A RISK FACTOR OF MUSCULOSKELETAL DISORDERS: EXCESSIVE BODY WEIGHT AND THE IMPACT OF WORK-SITE HEALTH PROMOTION PROGRAMS ON WEIGHT REDUCTION

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ABSTRACT

Musculoskeletal disorders (MSDs) are a prevailing occupational health disorder affecting the global workforce. The costs associated with musculoskeletal disorders have a substantial economic effect on businesses. Excessive body weight has been identified as a risk factor of musculoskeletal disorders. A positive correlation between body mass index and the occurrence of MSDs has been shown. Excessive body weight is a growing concern in the United States (U.S.) and has become an epidemic. It appears that weight reduction may be an important strategy in reducing the incidence of musculoskeletal disorders. Work-site health promotion programs promote health and the reduction of disease risks. The purpose of this project is to evaluate the impact of work-site health promotion programs on excessive body weight. This study addresses the National Occupational Research Agenda (NORA) priority of Musculoskeletal Disorders. A literature review was conducted using the MEDLINE database and the bibliographies to identify additional relevant articles. Participation in work-site health promotion programs may result in a reduction of excessive body weight.

INTRODUCTION

Musculoskeletal disorders continue to be a costly and prevalent occupational health problem. According to the Bureau of Labor Statistics (BLS), over one-third of nonfatal occupational injuries and injuries involving days away from work were attributed to MSDs (2001). The greatest number of MSDs was reported by the services industry. Musculoskeletal disorder, defined by the U.S. Department of Labor, is a disorder or injury of the muscles, tendons, nerves, spinal discs, joints and cartilage (BLS, 2001). The average median days away from work for all cases of work injuries and illnesses was six days (BLS, 2001). Carpal tunnel syndrome (CTS) accounted for the highest number of median days away from work at 25 days compared to other major disabling injuries and illnesses (BLS, 2001). According to the National Institute for Occupational Safety and Health (NIOSH), MSDs are a prevalent medical problem that affects 7% of the population and accounts for 19% of hospital stays and 14% of doctor's office visits (NIOSH, 1997).

A recent study identified low back pain and back disorders (not specified as low back) as two of the top ten most costly physical conditions affecting six large U.S. employers (Goetzel, 2003). Low back pain was ranked fourth and back disorders (not specified as low back) ranked seventh.

Among the top twenty most costly physical conditions, six of the conditions were identified as MSDs (Goetzel, 2003). The rate of occurrence per 1000 employees for all six musculoskeletal disorders was 201.3 and the average expenditure per eligible employee per year was $333.65. Goetzel et al. considered the costs associated with medical expenses incurred, absenteeism, and short-term disability and found a significant proportion of work-related absences attributed to MSDs.

BACKGROUND

Risk Factors of Musculoskeletal Disorders

There is an obvious interest in identifying, reducing, and preventing exposures that contribute to the occurrence of MSDs. According to a comprehensive review of epidemiologic research conducted by NIOSH, there is compelling evidence of an association between certain work-related physical factors and MSDs when the levels of exposure are high (United States Department of Health and Human Service [HHS], 1997). The physical factors include posture, vibration, repetition, and force. The study also found evidence to support the influence of individual risk factors on the occurrence of MSDs. These individual risk factors include elevated body mass index (BMI). Potential risk factors identified in studies for MSDs, in particular lumbar disc herniation and CTS, include BMI, weight, height, and obesity (HHS, 1997).

A study of a sample of the Australian population found a statistically significant positive relationship between level of obesity and the probability of having a MSD (Kortt, 2002). In a case-controlled study of subjects undergoing electromyography and nerve conduction studies, obesity was confirmed as an independent risk factor for CTS (Becker, 2002). Koleva and Kostova (2003) report that the development of MSDs is 2.38 times more frequent in overweight individuals than in individuals not considered to be overweight. In a study of men and women with newly diagnosed CTS, the risk of CTS increased 8% with a weight gain of approximately six pounds (Nordstrom, 1997). Similar findings supporting the significant positive relationship between BMI and CTS have been published (Karpitskaya, 2002; Kouyoumdjian, 2002; Lam, 1998; Stallings, 1997).

The Obesity Epidemic

An estimated 64% of U.S. adults are obese or overweight, with 31% of U.S. adults considered obese (National Center for Health Statistics, 2002). Body mass index is a measure used to classify weight and is calculated by dividing body weight in kilograms by height in meters squared (kg/m^2). A BMI of 25-29.9 kg/m^2 is considered overweight and a BMI greater than or equal to 30 kg/m^2 is considered obese (American College of Sports Medicine [ACSM], 2000). The Center for Disease Control and Prevention (CDC) estimated the total cost of obesity in the U.S. in 2000 to be $117 billion and noted an increase in obesity during the past 10 years of more than 60% (CDC, 2003). Poor diet and physical inactivity was the second actual cause of death in the U.S. in 2000 and was responsible for 400,000 deaths (CDC, 2004). Tobacco was listed as the number one actual cause of death claiming 435,000 deaths (CDC, 2004).

Obesity is a global epidemic. Almost half a billion of the world's population is considered obese or overweight (Rossner, 2002). The majority of European countries have experienced an increase in the prevalence of obesity during the past 10 years (Rossner, 2002). Adult obesity rates are rapidly increasing throughout the world (Kumanyika, 2002). In some cities in China almost 20% of adults are obese (Kumanyika, 2002). Almost 22 million children in the world under the age of five are overweight (Kumanyika, 2002).

The increase in weight gain worldwide can be attributed to changes in society. While genes may have some impact in weight gain, the rate at which obesity has risen has occurred too quickly for populations to experience evolutionary genetic changes (Kumanyika, 2002; Rossner, 2002). Reduced physical activity and/or diets high in fat and energy are products of modernization, economic growth, globalization of food markets, and urbanization (Kumanyika, 2002).

In addition to MSDs, obesity is also a known risk factor for hypertension, type 2 diabetes, cardiovascular disease, dyslipidaemia, some cancers, and sleep apnea (Rossner, 2002).

Purpose/Rationale

The National Occupational Research Agenda (NORA) for Musculoskeletal Disorders identifies the need for research to determine the impact and effectiveness of general safety, wellness, and fitness programs on work-related MSDs. Given the positive relationship between MSDs and BMI, it appears that weight loss may result in a decrease in the prevalence and occurrence of MSDs. Work-site interventions provide an opportunity to reach many employees. Health promotion programs are designed to assist in the prevention of disease and premature death and in the improvement of quality of life (Aldana, 2001). The purpose of this paper is to determine the impact of work-site health promotion programs on excessive body weight.

LITERATURE REVIEW

Work-site health promotion programs vary in design. The programs range from distribution of educational material to onsite exercise facilities. In addition to the variations in work-site health promotion programs, there are different approaches to facilitating weight loss. Many of the work-site health promotion programs focusing on weight reduction include some form of weight loss competitions, exercise, dietary intervention, education, and counseling.

Dietary Intervention

Work-site wellness programs have been identified as facilitating participation of people that may not typically request advice on weight loss (Leslie, 2002). Leslie et al. conducted a study of 122 men at a large petrochemical work-site. The purpose was to determine the effectiveness of a daily energy deficit diet of 600 kcal compared to a generalized low-calorie diet of 1500 kcal. In addition, a diet excluding red meat was compared to a diet that included red meat (quality lean cuts) at least five times a week. A randomized –controlled design was used and subjects were individually randomized into one of four groups (energy deficit meat, energy deficit no meat,

generalized low-calorie meat, generalized low-calorie no meat). Subjects were recruited using electronic mail (e-mail) and those eligible were invited to participate. Subjects in the energy deficit diet group received individualized energy prescriptions. The study consisted of 12 weeks of weight loss and 12 weeks of maintenance. Each participant received an individual initial dietetic consultation explaining the weight loss intervention and an individual consultation every two weeks thereafter for the first 12 weeks. During the maintenance period, contact was made with subjects via e-mail every two weeks and subjects were asked to complete a questionnaire on eating habits. The 12-week weight loss period was completed by 91 men. Eighty-five men completed the full 24-week program.

At week 12, Leslie et al. found the weight of the subjects in the control group to be stable and found mean weight loss to be significant in the four diet groups. During the initial 12-week period, 77 men lost weight. Of the 77 men that lost weight, 58 regained weight, 17 lost more weight and two remained weight stable during the maintenance period. Significantly more subjects dropped out of the generalized low-calorie diet group during the weight loss period when compared to energy deficit group. The consumption of lean red meat at least five times per week did not affect weight loss or maintenance.

In summary, the generalized low calorie diet was not any more effective in regard to weight loss than the individualized energy deficit diet although completion appeared to be more successful in the latter. The individual consultations were reported by the men in the study to be an important factor of their participation.

Weight Loss Competitions

Brownell, Cohen, Stunkard, Felix, and Cooley (1984) evaluated three separate weight loss competitions. The competitions ranged from 12 weeks to 15 weeks in length. Two of the competitions were held within industries and the third competition was between three banks. A weight loss goal, not to exceed 20 pounds, was provided to each participant. Participants were weighed weekly and were given part of a behavioral treatment manual. Each competition consisted of three teams and their progress was displayed at each worksite. The winner of the competition was the team that obtained the largest percentage of their weight loss goal. Management and employees completed a questionnaire upon program completion. As an incentive, each participant contributed five dollars and the pool of money was given to the winning team. The average weight lost was 5.5 kilograms and attrition was less than 1%. Eighty percent of the weight lost during the competition was maintained at the six-month follow-up. Sixty-two percent of the participants reported greater success losing weight in this program than in their previous weight loss attempts. Managers and employees reported positive changes in employee/manager relations and morale, and manager involvement was found to be important to the success of the program. The average cost of the programs was $2.93 per 1% reduction in percentage overweight.

A weight loss competition, similar to the competitions evaluated by Brownell et al., was offered to federal employees by Phillips and Philbin (1992). Fifty participants completed the 12-week program and the total weight lost was 399.5 pounds. Phillips and Philbin reported an attrition

rate of 3.85%. The authors did not evaluate maintenance of the weight lost and report that their plan for subsequent programs will include three, six, nine, and 12-month weigh-ins.

Stunkard, Cohen, and Felix (1989) conducted a series of studies to assess the effectiveness of weight loss competitions. The first study consisted of a 12-week work-site weight loss program and compared three different treatments. The first treatment involved a team competition, the second treatment an individual competition, and the third treatment was pure cooperation where the goal was based on the outcome of the entire worksite. An introductory meeting was held where height and weight measurements were taken. Individuals set their weight loss goal. The participants were advised that the goal could not exceed 20 pounds to discourage unsafe weight loss. Participants and management contributed money that was placed in a pool to serve as an incentive. The participants were then randomly assigned to one of the three different treatments. All three treatments included weekly weigh-ins where each participant was given a page of information regarding weight loss based on behavioral principles. In the first treatment, attrition was found to be lower in the team competition and the cooperation competition. Men lost more weight in the team competition and women lost more weight in the team and cooperation conditions.

The second study conducted by Stunkard et al. (1989) repeated the team competition at work-sites and found the team competition to be as effective as in the first study. Twenty-one percent of employees participated in the competition. Among the participants that were more than 10% overweight at the start of the program, weight loss was 4.4 kilograms for women and 6.3 kilograms for men. The average expense to lose 1% of body weight was $.92. The third study addressed maintenance of weight loss and found that after six months 54% of the weight loss had been maintained, after eight months 51% of the weight loss had been maintained, and after one year only 27% of the weight loss had been maintained.

Worick and Petersons (1993) evaluated an annual five-week weight loss competition offered to employees at Bronson Methodist Hospital. The competition was held in March for five consecutive years. The design of the weight loss competition was similar to the design of the previously listed weight loss competitions. Total enrollment of the five annual competitions equaled 1,386 employees. The mean weight lost by participants during the contest was 4.8 to 5.2 pounds. Two hundred and four employees were repeat participants enrolling in two or more successive competitions. Greater than two-thirds of repeat participants gained weight during the 47 weeks between the competitions. The authors suggest that while weight loss competitions promote healthful weight loss, the competitions may result in the participant regaining weight after the competition is over.

Education and Contracting

Overweight employees at a large corporation in Michigan participated in a study measuring weight loss (Zandee, 1996). The 23-week study included a 10-week weight loss program and a weight follow-up at week 23. The 119 participants were originally randomly assigned to one of three groups: contingency contracting with a partner, with oneself, and no contingency contracting. Seventeen of the participants assigned to the contracting with a partner group chose to either not contract or to contract alone and four participants assigned to the contracting alone

group decided not to contract. Eighty-four subjects completed the first 10 weeks and 57 subjects returned on week 23 for the weight follow-up. All participants received weekly educational handouts that included recommended behavioral change goals relating to exercise and diet. All participants were encouraged to select behavioral change goals. The participants in the contracting groups completed a contract that was to contain a measurable, realistic change goal and a reinforcer that would serve as a motivator. The participants in the contingency contracting with a partner group selected a partner to assist the participant in behavior change.

Significant weight loss was reported in all groups at week 10 and no significant differences in weight lost were found between groups (Zandee, 1996). At week 23, weight lost was not statistically significant in any group or between groups. The authors report coworker support as a confounding variable. Of the participants completing the entire 23-week study, 63.2% acknowledged receipt of encouragement and support from their coworkers. Participants reporting coworker support lost on average 2.5 pounds between week 10 and week 23 while participants who did not report coworker support gained 0.8 pounds on average. The authors suggest that over time, behavioral change might be maintained through coworker support. It is also suggested that interventions be individualized when possible.

Education, Counseling, and Exercise Interventions

LIFECHECK is a worksite cardiovascular risk identification and reduction program implemented at Coors (Henritze, 1992). The eight-week program is voluntary and complements the Coors Wellness Center-based programs. LIFECHECK was offered to employees at the Coors Engineering Center and Can Manufacturing Complex and was comprised of several components including an initial 30 minute screening, activity competition, educational classes, individual counseling, exercise equipment, and educational information posted and sent electronically. Of the 692 participants, 32% had never utilized the Wellness Center in the past eight years. Statistically significant improvements were found in risk factors including weight. The program successfully reached at-risk employees. The authors attribute much of the success to the activity contest and management support was considered essential.

Heirich and colleagues (1993) conducted a three-year experiment to compare the effectiveness of different program designs on the reduction of cardiovascular risks. The experiment was conducted in four automotive manufacturing plants. The program designs included individual counseling with at-risk employees, a staffed physical fitness facility, and individual counseling for all employees combined with organized fitness activities utilizing coworker support. Providing participants with individual counseling and support to incorporate exercise into their daily routine was found to be more effective than simply providing access to a physical fitness facility (Heirich, 1993)

DISCUSSION

Musculoskeletal disorders are a costly occupational health disorder and are prevalent in the workforce. Excessive body weight has been linked to MSDs, hypertension, type 2 diabetes, cardiovascular disease, dyslipidaemia, and some cancers. Reducing body weight may reduce the

risk of developing these chronic diseases. The prevalence of excessive body weight is rising and continues to negatively impact the workforce.

As mentioned previously, poor diet and physical inactivity has been identified in the U.S. as the second actual cause of death in the year 2000. Poor diet and physical inactivity lead to an increase in caloric intake and a decrease in energy expenditure. As a result, the body stores more energy than it uses and weight is gained. Behaviors relating to diet and activity can be modified. Work-site health promotion programs serve as an important tool in achieving a healthy workforce. Work-site health promotion programs have been shown to be cost effective and have been successfully implemented in diverse industries. Some of the key factors to the success of these programs appear to be social support, management involvement, setting realistic goals, individual counseling, and follow-up.

It appears that in order to achieve a healthy workforce, continuous work-site health promotion programs must focus on promoting a healthy lifestyle. While health promotion programs focusing on weight loss have been shown to facilitate short-term weight loss, these programs have not been shown to be effective in maintaining long-term weight loss. More research is needed to evaluate the impact of work-site health promotion programs on long-term weight loss and maintenance. Additionally, research is needed to determine the effect of weight loss on MSDs.

CONCLUSION

Excessive body weight is recognized as a controllable risk factor for MSDs. It would appear that a reduction in body weight may reduce the risk of developing MSDs and may result in fewer occurrences of MSDs. Work-site health promotion programs provide an invaluable opportunity to positively impact numerous participants and industries. Studies show that short-term weight loss can be achieved through various work-site health promotion programs. Additional research is needed to identify effective long-term weight loss and weight maintenance interventions and to explore the effect of weight reduction on MSDs.

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