

Four worksite weight loss programs with high-stress occupations using a meal replacement product

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The objective was to evaluate the efficacy of worksite weight reduction programs at high-stress worksites. We employed a longitudinal study based on two meal replacements daily with subjects choosing a third 'sensible' meal. The subjects were 492 healthy, overweight men and women working in high-stress occupations (police, hospital health professionals, flight crew members, firefighters). The mean group ages ranged from 32.17 ± 5.70 to 44.50 ± 16.40 years; the mean group body mass indexes (BMIs) ranged from 27.40 ± 2.54 to 32.90 ± 3.39 kg/m². The completion rate for the 12 weeks was 79.8%. Reductions in mean weight and mean BMI were greater than in medically supervised clinical trials with non-worksite adults. Firefighters lost the most weight and medical personnel the least. Follow-up found considerable retention of weight loss. Men lost significantly more weight than women ($P < 0.006$). We conclude that employees in some high-stress settings may participate productively in worksite weight reduction and maintenance programs that use meal replacements.

Key words: High-stress occupations; meal replacement products; weight loss and maintenance.

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Introduction

Obesity contributes to the prevalence of morbidity and mortality in the working population, and can also be an occupational hazard [1–3]. As a result, a variety of occupational medicine approaches deal with overweight and obesity. Among the appeals of such worksite health programs are the accessibility of large numbers of employees, the impetus of social support and the reduction in health care expenses. Such programs, which are conducted in two-thirds of all American private worksites with 50 or more employees, may contribute to positive attitudes, work efficiency and overall health [4].

Significant benefits are possible even if there is a relatively modest weight loss at a worksite [5]. The attrition rate in worksite weight loss programs can be relatively high [6]. A worksite could target weight control or combine it with other health goals [7]. Financial

incentives and behavioral treatment are found in a number of programs [8].

This study investigated workers in high-stress occupations seeking to achieve weight loss by the use of a meal replacement regimen. The use of the meal replacement product in a worksite program differs from its use by an individual consumer. The employee receives information about the program from the employer and the employee's motivation to participate is enhanced by knowing the employer's role. There is a procedure to screen applicants and reinforcement from colleagues' participation. Worksite distribution of the product requires minimal logistic effort. Employees can pace themselves toward a goal. Weekly weigh-ins are provided by the employer.

Materials and methods

Study design

A 12 week program was conducted with four high-stress

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occupational groups: urban police; suburban firefighters; hospital medical and collateral personnel; and commercial airplane pilots and flight attendants. The work culture of all four groups typically includes a hierarchical organization, environmental hazards, rotating work shifts with irregular meal schedules and circadian disruption, and potential responsibility for life-and-death emergencies. Because these occupations all serve the public, there is considerable interest in their health [9–12]. Some of the occupations have been followed in longitudinal health research, such as the Nurses' Health Study [13].

Methods

The subjects were: 286 police officers at 38 precincts in New York City; 31 firefighters at two fire houses in Connecticut; 150 physicians, nurses and other personnel at a 341 bed voluntary general hospital in Florida; and 25 pilots and flight attendants based at Newark International Airport in New Jersey.

Three occupational groups included both males and females; the firefighters only included males. Participants were required to be in general good health and to be 15–45% above the ideal weight for their height and frame. Excluded were people taking prescribed medication other than birth control pills; subjects with clinical or endocrine disease, or surgical conditions; substance abusers; females who were pregnant, lactating or engaging in unprotected sexual intercourse; and recent participants in a weight reduction program. Also excluded were recent users of any investigational drug, i.e. one that is still in the developmental pipeline and has not yet been approved by the US Food and Drug Administration for safety and efficacy. The target age range was 18–65, and most subjects were between 30 and 45 years old.

For three of the occupational groups, employees were invited to attend a dinner meeting at which details of the program were set out and questions answered. Interested employees were given a medical history and health screening questionnaire to complete. With the hospital personnel, there was no meeting, but a detailed flyer with information about the program was distributed to all personnel together with the questionnaire. The subjects did not pay for the product and no subject received any remuneration or expense money. All subjects were told that they could withdraw from the program at any time.

Procedures

The study's meal replacement products were delivered to the subjects weekly. The subjects were weighed weekly on the same scales, provided by the project. Participants' weight at the beginning and end of the study was measured by a member of the research staff. All participants completed questionnaires on their experience with the product weekly and after week 12. All participants were

given adverse reaction forms and the telephone number of a contact person to call in the event of any question, concern or untoward reaction. Special arrangements were made for vacation and travel periods.

Each participant received a package with 14 portion-controlled servings of the product for each week, along with 12 nutritious crunch snack bars. The product is a nutritionally dense, complete meal replacement beverage powder (Slim-Fast®) that the user blends with 8 ounces of skim milk to create a shake, which is a replacement for one meal. Each shake contains 200–220 kcal and 25–35% of the daily requirements for 19 vitamins and minerals.

The subjects were to replace two meals a day with the shakes and also consume one 'sensible' meal daily, as outlined on the package inserts. This third meal, containing up to 500 calories, could be individually prepared by the subject or purchased at a store. Each day, subjects could also have two snacks consisting of fruits and vegetables of their choice, or the snack bars, which each contain 120 kcal. The two shakes, the two snacks and the dinner represent a maximum of ~1160 kcal per day.

Table 1 gives the baseline characteristics of the four occupational groups. There were no counseling or dietary counseling sessions. Participants were told that they should carefully read the package and insert instructions, which contained information on nutrition and exercise. The subjects were to make their own decisions about any exercise activity.

Comparison groups

Three previous clinical studies, of the same meal replacement product over a 12 week period, provide a comparison population. A Pennsylvania physician directed a clinical study with 30 subjects [14]; a University of California at Los Angeles (UCLA) School of Medicine team conducted a clinical study in six states with 273

Table 1. Characteristics of members of four occupational groups at start of program

Occupational group	n	Mean age (years)	BMI	Weight (kg)
Police				
Male	251	33.52 ± 6.70	32.57 ± 3.71	105.02 ± 15.24
Female	35	32.17 ± 5.70	28.85 ± 4.14	78.58 ± 12.65
Health care				
Male	18	44.50 ± 16.40	^a	101.82 ± 17.00
Female	132	40.40 ± 10.70	^a	82.95 ± 17.40
Flight crews				
Male	9	42.56 ± 9.26	32.45 ± 5.10	99.40 ± 8.08
Female	16	35.60 ± 9.26	27.40 ± 2.54	73.04 ± 9.61
Firefighters				
Male	31	41.20 ± 8.46	32.90 ± 3.39	102.05 ± 10.91

^aBMI data not available.

subjects [15]; and the obesity center at the University Hospital of Ulm, Germany, had 50 subjects [16].

The retention rates and changes in weight in these clinical studies, which had direct medical supervision, were compared with the weight changes in our occupational subjects. The characteristics of the three clinical comparison groups are set out in Table 2, and Table 3 summarizes some characteristics of both the clinical and occupational subjects. The clinical population was older, included more females and had higher starting weight than the occupational subjects.

Data analysis

The weight and attitudinal data were collected weekly and tabulated for each occupational group. Attrition rates and weight changes were tabulated and then compared with those reported for the three comparison groups.

Because of the demographic differences between the clinical and occupational groups, and the absence of a full database on the clinical subjects, we did not compute the statistical significance of differences between the two groups in retention and weight loss. Statistical analyses were, however, conducted with the data on the occupational subjects.

Results

Clinical and occupational group comparisons

The rate of completion of the study's 12 weeks was higher among the clinical (90.4%) than the occupational (79.8%) subjects. In both the clinical and occupational groups, significant weight loss ($P < 0.001$) was achieved. Occupational males lost approximately the same (8.47 kg) as the clinic males (8.45 kg), on average. However, the average occupational female lost less (5.26 kg) than the average clinic female (6.38 kg). The average loss combining men and women was 7.34 kg for occupational subjects and 6.88 kg for clinic subjects. The mean body mass index (BMI) loss was 2.68 for the occupational and 2.28 for the clinical participants.

Occupational group outcomes

The mean age of the occupational program completers (37.46 years) was significantly ($P < 0.05$) greater than that of the non-completers (34.74 years). The occupational completion rate was significantly higher ($P < 0.05$) for men (75.5%) than for women (65.6%). Differences in the completion rate among occupations are set out in Table 4.

An analysis of covariance found no statistically significant differences between program completers and non-completers. There was no statistically significant difference in starting weight between those who completed

Table 2. Characteristics of participants in three clinical studies at start of studies

Study site	<i>n</i>	Mean age (years)	BMI	Weight (kg)
Pennsylvania				
Male	3	34	32.53 ± 3.03	103.18 ± 6.30
Female	31	43	30.67 ± 5.76	81.60 ± 17.40
Six states				
Male	71	38.70 ± 2.70	28.10 ± 1.50	89.55 ± 6.36
Female	223	38.30 ± 8.30	27.90 ± 1.90	83.51 ± 5.90
Germany				
Male	12	46.50 ± 9.50	33.00 ± 3.70	104.10 ± 13.10
Female	38	44.30 ± 9.80	33.10 ± 4.10	89.10 ± 12.10

Table 3. Selected mean aggregate characteristics of subjects at the start of three clinical investigations ($n = 378$) and four occupational studies ($n = 492$) of a meal replacement program

Characteristic	Clinical subjects	Occupational subjects
Age (years)	44.50	34.50
BMI	30.86	31.97
Weight (kg)	116.34	102.26
Gender (%)		
Females	79.30	62.80
Males	37.20	20.70

and those who did not, or in starting weight among the occupations.

Gender

Analysis of covariance found that the occupational males' starting weight was significantly greater than that of the females ($P < 0.001$). The younger subjects (aged up to 33) were more likely to lose weight than the older subjects (34 and above), a relationship that may be related to the female subjects being significantly older than the male subjects: of the subjects aged 34 and above, 60.9% were female and 39.1% were male ($P < 0.001$).

There were more high-weight subjects in the older population. A repeated measures multivariate analysis of variance controlled for normal gender weight differences, with starting weight, finishing weight and weight loss standardized separately by gender. Men lost significantly more weight than women ($F = 7.764$, d.f. = 1, $P = 0.006$).

Differences between occupational groups

The public sector employees (police, firefighters) lost approximately twice as much as the private sector (health care, flight crews) employees, in terms of percent body

Table 4. Characteristics of members of four occupational groups after the 12 week program

Occupational group	No. (%) completing	Mean BMI	Mean BMI loss	Mean weight (kg)	Mean weight loss (kg)
Police					
Male	216 (76%)	29.96 ± 3.32	2.61	96.40 ± 13.21	8.62 ± 5.30
Female	24 (69%)	25.83 ± 3.52	3.02	71.77 ± 13.12	6.81 ± 4.40
Health care					
Male	15 (83%)	^a	^a	95.45 ± 18.45	6.37 ± 2.90
Female	81 (61%)	^a	^a	78.60 ± 18.00	4.35 ± 3.40
Flight crews					
Male	8 (89%)	29.46 ± 4.98	2.99	88.92 ± 7.61	10.48 ± 2.30
Female	14 (88%)	24.80 ± 2.89	2.60	65.97 ± 10.63	7.07 ± 3.90
Firefighters					
Male	22 (71%)	29.30 ± 3.13	3.60	90.90 ± 1.00	11.15 ± 4.60

^aBMI data not available.

weight lost, a difference that fell just short of significance ($F = 3.809$, d.f. = 1, $P < 0.052$).

A dummy variable regression analysis was conducted. The hospital personnel lost significantly less weight ($R^2 = 0.072$, $P < 0.001$) and the firefighters lost significantly more weight ($R^2 = 0.230$, $P < 0.014$) than the other occupations.

Among all the occupational groups, there were very positive attitudes toward the experience with the program, in terms of recommending it to a friend (99%), as a diet plan (94%), convenience (93%), taste (91%), energy level (87%) and hunger satisfaction (79%). No serious side-effects were reported. A small number of subjects reported transient minimal and clinically insignificant gastrointestinal reactions.

Follow-up

Although the project cycle covered 12 weeks with no follow-up, it was decided to recontact the subjects in the two smallest groups—firefighters and aviation personnel—3 and 8 months, respectively, after the twelfth week, in order to determine the extent to which they might have continued weight management activities on their own.

Twenty of the 22 firefighters were contacted 3 months after, and 18 of the 22 airline personnel were contacted 8 months after, the initial 12 weeks. All these subjects provided their current weight. Three months after the program ended, the firefighters had regained a mean of 1 kg. Eight months after the program ended, the airline personnel had regained a mean of 0.2 kg. The subjects who could not be contacted were traveling or on duty elsewhere.

We recontacted the aviation personnel 4 months later, by which time they had regained another 0.2 kg on average. At this 15 month mark, two-thirds had retained >80% of their weight loss at week 12 and half of these weighed less than at week 12.

Discussion

The retention rate of the occupational subjects in the current study was higher than in most worksite programs [17]. The reasons for dropping out tended to be social or domestic events, or clinical events not related to the dietary regimen.

The high retention rate of the male (89%) and female (88%) flight crew personnel is noteworthy because their participation included the Thanksgiving–New Year period, a traditional time for holiday eating. Not one person dropped out and only one airline employee gained weight during this season.

Follow-up interviews were not conducted in order to remove a possible source of pressure or anxiety for the subjects. We thus do not know what combination of factors led to the comparative success in the firefighters' and airline personnel's continuation of weight maintenance or control. The close interaction in their work setting may have been a factor. Also, the minimum time required to prepare the shake could be appealing to workers who must always be ready to interrupt a meal. The communal eating of the cockpit and firehouse settings may make it difficult to have an 'unofficial' snack [18].

One contributory factor to the comparatively low weight loss rates of the hospital personnel could have been the non-availability of the pre-program group dinner briefing and question-and-answer session. Another reason could be their mental set, in that many physicians and nurses tend to be non-compliant patients who find it difficult to be patients in the hospital in which they work [19,20].

The lack of reminders could have contributed to the subjects' sense of self-direction and internal locus of control over their weight loss. When an external locus of control takes over, some people may no longer feel that they can control their weight [21]. Even though the internal locus of control is important, this use of meal replacement materials could provide momentum for

participation because it was implemented by the employer.

None of the four occupational groups, however, was under employer-related pressure to lose weight for any reason; all participants were completely voluntary. In all four groups, there was no upper acceptable limit for body weight or BMI in terms of job retention, promotion or similar considerations. Although the New York City Police Department does have upper limit criteria for height and weight, they are only used to screen new applicants and subsequently during their probationary period, after which height and weight considerations are factors in making assignments.

Worthy of further study is the finding that the older subjects (34 and older) stayed longer ($P < 0.01$) but the younger subjects lost more weight ($P < 0.05$). The use of weight loss competitions in order to enhance motivation and social support also merits further investigation. Competition has had robust effects in improving recruitment, retention, cost effectiveness and weight loss [22].

This approach might be tried with other occupations in which there are different group dynamics, less stress and less contact with the public, in work organizations of different scope and with mainstream program components like formal exercise activities and behavior modification.

How long is the weight loss reported in this study likely to be maintained? Two of the comparative clinical studies provide relevant data. In the UCLA study, in which the subjects took the product on a maintenance basis (one shake daily) from week 12 to week 116, the mean weight loss from baseline to the last week was 6.1 kg for men and 6.3 kg for women [15]. In the German study, for 2 years after the initial 3 months, the subjects replaced one meal and one snack daily with a shake and a snack bar, and lost on average an additional 0.07% of their initial body weight every month ($P < 0.01$) [16].

Additional data on program effects in a self-managed setting derive from a case-control prospective study in a rural Wisconsin town [23]. Other than receiving the meal replacement product free for 5 years, there was no intervention, medical or otherwise. The 50 male and 84 female adult subjects were followed for the 5 years, along with 142 matched male and 247 matched female controls. By the end of the program, the program males were -5.8 ± 5.4 kg and the females -4.2 ± 6.9 kg from their original weights, suggesting that there was significant secondary prevention of weight gain. In contrast, the male controls gained 6.7 ± 10.2 kg and the female controls gained 6.5 ± 10.7 kg, after 5 years.

A meal replacement weight maintenance program in a work setting might be more effective than previous worksite programs using other approaches. It may be that the unobtrusive features of this study, in which the only contact with the subjects involved delivery of the product and recording their weight, helped some workers

to continue the better living habits that were developed during the initial 12 weeks.

In 1994, the first year in which such costs were tallied, the direct cost of obesity to American employer health plans was \$12.7 billion [24]. In America, ~20% of adult men and 25% of adult women have a BMI over 30, and the prevalence of such obesity has increased by >50% over the last 10–15 years [25]. In light of such trends, even though we do not know precisely how the availability of meal replacements affected other behavior that influenced body weight, the results of this study suggest that further data on this approach could be useful in occupational medicine.

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