

Effectiveness of workplace interventions in Europe promoting healthy eating: a systematic review

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Background: The worksite is a promising setting for health promotion. This review summarizes the evidence of effect of intervention studies in European countries promoting a healthy diet solely and in combination with increasing physical activity at the workplace. **Methods:** A systematic review of published literature was carried out. Inclusion criteria were: studies conducted in European countries; papers published from 1 January 1990 to 1 October 2010; worksite-based interventions promoting a healthy diet solely or in combination with physical activity; primary prevention; measurement of anthropometrical or behavioural change and adults (≥ 18 years old). Levels of evidence for intervention effectiveness on behavioural determinants, nutrition and physical activity behaviours and body composition and the quality of the included interventions were assessed. **Results:** Seventeen studies solely focusing on promotion of a healthy diet were identified. Eight were educational, one used worksite environmental change strategies, and eight used a combination of both (multi-component). None of the interventions were rated as 'strong'; seven met the criteria for 'moderate' quality. The reviewed studies show moderate evidence for effects on diet. Thirteen studies focusing both on nutrition and physical activity (nine educational and four multi-component studies) were identified. Ten were rated as having 'weak' and three as having 'moderate' methodological quality, providing inconclusive evidence for effects. **Conclusion:** Limited to moderate evidence was found for positive effects of nutrition interventions implemented at the workplace. Effects of workplace health promotion interventions may be improved if stronger adherence to established quality criteria for such interventions is realized.

Introduction

Highly prevalent health problems related to eating habits, such as obesity, myocardial infarction and stroke, type 2 diabetes mellitus and musculoskeletal disorders not only affect the elderly population, but also the middle aged adult working population.¹ Furthermore, nutrition related health problems may lead to high rates of absenteeism and productivity loss.^{2–5} Effective interventions to prevent such burden of disease may have economic benefits⁶ next to improvement of health and quality of life.

Healthful nutrition promotion at the worksite also has the potential to reach large parts of the adult population from different social background and adults spend a considerable amount of time at work.

Several reviews have summarized the effectiveness of workplace healthy nutrition promotion.^{7–19} These reviews covered mainly studies conducted outside European countries. All these reviews differed in their focus regarding the type of studies, the type of intervention and the type of outcome variables included. The published reviews primarily aimed at the inclusion of studies with strong internal validity, i.e. RCTs and on the reporting of effect sizes. It has, however, been argued that such a strong focus on internal validity in a field where RCTs may not be always appropriate, may result in biases about effectiveness,²⁰ and may prevent interventions with stronger external validity to be included in the reviewed literature.¹⁴ Only Harden *et al.*¹⁶ paid explicit attention to characteristics of the interventions that might lead to a large reach of the target population and the sustainability of the interventions, and identified specific characteristics that appeared to mediate success of the intervention.¹⁶

In the USA, the implementation of workplace health promotion is mainly driven by the expectation of the employers to reduce costs.⁸ In Europe, there are less financial incentives for the employer to implement health promotion programmes in the workplace. In most European countries, the costs for sick employees are only paid for by the employers directly during a limited period of time; after that period, national health systems take most of the responsibility by far. For employers in European countries reducing absenteeism because of sickness and enhancing employee performance, safety and morale might be more important drivers for workplace health promotion than direct costs. The lower nutrition and physical activity-related health problems in Europe and the less important financial drivers create a different environment for European employers and for employees concerning workplace health promotion. This might lead to a lower motivation in European companies to finance and implement complex and effective interventions that comply with the quality criteria for successful interventions (European Network of Workplace Health Promotion, www.enwhp.org). Also from the side of the workers there might be less acceptance of and a lower and more selective participation in these interventions.

Given the different contexts regarding the workplace, health systems and nutrition between Europe and other parts of the developed world and the potential differences in underlying rationale and given the lack of existing reviews of interventions conducted across Europe, the review has two aims: (i) to summarize the evidence of effect (on body composition, behaviour and determinants of behaviour) of interventions promoting a healthy diet solely and in combination with increasing physical activity in workplaces in Europe; (ii) to evaluate the quality of the included interventions against the general criteria of good workplace health promotion.

This review was executed in the context of the HOPE-project [Health Promotion through Obesity Prevention across Europe (www.hopeproject.eu)], a European commission funded 6th framework project.

Methods

Literature search

Pubmed, Web of Science, CINAHL, The Cochrane Library and MDConsult were searched from 1990 up to 1 October 2010. The search was run by one reviewer (EVC) in October 2007 and was rerun in January and June 2008 (EVC), and October 2010 (EDP). Reference lists of all retrieved articles and review articles were reviewed for potentially eligible articles; also specialized websites were scanned.

Selection criteria

Inclusion criteria were: studies in countries of the European continent, dealing with interventions at the worksite aiming at the primary prevention of obesity and obesity-related diseases in which the main component or one of the components was the promotion of a healthy diet in ≥ 18 years old; including anthropometrical measures of obesity and dietary intake. There were no restrictions on study design, study duration, follow-up period, intervention strategies and control condition or on who delivered the intervention.

Exclusion criteria were: studies conducted outside the European continent; published before 1990; evaluating interventions that had a worksite component but conducted mainly outside the worksite (e.g. community, family); interventions that were not designed for health promotion and primary prevention (i.e. for the treatment of chronic diseases, aimed at obese or diabetic adults, aimed at treatment or management of eating disorders, or aimed at adults with an elevated cholesterol level) and studies that did not report the effect on behaviour and/or on anthropometrics.

One reviewer (E.V.C.) reviewed all titles and abstracts until June 2008 and one reviewer (E.D.P.) from June 2008 until October 2010; an evaluation of the full copies was conducted by the review team (E.V.C., H.S., I.D.B. and L.M.) to further refine the results using the aforementioned criteria. Disagreements between the reviewers were resolved by discussion until consensus was reached.

Assessment of the study design quality

A standardized tool²¹ for the assessment of the quality of the study design was used. The six criteria used were: representativeness of the study population, allocation bias, control of confounders, blinding, reliability and validity of the data collection tools and the withdrawals and drop-outs. Each criterion was rated as strong, moderate or weak and then summed to obtain an overall rating for each study. Studies with at least four criteria rated as strong and with no criteria rated as weak were given an overall rating of 'strong'. Those studies receiving less than four strong ratings and only one weak rating were given an overall rating of 'moderate', and those studies with two or more criteria rated as weak were given an overall study rating of 'weak'.

The assessment instrument for the quality of the study design was pilot-tested independently by two reviewers (E.V.C. and H.S.) on four studies. The reviewers compared their ratings, and where disagreement was noted, a consensus was reached through discussions. The quality assessment of the remaining studies was completed by one reviewer (E.V.C.) and doubts were discussed with another reviewer (H.S.) until disagreements were resolved.

Intervention quality

The quality of the evaluated interventions was assessed using the criteria of The European Network for Workplace Health Promotion (ENWHP, www.enwhp.org). The following criteria were rated: prior analysis of the needs of the worksite; involvement of all stakeholders; improvement of the quality of working life and conditions as well as focusing on the behaviour of the individual worker; integration of the activities in the

management practices and daily working life of the enterprise. Additionally, the criterion 'theory-based intervention development' was added as theories help to explain health behaviours or provide a systematic method to guide health promotion practice.²² The quality assessment of the interventions was done by one reviewer (W.V.L.); in case of uncertainty about certain quality assessment criteria, a second reviewer independently repeated the assessment (L.M.).

Data extraction

To review the characteristics of the included studies, one reviewer (E.V.C.) extracted detailed information into summary tables.

Grading of evidence

A rating system of levels of evidence was used to draw conclusions on effectiveness on determinants, behaviours and anthropometrics.^{11,23–25} Some important adaptations were made to the system because this review included studies regardless of their design and because a slightly different quality assessment tool was used.

The following five levels were distinguished based on the number, design, overall methodological quality and overall effectiveness of studies: (i) strong evidence: (a) at least two RCTs rated as strong or (b) one strong RCT and at least two RCTs rated as moderate. For both situations consistent results are required; (ii) moderate evidence: (a) one RCT rated as moderately strong and at least one RCT rated as weak or (b) one RCT rated as moderately strong and at least one non-randomized but controlled trial of moderate strength or (c) at least three strong non-random but controlled trials or (d) one strong controlled trial and at least three moderate controlled trials. For all situations, consistent results are required; (iii) limited evidence: (a) more than one RCT rated as weak or (b) one controlled trial without randomization rated as strong and two weaker of such trials or (c) at least two of such weaker controlled trials and at least two before-after, cohort or longitudinal studies. For all situations, consistent results were required; (iv) inconclusive evidence: (a) only one study or (b) multiple before-after, cohort or longitudinal studies or (c) contradictory results; and (v) no evidence: more than one study with the consistent result that no significant or relevant results were shown. If none of the relevant studies pointed in the opposite direction (i.e. a study with a significant negative effect) and maximum 33% of them had mixed results, the overall results were considered to be consistent.

Data synthesis

Because of the heterogeneity of studies with respect to study designs, interventions, participants, measures and outcomes, a meta-analysis was not conducted to estimate a pooled effect size. Our findings, therefore, resulted in a descriptive systematic literature review. We assessed levels of evidence according to outcome measure (i.e. behavioural determinants, behaviour and anthropometrics) and type of intervention (i.e. educational, environmental and multi-component).

Results

Literature search

The initial search yielded 3709 publications (figure 1), after reviewing the titles or abstracts or both, 140 were left. Checking the references in these papers and in review articles produced an additional 15 papers. After completely reviewing the 155 articles, 118 publications were excluded because they did not meet one or more of the inclusion criteria. Thirty studies (reported in 37 articles) were included, 17 studies focused on nutrition while 13 studies focused on nutrition and physical activity.

Characteristics of the studies

Descriptions of the intervention characteristics can be found in Supplementary Appendix 1a and 1b.

There was a great difference in the quality of the study designs. None of the 30 studies met all six methodological criteria needed to be rated as

Table 1 Summary of the level of evidence of different interventions and effect indicators

Intervention type and study quality	Effect indicator	Level of evidence
Nutrition only: educational (n=8)		
Armitage <i>et al.</i> 2001 (r7) (<i>moderate quality</i>)	Anthropometric measures	Inconclusive
Brug <i>et al.</i> 1996 (r2) (<i>moderate quality</i>)	Dietary behaviours	Moderate
Brug <i>et al.</i> 1999 (r3) (<i>moderate quality</i>)	Potential determinants	Moderate
Oenema <i>et al.</i> 2001 (r4), 2005 (r5) (<i>moderate quality</i>)		
De Bourdeaudhuij <i>et al.</i> 2007 (r6) (<i>moderate quality</i>)		
Siggaard <i>et al.</i> 1996 (r1) (<i>moderate quality</i>)		
Armitage <i>et al.</i> 2004 (r7) (<i>weak quality</i>)		
Papadaki <i>et al.</i> 2005 (r11), 2006 (r12) (<i>weak quality</i>)		
Nutrition only: environmental (n=1)		
Lassen <i>et al.</i> 2003 (r13) (<i>weak quality</i>)	Anthropometric measures	No studies
	Dietary behaviours	Inconclusive
	Potential determinants	No studies
Nutrition only: multi component (n=8)		
Braeckman <i>et al.</i> 1998 (r8), 1999 (r9) (<i>moderate quality</i>)	Anthropometric measures	Inconclusive
Steenhuis <i>et al.</i> 2004 (r15) (<i>weak quality</i>)	Dietary behaviours	Moderate
Holdsworth <i>et al.</i> 2000 (r16), 2004 (r17) (<i>weak quality</i>)	Potential determinants	Inconclusive
Liddell <i>et al.</i> 1992 (r21) (<i>weak quality</i>)		
Thorsteinsson <i>et al.</i> 1994 (r14) (<i>weak quality</i>)		
Oshaug <i>et al.</i> 1995 (r20) (<i>weak quality</i>)		
Balfour <i>et al.</i> 1996 (r19) (<i>weak quality</i>)		
Gill <i>et al.</i> 2004 (r18) (<i>weak quality</i>)		
Nutrition and Physical activity: educational (n=9)		
Hanlon <i>et al.</i> 1995 (r34), 1998 (r35) (<i>moderate quality</i>)	Anthropometric measures	Inconclusive
Hedberg <i>et al.</i> 1998 (r36) (<i>moderate quality</i>)	Dietary behaviours	Inconclusive
Cockcroft <i>et al.</i> 1994 (r25) (<i>weak quality</i>)	Physical activity	Limited
Nisbeth <i>et al.</i> 2000 (r31) (<i>weak quality</i>)	Potential determinants of dietary behaviours	Inconclusive
Proper <i>et al.</i> 2003 (r22) (<i>weak quality</i>)	Potential determinants of physical activity	Inconclusive
Karlehagen <i>et al.</i> 2003 (r23) (<i>weak quality</i>)		
Talvi <i>et al.</i> 1999 (r33) (<i>weak quality</i>)		
Addley <i>et al.</i> 2001 (r24) (<i>weak quality</i>)		
Schilling <i>et al.</i> 2001 (r26), 2005 (r27) (<i>weak quality</i>)		
Nutrition and physical activity: multi component (n=4)		
Hope <i>et al.</i> 1998 (r29), 1999 (r30) (<i>weak quality</i>)	Anthropometric measures	Inconclusive
Murza <i>et al.</i> 1994 (r28) (<i>weak quality</i>)	Dietary behaviours	Inconclusive
Saarni <i>et al.</i> 2001 (r32) (<i>weak quality</i>)	Physical activity	Inconclusive
Kwak <i>et al.</i> 2009 (r37), 2010 (r38) (<i>moderate quality</i>)	Potential determinants of dietary behaviours	Inconclusive
	Potential determinants of physical activity	Inconclusive

References within parenthesis are available as Supplementary Appendix online.

‘strong’. Of the 17 nutritional interventions, 7 were rated as ‘moderate’ (Online refs r1–r9, available as Supplementary Appendix online) and 10 were rated as having a weak quality. (Online refs r10–r21, available as Supplementary Appendix online) Most (10 out of 13) of the studies focusing on nutrition and physical activity were rated as ‘weak’, (Online refs r22–r33, available as Supplementary Appendix online) only three studies were evaluated as ‘moderate’ (Online refs r34–r38, available as Supplementary Appendix online).

Only one of the interventions fulfilled all the necessary quality criteria. (Online ref r28, available as Supplementary Appendix online)

Evidence of effect

The results of each study for anthropometrics, behaviour and determinants separately, and also information concerning the quality of the study design and study type can be found in Supplementary Appendix 2a and 2b. Several studies reported on more than one outcome to measure the effect on anthropometrics, behaviour and determinants.

The conclusion of the levels of the evidence is given in table 1.

If a significant intervention effect in the intended direction was found in a study on at least one outcome indicator, this intervention was regarded as having resulted in an improvement.

Overall, only 11 of the 30 studies reported results on body composition, four of which were in the desired direction. All but three studies reported results on dietary behaviour, 18 out of 30 reported some positive effects on dietary behaviour. Only 10 studies reported results on potential determinants of dietary behaviour and all but two studies reported a positive effect on one or more of such presumed determinant.

Nutrition only interventions

Only four nutrition only studies reported effects on body composition. One programme, using only educational materials reported a long term effect on BMI in the positive direction. (Online ref r1, available as Supplementary Appendix online) However, one study implementing a multi-component intervention showed a small effect on BMI in the wrong direction (Online ref r8, available as Supplementary Appendix online).

All educational studies documented the effect on dietary behaviour; only in two studies no effect was found. (Online refs r3, r4, available as Supplementary Appendix online) The environmental only study reported a significant effect on the consumption of fruit and vegetables during lunch (Online ref r13, available as Supplementary Appendix online).

Out of seven multi-component studies focussing on the effectiveness regarding dietary behaviour, six reported positive changes (Online refs r8, r16–r21, available as Supplementary Appendix online) in three programmes a sustained effect at the long term was detected (Online refs r16–r18, r20, available as Supplementary Appendix online).

Only two studies on multi-component programmes mentioned the effect on dietary determinants (Online refs r8, r9, r16, r17, available as Supplementary Appendix online). Both reported a positive effect, one study even notified a sustained effect at the long term (Online refs r16, r17, available as Supplementary Appendix online).

Of the 17 interventions, 5 studies reported effects measured at least 6 months after the end of the intervention.

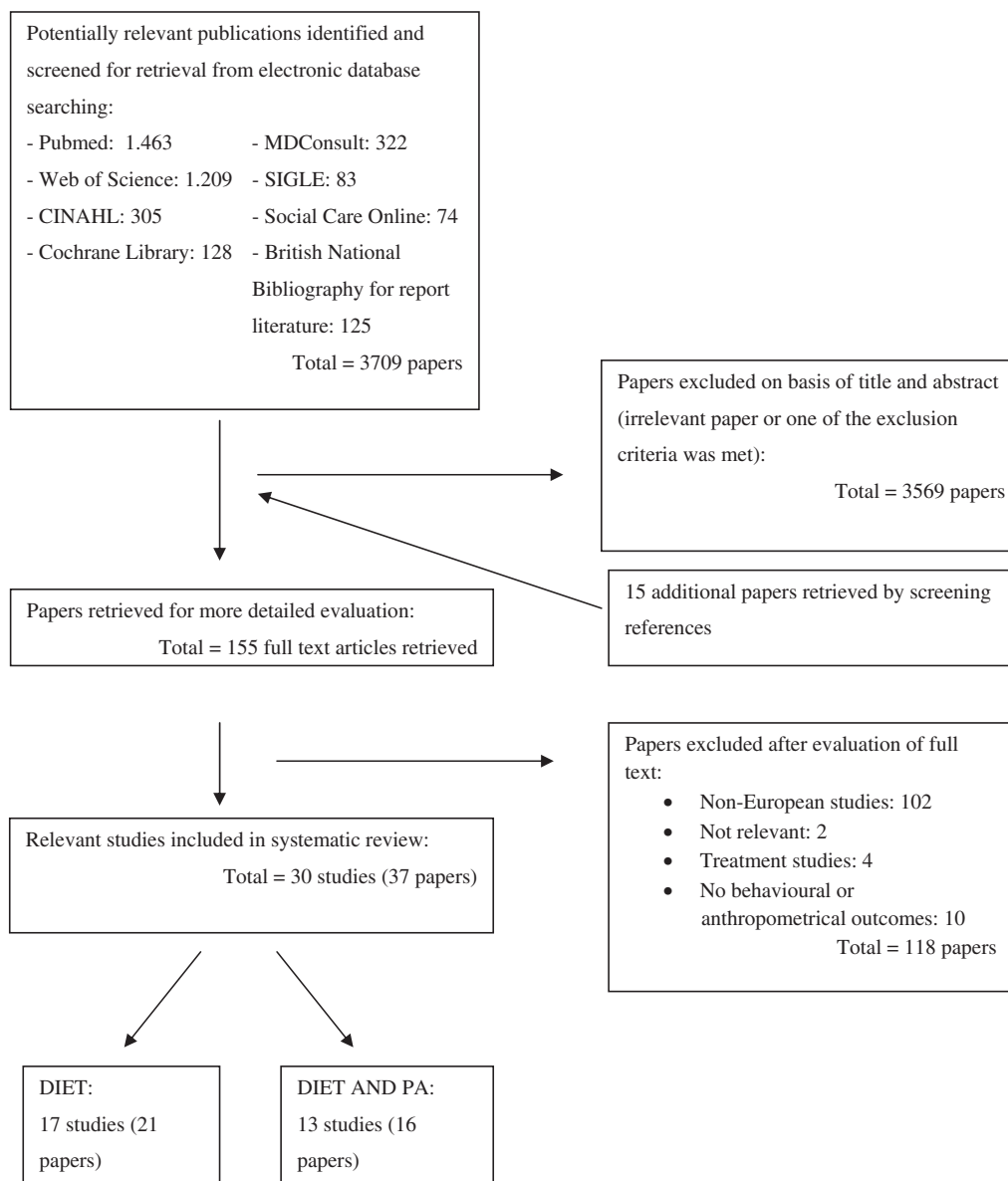


Figure 1 Flow chart of study selection process

Nutrition and physical activity interventions

Five studies evaluated the effect of educational interventions on BMI (Online refs r22, r23, r25, r33–r35 available as Supplementary Appendix online), one found a positive effect (Online ref r25, available as Supplementary Appendix online). Two studies reported the effect of a multi-component intervention on BMI but no positive effect was found (Online refs r32, r38, available as Supplementary Appendix online).

Six educational (Online refs r24–r27, r31, r33–r35, available as Supplementary Appendix online) and three multi-component studies (Online refs r29, r30, r32, r37, available as Supplementary Appendix online) evaluated the effect on diet, five found a positive effect. (Online refs r24, r26, r27, r29, r30, r34, r35, r37, available as Supplementary Appendix online).

Eight studies (Online refs r22, r24–r27, r31, r33, r34–r36, available as Supplementary Appendix online) focussed on the effect of educational interventions on exercise in different contexts. Only three of them (Online refs r22, r24, r26, r27, available as Supplementary Appendix online) found an improvement on total physical activity and two (Online refs r25, r36, available as Supplementary Appendix online) showed a positive effect on physical activity in leisure time. From the multi-component studies (Online refs r29, r30, r37, available as Supplementary Appendix online) two found an effect on physical activity.

Two education only studies (Online refs r26, r27, r36, available as Supplementary Appendix online) and two multi-component studies (Online refs r28, r37, available as Supplementary Appendix online) aimed to influence the determinants with regard to dietary habits, three studies (Online refs r26–r28, r36, available as Supplementary Appendix online) stated significant changes.

Of the 13 studies, 8 reported effects measured at least 6 months after the end of the intervention.

Relation between intervention quality and intervention effectiveness

The majority of the studies provided only little information concerning the quality of the interventions investigated. Nevertheless, the results suggest a possible relation between intervention quality and program effectiveness. Within the nutrition studies, only three studies met at least three of the quality criteria (Online refs r6, r8, r9, r18, available as Supplementary Appendix online). All these studies found a positive effect on diet (Online refs r6, r8, r9, r18, available as Supplementary Appendix online) and/or dietary determinants (Online refs r6, r8, r9, available as Supplementary Appendix online). All the educational nutrition and physical activity interventions fulfilled only one or two quality criteria. However, three out of four

multi-component diet and exercise studies met at least three quality criteria (Online refs r28–r30, r37, r38, available as Supplementary Appendix online) One of these met all five (Online ref r28, available as Supplementary Appendix online). Those three studies found positive effects, two studies found effects on diet and physical activity (Online refs r29, r30, r37, r38, available as Supplementary Appendix online), one on determinants regarding nutrition and physical activity (Online ref r28, available as Supplementary Appendix online).

Discussion

This review is the first to summarize the evidence of effects on body composition, nutrition behaviour and potential determinants of such behaviour of interventions promoting a healthy diet solely and in combination with increasing physical activity in the workplace in European countries. This review is unique in its broad inclusion of studies with different research designs and its extensive attempt to grade study and intervention quality of the included studies.

From this review, it can be concluded that there is only moderate evidence of effect of educational and multi-component dietary interventions on dietary behaviours and potential dietary determinants of such behaviours. Combined nutrition and physical activity interventions showed less positive results. Based on the present review we could not conclude that any of the types of interventions consistently produced effects on body composition but this may be due to the lack of studies in general and high quality studies in particular. Also, for all other assessed effects there was only inconclusive evidence again possibly due to a lack of studies in general and of high quality studies in particular.

Comparison with other reviews

The findings of the present review differ from the results of earlier reviews which include studies mostly conducted in non-European countries. Andersen *et al.*¹⁷ found that worksite nutrition and physical activity programmes achieved modest improvement in weight status. Engbers *et al.*,⁸ Goetzel and Ozminkowski,¹¹ and Mhurchu *et al.*¹⁸ found strong evidence for the effectiveness of workplace interventions on fat intake and Engbers *et al.* and Mhurchu *et al.* also found strong evidence for the effect of interventions on the intake of fruit and vegetables. The different results might be due to the fact that Goetzel and Ozminkowski included all types of interventions and Engbers *et al.* only included multi-component or environmental only interventions.^{8,11} In other earlier reviews also moderate evidence was found for effects of a diverse type of interventions on some dietary behaviours.^{7,15,16}

Quality of the interventions

It was remarkable that only a few articles gave information on the quality of the intervention and from those giving the information it could be concluded that these interventions did only met a few of the criteria of the ENHPWP.

The further diffusion of the quality criteria for workplace interventions of the ENHPWP and information on the necessary steps that need to be taken to develop interventions as described in the Intervention Mapping Protocol²⁶ could enhance the quality of the interventions. If however the workplaces experience problems with meeting the quality criteria more discussion on the criteria should be started and solutions sought for the problems encountered. Giving information on problems with the implementation of interventions in the effect studies can contribute to this discussion.

Methodological problems

As the included studies differ largely on design, type of intervention and outcome measures, it was not possible to compute effect sizes on anthropometric measures or on behaviours. This review extensively graded and scored the quality of the studies and the interventions and it was found that the majority of the studies were of moderate or low methodological quality, the same result was found for the quality of the

interventions. In many studies there was also a lack of information on design of the study and the intervention.

Publication bias might be an issue in this like in most reviews; the majority of the studies reported some positive effects. However this finding did not lead to an overall positive picture of the effects of worksite interventions on nutrition only or combined with physical activity because of the moderate and weak design of the studies.

Pelletier identified as early as in 1999 a trend towards the publication of lower quality studies in the field of workplace interventions.²⁷ He noted a trend towards companies conducting very focused pre- and non-experimental demonstration disease management programmes that are particular important for the employer. In the present review, 11 out of the 30 European studies included were case studies or before–after studies. This tendency towards case studies and before–after studies might be the result of priorities of employers. There is also a lively debate in the literature on the grading of evidence for public health interventions.^{21,23,28} There is now consensus about the fact that the RCTs, providing the design with the strongest internal validity for gaining evidence regarding the effect of an intervention, are often inappropriate, unachievable, or irrelevant for public health interventions. New frameworks have been proposed for categorizing interventions on their level of ‘promise’ for public health gains in which certainty of effectiveness and potential population impact (taking into account efficacy, reach and uptake of the interventions) are combined.²⁸ Using this framework, interventions with a rather low score on effectiveness but with a high score on reach and high uptake can be considered as ‘promising’. In the context of this discussion also the modest and inconclusive results of the present review might be important when the participation in the interventions is high and when many companies and organizations adopt the interventions. However the review of Bull *et al.* made clear that the rate of participation among eligible study participants in worksite interventions studies can vary from 8 to 97% with a median of 61%, indicating that participation rates can be very low, an issue that was also noted and discussed by Kwak *et al.*^{14,29}

In general, this review found that for those studies reporting data on quality aspects of the interventions, the effects of the interventions meeting most of the quality criteria had the most promising results.

Although it was the intention to produce results that could be generalized for Europe, all included studies were done in Northern and Western European countries leaving the question if the same results are applicable for the South and East of Europe.

Supplementary data

Supplementary data are available at *EURPUB* online.

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Key points

- The quality of the interventions should be enhanced and more information should be given on the quality of the interventions in effect studies

- There is enough evidence to implement nutrition interventions in worksites, both educational and multi-component interventions, as they are able to favourably change dietary behaviour and potential determinants of these behaviours.
- Reporting effects on potential determinants of dietary behaviour is important as this provides information on likely mediators of effects which might help in developing future interventions.
- Priority should be given to the initiation of studies meeting the highest possible methodological quality criteria. A consensus should be build on what the quality criteria for this type of studies should be.
- To make meta-analysis and cost effectiveness studies possible, a consensus on the outcome measures to be measured and reported is needed.
- To evaluate the potential public health impact of the interventions researchers have to report more process evaluation data.

References

- 1 World Health Organization. Diet, nutrition and the prevention of chronic diseases. *World Health Organ Tech. Rep Ser* 2003;916:i-viii,1-149.
- 2 van Duijvenbode DC, Hoozemans MJM, van Poppel MNM, Proper KI. The relationship between overweight and obesity, and sick leave: a systematic review. *Int J Obes* 2009;33:807-16.
- 3 Ferrie JE, Head J, Shipley MJ, et al. BMI, obesity, and sickness absence in the Whitehall II study. *Obesity* 2007;15:1554-64.
- 4 Berghöfer A, Pischon T, Reinhold T, et al. Obesity prevalence from a European perspective: a systematic review. *BMC Public Health* 2008;8:200.
- 5 IOTF. Increasing obesity rates in Europe 1985-2005. London 2007. Available at: www.who.int/dietphysicalactivity/TrendsEuropeadultsthroughtimev3.htm (10 April 2009, date last accessed).
- 6 Proper KI, de Bruyne MC, Hildebrandt VH, et al. Costs, benefits and effectiveness of worksite physical activity counselling from the employer's perspective. *Scand J Work Environ Health* 2004;30:36-46.
- 7 Katz DL, O'Connell M, Yeh MC, et al. Public health strategies for preventing and controlling overweight and obesity in school and worksite settings: a report on recommendations of the Task Force on Community Preventive Services. *MMWR Recomm Rep* 2005;54:1-12.
- 8 Goetzel RZ, Ozminkowski RJ. The health and cost benefits of work site health-promotion programs. *Annu Rev Public Health* 2008;29:303-23.
- 9 Pratt CA, Lemon SC, Fernandez ID, et al. Design characteristics of worksite environmental interventions for obesity prevention. *Obesity* 2007;15:2171-80.
- 10 Benedict MA, Arterburn D. Worksite-Based weight loss programs: a systematic review of recent literature. *Am J Health Promot* 2008;22:408-16.
- 11 Engbers LH, van Poppel MNM, Paw M, et al. Worksite health promotion programs with environmental changes - a systematic review. *Am J Prev Med* 2005;29:61-70.
- 12 Pelletier KR. A review and analysis of the clinical- and cost-effectiveness studies of comprehensive health promotion and disease management programs at the worksite: 1998-2000 update. *Am J Health Promot* 2001;16:107-16.
- 13 Matson-Koffman DM, Brownstein JN, Neiner JA, et al. A site-specific literature review of policy and environmental interventions that promote physical activity and nutrition for cardiovascular health: What works? *Am J Health Promot* 2005;19:167-93.
- 14 Bull SS, Gillette C, Glasgow RE, et al. Work site health promotion research: To what extent can we generalize the results and what is needed to translate research to practice? *Health Educ Behav* 2003;30:537-49.
- 15 Janer G, Sala M, Kogevinas M. Health promotion trials at worksites and risk factors for cancer. *Scand J Work Environ Health* 2002;28:141-57.
- 16 Harden A, Peersman G, Oliver S, et al. A systematic review of the effectiveness of health promotion interventions in the workplace. *Occup Med* 1999;49:540-8.
- 17 Anderson LM, Quin TA, Glanz K, et al. The effectiveness of worksite nutrition and physical activity interventions for controlling employee overweight and obesity. *Am J Prev Med* 2009;37:340-57.
- 18 Mhurchu CN, Aston LM, Jebb SA. Effects of worksite health promotion interventions on employee diets: a systematic review. *BMC Public Health* 2010;10:1-7.
- 19 Soler RE, Leeks KD, Razi S, et al. A systematic review of selected interventions for worksite health promotion. The assessment of health risks with feedback. *Am J Prev Med*;38:237-62.
- 20 Green LW. Making research relevant: if it is an evidence-based practice, where's the practice-based evidence? *Fam Pract* 2008;25:i20-4.
- 21 Thomas H. *Quality assessment tool for quantitative studies. Effective Public Health Practice Project*. Hamilton, Canada: McMaster University, 2003.
- 22 DiClemente RJ, Crosby RA, Kegler MC. *Emerging theories in health promotion practice and research*. San Francisco: Jossey-Bass, 2002.
- 23 Rychetnik L, Frommer M, Hawe P, et al. Criteria for evaluating evidence on public health interventions. *J Epidemiol Community Health* 2002;56:119-27.
- 24 Proper KI, Staal BJ, Hildebrandt VH, et al. Effectiveness of physical activity programs at worksites with respect to work-related outcomes. *Scand J Work Environ Health* 2002;28:75-84.
- 25 Van Sluijs EMF, McMinn AM, Griffin S. Effectiveness of interventions to promote physical activity in children and adolescents: systematic review of controlled trials. *BMJ* 2007;335:703-7.

- 26 Bartholomew LK, Parcel GS, Kok G, Gottlieb NH. *Planning health promotion programs: an intervention mapping approach*. San Francisco: Jossey-Bass, 2006.
- 27 Pelletier AR. A review and analysis of the clinical and cost-effectiveness studies of comprehensive health promotion and disease management programs at the worksite: 1995-1998 update (IV). *Am J Health Promot* 1999;13:333-45.
- 28 Swinburn B, Gill T, Kumanyika S. Obesity prevention: a proposed framework for translating evidence into action. *Obes Rev* 2005;6:23-33.
- 29 Kwak L, Kremers SP, van Baak MA, et al. Participation rates in worksite-based intervention studies: health promotion context as a crucial quality criterion. *Health Promot Int* 2006;21:66-9.

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Socio-demographic and work-related risk factors for medium- and long-term sickness absence among Italian workers

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Background: Few studies investigated determinants of sickness absence in representative samples of the general population, none of which in Italy. Aim of this study was to assess influence and relative importance of socio-demographic and work-related characteristics on medium- and long-term sickness absence in a random sample of Italian workers. **Methods:** Approximately 60 000 workers participating in a national survey in 2007 were interviewed regarding sickness absence during the whole previous week, and on socio-demographics, employment characteristics and exposure to a set of physical and psychosocial hazards in the workplace. The association between sickness absence and potential determinants was estimated by multivariable logistic regression models stratified by gender. **Results:** From the final multivariate models, in both genders sickness absence was statistically significantly associated with tenure employment, working in larger firms, exposure to risk of injury and to bullying or discrimination and, among employees, with shift work. In males, sickness absence was also associated with lower education, employment in the public administration and with exposure to noise or vibration, whereas among women also with manual work and ergonomic factors. In both genders, the attributable fraction for employment-related characteristics was higher than that for socio-demographic ones. **Conclusions:** The association with tenure or salaried jobs, and with employment in larger firms or in the public sector suggests that, besides illness, job security is the most important determinant of sickness absence, consistently with the results of previous studies. However, our results indicate that a reduction in exposure to workplace hazards may contribute to reduce absenteeism.

Introduction

Sickness absence has high costs for society in terms of lost productivity and workers' compensation. In Italy, during 1990-99, its cost for the state has been estimated approximately at 0.5% of the Gross Domestic Product.¹ In most developed countries, absence spells tend to be longer than 1 week, with a ratio above three between medium-long and short spells (below or above one week) in Italy, France, Germany and Belgium²; therefore, especially programmes aimed at decreasing medium-long spells would greatly reduce production losses due to sickness absence. Sickness absence is only in part determined by illness or health conditions,³ whereas social, cultural and individual factors appear to play an important role. Particular relevance on sickness absence rates would have national policies on payment for lost work days² and workplace and local community attitudes.⁴ Employment characteristics have also been found to influence sickness absence rates, with wide variations observed by firm size,⁵ economic sector⁶ and type of contract⁷ suggesting an effect of job insecurity on the risk of absence. Furthermore, exposure to various workplace physical and psychosocial factors has been associated with sickness absence, especially ergonomic factors,^{8,9} low job control,¹⁰ low social support¹¹ and bullying or violence in the workplace.^{5,12} Among individual characteristics, higher rates have been found consistently associated with lower socio-economic status,^{10,13} female gender¹⁴ and obesity,^{9,15} whereas the relationship with age, smoking, alcohol consumption, marital status and presence of children in the household appears more controversial.

However, most studies assessed determinants of sickness absence in a circumscribed number of economic sectors, occupations or firms, which limits the generalizability of their results to the general population, especially with regard to the relative contribution of the different

factors. Moreover, we are not aware of any study on sickness absence conducted on samples of the general population in Italy. Therefore, aim of this study was to investigate, in a national representative sample of Italian workers, the effect and the relative importance of socio-demographic and work-related characteristics, including exposure to hazards in the workplace, on the risk of medium- and long-term sickness absence.

Methods

Data collection

In 2007, a cross-sectional survey based on a two-stage sampling design (municipalities and families) was conducted by the National Institute of Statistics on a representative sample of the Italian population, as the Italian component of the European 'Labour Force Survey 2007', including 81 812 men and 89 684 women. The European Labour Force Survey is conducted in the 27 EU countries and 2 EU candidate countries (Croatia and Turkey) on a continuous basis, to obtain information on employment, job search and attitudes of subjects in working age towards the labour market.¹⁶ Furthermore, the 2007 edition included an *ad hoc* module on working conditions and injury occurrence.¹⁷ A list with all the questions in the questionnaire is available in the Labour Force 2007 User Guide.¹⁸

In Italy, the survey was conducted on 75 000 households, sampled with substitution of those non-responding, for a maximum of three substitutions allowed, and included 0.3% of the total Italian population.¹⁹ Households response rate was 95%; 4.5% of the records had one to three items with missing information, which were corrected by imputation.²⁰ Subjects were interviewed by trained interviewers using a