

Original Article**An innovative program for changing health behaviours**

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Health-related behaviours affecting diet, weight control and physical activity are important for long-term cardiovascular health but behaviour change is difficult to initiate and even more difficult to maintain. We have developed a health promotion program, in which social support has a key role, to encourage a prudent diet, weight control and physical activity. Behaviour change is based on evaluating initial behaviour, weighing up costs and benefits, assessing barriers to change and goal-setting. We first evaluated the program in couples beginning to live together, a group chosen because of the risk of weight gain and decreased physical activity after marriage, readiness to change behaviour at that time in the life course and the opportunity to use partner's support in achieving behaviour change. In an initial short-term study with 39 couples, intake of fat and take-away foods decreased and consumption of fruit, vegetables and reduced fat foods increased. Physical activity increased and there was a 6% fall in blood cholesterol. Further evaluation in 137 couples included assessment after 12 months. A decrease in fat intake and increase in physical activity and fitness seen at the end of the program persisted 1 year later. Lower cholesterol and a trend to lower weight gain and lower blood pressure were also maintained after 12 months. We have modified the program aiming for weight loss, improved dietary habits and increased physical activity in overweight treated hypertensives, supported by their partners. Decreased intake of energy, total and saturated fat, and weight loss seen at the end of the 16 week program was significantly greater in the intervention group than with usual care. Blood pressure fell in the program group at the end of intervention and, in men, withdrawal of antihypertensive drugs was significantly associated with the intervention. Weight loss and a decrease in waist circumference were maintained in the program group up to 16 months after entering the study. This program has the potential for wider application in other at-risk groups.

Key words: Blood pressure, cholesterol, diet, weight control.

Introduction

The benefits of physical activity, a prudent diet and weight control on risk for lifestyle diseases are well recognized. However, about half of the population of adult Australians, particularly women, do not exercise at a level adequate to achieve health benefits.^{1,2} Sedentary habits among Australians have been estimated to be responsible for over 6000 deaths per year and a health care cost of \$A377 million.³ Excessive intake of fat, particularly saturated fat⁴ and inadequate consumption of fruit and vegetables are common in young Australians, with less than a quarter of adolescents reporting an adequate intake of fruit and only one-third reporting an adequate intake of vegetables.⁵ In 1989, 48% of Australian men and 34% of women were overweight or obese.⁶ By 2000 the proportion had increased to 67% of men and 52% of women.⁷ Among Australians at least 45 years old, only 25% of men and 35% of women were in an acceptable weight range in 1995.⁸ These disturbing trends make it a priority to target the adoption and maintenance of healthy lifestyle choices.

In developing an intervention program to encourage physical activity, a healthy diet and weight control, we incorporated strategies reported to improve long-term maintenance of improved health-related behaviours.^{9–12} These included behavioural-cognitive manipulations, contact sessions with program facilitators, a duration of intervention chosen to maximize compliance without encountering problems of attrition, and an emphasis on social support, particularly from partners. We initially applied the program in couples early in the course of cohabitation, a group not previously targeted in health promotion but at risk of weight gain associated with increased food intake and a decrease in exercise.^{13–17} Targeting this group also has the potential to influence health behaviours in the children of these couples.

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in the long term, an important consideration given the tracking of health behaviours from childhood.¹⁸

We considered that willingness to adopt positive health-related behaviours at this point of change in the life-course may facilitate acceptance of a health promotion program, especially one that built on the social support provided by a partner.^{19,20} Encouraging results with the intervention in couples led us to modify the program for use in overweight hypertensive patients on drug treatment with the aim of increasing physical activity, improving dietary habits, achieving weight loss, reducing alcohol intake and reducing requirements for antihypertensive drugs.

Study 1

The intervention program in couples

The prototype program was delivered during a 4 month period and focused on physical activity and nutrition. We aimed to achieve the recommended level of at least 30 min of moderate activity on most days²¹ and to promote the consumption of a variety of foods low in fat and salt and high in fibre, consistent with Australian national dietary guidelines.²² Specific aims were an intake of not more than 30% energy as fat, not more than 10% as saturated fat, and fibre consumption of 30 g per day to include increased intake of fruit and vegetables.

We carried out a pilot study as a randomized controlled trial involving 39 couples who had cohabited for not more than 2 years. At the end of the 4 month intervention, relative to controls, the program group showed increased self-efficacy for diet and physical activity, an increased ranking of beliefs about the benefits of a healthy lifestyle and a decreased ranking of perceived barriers to changing behaviours related to physical activity and diet.²³ The program was also associated with a decrease in fat intake, an increase in fruit and vegetable consumption and in time spent in physical activity and greater physical fitness. Blood cholesterol fell by 6% in the program group relative to controls. With these improvements in cognitive variables, health-related behaviours and cardiovascular risk, we extended the study to a larger group of couples to document longer-term changes to 12 months after beginning the program. The second couples study also compared two methods of delivering the program, either by mail or by a combination of mail and interactive group sessions, to allow cost–benefit analysis as an economic basis for possible wider application of the program.

Participants and methods

One hundred and thirty-seven couples entered the study and were randomised to a usual care group ($n = 43$), or to a low level ($n = 47$) or high level ($n = 47$) intervention lasting 16 weeks. The program consisted of six printed modules slightly modified following the pilot program²³ in response to information collected in focus groups. The program targeted nutrition and physical activity, including incidental activity, and provided information about the benefits of stopping smoking and drinking alcohol within Australian national guidelines as in the prototype.^{23,24}

Couples in the high-level intervention group received the modules every 2 weeks, half by mail and half at contact sessions where the facilitators explained the aim of the modules, demonstrated exercise techniques, answered questions and reviewed progress. In the low level group, following a contact session at which the first module was delivered, all other modules were mailed every second week. Modules encouraged self-directed change in behaviour and focused on barriers to change, costs and benefits of a healthy lifestyle, goal setting, time management and stress management. Table 1 shows an outline of the content of the module

Measurements

Measurements were recorded at baseline, at the end of the 16 week intervention and 1 year after commencing the program. Perceived barriers to positive health behaviours and beliefs about the benefits of health behaviours were recorded using a 6 point scale.²⁵ Health beliefs were elicited using separate questionnaires for diet and physical activity addressing beliefs about associations between each behaviour and blood pressure, cholesterol, risk of heart disease, longevity, general health and control of weight gain. For each item, a higher score indicated a stronger belief in the benefits of the behaviour. An 18 item instrument was used to assess self-efficacy for each behaviour.²⁶

Dietary intake, using household measures, was assessed at baseline, at the end of intervention and at 12 month follow-up using 3 day diet records that included one weekend day. Nutrient intake was calculated using the Xyris Diet/1 Software (Xyris, Brisbane, Australia) with reference to the Commonwealth of Australia Department of Health NUTTAB 1995 database updated from Lewis and Holt.²⁷

Physical activity was recorded using a 7 day recall that is an interviewer-administered recall of both leisure-time and occupational activity.²⁸ A self-administered 14 day recall was modified from the questionnaire used by the Australian Department of the Environment, Sport and Territories.²⁹ Amount and type of alcohol intake was recorded using 7 day retrospective diaries and converted to g/day of ethanol. Smoking habits were elicited by questionnaire.

Blood pressure (BP) and heart rate were measured in triplicate at 1 min intervals using an automated recorder (Dinamap 1846 SX/P, Critikon, Tampa, Florida, USA) after participants had been seated quietly for 5 min and the mean was used in analysis. Height and weight were recorded and fasting cholesterol measured. Physical fitness was assessed using the Physical Work Capacity (PWC₇₅) at 75% of maximum heart rate using bicycle ergometers.³⁰

Random effects models (PROC MIXED, SAS Institute, Cary, NC, USA) adjusted for age and sex were used for analysis to allow for the correlated error structure of the data in which couples rather than individuals were the unit of randomization.³¹

Results

Of the 137 couples entering the study, 111 completed testing at the end of intervention and 81 attended for follow-up

Table 1. Outline of the modules used in the program for couples

Module number	Physical activity	Nutrition	General
1. Workshop session	Health benefits of exercise How to start an exercise program	Health benefits of good nutrition Principles of the Healthy Eating Pyramid	Barriers to a healthy lifestyle Costs & benefits of a healthy lifestyle Goal setting Rewards
2. Workshop session	How to judge exercise intensity Exercise for health fitness & weight loss Exercise & back care	Fat & fibre Low fat recipe modification	Goal setting
3. Mail-out	Injury prevention Signs of overexertion Correct exercise technique	Healthy eating on a budget Time management	Review of goal setting, costs & benefits & rewards Exercise myths Time management
4. Mail-out	Exercise myths Correct exercise technique	Specific nutrients Food for vegetarians Food for active people Vitamin & mineral supplements	
5. Workshop session	Cultivating exercise partners Relapse prevention Exercise & blood pressure, antioxidants, asthma, cholesterol	Dining out & socializing Current interest topics (e.g. red wine, fish oils)	Stress management Smoking Alcohol
6. Mail-out	Exercise & pregnancy Children's exercise needs	Pregnancy issues Nutrient needs Food safety Breastfeeding Nutrition for children Weight control for life	Summary & review

Table 2. Baseline characteristics of participants according to treatment group

Variable	Control		Low level		High level	
	Men <i>n</i> = 43	Women <i>n</i> = 43	Men <i>n</i> = 47	Women <i>n</i> = 47	Men <i>n</i> = 47	Women <i>n</i> = 47
Age (years)	31.5 (1.4)	29.2 (1.3)	29.8 (1.3)	27.7 (1.0)	30.9 (1.2)	27.4 (1.0)
BMI (kg/m ²)	26.6 (0.6)	24.4 (0.7)	26.9 (0.6)	24.6 (0.8)	27.0 (0.5)	23.2 (0.6)
Overweight or obese*	25 (57%)	11 (29%)	29 (62%)	17 (36%)	30 (65%)	10 (22%)
Total cholesterol (mmol/L)	5.0 (0.2)	4.7 (0.1)	5.0 (0.1)	5.0 (0.1)	4.9 (0.2)	4.9 (0.1)
SBP (mmHg)	115.6 (1.8)	104.9 (1.4)	116.4 (1.9)	103.7 (1.2)	115.1 (2.0)	103.5 (1.5)
DBP (mmHg)	60.2 (1.1)	57.8 (0.9)	59.6 (1.0)	57.1 (0.9)	59.9 (1.2)	57.6 (1.1)
Frequency of exercise (days/week)	2.3 (0.3)	2.1 (0.3)	1.6 (0.2)	1.8 (0.3)	2.5 (0.3)	1.7 (0.3)
Sufficient physical activity†	11 (25%)	12 (27%)	9 (19%)	8 (17%)	15 (32%)	11 (24%)
Smokers	10 (23%)	5 (11%)	8 (17%)	6 (13%)	11 (24%)	4 (9%)
Total fat > 30% energy	25 (58%)	26 (61%)	38 (81%)	36 (77%)	36 (78%)	31 (67%)
Saturated fat > 10% energy	38 (88%)	36 (84%)	45 (96%)	45 (96%)	42 (91%)	40 (87%)
Fibre > 25 g/day	15 (35%)	9 (21%)	13 (28%)	11 (23%)	16 (35%)	10 (22%)
Energy (MJ)	10.4 (9.6, 11.2)	8.2 (7.6, 8.7)	10.2 (9.6, 10.9)	7.9 (7.4, 8.4)	10.8 (10.3, 11.3)	8.0 (7.5, 8.6)
Sodium (g/day)	3.5 (3.2, 3.8)	2.7 (2.5, 2.9)	3.7 (3.4, 4.0)	2.8 (2.6, 3.1)	3.8 (3.6, 4.1)	2.8 (2.5, 3.1)

There were no significant differences between groups.

*Overweight: BMI > 25 kg/m²; Obese: BMI > 30 kg/m².

†Equivalent to 150 min of moderate exercise weekly.

1 year later. Their baseline characteristics are shown in Table 2.

Changes in cognitive variables

Figure 1 shows self-efficacy, scores for the importance of perceived barriers to behaviours and scores for the

importance of health beliefs related to dietary and physical activity behaviours. Self-efficacy for dietary behaviours increased significantly in both the low and high level groups at the end of intervention and at follow-up. Physical activity self-efficacy increased in the high level group both at the end of intervention and at follow-up but changes did not differ

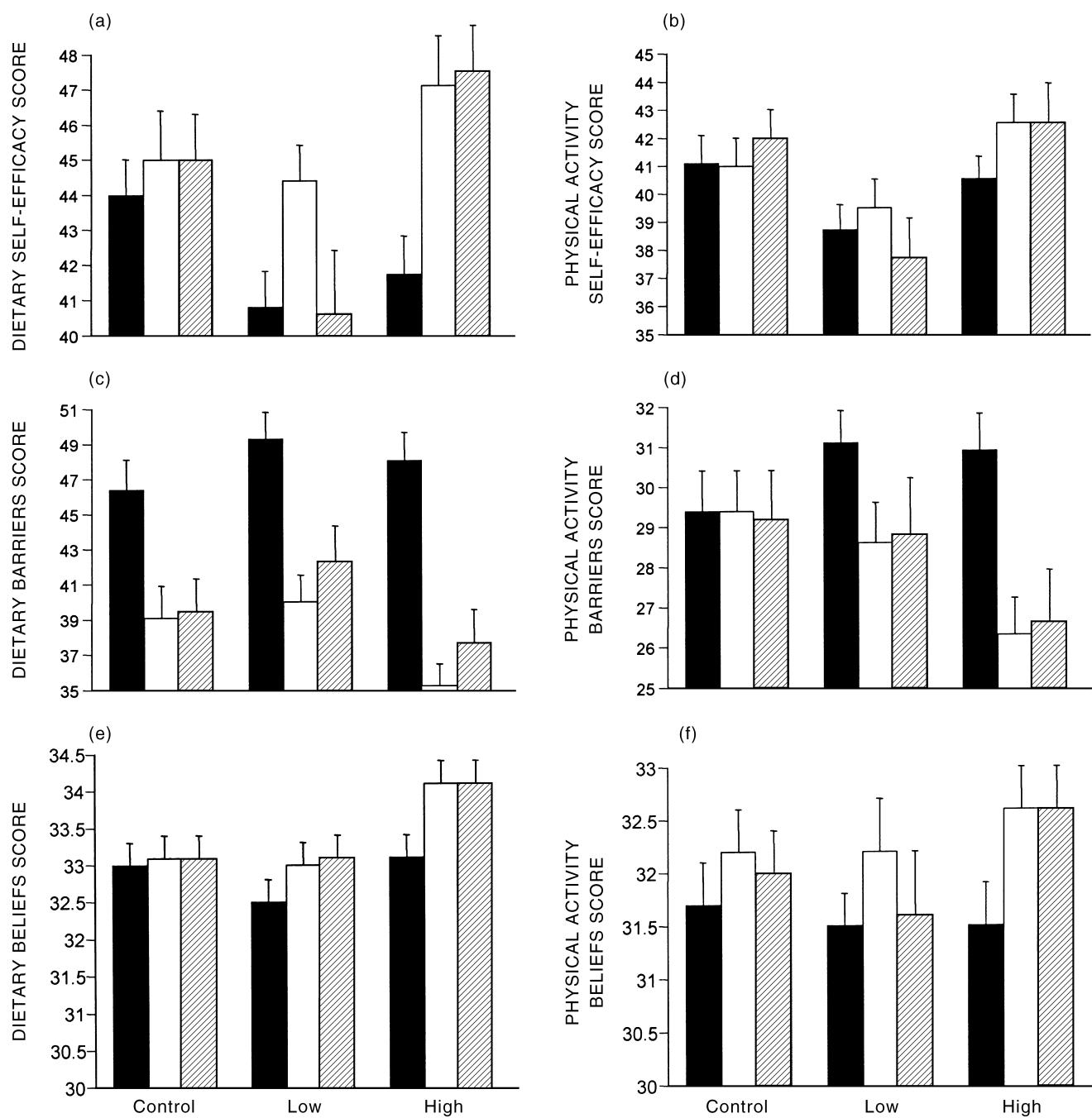


Figure 1. Self efficacy score, scores for perceived barriers to behaviours and scores for health beliefs for diet and physical activity at baseline, end of intervention and at follow-up after one year in the study of young couples. (a) Dietary self-efficacy score; (b) physical activity self-efficacy score; (c) dietary barriers score; (d) physical activity barriers score; (e) dietary beliefs score; (f) physical activity beliefs score. (■) Baseline; (□) End of intervention; (▨) One year follow-up.

significantly between groups. Overall score for the perceived importance of barriers to changing behaviours related to diet decreased significantly relative to controls in both program groups at the end of intervention and in the high level intervention group at follow-up after 12 months. For physical activity, the fall in the importance of perceived barriers to change was significantly greater in the high level group at the end of intervention, but a similar trend after 1 year did not show significant between-group differences. An increase

in the score for beliefs about the benefits of a healthy diet and physical activity showed a trend to greater change in the high level group at the end of intervention and this difference was significant after 1 year (Fig. 1).

Change in dietary and physical activity behaviours

Changes in nutrient intake were significantly greater than the control group for both interventions. Decreased intake of total and saturated fat in the intervention groups was significantly

different to controls at the end of intervention and at follow-up (Fig. 2). Fibre intake increased in the intervention groups at the end of the program and was maintained in the low level group at follow-up. Both energy intake and sodium intake fell in all groups with no significant between-group differences at the end of the program or at follow-up. There were no between-group differences in alcohol consumption (Fig. 2).

As shown in Fig. 3a, time spent in exercising at moderate intensity increased relative to baseline in all groups at the end of the program and at follow-up and although changes were greater in the intervention group, between-group differences were not significant. Fitness increased significantly in the high level intervention group both at the end of intervention and after 12 months relative to the control group. Decreased fitness in the control group and the low level group at follow-up appears inconsistent with their self-reported increase in physical activity (Fig. 3b), suggesting that self-reports are an overestimate of activity in these participants.

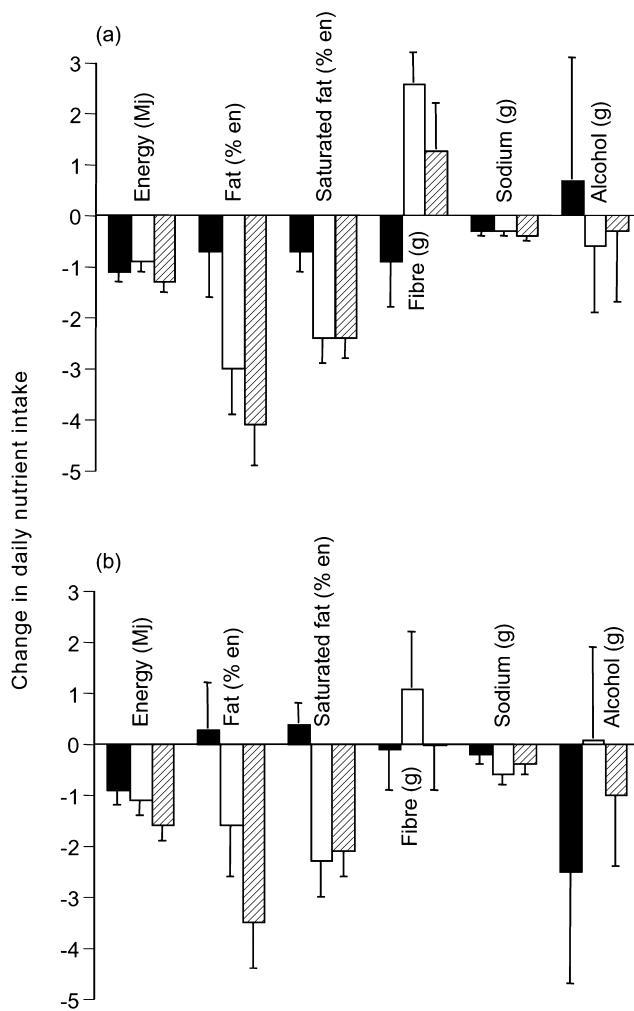


Figure 2. Change in nutrient intake at the end of intervention (a) and at follow-up one year after entering the study (b) in a randomised controlled trial in young couples. (■) Control group; (□) Low level intervention; (▨) High level intervention.

Change in cardiovascular risk factors

In the control group the proportion of overweight or obese individuals ($\text{BMI} > 25 \text{ kg/m}^2$) increased by 5% at the end of intervention and by 11% after 1 year, relative to baseline. In the low level group there was an increase of 2% in the proportion of overweight or obese participants at the end of intervention and 9% at follow-up. However, in the high level group at the end of intervention there was no change in the proportion of overweight or obese participants. After 1 year the proportion of overweight or obese individuals had increased by 4%, that is, less than half the increase seen in the low level or control groups.

There were no significant between-group differences in change in BMI. However, at the end of the program BMI had decreased in both intervention groups while it had increased in the control group. At follow-up BMI increased in all groups but there was a trend to a smaller increase in the high level intervention group (Fig. 4). Blood pressure fell in the high level group at the end of intervention and at follow-up

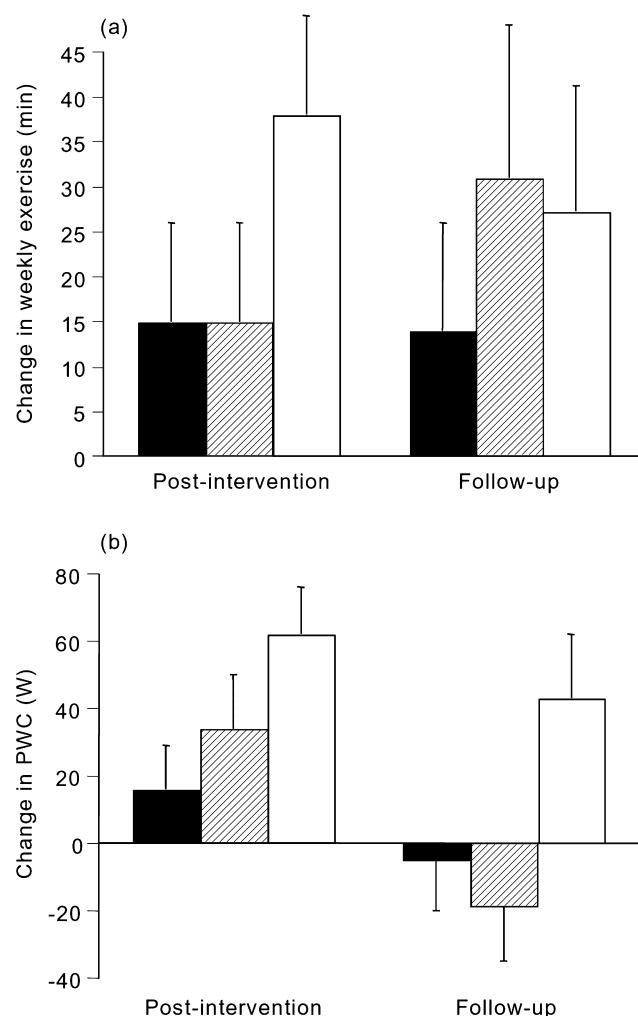


Figure 3. Change in time spent in moderate activity (a) and change in fitness levels (b) at the end of intervention and one year after entering the program. (■) Control group; (□) Low level intervention; (▨) High level intervention.

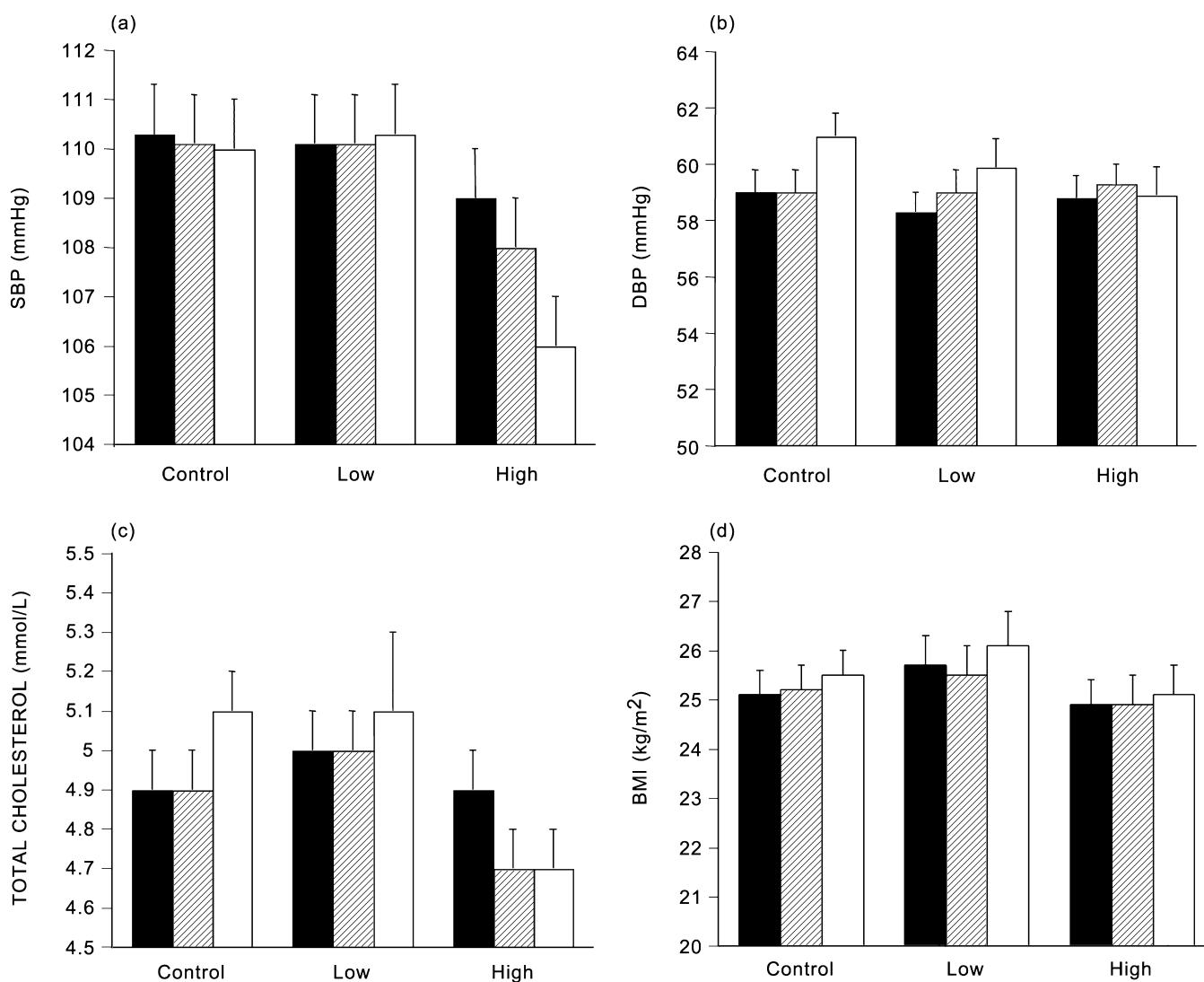


Figure 4. Blood pressure, total cholesterol and body mass index at baseline, end of intervention and at follow-up. (■) Control group; (□) Low level intervention; (▨) High level intervention.

1 year later while BP increased in the low level and the control groups but between group differences were not significant. Total cholesterol fell significantly in the high level group relative to controls both at the end of intervention and at follow-up (Fig. 4).

Study 2

The intervention program in overweight treated hypertensives

Having found positive effects on cognitive variables, health-related behaviours and cardiovascular risk factors in couples, we modified the program to encourage weight loss, using group and individual counselling from a dietitian, and to improve dietary habits, reduce alcohol intake and increase physical activity in overweight patients on drug treatment for hypertension.

The Dietary Approaches to Stop Hypertension (DASH) study showed that blood pressure could be lowered substantially in the short term by a diet rich in fruit and vegetables

and low fat dairy foods, including whole grains, nuts, poultry and fish and restricted in fats, red meat, sweets and sugar-containing beverages.³² The effects of weight loss³³ and alcohol restriction³⁴ on blood pressure are well-recognized, and meta-analysis has shown that aerobic exercise can also lower BP.³⁵ Additive effects of lifestyle changes to lower blood pressure have been found with combinations of weight loss and salt restriction, weight loss and dietary fish, weight loss and alcohol restriction and the DASH diet with salt restriction.^{36–39} We therefore aimed to implement the principles of the DASH diet, as well as including at least four fish meals weekly, reducing salt intake and alcohol consumption, to increase physical activity and to achieve weight loss in these overweight participants. We hypothesized that the additive effects of these modalities would lower blood pressure sufficiently to allow withdrawal of antihypertensive drugs, or a reduction in dosage. Potential benefits were related to the side-effects of drugs, drug interactions, failure to comply with treatment and costs to individuals and the

community. This study is ongoing but we have undertaken some interim assessment of data.

Participants and methods

Men and women aged between 40 and 70 years with $\text{BMI} > 25 \text{ kg/m}^2$ and being treated with not more than two antihypertensive drugs were recruited by media advertising. Patients were randomised to receive the program or to the usual care group who were provided with information about lifestyle readily available to the public through agencies, such as the National Heart Foundation of Australia. As it was considered unethical to attempt to prevent this group from making changes in lifestyle, the study aimed to compare the results of the program with the effects of educational materials and other resources generally available.

The program was delivered during a period of 16 weeks with individual or group counselling every 2 weeks and included printed materials. The content of the modules was similar to the earlier version of the program but information tailored to young couples was replaced with explanations about hypertension and the potential impact of lifestyle changes on BP. As delivery of the program entirely by mail had been less successful in our earlier study, the intervention used regular face-to-face group or individual sessions. Because of the emphasis on weight loss in this overweight group, participants had the option of individual discussion with a dietitian. Participants were asked to involve a partner in the program to provide social support. Partners were offered measurement of weight and BP and were encouraged to attend interactive sessions, participate in discussion, and ask questions of the research staff.

After 16 weeks, ambulatory blood pressure monitoring (ABPM) was carried out in both program and usual care groups using Spacelabs monitors (Spacelabs Medical Inc, Redmond, WA, USA). Participants with mean 24 h ABP $< 130/85 \text{ mmHg}$ were eligible to begin drug withdrawal whether they had been randomised to the program or to the usual care group. Drug withdrawal was carried out gradually during a period of 4 weeks with BP monitored weekly using the A & D UA-767PC home monitor (A & D Medical, Thebarton, Australia). If BP exceeded safety criteria, ABPM was carried out and drug withdrawal ceased if mean 24 systolic blood pressure (SBP) $> 135 \text{ mmHg}$ and diastolic blood pressure (DBP) $> 85 \text{ mmHg}$ or SBP $> 140 \text{ mmHg}$ and DBP $< 85 \text{ mmHg}$. Participants who were not eligible to continue drug withdrawal returned to the care of their own doctor for management of hypertension.

If drug withdrawal was successful, patients continued to be monitored weekly using the A & D home monitor at home and monthly at clinic visits for the first 3 months and every 3 months thereafter until the 12 month follow-up. Participants who had achieved drug withdrawal regularly reported their BP readings by telephone to the program staff and these interactions provided further opportunity for reinforcing health messages or dealing with other concerns. If BP exceeded safety criteria, as in the period of drug withdrawal, ABPM was carried out and drug treatment reinstated accord-

ing to the criteria described. If ABP exceeded these values, patients re-commenced antihypertensive drugs at the lowest dose that had controlled hypertension and returned to their own doctor for management.

Weight and height and waist and hip circumferences were measured at baseline and repeated at the end of the 16 week program, at the end of the 4 weeks of drug withdrawal and after a further 6 months and 12 months.

Patients continued to be reviewed every 3 months for 12 months. Endpoints to be examined are the number of participants with hypertension controlled without the use of drugs, the number of cardiovascular events and ambulatory blood pressure. The present analysis relates to the first 63 participants, focusing on diet, weight change, blood pressure and antihypertensive drug requirements. However, at this stage of the analysis only change in weight and waist circumference have been examined in the long term.

Results

Table 3 shows the baseline characteristics of the hypertensive patients. Figure 5 shows the change in dietary variables achieved at the end of the first 16 weeks of the study corresponding to completion of the program in the intervention group. There were significant differences between the program and usual care groups in energy intake and intake of total and saturated fat. Fibre intake increased and alcohol and sodium consumption decreased in both groups with no significant between-group differences. Nutrition calendars were used as a self-monitoring device in the program group and showed a daily mean of 2.5 serves of fruit, 5.5 serves of vegetables, 6 serves of fish per week and an alcohol intake of four standard drinks weekly.

Five months after beginning the study both usual care and program groups lost weight and reduced waist circumference

Table 3. Baseline characteristics of hypertensive participants

Variable	Usual care <i>n</i> = 30	Program <i>n</i> = 33
M/F	13/17	15/18
Age (years)	53.9 (6.8)	55.7 (7.3)
BMI (kg/m^2)	29.9 (2.8)	31.3 (2.9)
Weight (kg)		
Men	90.0 (1.6)	94.3 (1.7)
Women	79.5 (1.3)	80.7 (1.4)
Waist circumference (cm)		
Men	99.0 (1.3)	102.8 (1.0)
Women	89.6 (1.1)	91.4 (1.4)
24 h mean SBP (mmHg)	122 (9)	123 (8)
24 h mean DBP (mmHg)	75 (8)	75 (6)
Antihypertensive drugs		
One	25 (83%)	23 (70%)
Two	5 (17%)	10 (30%)
Current smokers	3	1
Alcohol intake (ml/day)	19 (4)	21 (3)

BMI, body mass index, DBP, diastolic blood pressure; SBP, systolic blood pressure.

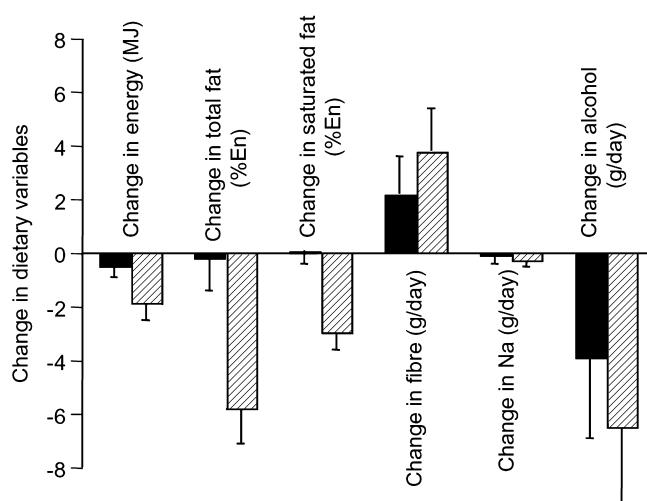


Figure 5. Change in nutrient intake at the end of intervention in a randomised controlled trial in overweight hypertensives. (■) Usual care; (▨) Program group.

(Fig. 6). The fall was significantly greater in the program group for weight in both men and women and for waist circumference in men. There were also significant between group differences in weight loss for men and for women 6 months and 12 months after the end of the program. Changes in waist circumference remained significantly greater in the program group in men at 6 and 12 months after the end of the program, and after 12 months in women.

Figure 7a shows changes in 24 h mean BP at the end of the 16 weeks of the program. Blood pressure fell significantly in both men and women in the program group relative to the usual care group. For men, drug withdrawal of antihypertensive drugs was achieved in 90% of the program group and in 30% of the usual care group. In women, 80% of both the program and the usual care group achieved drug withdrawal (Fig. 7b).

Discussion

This health promotion program has been associated with long-term improvements in cognitive variables, health behaviours and cardiovascular risk factors in couples beginning a shared lifestyle. The program has helped overweight hypertensive patients to achieve weight loss, reduce waist girths, lower blood pressure and lower requirements for antihypertensive drugs.

Because the study in hypertensive patients is still in progress complete analysis has not been undertaken. Diet records at the end of the intervention period showed reduced energy intake and lower intake of total and saturated fat in the program group relative to the usual care group. Self-reports from hypertensives in the program group suggested compliance with the dietary messages to eat more fruit, vegetables and fish and limit alcohol intake. As this information came from diaries used in self-monitoring by the program group, no comparable data were available for the usual care group. Information about cognitive variables

collected in the study of treated hypertensives will not be analysed until the end of the 12 month follow-up for all participants. However, the change in weight, loss of central adiposity, lower BP and lower drug requirements in the program group suggest that the program has been successful at the end of the intervention period, and at 6 months and 12 months follow-up. The success of some women in the usual care group in reducing the need for antihypertensive drugs is unexplained and was independent of change in weight and change in blood pressure. Possible reasons for this finding will be explored when the full data set is available. Physical activity, for example, has not been examined at this stage.

The program uses strategies derived from social-cognitive theory with particular emphasis on self-efficacy, that is, an individual's belief that they can enact a behaviour.⁴⁰ Self-efficacy has been reported to predict adoption and maintenance of health-related behaviours.⁴¹ Increased scores for self-efficacy in the study of young couples are consistent with improved dietary and physical activity habits associated with the program. Setting attainable goals, self-monitoring and self-rewards were all incorporated into the program and have been reported to encourage long-term maintenance of behaviour change.^{42,43} The Health Belief Model, which proposes that health-related behaviours depend on individual perceptions of the consequences of a behaviour and perceptions of risk, and the Theory of Reasoned Action also provide a theoretical basis for the intervention.^{44,45} Motivation to adopt physical activity has been considered in relation to decisional balance with the implication that behaviour change will not be achieved unless an individual considers the benefits of change to exceed the disadvantages.⁴⁶ Increased scores for beliefs about the benefits of healthy behaviours and a decrease in the perceived importance of barriers to these behaviours in couples are relevant to these models.

Although knowledge is not a strong predictor of behaviour change⁴⁷ it can influence behaviours and is likely to have been increased by group sessions and by the printed materials provided as program modules. This may be one mechanism by which printed materials may promote longer-term adherence to lifestyle change.⁴⁸ In the hypertensives, regular telephone contact with staff to report home BP readings may also have contributed to maintenance of behaviour change.⁴⁹

Social support was provided by including partners in the study of young couples and encouraging partners to support hypertensive participants in their efforts to change behaviours by becoming actively involved in group sessions and reinforcing the aims of the program at home. Focus groups both with the couples in our first study and with the hypertensive participants in the second study showed that social support was perceived as an important aspect of the program. Couples were unanimous in perceiving the 'partners-based' strategy as a strength of the program and reported that partners reinforced positive behaviours and discouraged negative behaviours. Before including hypertensive volunteers

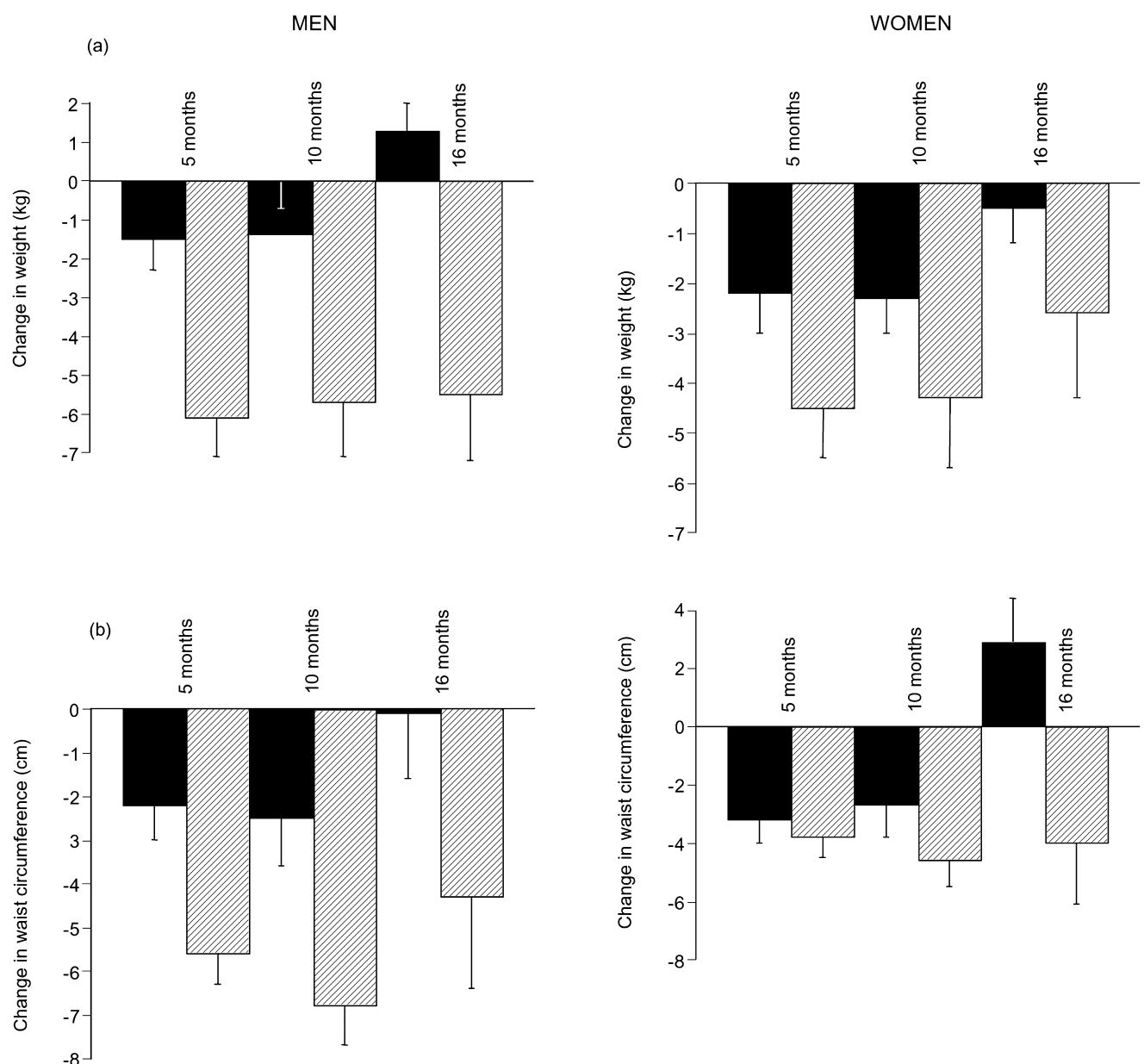


Figure 6. (a) Change in weight one month after the end of the 4-month program and 6 and 12 months later in overweight hypertensives; (b) Change in waist circumference one month after the end of the 4 month program and 6 and 12 months later in overweight hypertensives. (■) Usual care; (▨) Program group.

in the study, we sought permission from their general practitioner, who had been given details of the program. In focus groups, the hypertensive patients saw their doctor's support as important in encouraging behaviour change. Support from friends, family members and work colleagues was also seen as important in encouraging behaviour change.

Previous studies have reported some success in changing health-related behaviours in the short term but maintenance of behaviour change is difficult and relapse within 6–12 months is common.¹² Meta-analyses indicate that physical activity can be increased in the short term⁵⁰ but few studies have examined maintenance of physical activity over periods of more than 6 months.⁹ Factors that appear to

favour longer-term maintenance of physical activity include programs using a higher intensity of exercise and a home-based⁵¹ or community based setting.⁵² Regular interaction with the program facilitators and the use of printed materials or telephone contact also appeared to encourage maintenance of physical activity behaviours.^{48,49} Behavioural strategies based on social-cognitive theory⁴⁰ and the transtheoretical model⁵³ have been used successfully with goal-setting, self-monitoring and self-rewards and the use of social support.^{42,43}

Assessment of long-term changes in dietary behaviour is complicated by the different outcomes targeted in different studies, including consumption of fat, fibre, fruit, vegetables

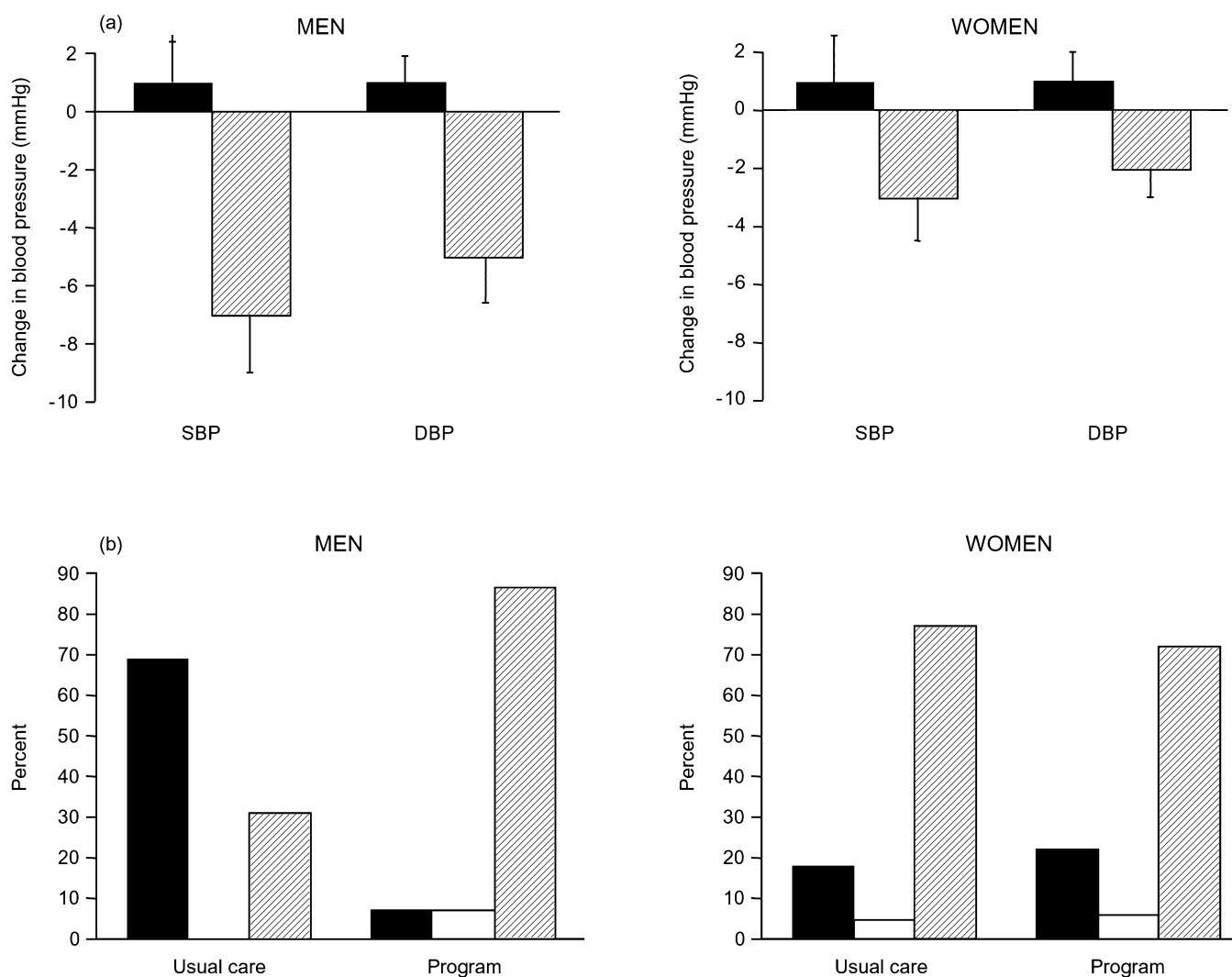


Figure 7. (a) Change in 24 h mean blood pressure in overweight hypertensive men and women. (■) Usual care; Program group (b) the proportion having drug treatment (■) unchanged; (□) reduced; or (▨) stopped.

and salt.¹⁰ Intervention studies, particularly those that have achieved long-term success in changing dietary behaviour, have often focused on at-risk groups. Decreased intake of fat⁵⁴ increased intake of fibre⁵⁵ and increased fruit and vegetable consumption⁵⁶ have all been achieved in the longer term in individuals at risk of cancer while trials of reduction in dietary sodium have involved patients with hypertension.³⁷ However, successful long-term changes in dietary behaviours have been associated with behavioural-cognitive approaches including strategies such as, self-monitoring, feedback from program facilitators on dietary progress and practical information about reading food labels.¹⁰ Meta-analyses examining interventions that aimed to reduce fat intake^{57,58} suggest that programs of longer duration with more rigorous goals, more frequent contact with facilitators and those that target the family are likely to be more successful in the long term.

While short-term weight loss is achievable, most attempts to lose weight are associated with short-term changes in behaviour.⁵⁹ Long-term weight loss is well-

known to be difficult to attain. Typically the pattern is one of initial weight loss with a gradual decrease in the rate of loss over about 6 months, followed by weight gain, usually to levels slightly lower than the starting point. However, in our study of overweight hypertensive patients, weight loss and decreased waist circumference persisted in the program group relative to the usual care group up to 16 months after beginning the intervention. Long-term weight loss has been improved by programs of longer duration.⁶⁰ However, an attempt to improve long-term weight loss by prolonging contact with program facilitators found attrition in numbers and weight gain after the first 6 months.⁶¹ Combining exercise with the weight loss regime has proved successful.⁶² Meta-analysis has shown small but significant benefits with the inclusion of support from partners⁶³ and social support provided by groups of participants may also be a useful strategy.⁶⁴

Our program incorporates factors reported to influence adoption and maintenance of positive health-related behaviours. It may also be that our choice of target groups has

recruited highly motivated individuals with responses similar to those reported in other at-risk groups⁵⁰ and further modification of the program may be needed before it can be generalized to the wider community. However, comments made during focus groups indicate that the program was unanimously considered to be valuable, accessible, and provided information and strategies not easily available elsewhere. Participants believed that the program taught them to 'take responsibility for yourself and by using the lifestyle changes that we learned about, you can be 100% healthier and enjoy life much more', consistent with our aims. While the study in hypertensive patients is not yet completed, results suggest that the program designed originally for couples has been applied successfully in an older group of overweight participants. The program has the potential for health promotion in other groups at risk.

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