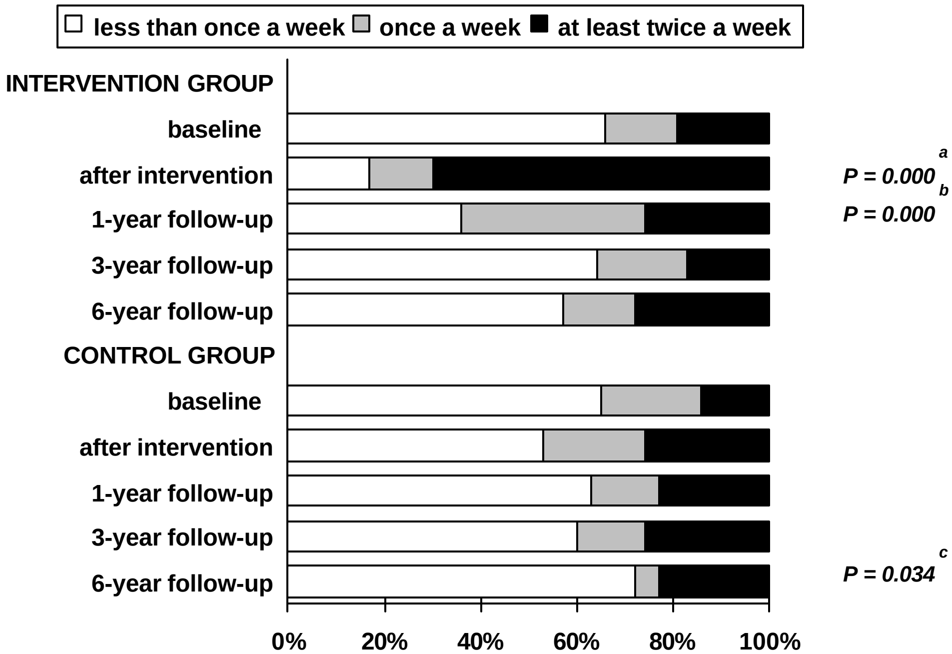
In the 6-year follow-up the commonest exercise was walking (58% in the intervention group and 43% in the control group), followed by cycling (20%), guided fitness gymnastics (14%) and cross-country skiing (12%).



[a] before vs. after group counselling

[b] before group counselling vs. 1-year follow-up

Figure 4. Leisure-time physical activity at the time of baseline examination, after the intervention, and at the time of the 1-, 3- and 6-year follow-ups (n=91).

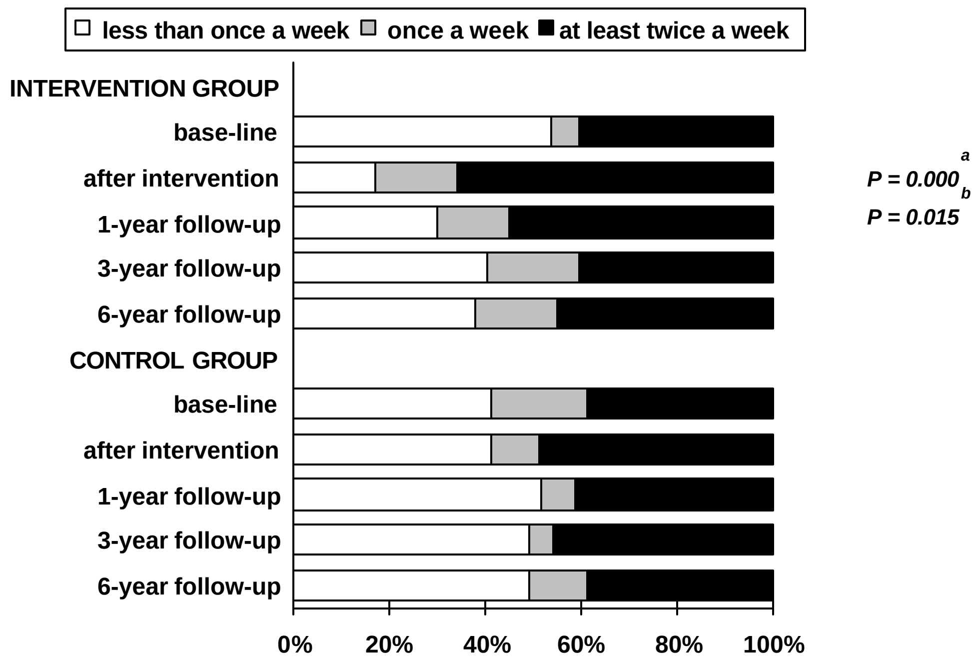


[a] before vs. after group counselling

[b] before group counselling vs. 1-year follow-up

[c] before group counselling vs. in 6-year follow-up

Figure 5. Home gymnastics at the time of baseline examination, after the intervention, and in the at the time of 1-, 3- and 6-year follow-ups (n=91).



[a] before vs. after group counselling

[b] before group counselling vs. 1-year follow-up

Figure 6. Pause gymnastics at the time of baseline examination, after the intervention, and at the time of 1-, 3- and 6-year follow-ups (n=91).

5.3.2. Effects on physical fitness and body mass index

The only significant difference (P=0.013) between the EE and EEI groups in the effects of group counselling on physical fitness was the greater increase in trunk flexion in the EEI group, from 17 repetitions to 22 repetitions, in the 6-year follow-up than in the EE group (29 repetitions unchanged). Therefore the results of the EE and EEI groups, and also those of the control groups were combined.

The changes in muscular strength and endurance did not differ significantly in the intervention and control groups after the intervention or at the time of the 1-, 3-, and 6-year follow-ups. As compared with the baseline values, muscular strength and endurance were higher at the end of the intervention and in the 1-, 3- and 6-year follow-ups both the intervention and control groups (Tables 5 and 6).

In the 1-year follow-up the improvement in lateral flexion of the back was greater in the intervention group than in the control group (P=0.001). In the intervention group the static balance was better after the intervention, and also in the 1- and 3-year follow-ups, than in the beginning of the study (Tables 5 and 6).

The changes in UKK Walk Test index did not differ significantly in the intervention and control groups at the time of the 1-, 3-, and 6-year follow-ups. As compared with the baseline values, cardiorespiratory fitness was higher in the 1-, 3- and 6-year follow-ups in both the intervention and the control groups (Tables 5 and 6).

Before the intervention 49% of the subjects in the intervention group and 44% of the subjects in the control group were overweight (body mass index > 25 kg/m^2), the corresponding values in the 6-year follow-up were 44% and 56%, respectively. Before the intervention 4% of the subjects in the intervention group and 14% of the subjects in the control group were obese (body mass index > 30 kg/m^2), the corresponding values in the 6-year follow-up being 7% and 14%, respectively. The mean body mass index of the control group had increased in the 6-year follow-up as compared with the baseline values (Tables 5 and 6).

Table 5
Physical fitness and body mass index in the baseline, after the intervention and in the 1-year, 3-year and 6-year follow-ups in the intervention group. Means and 95% confidence interval of change (n=51)

Test	Baseline (Mean)	After intervention (Mean)	Change[a] Mean	Change[a] 95% CI	1-year follow-up (Mean)	Change[b] Mean	Change[b] 95% CI	3-year follow-up (Mean)	Change[c] Mean	Change[c] 95% CI	6-year follow-up (Mean)	Change[d] Mean	Change[d] 95% CI
Body mass index, (kg/m^2)	25.5	25.2	-0.3	-0.7- 0	25.5	0	-0.4- 0.4	25.8	0.3	-0.1- 0.6	25.9	0.3	-0.1- 0.7
Trunk flexion strength, dynamic[e]	23	28	5	3- 8	27	4	1- 7	27	4	1- 7	26	2	0- 5
Trunk extension strength, static[f]	154	173	19	5- 34	177	23	8- 38	167	13	-2- 29	183	29	14- 44
Squatting[e]	28	35	7	4- 10	32	4	1- 8	33	5	2- 9	31	3	0- 6
Lateral flexion of the back (mm)	384	396	12	-2- 25	395	10	-3- 24	381	-3	-17- 10	358	-26	-41- -13
Static balance[g]	19	24	5	0- 10	25	6	1- 12	25	6	1- 12	22	3	-3- 8
UKK Walk Test index n=48[h]	96	-	-		98	2	0- 5	98	2	0- 5	100	4	1- 7

[a]Change after intervention vs. baseline.
[b]Change 1-year follow-up vs. baseline.
[c]Change 3-year follow-up vs. baseline.
[d]Change 6-year follow-up vs. baseline.
[e]Maximum 50 repetitions.
[f]Maximum 240 seconds.
[g]Maximum 40 seconds.
[h]Three subjects had a heart rate of <110 beats/min in the baseline measurement, and they were excluded from the analyses

Table 6
Physical fitness and body mass index in the baseline, after the intervention and in the 1-year, 3-year and 6-year follow-ups in the control group. Means and 95% confidence interval of change (n=48)

Test	Baseline (Mean)	After intervention (Mean)	Change[a] Mean	Change[a] 95% CI	1-year follow-up (Mean)	Change[b] Mean	Change[b] 95% CI	3-year follow-up (Mean)	Change[c] Mean	Change[c] 95% CI	6-year follow-up (Mean)	Change[d] Mean	Change[d] 95% CI
Body mass index, (kg/m^2)	25.6	25.5	-0.1	-0.5- 0.3	25.7	0.1	-0.3- 0.5	25.9	0.3	-0.1- 0.8	26.3	0.8	0.4- 1.2
Trunk flexion strength, dynamic[e]	25	27	2	0- 5	29	4	2- 7	27	2	-1- 5	28	3	0- 6
Trunk extension strength, static[f]	165	177	12	-3- 27	180	15	-1- 31	176	11	-6- 28	177	12	-5- 28
Squatting[e]	30	33	3	0- 6	33	3	0- 7	35	5	1- 9	32	2	-1- 6
Lateral flexion of the back (mm)	416	422	5	-9- 19	387	-29	-44- -15	396	-21	-36- -5	384	-32	-47- -17
Static balance[g]	17	21	4	-2- 9	23	6	1- 12	18	1	-5- 8	22	5	-1- 11
UKK Walk Test index n=46[h]	97	-	-		101	4	1- 7	102	4	1- 7	104	7	4- 10

[a]Change after intervention vs. baseline.
[b]Change 1-year follow-up vs. baseline.
[c]Change 3-year follow-up vs. baseline.
[d]Change 6-year follow-up vs. baseline.
[e]Maximum 50 repetitions.
[f]Maximum 240 seconds.
[g]Maximum 40 seconds.
[h]Two subjects had a heart rate of <110 beats/min in the baseline measurement, and they were excluded from the analyses

5.3.3. Reported changes in work methods, devices and equipment

There were no differences between the EE and EEI groups in reported changes in work methods, devices and equipment during 6-year follow-up. Almost one-fifth (17%) of the subjects in the intervention group made changes in their work methods according to the 1-year of follow-up, 32% according to the 3-year follow-up and 45% according to the 6-year follow-up. In the control group the corresponding values were 7%, 9% and 34%, respectively. The difference between the groups was significant (P=0.007) in the 3-year follow-up. The commonest changes in work methods and equipment were the implementation of the rail system for milking (n=8), grass in round bales (n=7), new milking units (n=7), and a milking chair (n=5).

There were no differences between the groups with respect to the procurement of work devices and equipment during the 6-year follow-up. During the 1-year follow-up 13% of the subjects in the intervention groups had obtained some devices and equipment for decreasing work load. The corresponding value was 11% in the control group. In the 3-year follow-up these values were 26% and 25%, respectively, and in the 6-year follow-up they were 49% and 48%, respectively.

5.3.4. Effects on perceived physical fitness and physical strain at work

There were no significant differences in the changes in perceived physical fitness and physical strain at work during the 6-year follow-up period between the EE and EEI groups and between both intervention groups (EE and EEI) and the control groups. Before the intervention 51% of the subjects in the intervention group perceived their physical fitness as good or rather good. The respective value was 55% for the 1-year follow-up, 47% for the 3-year follow-up and 45% for the 6-year follow-up. For the control group the corresponding values were 55%, 64%, 52% and 39%, respectively. Before the intervention 23% of the subjects in the intervention group perceived their work as highly straining (alternatives 3-4 on scale 0-4), the corresponding values being 23% for the 1-year follow-up 23%, 26% for the 3-year follow-up, and 30% for the 6-year follow-up. For the control group the corresponding values were 20%, 25%, 25% and 23%, respectively.

5.3.5. Effects on work ability index

In the baseline examination the mean value of the work ability index was 42 (SD 4) in both the intervention and the control groups. In the intervention group the work ability index was lower in the 6-year follow-up [mean 40 (SD 6), P=0.002], and in the control group it was lower in both the 3-year [mean 40 (SD 5), P=0.010] and the 6-year [mean 40 (SD 4), P=0.001] follow-ups than in the beginning of the study. The changes in the work ability index did not differ between the EE and EEI groups or between the intervention and control groups during the 6-year follow-up period.

5.3.6. Effects on musculoskeletal and psychosomatic symptoms and sick leaves

There were no significant differences in the changes in musculoskeletal and psychosomatic symptoms and sick leaves during the 6-year follow-up time between the EE and EEI groups.

The musculoskeletal symptoms in the lower part of the body had decreased more often in the intervention group than in the control group in the 1-year (P=0.043) and 6-year (P=0.003) follow-ups (Figure 7). When compared with the baseline situation, the number of musculoskeletal symptoms of the lower part of the body was smaller in the intervention group at the time of the 1-year (mean change in points -0.5, 95% CI -0.7 - -0.2), 3-year (mean change in points -0.3, 95% CI -0.6 - 0.0) and 6-year (mean change in points -0.4, 95% CI -0.6 - -0.1) follow-ups. In the control group the number of musculoskeletal symptoms in the lower body was greater at the time of the 6-year follow-up (mean change 0.5, 95% CI 0.2 - 0.8) when compared with the baseline value.

There were no changes in the number of psychosomatic symptoms and sick leave days during the follow-up period.

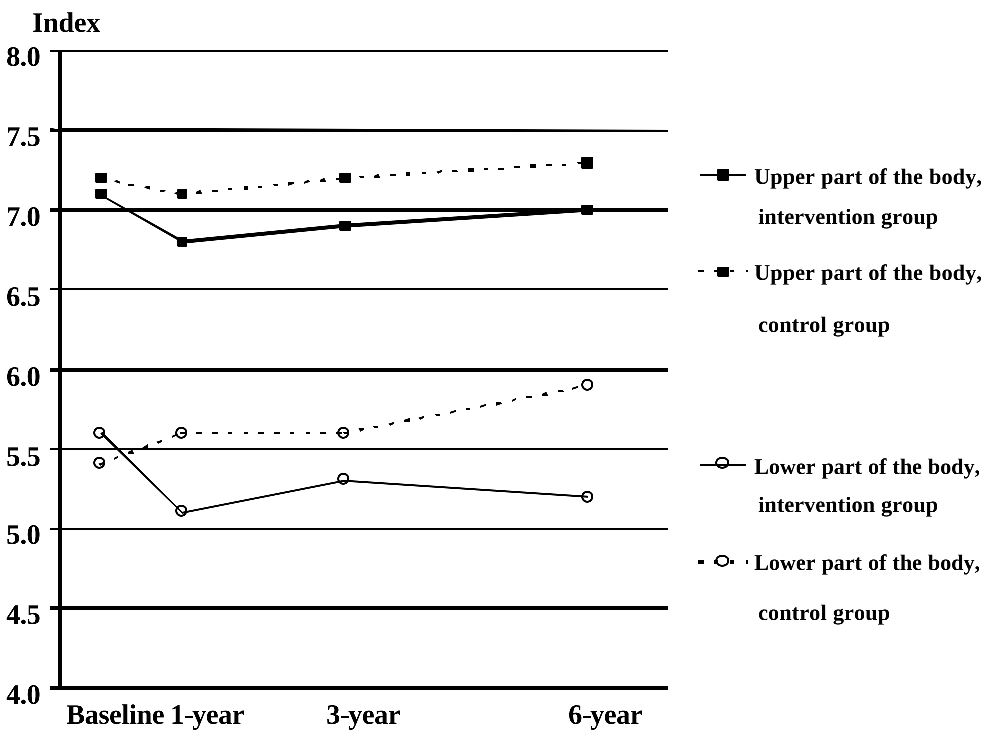


Figure 7. Prevalence of musculoskeletal symptoms of the upper (neck, shoulders, upper back, elbows, wrist or hands) and lower (lower back, hips or thighs, knees, ankles or feet) parts of the body at the time of the baseline examination and the 1-, 3- and 6-year follow-ups. Given are the means of the sum index for the intervention (n=51) and control group (n=48).

5.3.7. Effects on perceived health

Before the intervention 21% of the subjects in the intervention group perceived their health as good or rather good, the corresponding value being 34% for the 1-year follow-up, 17% for the 3-year follow-up and 15% for the 6-year follow-up. In the control group the respective values were 28%, 37%, 21% and 12%.

The changes in perceived health did not differ significantly between the EE and EEI groups or between the intervention and the control groups during the follow-ups. As compared with the baseline values, the number of subjects in the control group who perceived their health as good or rather good decreased (P=0.008) in the 6-year follow-up.

6. DISCUSSION

6.1. Methodological considerations

6.1.1. Telephone interview (study I)

The strengths of the computer-assisted telephone interview are its good response rate and item response, its rapidity, and its suitability for studies with large, complex questionnaires (115). Also in this study, the response rate (92%) and item response (99%) were excellent. Differences in answering questions concerning health items have been reported to be small between data from postal questionnaires and telephone interviews (116). The interviewers were trained and monitored during interviews, and the researcher also made some of the interviews.

Estimates of chronic morbidity based on health interview data have been close to the prevalence of definite somatic diseases diagnosed in health examinations, and the agreement between the two methods can be considered moderate. Particularly the prevalence of respiratory and musculoskeletal diseases and mental disorders has been underestimated in interviews (117). Since the question items have been widely used in Finland (4, 7, 118), a comparison between different study results was possible.

6.1.2. Intervention (studies II-IV)

The main strengths of this study were the randomisation of the subjects into intervention and control groups, the high participation rate, good adherence and the long follow-up period of 6 years. Randomised controlled designs are rather rare in intervention research in the field of ergonomics (75) and in worksite physical activity intervention (55). Goldenhar and Schulte (74) concluded that many of the intervention studies on occupational health and safety have had a weak theoretical basis, small samples, and intervention programmes lacking the intensity to cause desired changes. Most of the studies have been either non-experimental or quasi-experimental.

In the present study, 84% of the initial sample of female farmers from dairy farms was willing to participate after having received basic information on the study. Often only people who are physically active take part in worksite fitness programmes (46). In this study also physically inactive female farmers (53% exercised less than once a week) were involved. They participated in the groups actively, and none of them dropped out. The participation rate in the follow-up assessments was also high, ranging from 69% to 100%.

About every fifth (21%) of the subjects terminated their farmwork during the 6-year follow-up (most due to productivity problems, 3 had retired on a disability pension, 3 had divorced, and 1 died) and were excluded from the study. In Finland, there is a trend towards fewer but larger farms. Small farms are not productive enough because of changes caused by European integration (11). Moreover, the tests of muscular and cardiorespiratory fitness were not attended by 16% and 23% of the subjects, respectively. The main reasons for non attendance were lack of time and the presence of musculoskeletal disorders and pain. The statistical analysis implemented for evaluating the effects of the group counselling on physical fitness was a mixed application that also took missing observations into account (119).

The validity and reliability of the questionnaire items (83, 95, 97, 110) and the fitness tests (103, 111) have been reported to be good. The UKK Walk Test used in this study was not performed in two municipal health care centres in the beginning of the study, and the researcher did the tests together with the physiotherapist and occupational health nurse. All the questionnaire items and tests were selected for their easy use in clinical practice in occupational health services. The same physiotherapist conducted the musculoskeletal fitness tests in the baseline examination and the follow-ups in each municipal health care centre except one. The municipal health care centres involved in this study can be considered to be typical in Finland.

6.2. Need for health and work ability promotion (study I)

Over one-third of the studied farmers (38%) had a chronic disease diagnosed by a physician, and 72% of them reported problems at work caused by the disease. Musculoskeletal disease was the commonest form of chronic disease, and 90% of them reported problems at work caused by the musculoskeletal disease. Back disease was the commonest musculoskeletal disease.

The male farmers' prevalence of chronic diseases was at the same level as that of male blue-collar workers and at a higher level than that of white-collar workers in Finland. The female farmers had a higher prevalence of chronic diseases than female blue- and white-collar workers (118, 120). These results are not in the agreement with those of Thelin (121), who showed that morbidity was generally low among Swedish farmers. The low prevalence was based on hospital records, and the use of hospital records may explain some of the differences because Finnish farmers seemed to use health services less than other occupational groups. (7).

This study confirmed that farming is a high-risk occupation for musculoskeletal disorders and work-related disability (3-5). It was also confirmed that back disease is the commonest among farmers from small farms (122) and upper-limb diseases are commoner among milkers than non-milkers (20).

Farmers' self-reported work ability has been reported to be poorer than that of blue- and white-collar workers. Especially female farmers have perceived their work ability as poorer than Finnish women in other occupational groups. When subject have assessed their work ability on a scale from 0-10, the age-adjusted mean has been 7.8 for female farmers, 8.7 for female blue-collar workers and 8.8 for female white-collar workers (7). In the present study more than half of the farmers (56%) perceived their work ability to be moderate or poor and nearly half of them (44%) reported restricted function that hampered their everyday activities. These values are alarming because farm work is still physically demanding and requires good work ability and physical fitness. The work ability reflects the perceived interaction between the work and the worker. It is influenced by several individual factors, such as psychophysiological capacities and professional competence, and by the work environment, the work organisation and also management issues (8).

Especially the farmers over 34 years of age, the female farmers, farmers having less than 10 years of education, farmers from small farms (less than 20 hectares of cultivated land), farmers who milk regularly, and farmers with depression had the highest risk for chronic diseases and various problems at work caused by a disease, poor work ability or low physical fitness. The risk tended to accumulate among the same persons (e.g., 63% of the women and 40% of the men milked regularly and the 35- to 54-year-old farmers were the most active milkers).

The number of hectares cultivated can be an indicator of the technological level of the farm. Problems associated with ergonomics are more frequent on small farms and in cattle operations than on large farms and in other operations (32). Work on small farms is hard and physically demanding, particularly for women. In Finland, women have traditionally taken care of cattle and milking, while men have become active in this domain only recently.

There is a lack of studies on farmers' work ability and physical fitness. An early identification of high-risk groups of farmers with respect to health, work ability and physical fitness is important in order to target and improve programmes aiming at promoting their health and work ability. The physical fitness of ageing workers can be improved (123). Work on farms can be made physically lighter through the development of work methods and equipment, for example through the installation of a rail system in tie stall milking (124).

6.3. Feasibility of group counselling intervention (studies II-IV)

In the present intervention study, two different programmes for group counselling were developed and evaluated as a part of FOHS. Both models were feasible and affected similarly the farmers' functional capacities and work ability. Nevertheless the farmers and health care personnel who participated in the study made some developmental proposals. They felt that the activities of the EEI group contained too many topics and that those of the EE group were too monotonous. They suggested that the main topics of the group counselling should be work habits and leisure-time physical activity.

The participation rate for group activities was very high, and the farmers hoped that this kind of activities would be continued as a part of their occupational health services. The groups were organised in the middle of the day because milking was done in the mornings and evenings. This probably had a positive effect on the participation rate.

The programmes were carried out as planned in each municipal health care centre according logs made by the physiotherapists and the health care personnel were pleased with the group activities. The personnel liked the new content of their work, and they planned to continue the use of group counselling as a part of the services if the necessary resources (personnel, time and money) could be obtained. Thus far 3 municipal health care centres have been able to continue with group counselling.

The success of various group activities depends greatly on the attitude and skills of the instructor (125). In this study the education and familiarity of physiotherapists with farm work were inquired about with a questionnaire before the intervention. All the physiotherapists had worked in occupational health services and were familiar with farm work. The personal charisma, enthusiasm, and ability to get along with people and take work seriously are important qualities for a good instructor (125). Although the researcher visited the groups a few times, it was impossible to assess the personal abilities of the physiotherapists. However it seemed that they had a serious commitment to group counselling and the atmosphere of the groups was open.

In this study the groups varied from 8 to 13 female farmers. This size can be considered almost optimal (125) because the goal was to activate each farmer and guide her individually.

The costs of group counselling and fitness tests were reasonable in the present study. The Farmers' Social Insurance Institute paid the expenses for this developmental study. It has been estimated that the cost of 20 hours of group counselling, including 10 subjects per group, would be about FIM 450 (USD 70) per subject, the costs of the musculoskeletal fitness tests (done twice) would be about FIM 250 (USD 40) per subject, and the costs of cardiorespiratory fitness tests (done twice) would be about FIM 100 (USD 15). The total costs for each farmer could be about FIM 400 (USD 60), because the Social Insurance Institution later compensates for the half of the expenses.

6.4. Effects of the group counselling intervention (studies II-IV)

Group counselling increased leisure-time physical activity and decreased musculoskeletal symptoms in the lower part of the body over the follow-up period of 1 year. Some positive effects on musculoskeletal symptoms remained after the period of 6 years.

The female farmers' leisure-time physical activity was lower than the average level of Finnish women, but it was at the same level as that of other groups of farmers (7, 120).

The increases in leisure-time physical activity achieved with the intervention slowly diminished as the follow-up time increased. This result supported the observation of Dishman and Sallis (126). At the time of the 1-year follow-up, the female farmers of this study could not be informed about whether or not there would be further follow-ups. Regular feedback, contacts and information on the future part of the programme might have increased their activity. The intervention period of this study was short (2½months). Probably a longer intervention and repeated intervention during the follow-up would have made the effects more permanent. Simons-Morton et al. (40) and Verhoeven (46) recommended that health-related intervention be continuous and intensively provided to attain long-term effects. In this study continuity was hoped to be provided through occupational health services. On average in Finland an occupational health nurse meets a farmer once in every 2nd year in connection with health check-ups. During these meetings the occupational health nurse could also discuss leisure-time physical activity habits and work techniques and give individual counselling.

There are several theories and models used to increase adherence to physical activity. For example the use of the life-style approach (integrating physical activity into daily routines) (42) may increase the maintenance of leisure-time physical activity. During the present intervention, probably not enough attention was paid to the stages of behavioural change that people pass through as they permanently try to change their physical activity (127). In this study the female farmers in the action stage did not maintain in their action, or they did not progress from the action stage to the maintenance stage. On the contrary, they dropped from the action stage to the stage of preparation or earlier stages. Repeated intervention during the 6-year follow-up period and measures reinforcing behavioural change might have increased the number of female farmers in the maintenance stage. It has been estimated, that, if maintenance lasts 5 years, the risk for relapse drops considerably (127).

The baseline musculoskeletal fitness of the studied female farmers was about average as compared with that of Finnish women in the same age groups. The only exception was the static strength and endurance of the trunk extensors, which was higher among the female farmers than population average values (111). The cardiorespiratory fitness of the studied female farmers could be classified as the age-matched average (103). In this study the UKK Walk Test was used as an indicator of cardiorespiratory fitness. Laukkanen and her coworkers (103, 105, 128) have developed a formula to predict the VO_2 max from the UKK Walk Test using gender-specific equations including age, body mass index, performance time for the walk and heart rate immediately at the walk. This could not be used in this study, because, in some cases, only the index value was available for the data analysis.

In this study the female farmers' physical fitness improved in both the intervention and the control groups. The farmers in the control group also received some form of "intervention" because their physical fitness was tested with several tests 5 times during the follow-up and after each test they received feedback on their physical fitness. The farmers in the control group were also involved in basic occupational health services during the follow-up. Learning in tests could also have improved the results.

The physical activity of the groups focused on musculoskeletal fitness, but the training of cardiorespiratory fitness was also involved. The training in ergonomic work techniques that was included in the group counselling may have decreased the occurrence of musculoskeletal symptoms. These results support the findings of previous studies (8, 129, 130), in which worksite exercise programmes improved physical fitness and reduced musculoskeletal symptoms. The farmers in the intervention groups had made more changes in their work methods in the 3-year follow-up than did the farmers in the control groups, and this difference could also have had a positive influence on the occurrence musculoskeletal symptoms.

Farm work is heavy dynamic work (2) that consists of many static components. Young male workers who did physically heavy work had better aerobic fitness and hand-grip strength than those in physically light jobs. For women the trend was similar, but the differences between the job categories (heavy vs. light) were not significant (131). The results of Tammelin and Rintamäki (131) deviated from those regarding ageing workers, for whom physically heavy work has been associated with decreased physical fitness (132). In the present study, the female farmers' leisure-time physical activity was less than average, but their physical fitness level was average.

The total amount of physical activity involved in farming during the work day should be quantified to identify the possibilities of making farm work more varied and less static with changes in work techniques and work-rest regiments during a work day. Sometimes farm work may have some training effects on aerobic and muscular fitness. Probably, however, the most efficient way affect fitness is to minimise the potentially harmful physical load and incorporate physiologically correct dynamic load into work or leisure time, such as walking.

According to the work ability index the female farmers studied had, on average, good work ability (110). There were no differences in the changes in the values of the work ability index during the 6-year follow-up in the intervention and control groups. The baseline value was rather good, however, and none of the farmers rated their work ability as poor, only 9% having a moderate rating in the beginning of the study. It is easier to increase a moderate or poor level of work ability than an already good one (133).

Because of the physical nature of farm work, better physical fitness, improved work techniques and the use of less straining work methods should lead to a decrease in work load and strain and eventually result in better work ability and fewer days of sick leave. In this study the positive changes in physical fitness and work techniques did not affect work ability index, but they did seem to decrease the occurrence of some musculoskeletal symptoms.

A farm is not an ordinary worksite. Farmers live in their worksite in scattered settlements, and work is done in many sessions during the day. For example, participating in arranged physical activity groups is difficult because these groups usually meet in the evenings. Transportation to these group meetings can also be a problem. In most cases the workers on Finnish farms are a husband and a wife, and the only support network in the work community is the spouse and children. Support from the neighbourhood is questionable. Many farmers believed that the amount of physical activity required in their occupation negated the need for leisure-time physical activity although some of them felt that, despite their work, their aerobic fitness was poor (72).

Every farm and farmer is unique. The occupational health nurse from the FOHS familiarises herself with the farm environment during walk-through surveys and evaluates the farmers' health during health checks. It would be valuable to carry out an intervention in which individual counselling is 1st offered as a part of the FOHS and there after group counselling is provided, for example, once a week for 1 to 2 hours so that farmers would have a system to support behavioural change. A recently published practical model for the counselling of health-related physical activity could also be valuable for FOHS (134). The model was constructed around the following 5 steps: assessment of the current situation, planning, definition of the target, implementation and monitoring, evaluation, and reformulation. The model incorporates central behavioural strategies that are useful for increasing adherence to physical activity.

Because of a well-documented dose-response relationship between physical activity and health outcomes (43), the health value of daily moderate physical activity should be emphasised. This concept of reasoning provided the basis for recommendations that underline the health value of moderate physical activity or exercise performed in short bouts (as little as 10 minutes) if a sufficient number (3-5) of bouts accumulate almost every day (38, 43).

7. CONCLUSIONS AND RECOMMENDATIONS

This study confirmed that female farmers have a higher prevalence of chronic diseases than female blue- and white-collar workers in Finland. The prevalence of chronic diseases of male farmers equalled that of male blue-collar workers and was higher than that of white-collar workers. Musculoskeletal diseases, particularly back diseases, were the commonest chronic diseases among farmers. The perceived work ability of farmers seems to be poorer than that of other age-matched Finnish workers.

The exercise- and ergonomics-focused group counselling applied in this study was feasible as a part of the FOHS in municipal health care centres. The participation rate for group counselling was very high. The farmers and the personnel of the municipal health care centres considered this kind of approach suitable for occupational health services.

The group counselling increased leisure-time physical activity over the follow-up period of 1 year. The occurrence of musculoskeletal symptoms in the lower part of the body decreased in the intervention groups and increased in the control groups during the 6-year follow-up. Longer intervention and repeated intervention during the follow-up period might have made the effects on leisure-time physical activity more permanent.

The promotion of health and work ability for farmers should focus on the risk factors of musculoskeletal disorders in particular. Special attention should be given to farmers older than 34 years, female farmers, farmers having less than 10 years of education, farmers from small farms (less than 20 hectares of cultivated land), farmers who milk regularly, and farmers with symptoms of depression.

Promoting health and work ability is an essential part of FOHS, and different types of approaches should be evaluated. For example the feasibility and effects of the life-style exercise and a practical model for counselling with respect to health-related physical activity should be evaluated in FOHS. Ergonomic job redesign involving the introduction of improved work techniques should also be emphasised in such services.

YHTEENVETO

Suomessa oli vuonna 1997 noin 90 000 aktiivista maatilaa, joiden tilakoko oli keskimäärin 24 hehtaaria. Maataloustyö on edelleen fyysisesti raskasta, vaikka fyysiset kuormitustekijät ovat muuttuneet työn koneellistumisen myötä. Maatalousyrittäjillä on runsaasti tuki- ja liikuntaelinsairauksia ja niistä johtuvaa työkyvyttömyyttä. Maatalousyrittäjät kokevat työkykynsä heikommaksi ja harrastavat vähemmän vapaa-ajan liikuntaa kuin muut ammattiryhmät Suomessa. Maatalousyrittäjien työterveyshuolto on toiminut Suomessa vuodesta 1985 lähtien ja lähes puolet (44%) päätoimisista maatalousyrittäjistä on liittynyt terveyskeskusten tarjoamaan työterveyshuoltoon. Maatalousyrittäjien työterveyshuoltoon kuuluu määräajoin toteutettava työoloselvitys, terveystarkastus sekä yksilöllinen neuvonta ja ohjaus.

Tutkimuksen tavoitteena oli selvittää, ketkä maatalousyrittäjät erityisesti tarvitsevat terveyden ja työkyvyn edistämistä sekä arvioida työterveyshuollon järjestämän liikunta- ja ergonomianeuvonnan toteutettavuutta sekä sen lyhyt- ja pitkäaikaisvaikutuksia. Erityisesti selvitettiin neuvonnan vaikutuksia maatalon emäntien liikuntakäyttäytymiseen, fyysiseen kuntoon, tuki- ja liikuntaelinoireisiin ja työkykyyn.

Tutkimukseen kuului puhelinhaastattelu ja satunnaistettu kontrolloitu interventiotutkimus, johon kuului 1-, 3- ja 6-vuotisseuranta. Puhelinhaastatteluun osallistui 577 päätoimista maatalousyrittäjää ja interventiotutkimukseen yhteensä 126 lypsykarjatilan emäntää. Interventiotutkimuksen tutkimusmenetelmiä olivat kysely ja fyysisen kunnon mittaukset. Ryhmätoiminnan tavoitteena oli tukea ja lisätä emäntien liikunnan harrastamista, parantaa fyysistä kuntoa ja työkykyä sekä vähentää tuki- ja liikuntaelimistön kuormitusta ja oireita. Ryhmät kokoontuivat 1-2 kertaa viikossa keskipäivällä 1-3 tuntia kerrallaan terveyskeskusten tiloissa 2½ kuukauden ajan.

Maatalon emännillä oli yleisemmin pitkäaikaissairauksia kuin muilla työssäkäyvillä suomalaisnaisilla. Maatilan isäntien pitkäaikaissairastavuus oli yhtä yleistä kuin työntekijämiehillä, mutta yleisempää kuin toimihenkilömiehillä. Tuki- ja liikuntaelinsairaudet, erityisesti selkäsairaudet, olivat maatalousyrittäjien yleisimpiä pitkäaikaissairauksia. Yhdeksän kymmenestä tuki- ja liikuntaelinsairaasta

maatalousyrittäjästä ilmoitti, että sairaus oli aiheuttanut heille ongelmia työssä. Maatalousyrittäjät kokivat työkykynsä muita ammattiryhmiä huonommaksi.

Liikunta- ja ergonomiapainotteinen ryhmätoiminta toteutui hyvin maatalousyrittäjien työterveyshuollossa. Sekä emäntien että terveyskeskuksen henkilökunnan mielestä toiminta sopii hyvin maatalousyrittäjien työterveyshuoltoon.

Liikunta- ja ergonomiapainotteisiin ryhmiin osallistuneiden emäntien vapaa-ajan liikunnan harrastaminen lisääntyi ensimmäisen seurantavuoden aikana. Alavartalon tuki- ja liikuntaelinoireet vähenivät kuuden vuoden seuranta-aikana koeryhmissä, mutta lisääntyivät vertailuryhmissä. Sekä koe- että vertailuryhmiin osallistuneiden emäntien fyysinen toimintakyky parani kuuden vuoden seuranta-aikana. Pidemmät ja toistuvat interventiot seuranta-aikana olisivat todennäköisesti aikaansaaneet pysyvämmän muutoksen emäntien liikuntakäyttäytymisessä.

Maatalousyrittäjien terveyden ja työkyvyn edistäminen tulisi kohdistua erityisesti tuki- ja liikuntaelinongelmaisiin maatalousyrittäjiin. Pitkäaikaissairastavuuden, alentuneen työkyvyn ja heikon fyysisen kunnon riskiryhmiin kuuluivat yli 34-vuotiaat, naiset, vähän (alle 10 vuotta) koulutetut, pienillä tiloilla (viljelyala alle 20 hehtaaria) työskentelevät, säännöllisesti lypsytyötä tekevät ja masennuksesta kärsineet.

Terveyden ja työkyvyn edistäminen on olennainen osa maatalousyrittäjien työterveyshuoltoa. Tulevaisuudessa tulisi selvittää, miten työterveyshuollossa annettu yksilöllinen liikuntaneuvonta ja työtapojen ohjaus yhdistettynä ryhmätoimintaan vaikuttaa maatalousyrittäjien työ- ja toimintakykyyn. Lisäksi tulisi selvittää miten liikunta niveltyy maatalousyrittäjien päivittäiseen toimintaan.

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