Evaluation of a participatory ergonomic intervention process in kitchen work


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Abstract

We evaluated a participatory ergonomic intervention process applied in 59 municipal kitchens. In groups of three to five kitchens, the workers participated in eight workshops, and generated and evaluated solutions to optimize musculoskeletal load in their work. An ergonomist initiated and supported the process. By the end, 402 changes were implemented. Evaluative data were collected using research diaries, questionnaires, and focus group interviews. The intervention model proved feasible and the participatory approach was mostly experienced as motivating. The workers' knowledge and awareness of ergonomics increased, which improved their ability to tackle ergonomic problems by themselves. The changes in ergonomics were perceived to decrease physical load and improve musculoskeletal health. As hindering factors for implementation, lack of time and motivation, and insufficient financial resources were mentioned. In addition, the workers expressed a wish for more support from the management, technical staff, and ergonomists.

Keywords: Participatory approach; Intervention process; Musculoskeletal load

1. Introduction

Both physical load and psychosocial factors at work have been shown to play a role in the aetiology of musculoskeletal disorders (Ariens et al., 2001; Hoogenboom et al., 1999, 2000; National Research Council and Institute of Medicine, 2001; Riihimäki and Viikari-Juntura, 1999). We can therefore hypothesize that musculoskeletal problems can be reduced by optimizing the biomechanical and psychosocial load at work.

The participatory approach has been successfully used in several studies to reduce physical work demands and to prevent musculoskeletal disorders (Hignett et al., 2005; van der Molen et al., 2005a; Vink et al., 2006). In this approach, workers play an active role in the analysis of work and the planning of improvements (Haines and Wilson, 1998). Its benefits have been the utilization of workers' experience and knowledge, learning of participants, and their commitment and better acceptance of changes (Wilson, 1995).

Intervention programmes have seldom been documented and evaluated adequately (Lincoln et al., 2000; van Poppel et al., 1997; Westgaard and Winkel, 1997). Among the most obvious objects of evaluation are the incidence of disorders, work satisfaction, and productivity. However, even the process of intervention deserves to be assessed, e.g., the number of changes implemented, participants' satisfaction with their involvement (Wilson and Haines, 2001), as well as their awareness and knowledge of ergonomics.

Kitchen work includes many physical and psychosocial load factors and the employees have plenty of musculoskeletal problems (Arbetsmiljöverket and Statistiska centralbyrån, 2004; Huang et al., 1988; Ono et al., 1998; Pekkarinen and Anttonen, 1988; Perkiö-Mäkilä et al., 2008).
This study is part of a randomized controlled trial aimed at reducing the occurrence of musculoskeletal disorders. The aims of the intervention were to increase workers’ knowledge and awareness regarding ergonomics of their work, to encourage workers to be active participants in developing ergonomics, and to implement improvements in kitchen ergonomics. This article describes the intervention process and evaluates its feasibility with regard to the elements of the intervention process, and available resources and support. We also report the effects of the intervention on ergonomic knowledge and awareness, and the workers’ expectations and perceived effects of the intervention on workload and musculoskeletal health. The efficacy of the intervention will be reported elsewhere.

2. Material

The study was performed in municipal kitchens of four large cities in Finland. Kitchens with at least three full-time employees working at least 6 h per day were included. Kitchens were randomized to intervention \( n = 59 \) and control \( n = 60 \) group. This article involves only the intervention kitchens, in which the workers developed their working conditions over an 11–14-month intervention period.

The 59 intervention kitchens belonged to schools \( n = 43 \), kindergartens \( n = 10 \), nursing homes and geriatric service centers \( n = 5 \), and one was a central kitchen. The total number of workers was 263. Eighty-six percent \( n = 227 \) of them remained employed in the same kitchen throughout the intervention phase. The workers were mainly women (96%) with a median age of 46 (range 19–63) years. The median time in kitchen work was 17 (range 0–40) years. Over the last 3 months, 87% of workers had reported pain in some part of the musculoskeletal system, mostly in the neck (71%), lower back (50%), or forearms or hands (49%) (Haukka et al., 2006).

3. Intervention process

The intervention was carried out in a participatory way based on the experiences and model developed earlier at the Finnish Institute of Occupational Health (Leppänen, 2001; Leppänen et al., 2005). The approach was based on active group work: the workers identified problems in their work and generated and evaluated solutions for them. The changes were implemented together with the workers, middle management and technical staff. The role of the ergonomist was to initiate and guide the process, train the participants, and be available for consultation. In two cities, a local steering group was set up for improving the exchange of information between the research group and food service management.

To be able to provide sufficient research personnel to support the intervention and to manage the data collection, the intervention phase was executed in series of three to five kitchens. The series \( n = 16 \) entered the study sequentially (Fig. 1). The study was carried out by four teams, composed of two researchers each. One researcher (later in the text ‘ergonomist’) was in charge of the implementation, whereas the main task of the other was to assess the state of ergonomics and document the implemented changes. Two teams handled seven series, and the other two one series each. Regular meetings were held to standardize the working methods of the teams. In addition, a project coordinator participated in the workshops, observed the working of the researchers, and provided them with feedback.

The intervention phase was composed of a 2-month pre-implementation phase and a 9–12-month implementation phase (Fig. 2). The total duration of the intervention phase was usually 14 months (in 40 kitchens in 11 series). In 19 kitchens (5 series), the length was 11 months because the kitchens of schools were closed for over 2 months during summer holidays.

3.1. Pre-implementation phase

At the beginning, the management and kitchen workers were informed of the project and encouraged to participate...
in the study. The first meetings were held with representatives of food service management in order to obtain their commitment. Later the workers of the eligible kitchens were invited to meetings, where the objectives and study protocol were presented. Informed consent to participate was obtained from each kitchen and worker separately.

At baseline, musculoskeletal risk factors, ergonomics of the workplace, work environment, and safety at work were assessed during 1 day in each kitchen using standardized methods developed for the study. In addition, the workers received questionnaires on musculoskeletal disorders and the physical and psychosocial load at work.

During the pre-implementation phase, all participating workers of each series of three to five kitchens gathered twice for a 5-h workshop. The foodservice management and technical staff were also invited to participate. In the first workshop, the ergonomist trained the workers to model their work as a complete process. Kitchen work was structured to include seven main tasks: (1) preparation, (2) cooking and baking, (3) distributing and serving food, (4) packing food to be delivered to customers, (5) dishwashing, (6) cleaning and maintenance of room and equipment, and (7) receiving and storing of raw material. Each kitchen selected two or three work tasks that the workers considered physically loading, split them up into sub-tasks, and started the ergonomic analysis. The workers were advised to target the changes to tasks that were physically strenuous, repeated at least weekly, performed by several workers, or involved a risk of sudden overloading.

Before the second workshop, the workers had a 1-month period to study the selected work tasks, collect the necessary data, and continue analysing the tasks. The ergonomist supported their work by visiting and phoning each kitchen once during this period. In the second workshop, the kitchens selected the first targets for development, planned the implementation, and agreed on the time schedule and responsible persons.

3.2. Implementation phase

In the implementation phase, the intervention process was activated by training the workers in ergonomics. Six 3-h workshops were arranged, which rotated between the kitchens within the series. This enabled the workers to see different solutions in other kitchens and learn from them. Each workshop had a specific theme and the workers received relevant practical training (Fig. 2). The order of the themes varied according to the needs in the process. The workers discussed the progress and further actions of the ongoing development, evaluated solutions and tried to solve problems together. The researchers collected the experiences of good practices in the kitchens into an idea folder, which served as background information for the development. During the implementation phase, the ergonomist supported the development at the workshops, and visited the kitchens on demand. If needed, he/she convened a meeting with collaborative partners, e.g., schoolteachers or deliverers of goods. No extra funding for ergonomic improvements was available, and the changes were implemented within the annual food service budgets.
4. Evaluation of the intervention process

Several types of data were used to study the feasibility of the intervention process and intermediate effects of the intervention. Feasibility was assessed by questionnaires and focus group interviews. The research diaries served as background information. In the evaluation of effects, we focused on implemented changes as well as the changes in workers’ knowledge of ergonomics, their attitudes and ways of functioning. Table 1 presents the data collection scheme and response rates in the study. Table 2 shows the methods to assess feasibility and effects of the intervention.

4.1. Feasibility of participatory approach

The success of the intervention process was evaluated by a questionnaire, filled in collectively by the staff of each kitchen at the end of the intervention phase. Satisfaction with the arrangements of the project, flow of information, implemented changes, and support from the management were assessed on a five-point scale (1 = very dissatisfied, 2 = fairly dissatisfied, 3 = undecided, 4 = fairly satisfied, 5 = very satisfied).

In two cities, the experiences of the project were collected after the intervention phase through focus group interviews.
In both cities, the interviewed group consisted of three kitchen workers and three food service management representatives. The duration of the semi-structured interviews was 1.5 h, during which 10 topics were presented in question form to the participants. Eight of them were for collecting experiences in order to assess feasibility: general opinions regarding the process, experiences of the participatory approach, benefits of the project, difficulties in the project, facilitating factors in the implementation, hindering factors in the implementation, support and time needed for development, and the organization of work tasks during the intervention phase. The interviews were recorded on a minidisc.

In the research diaries, the researchers documented dates and time of visits made to the kitchens, meetings with collaborative partners, and the participation rates of the workers, management and technical staff in the workshops. The kitchens registered the time they used for the project.

4.2. Measuring the effects

The level of knowledge on ergonomics was assessed before and after the intervention phase in two cities by a questionnaire. Each worker filled in the questionnaire individually. The questionnaire included 10 statements (ranging from 1 = totally agree to 7 = totally disagree) on the topics discussed in the workshops. For each question, the response was given a score from one to seven, one reflecting incorrect answer and seven correct answers.

Workers’ expectations regarding the effects of the intervention process were examined in two cities (n = 101 workers) before the intervention phase using a questionnaire with three questions. (1) “To what extent can ergonomics be improved in your kitchen?” (2) “How much could the workload be reduced by changes in ergonomics in your kitchen?” (3) “To what extent can the health of the musculoskeletal system be influenced by ergonomic changes in your kitchen?” The workers filled in the questionnaires individually using a five-point scale (1 = not at all, 5 = very much). After the intervention phase, identical questions were posed in all cities (n = 216 workers). Eighty workers responded the questionnaire both before and after intervention.

Focus group interviews included two topics on the effects of the intervention: effects on the level of knowledge and attitudes regarding ergonomics, and effects on workload and musculoskeletal health.

The researchers documented all changes in the kitchens during the intervention and 1-year follow-up. They evaluated their significance with regard to the load on the musculoskeletal system and occupational safety. They also documented reasons for any planned measures not being completed. Later they classified the implemented changes into six categories by target of change, and the incomplete or unfinished attempts into six categories according to the reasons for incompletion.

4.3. Data analysis

Descriptive statistics were computed for the turnover of staff in kitchens, participation rates in the workshops, and time needed for development. Descriptive results are also given for the questionnaire data on workers’ opinions on the success and effects of the process. The general knowledge level of ergonomics was assessed by calculating the mean score for the 10 statements on ergonomics: the higher the mean score the better the knowledge. Overall change in the general knowledge of ergonomics was analyzed using the paired t-test and mixed models. The difference between the expectations before and the perceived effects after the intervention was analyzed with the Wilcoxon signed rank test. The SAS 9.1 statistical package (SAS Institute Inc., 2004) was used in all analysis.

One of the authors (I.P.) studied the recordings of focus group interviews and identified emerging themes related to feasibility and effects.

5. Results

5.1. Feasibility of the intervention process

The results of the questionnaire show that the process was seen as very or fairly satisfying by the majority of workers (Fig. 3). Dissatisfaction was most common with collaboration between the kitchens and support from the management (Figs. 3 and 4), especially in city D. According to the focus group interviews, both the workers and management considered the intervention model feasible. The workers found it useful to become acquainted with other kitchens and to learn from each others’ solutions. The workers felt that community spirit in their own kitchens and co-operation between the kitchens had improved.

A total of 402 changes implemented during the intervention phase were assessed by the researchers to be beneficial with regard to the load on the musculoskeletal system or occupational safety. Furthermore, 101 changes took place during the 1-year follow-up period. A total of 113 planned changes were not completed. The reasons for interruption or delay of the implementation were lack of time or motivation of workers (30%), problems with collaborative partners (12%), technical problems (10%), and lack of financial resources (9%). In 8% of the cases, a new method or new equipment was tested, but the old one was preferred. In about a third of the cases, the reason for the interruption or delay was not known. Lack of time or financial resources were also cited as hindering factors for the implementation of changes in the focus group interviews.

In the workshops, the participation rate of the workers was 60–83%. The total time spent on the information meeting, workshops and support visits was about 30 h per worker. In addition, the median time used for the
development was 5.5 (range 1–20) h per kitchen. None of the kitchens dropped out during the intervention phase. The participation rates of the management and technical staff in the workshops varied between the cities. According to the questionnaire, the workers were relatively dissatisfied with support from the management. The proportion of dissatisfied kitchens was 56% varying between 27% and 93% according to city (Fig. 4). Based on the focus group interviews, workers felt that their expectations were not always met.

5.2. Effects of intervention process

Table 3 shows the implemented changes \((n = 402)\) classified by target. The changes were typically targeted at organization, methods and practices of work (41%), and machines, equipment or tools (27%).

In total, 70 workers answered both questionnaires on ergonomic knowledge. The majority of them (76%) participated in the intervention workshops five to six times and their general knowledge of ergonomics increased significantly (mean rating of the 10 statements increased from 3.5 to 4.4, \(p < 0.01\)). The rest of the workers participated zero to four times. Their ratings of ergonomic knowledge decreased slightly but non-significantly (from 4.6 to 3.8).

According to the questionnaire, the workers’ expectations of the effects of the intervention at baseline were more positive than their assessments of them at the end of the intervention phase (Fig. 5). Before the intervention, 51% expected much or very much improvement in ergonomics, 67% much or very much reduction of musculoskeletal loading, and 75% much or very much influence on musculoskeletal health. After the intervention, the corresponding proportions were 43%, 40%, and 39% (statistically significant difference for musculoskeletal loading and health, \(p < 0.01\)).

Based on the focus group interviews, the workers felt that the information on ergonomics during the project and the opportunity to learn how to develop their work, gave them more confidence and skills to tackle ergonomic problems in the future. In their own words, they “received permission to think about ergonomics and developed courage to ask for help from their colleagues”. They also experienced that they could take ergonomics better into account when purchasing new tools and equipment. The workers perceived that workload and musculoskeletal pain had diminished.

6. Discussion

The participatory ergonomic intervention process applied in 59 municipal kitchens was evaluated using questionnaires, focus group interviews and research diaries. The applied model was feasible and the participatory approach motivated the workers. The knowledge and awareness of ergonomics increased, and workers estimated...
the effects of the intervention on musculoskeletal load and disorders as positive. Yet their expectations regarding these effects before the intervention were higher than their assessments of them after the intervention. Furthermore, more support was desired from the management, technical staff, and ergonomists.

The applied approach proved to be practicable. Similar approach has been used earlier (de Jong and Vink, 2002; Rosecrance and Cook, 2000; Wilson, 1995; Vink et al., 1995), but in our study the workshops were held alternately in each kitchen of a series. This provided all employees the opportunity to become acquainted with other kitchens and share ideas and experiences with the other participants. The workers considered this very useful, but they would have desired more time to be allocated to this kind of practical learning. Visiting other workplaces of the same industry was also applied in a previous study, but only small representative groups of workers made these visits (Wilson, 1995).

Although the employees work much as a team in the kitchens, the participatory approach was a new concept and training could have been helpful in getting off the ground faster (Gjessing et al., 1994). The role of the ergonomist was more active at the start of the project, when he/she gave basic information on ergonomics, laying the foundation for the development process and activating the workers. Later the ergonomist worked more in the background by supporting the workers as has been proposed in earlier studies (Haims and Carayon, 1998; Westlander et al., 1995). However, in some kitchens more guidance from ergonomists might have given better results.

In this project, the workers were active members of the teams while the role of the management was to provide commitment and support to the project as well as to organize time and resources for the implementation of the interventions. The project was well accepted by the workers: none of kitchens dropped out during the intervention phase. The participation rate in the workshops was high, although it was often difficult to allocate time and simultaneously manage the ordinary tasks.

According to the questionnaire, the workers were not satisfied with the support from the management, but unfortunately we did not ask what kind of support was wished for (e.g., participation in the workshops, support during changes, financial support, time resources). Active participation of the management and technical staff would most likely accelerate the implementation of the interventions (Hignett et al., 2005), and this varied: in some series the management did not participate in the workshops at all and therefore the workers might have questioned their commitment to the project. It is possible that the role of the foodservice management was not made clear enough at the beginning. Based on the experiences in the first two cities, the ergonomists encouraged the foodservice management to participate more actively later on during the study. On the other hand, the participation of the management in the workshops may limit discussions between workers (Gjessing et al., 1994). In our study, the more satisfied the kitchen was with the support from the management the better the effects were evaluated by the workers.

According to the focus group interviews, the workers’ level of ergonomic knowledge and awareness of ergonomic aspects increased, which improved their confidence and ability to tackle these problems by themselves. The increase in general knowledge regarding ergonomics was associated with participation activity in the workshops, suggesting that the goal to disseminate information was reached.

More than 400 changes were implemented during the intervention phase. The kitchens had no extra funding for the development and therefore most of the changes were targeted at working methods and practices, and low-cost
solutions. Major changes of equipment are often expensive, for example, in dishwashing. In some kitchens, environmental constructions and equipment were old and therefore more extensive structural changes would have been needed. However, one benefit of the limited financial resources was that workers realized that good ergonomic solutions could be achieved at low cost.

About 100 planned measures were not completed. Most often the reason for non-completion was, as in a previous study (Rosecrance and Cook, 2000), the lack of time or often the reason for non-completion was, as in a previous solutions could be achieved at low cost. According to the focus group interviews, it was difficult to find common time for all workers. In spite of the participatory model, the kitchen manager had often taken the main responsibility for the development.

The intervention phase was time-consuming. The aim was that workers internalize the way of thinking of ergonomics, which would then lead to a sustainable change. Such a change may take time and therefore perhaps even a longer intervention period would have been beneficial. Long intervention studies, however, may be unshielded from unexpected changes (Cole et al., 2003; Kilbom, 1988; Silverstein and Clark, 2004; Smedley et al., 2003; Westlander et al., 1995). In our study during the intervention phase, major reorganization of foodservice began in two cities, which may have affected accessible personnel and financial resources, as well as the motivation of the workers. Nevertheless, the intervention phase proceeded well in spite of reorganization of kitchen work.

According to the literature (Haines and Wilson, 1998; Goldenhar et al., 2001; Van der Molen et al., 2005b), there is a number of ways to evaluate participatory programmes. In the present study, our focus was to evaluate the process mainly from the workers’ viewpoint. In focus group interviews also, the perception of the management was obtained. The study, however, provided a limited scope of the production system as a whole.

In conclusion, the participatory approach proved to be feasible and motivating. By combining theoretical learning and practical training with learning from each others’ solutions, the workers’ knowledge and awareness of ergonomics increased. Most workers were satisfied with the intervention and a great proportion of them felt that it had a positive influence on physical load and musculoskeletal health. A substantial number of changes were implemented in the kitchens, even though no extra funding for improvements was available. It may be that more active participation of the management and technical personnel as well as better collaboration and communication between workers, management, and technical personnel could have resulted in an even higher number of changes. The participation model used in this study could be modified for the use of occupational health or ergonomics services in development projects in kitchens and other workplaces.

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