Changing risk behaviours for non-communicable disease in New Zealand working men – is workplace intervention effective?

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Abstract

Aims. To evaluate the effectiveness of a health promotion programme targeting dietary behaviours and physical activity among male hourly-paid workers and to explore demographic and attitudinal influences on dietary patterns at baseline.

Methods. A controlled field trial compared workers at one intervention and one control worksite. The intervention comprised nutrition displays in the cafeteria and monthly 30-minute workshops for six months. Key outcome measures at six and twelve-months were self-reported dietary and lifestyle behaviours, nutrition knowledge, body mass index (BMI), waist circumference and blood pressure.

Results. 132 men at the intervention site and 121 men at the control site participated in the study and a high retention rate (94% at 6-months and 89% at 12-months) was achieved. At baseline, 40% of the total sample (253) were obese, 30% had elevated blood pressure, 59% indicated an excessive fat intake and 92% did not meet the recommended vegetable and fruit intake. The intervention reduced fat intake, increased vegetable intake and physical activity, improved nutrition knowledge and reduced systolic blood pressure when compared to the control site. There was no difference in change in mean BMI or waist circumference. Reduction in BMI was associated with reduction in fat intake.

Discussion. Low intensity workplace intervention can significantly improve reported health behaviours and nutrition knowledge although the impact on more objective measures of risk was variable. A longer duration or more intensive intervention may be required to achieve further reduction in risk factors.

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The high level of obesity and nutrition-related diseases in New Zealand is a significant public health issue.[1] It is of particular concern for men, especially Maori and Pacific men,[1,2] and those working in lower paid jobs, all of whom are at high risk of non-communicable diseases.[3] A manufacturing workplace is a key setting to access men in lower-paid jobs and influence risk behaviours, although male blue collar (hourly paid) workers may be less likely to participate in health education than female or white collar workers.[4] Strategies to reduce health risk behaviour are more likely to succeed when health education is combined with changes in the worksite environment.[5]

This study tested the hypotheses that a relatively low intensity workplace intervention with male hourly paid workers could significantly improve dietary behaviours (more vegetables and fruit, less high fat food), increase physical activity and reduce blood pressure and body weight.

Methods

Design. A controlled field trial compared workers at one intervention and one control worksite. Two South Auckland manufacturing worksites with supportive management, a company canteen and a stable workforce of at least 200 men were chosen. Participation was voluntary and the study was open to all male hourly paid employees (310 at the intervention site and 260 at control site) except those known by management to be leaving within one year. Participants were assessed concurrently at baseline, six and twelve months. The six-month health promotion programme was implemented at the intervention site immediately after baseline data collection. The intention was to deliver the same intervention to the control site after the six-month data collection. Production pressure made it impossible to implement more than one session to 40% of participants, however cafeteria food was substantially improved to include lower-fat options and all employees received a leaflet on healthy eating. The intervention 'dose' was difficult to quantify and a decision was made to regard this site as a control for the duration of the study with acknowledgement that any resulting bias would reduce the apparent effect of the intervention at twelve-months. Ethics approval was obtained from the Auckland Ethics Committees.

Data collection. Height (to the nearest 5 mm) and weight (to the nearest 0.1 kg, Seca electronic balance) were measured without shoes and in lightweight work clothes. Waist circumference was measured next to the skin at the umbilicus (to 0.5 cm). An automatic sphygmomanometer (Omron, HEM - 719 K) was used to measure blood pressure after sitting for five minutes. The mean of two measurements was recorded; treatment with blood pressure medication was not ascertained. Obesity was defined as BMI $\geq 30\ kg/m^2$ in European and Asian men[6] and $\geq 32\ kg/m^2$ in Maori and Pacific men.[7] Hypertension was defined as systolic ≥150 mmHg and/or ≥90 mmHg diastolic.[8]

Data on demographics and self-reported behaviours were collected using a ten-minute questionnaire. This included questions on fat, vegetable, fruit and alcohol intake, breakfast consumption, nutrition knowledge, stage of change in relation to readiness to lose weight, physical activity routine and attitudes to food and health. An interpreter fluent in Tongan and Samoan was available and participants were given the option of having the questionnaire administered to them. The Dobson short fat questionnaire (SFQ)[9] was selected to measure fat intake because of its low respondent burden and comparatively high validity. The 17-item SFQ included foods commonly consumed in New Zealand but was modified to 19 items to better reflect food frequently eaten by Maori and Pacific men. A 14-item multiple-choice nutrition knowledge section was specifically designed as no suitable published questionnaire was found. Participants were asked if they undertook any moderate leisure time activity (eg brisk walking) or vigorous activity (causing a person to breathe hard or sweat) during a normal week, and if so, its frequency and duration.

Intervention. Intervention site participants were rostered to attend a 30-minute workshop session once a month for six months. Topics included nutrition and non-communicable disease risk, safe use of alcohol, and benefits of physical activity. Key workers were consulted during planning, and the stages of change model[10] guided development and delivery. Six nutrition displays were rotated through the cafeteria. Additionally, illustrated point of choice messages promoting vegetables, fruit, lower fat items and water as a beverage were installed.

Statistical analyses. To examine the effect of intervention on outcomes, a mixed model (binary where appropriate) was fitted with the three time periods of baseline, six-months and twelve-months treated as repeated measures. The potential confounding variables of ethnicity, age, education and marital status were included and time, group interaction was the effect of interest. Where evidence of effect of intervention on change existed, the interaction contrasts of baseline versus six-months and twelve-months with group were tested. To investigate the influence of changes in intermediary variables on changes in outcome variables (BMI, waist circumference, systolic and diastolic blood pressure), a random coefficients model including the same four confounding variables and worksite was used. The intermediary variables examined were total fat score, nutrition knowledge score, vegetable and fruit intake, physical activity and alcohol intake. Regression techniques were used to investigate relationships among demographic factors, attitudes and knowledge, lifestyle behaviours and health outcomes at baseline.

Results

132 of 347 eligible men employed at the intervention site and 121 of 262 men employed at the control site volunteered to participate in the study. A high retention rate (94% at six-months and 89% at twelve-months) was achieved. One participant withdrew due to ill-health, one elected to withdraw from the study and 25 had terminated their employment. Attendance at the workshops averaged 77% despite increasing production pressure.

Participant characteristics are shown in Table 1, and changes in lifestyle behaviours and knowledge in Table 2. Fewer than 20% of participants achieved the recommended fat score (approximately equal to 30-34% of energy as fat[11]). A higher fat intake was associated with younger age ($p<0.0001$), lower nutrition knowledge ($p=0.0005$) and reduced belief in the importance of healthy eating ($p=0.02$). Participants who anticipated difficulty in changing the food eaten at home, despite wishing to do so, also demonstrated a higher fat intake ($p=0.03$). Vegetable and fruit intake was low with only 8.3% achieving the New Zealand goal (≥5 servings/day).[11] Higher nutrition knowledge score ($p=0.04$) and ethnicity ($p=0.02$, European higher) were associated with higher vegetable intake. Belief that healthy eating was important was associated with higher fruit intake ($p=0.0003$). Mean nutrition knowledge was similar at both worksites. Ethnicity ($p=0.002$, European higher) and higher education level ($p=0.0002$) were associated with greater nutrition knowledge whilst lower knowledge was associated with higher BMI ($p=0.02$).

Table 1. Baseline Characteristics of Study Participants by Worksite.

Factor	Intervention site (n=132)	Control site (n=121)
Ethnicity (%)		
Maori	12.1	29.7
European	25.7	39.7
Pacific	56.1	28.1
Other	6.1	2.5
Age (years)		
Mean ± SD	35.0 ± 11.2	42.9 ± 11.7
Marital Status (%)		
Single	30.3	17.3
Married/partner	61.4	77.7
Other*	8.3	5.0
Eductional level (%)		
<4 years high school	50.0	70.2
≥4 years high school	50.0	29.8
Smoking Status (%)		
Non-smoker	64.4	71.9
Current smoker	35.6	28.1
Drinking Status (%)		
Drinks less than 1x month	25.0	27.3
Drinks at least 1x month	75.0	72.7
Standard drinks per session†		
1-3	36.4	45.6
4-5	14.1	20.7
≥6	49.5	33.7

*Separated/divorced/widowed. †Applies to those drinking at least 1x/month.

There was little difference in attitudes to food and health between sites. Older age ($p=0.03$), lower fat intake ($p= 0.0005$) and ethnicity ($p=0.0001$, Pacific higher) were associated with belief that healthy eating was important. Anticipation of greater difficulty in changing the food eaten at home was associated with a higher BMI ($p=0.02$), and ethnicity ($p=0.0007$, Maori/Pacific having greater degrees of difficulty) as well as a higher fat intake. Over 40% of participants with a BMI >30kg/m^2 indicated that they were precontemplators, or not thinking about change,[10] in relation to weight loss.

At baseline, 23.5% European, 31.2% Maori and 47.3% Pacific intervention site participants were obese compared to 27.1% European, 33.3% Maori and 67.6% of Pacific control site participants. Higher BMI was associated with poorer self-perceived health ($p=0.0001$). Approximately one quarter (26%) of intervention site participants and one third of controls (35%) had hypertension. Higher dietary fat intake was associated with higher systolic blood pressure ($p=0.03$).

Effects of intervention (Tables 2 and 3). There was a strong relationship of the intervention to change in mean fat score ($p=0.0003$) with greater reduction at the intervention site between baseline and both six ($p<0.0001$) and twelve-months (p 0.005). There was also a significant difference in the change in vegetable intake ($p=0.007$) with increase at the intervention site at both six ($p=0.002$) and twelve-months ($p=0.05$) compared to a decrease at the control site. However, the intervention did not significantly affect fruit intake. It also did not have a significant effect on alcohol consumption.

The change in nutrition knowledge differed ($p<0.0001$) with a greater improvement in the intervention site at both six and twelve-months ($p<0.0001$ and $p=0.005$ respectively; Table 2). Attendance at more workshop sessions was associated with a significant increase in nutrition knowledge ($p=0.006$). There was also a difference in the change over time in the level of physical activity ($p=0.005$) with this increasing from baseline to twelve-months at the intervention site whilst decreasing at the control site ($p=0.002$; Table 2).

There was a difference in change in systolic blood pressure at the worksites ($p=0.0005$, Table 3) with a greater reduction at the intervention site from baseline to both six ($p=0.001$) and twelve-months ($p=0.0004$). There was no significant difference in the change in mean BMI or waist circumference (Table 3). Reductions in BMI within an individual were significantly related to decreases in fat score ($p=0.05$) whereas reductions in waist circumference were related to both decreases in fat score ($p=0.002$) and increases in fruit consumption ($p=0.03$).

Discussion

The aim of this workplace intervention was to improve dietary patterns, increase physical activity and reduce risk factors for non-communicable diseases in hourly paid male workers. The failure to significantly change fruit consumption, whilst fat consumption decreased and vegetable intake increased, reflects the overall low intake of fruit in New Zealand,[2] mirrors the result from a worksite study of similar size,[12] and indicates that this is a more difficult behaviour to change. The workshop session on alcohol was held in response to participants' questions concerning the safety of their high alcohol intake, however it did not have a significant effect on self-reported alcohol consumption.

Similar overseas worksite studies measuring weight or BMI have reported mixed results ranging from modest losses to modest gains.[13-15] Whilst the reduction in systolic blood pressure could not be associated with a specific behaviour change, the combined changes in fat and vegetable intake and physical activity may have contributed. Evidence for the combined effect of dietary changes is provided by the DASH study[16] in which a reduced-fat diet rich in vegetables, fruit and low-fat dairy foods substantially lowered blood pressure.

Table 2. Changes in lifestyle behaviours and nutrition knowledge by worksite.

Lifestyle factor	Intervention site			Control site			
	Baseline (n=132)	6 months (n=124)	12 months (n=116)	Baseline (n=121)	6 months (n=114)	12 months (n=110)	Probability of difference in change
Consume 2-3 serves fruit/day (%)	21.2	28.9	23.3	26.4	29.2	31.8	0.78*
Consume 2-3 serves vegetables/day (%)	14.4	26.6	21.5	21.5	14.1	22.7	0.007*
Consume breakfast before work (%)	35.6	45.2	47.4	53.7	53.9	58.2	0.34
Consume ≥6 drinks/session (%)†	49.5	31.8	35.4	33.7	21.7	23.7	0.32*
Vigorous activity/week (hours)‡	5.9 (7.9)	0.0 (9.6)	+2.8 (14.2)	10.6 (15.5)	-0.9 (16.4)	-2.6 (17.3)	0.005*
Moderate activity/week (hours)‡	4.5 (6.7)	+0.1 (10.2)	+0.9 (11.8)	6.53 (9.9)	-1.2 (11.6)	-1.7 (11.3)	0.005*
Fat score‡	31.0 (7.7)	-3.6 (7.2)	-3.4 (7.4)	30.9 (9.1)	-0.6 (6.0)	-1.1 (6.3)	0.0003
Nutrition knowledge score‡	8.5 (2.6)	+1.8 (2.2)	+1.4 (2.3)	8.3 (2.7)	+0.1 (2.4)	+0.5 (2.6)	<0.0001

*Probability applies to change in total quantity fruit or vegetables, total volume alcohol or total hours physical activity. †Applies to those drinking at least 1x month. ‡Mean (SD); 6 and 12-month values are changes from baseline.

Table 3. Change in biometric factors by worksite.

Biometric factor	Intervention site			Control site			
	Baseline*	Change 0-6 Months†	Change 0-12 months†	Baseline*	Change 0-6 months†	Change 0-12 months†	Probability of difference in change
BMI (kg/m^2)	30.0 (6.0)	+0.1 (0.1)	0.0 (1.2)	30.6 (5.2)	+0.2 (1.3)	0.0 (1.1)	0.68
Weight (kg)	92.1 (20.9)	+0.2 (3.1)	0.0 (3.8)	92.4 (17.0)	+0.5 (3.8)	0.0 (3.3)	0.63
Waist circumference (cm)	98.8 (15.5)	-0.5 (3.6)	-0.1 (6.2)	100.7 (13.5)	+0.2 (3.8)	+0.4 (4.2)	0.22
Systolic blood pressure (mmHg)	135.8 (18.2)	-5.0 (16.5)	-5.8 (15.3)	134.3 (18.8)	+1.5 (11.9)	+1.9 (13.5)	0.0005
Diastolic blood pressure (mmHg)	83.4 (12.2)	+0.5 (10.3)	-0.2 (10.8)	85.9 (12.2)	+2.1 (9.0)	+1.7 (9.9)	0.17

*means (SD). †means of difference (SD).

At baseline, belief in the importance of healthy eating and greater nutritional knowledge were associated with desirable eating behaviours. In contrast, increased difficulty with changing habitual food intake was associated with higher fat intake and higher BMI. Additionally, 43% of obese participants were not contemplating losing weight. These findings confirm the importance of strategies utilised in workshop sessions, namely, raising awareness about problem behaviours, personalising health risk and favourably influencing decisional balance (the weighing up of advantages and disadvantages associated with changing behaviour).

Self-reported measures of dietary intake and physical activity are subject to reporting bias and it is possible that intervention site participants may have sought to please the interviewer and underreported fat intake. However, the SFQ had been previously validated, intra-individual reduction in BMI and waist circumference was significantly related to decreases in fat scores, and data were collected at each time-point and responses analysed later (rather than directly asking the participants for reported changes). Based on the actual number of participants recruited and using the standard deviation of the mean intra-individual change, the study had an 80% power to detect changes of 0.66 kg in weight, 0.4 kg/m^2 in BMI, and 1.27 cm in waist circumference at the 5% level of significance. A more intensive, individually oriented intervention may have been able to demonstrate a further reduction in risk factors, however small changes achieved by a large number of people add up to a significant public health benefit.[17]

A standardised biometric measurement protocol was used to minimise error. Inter-observer error in waist circumference measurement was minimised by using one operator. Observer error in blood pressure measurements was eliminated by the use of a previously validated digital monitor.[18] If blood pressure was elevated, respondents at each worksite were counselled in the same manner by the same researcher. It is possible, though unlikely, that the difference in change between the worksites was due to intervention site participants seeking medical intervention more avidly than control participants.

Only 42% of the employees volunteered to participate in this study. Since, however, it was a controlled study to assess the effect of an intervention, any bias introduced by this is of less importance. The study had a comparatively high respondent burden and the numbers participating do not necessarily reflect the number who would be attracted to a similar education programme without the data collection burden. As only one worksite was included in each arm of the study, variation in the effect of the intervention at different sites could not be investigated. The commitment shown by the companies was vital to the programme's effectiveness and their support and tangible contribution, particularly at the intervention site, was considerable. These companies are perceived to be 'good employers' and the wider ability of New Zealand companies to support and sustain health promotion programmes in paid time has not been tested. The ethnic diversity of the population makes it more representative of a manufacturing worksite in Auckland than in other areas of New Zealand.

In conclusion, this study has shown that a manufacturing worksite is potentially a valuable setting for primary prevention of non-communicable disease and that a low intensity intervention can improve nutrition knowledge and change important lifestyle behaviours in a population who are difficult to reach. A longer or more intensive individually oriented intervention may have been able to demonstrate further reduction in the prevalence of risk factors.

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