Adherence to a Diet and Exercise Weight Loss Intervention amongst Women at Increased Risk of Breast Cancer

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Abstract: Maintained weight loss of five percent or more may reduce risk of breast cancer. We conducted a feasibility pilot study to assess adherence to an intensive 12 month diet and exercise weight control intervention aimed to achieve and maintain a five percent or greater weight loss as compared to a usual care group receiving written advice only.

Overweight premenopausal women at increased risk of breast cancer were enrolled in a 12 month diet and exercise weight loss programme (n = 40) or a comparison group receiving usual care (n = 39). Changes in weight, general (DXA, bioelectrical impedance) and central adiposity (intra abdominal fat; MRI, waist), dietary intake, physical activity, cancer worry (Lerman score) and quality of life (SF-36) were assessed at 6 and 12 months, as well as long-term changes in weight and adiposity 12 and 42 months after the end of the intervention.

Target weight loss (5%) was achieved by 55% of the intervention group at the end of the 12 month intervention but maintained by fewer at 24 (39%) and 54 months -(21%). Overall the intervention group achieved significant reductions in weight (mean [95% CI] -4.6 [-6.4 to -2.8] %), body fat (-4.0 [-5.2 to -2.7]) kg, intra abdominal fat (-25.0 [-39.0 to -8.0])% and waist circumference (-4.0 [-6.8 to -2.0] cm) during the 12 month intervention and reported large reductions in intake of energy (-24.3 [-33.2 to -15.1] %), fat (-32 [-44 to -20] %), and alcohol (-35 [-52 to -13] %), and increased moderate activity (27 [7 to 44] minutes/day). These parameters did not change in the usual care group (all $P<0.05$). A small proportion of the usual care group lost and maintained >5% of their weight at 6 (16%), 12 (11%), 24 (11%) and 54 (13%) months ($P<0.05$ at all time points). The intervention increased physical well being (SF-36; $P<0.05$) but had no measurable effect on mental well being or cancer worry.

Weight loss is achievable within our high risk women but not more so than in previous studies in the general population. Further studies are required to better understand factors which can promote compliance in women at increased risk of breast cancer.

Keywords: Adherence, weight loss, high risk, breast cancer.

INTRODUCTION

A family history (FH) of breast cancer is an important indicator of a woman's risk of developing the disease. These high risk women are managed in cancer family history clinics which provide risk assessment, counseling, breast screening and, where appropriate, molecular genetic testing. An increasing body of evidence suggests risk of breast cancer in women and particularly those at high risk is modifiable by lifestyle factors. Specifically data support the role of excess weight [1-5], central adiposity [6, 7] and the possible effects of sedentary behaviour [8] on risk which appear more important than intake of specific dietary factors such as fat [9] and fruit and vegetables [10]. Amongst BRCA mutation carriers excess weight [11, 12], lack of exercise and diet quality [13] have been linked to increased risk and earlier onset of breast cancer. These findings are, however, based on a limited number of mainly retrospective studies. The potential risk reduction with weight loss and exercise amongst high risk women needs to be tested in a large scale prospective intervention study.

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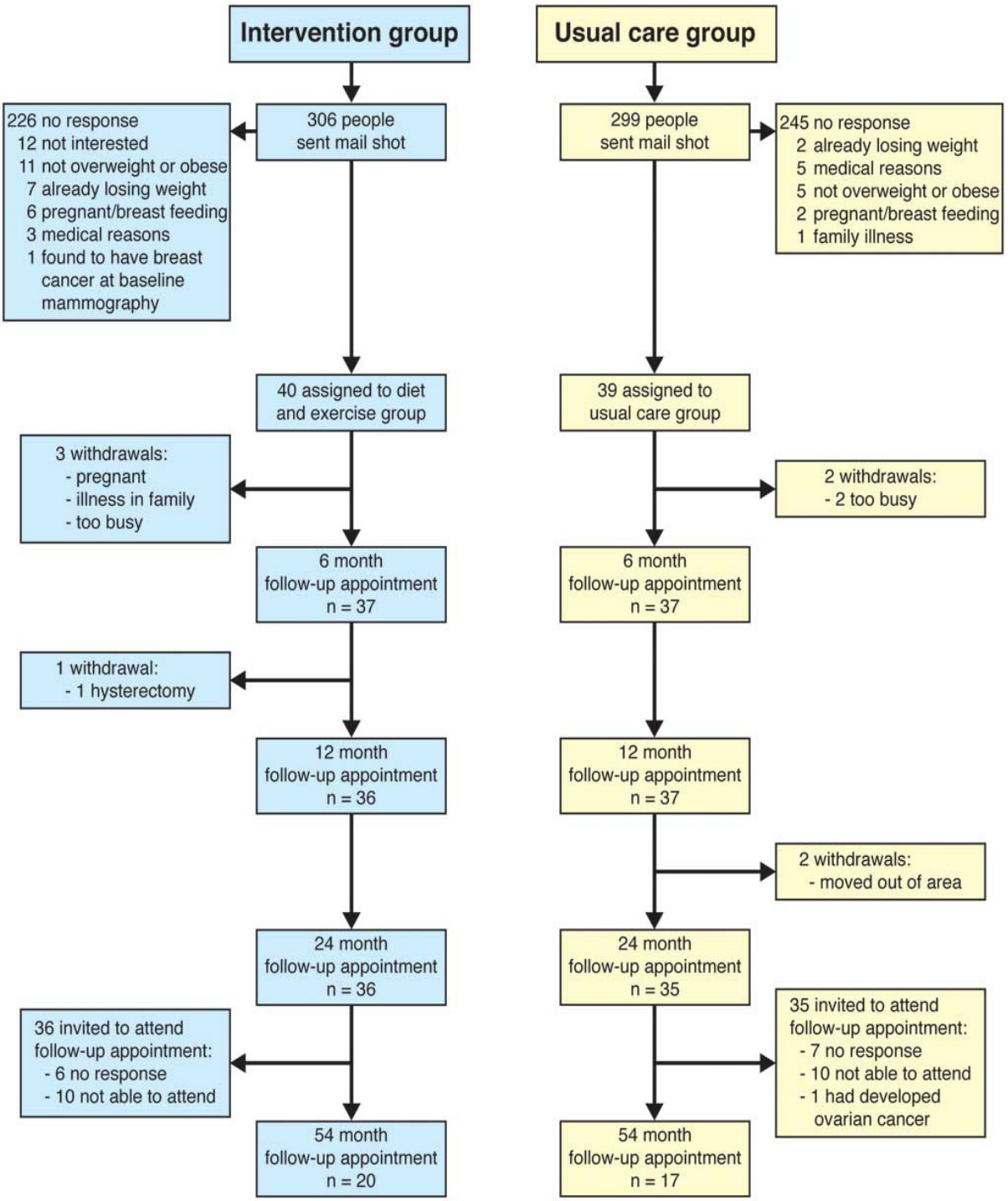

Fig. (1). Recruitment and retention to study.

Data within the general and high risk population suggest significant breast cancer risk reduction with modest weight loss (5%) [14, 15]. However, even modest weight loss is known to be difficult to achieve and maintain in many patient groups [16]. Here we report a pilot study to assess uptake and adherence to a 12 month diet and exercise weight control intervention aimed to achieve and maintain a five percent or greater weight loss amongst high risk women [17]. We compared an intensive to standard written advice only to assess the relative effects of the two approaches. This will inform the feasibility and numbers required to power a future large scale weight loss breast cancer risk reduction trial. We also determined any effects of the intervention on quality of life and cancer worry to see whether these parameters were improved by the intervention and whether risk perception and level of cancer worry predicted adherence and could be potential targets to motivate adherence.

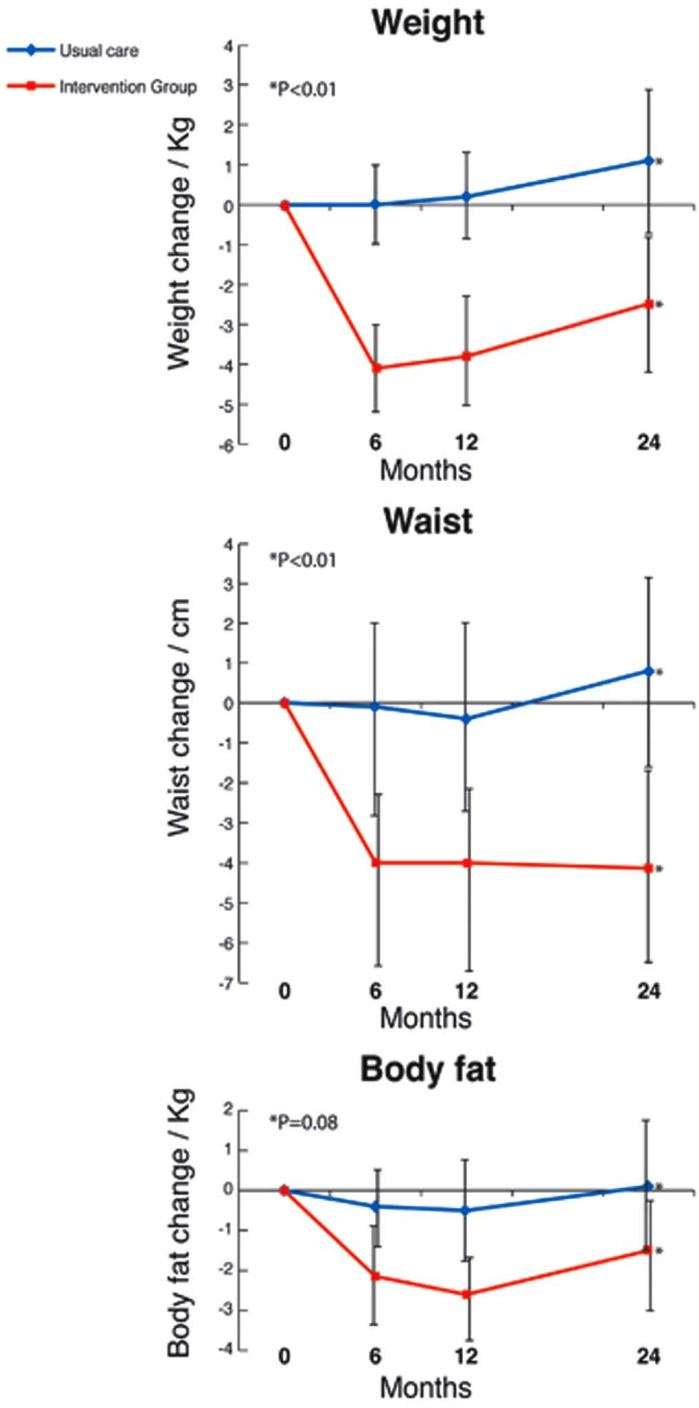

Fig. (2). Changes in weight, waist and body fat over 24 years in the intervention (n = 36) and usual care groups (n = 35).

SUBJECTS AND METHODS

Subjects

Attendees of our regional Family History Clinic (estimated lifetime breast cancer risk of 16 – 40%) [18] aged 35 – 45 received a mailed invitation to enter either a 12 month intensive diet and exercise weight loss programme or a usual care group receiving standard written advice only depending on their proximity to the hospital. Participants were required to have gained >7 kg weight since the age of 20, have 30% body fat, be sedentary, non-smokers, and premenopausal with no evidence of polycystic ovary syndrome [19] and were not taking oral contraceptives. They did not have diabetes, cardiovascular disease or previous history of cancer. Participants had previously received information of their genetic risk, and were attending annual mammographic screening. Uptake and retention within the two groups is shown in Fig. (**1**). All participants gave informed consent. The protocol was approved by the South Manchester Ethics Committee (Reference no 01/426).

Weight Loss Intervention

The intervention group was advised to follow an energy restricted diet providing 500-1000 kcal below their estimated energy requirements (1.4 times x estimated resting energy expenditure) [20] with 20% energy from protein, 30% from fat and 50% from carbohydrate. They were also instructed to increase exercise gradually to include at least five 30 minute sessions of moderate exercise (defined as 50–60% of age-estimated maximal heart rate) each week [21], equivalent to an additional 1.4 kcal/kg/day energy expenditure. The intervention was designed to achieve a gradual weight loss of 0.5-1 kg/week and a weight loss of 5% or greater at 6 months and maintenance of this at 12 months. Each participant received an individualised diet and a home based exercise plan from the study dietitian (MH) and exercise specialist (DA). To maximise compliance, they were asked to attend a weekly group exercise session for the first 12 weeks, and monthly appointments with the study dietitian throughout the 12 month intervention to assess change in weight and reinforce diet and exercise recommendations. The intervention was based on the trans theoretical model of behaviour change. A range of cog-nitive behavioural techniques such as self monitoring, obtaining peer/family support and stimulus control were encouraged to increase compliance [22].

Usual Care Group

This group were given a leaflet providing general lifestyle advice to reduce risk of cancer; to lose weight, increase exercise, increase intake of fruit and vegetables and limit intake of alcohol, fat and meat [23]. They agreed to be monitored throughout the year to assess normal changes in diet and exercise behaviour and adiposity in clinic attendees.

Study Protocol

Subjects in the intervention and usual care group were assessed at baseline, 6 and 12 months to determine any changes in weight, adiposity, dietary intake, level of physical activity, quality of life and cancer worry. Risk perception was assessed at baseline only.

Weight Related Factors

Weight, height, waist and hip circumferences were assessed using standardised methods in the morning after a 12 hour fast, wearing light clothing. Body circumferences were measured in triplicate [24]. Total body fat was measured both using a DXA whole body Hologic QDR 4500A scanner and V8.26a:3 software (Hologic Inc., Bedford, MA, USA) (coefficient of variation [CV]: fat mass 1.8%, lean muscle mass 0.6%) and using bioelectrical impedance (BI) (Tanita TBF-300A Tanita Europe BV Middlesex UK) (CV 2%). Intra-abdominal fat (IAF) was measured using magnetic resonance imaging (MRI) with a single axial water suppressed image at the L2/L3 vertebra level, with the technician blinded to the group allocation. Overall standardised CV of IAF estimation was 7.3%.

Changes in Diet and Physical Activity

Change in dietary intake was assessed using 4-day food diaries checked for completeness with the respondent. Mean energy, protein, fat and carbohydrate intake were estimated using the Compeat 4 Nutrition Analysis System (Carlson Bengston Consultants, London, UK). Change in physical activity was assessed using the validated 7-day physical activity recall questionnaire [25] expressed as kcal/kg/day. We also performed a 6 minute walk test as an objective measure of fitness [26].

Cancer Risk Perception, Cancer Worry and Quality of Life

Each subject reported her personal perception of her risk of developing breast cancer through selection of the appropriate odds ratio value which ranges from 1:2 to 1:100 with additional categories of 1 for "inevitable" and 1000 for "very unlikely" [27]. Personal risk accuracy was determined by comparing self-reported odds value for personal risk with actual odds value calculated by the clinician (e.g. 1 in 4). Women were classified as under, over or accurate reporters [28].

Worry about the risk of developing cancer and the impact of worry on daily functioning was assessed using the Lerman's Cancer Worry Scale. Each item on this 6 item scale is scored from 1 to 4 giving a possible total score of 24.

Health related quality of life was assessed using the SF–36 instrument reported as physical (physical functioning, role physical, bodily pain and general health scales) and mental (vitality, social functioning, role emotional and mental health) summary scores [29].

Follow Up Study

Long-term weight loss maintenance is most likely required for cancer risk reduction. We assessed long term changes in weight and adiposity, i.e. body fat (BI) and waist circumference, in both groups. All participants were invited for a review with the study dietitian 24 and 54 months after the start of the study i.e. 12 and 42 months after the end of the 12 month intervention.

Statistics

Data are presented as the mean (95% confidence intervals; CI), or geometric mean (95% CI) for the log transformed variable intra-abdominal fat. We assessed changes in weight-related parameters, quality of life, cancer worry and diet and exercise behaviours at 6 and 12 months in the intervention group as compared to the usual care group using a last observation carried forward (LOCF) analysis of variance (ANOVA) adjusted for baseline levels of each parameter. The proportion of women achieving weight loss of ≥5% at 6 months and maintaining this at 12, 24, months were determined in the groups using a LOCF analysis. Since only 50% of the intervention group and 43% of the control group were reassessed at 54 month we also undertook a baseline observation carried forward analysis at this time

point. We explored factors which may be linked to successful long-term weight loss (>5%) by comparing pre-intervention levels of cancer worry (Independent t test), personal risk perception scores (Mann-Whitney) and personal risk accuracy (Chi squared) between women achieving either greater than or less than 5% weight loss at 24 months. Researchers undertaking analyses of quality of life, cancer worry and risk perception data were blinded to the study group. Data were analysed using SPSS (version 14 SPSS Ltd, Chicago, IL, USA). A 2-sided statistical significance level of 5% was used.

RESULTS

Our mail shot elicited an uptake of 13% to the intervention group. Seventy–four percent did not respond, 9% were ineligible for medical reasons or were already losing weight. An earlier survey in our clinic suggests 50% of non responders to the mass (non-targeted) mailing had a normal BMI and thus would be ineligible [30]. Thus an estimated 24% of eligible women were recruited. Correspondingly amongst women invited to the usual care group, 81% did not respond, 5% were not eligible; hence an estimated 24% of eligible women were recruited. There was no difference in age or risk of responders compared with non responders in either of the mailings (data not shown).

Characteristics of the intervention and usual care groups are shown in Table **1**. Groups were comparable although the intervention group had a slightly higher body mass index (BMI) and lower predicted and perceived risk of breast cancer than the usual care group. These differences were not statistically significant.

The intervention group achieved significant reductions in weight (mean [95% CI] -4.6 [-6.4 to -2.8] %), body fat (-4.0 [-5.2 to -2.7]) kg intra abdominal fat (-25.0 [-39.0 to -8.0] % and waist circumference (-4.0 [-6.8 to -2.0] cm during the 12 month intervention weight mean (95% CI) = (-4.6 [-6.4 to -2.8] %), body fat (-14.6 [-19.0 to –10.0] %), intra-abdominal fat (-25.0 [-39.0 to -8.0] % and waist circumference (-5.0 [-8.1 to –1.2] cm) during the 12 month intervention, whilst these parameters did not change significantly in the usual care group (Table **2**). The intervention group reported large reductions in dietary intake of energy (-24.3 [-33.2 to -15.1] %), fat (-32 [-44 to –20] %), and alcohol (-35 [-52 to -13] %). On average an additional 16 (5 to 32) minutes moderate intensity exercise/day by 6 months and 27 (7 to 44) minutes/day by 12 months were undertaken. The usual care group did not report significant dietary changes but there was a short-term increase in physical activity at 6 months which was not sustained at 12 months. At 12 months there was an objective improvement in fitness in the intervention group as compared to the usual care group assessed by the 6 minute walk test ($P<0.05$) (Table **3**).

The intervention group experienced a significant increase in the physical aggregate quality of life score at 12 months (6%) which was unchanged in the usual care group ($P=0.05$). Neither the intervention nor usual care group experienced changes in mental aggregate quality of life or cancer worry scores. Neither of these scores appears to be influenced by weight loss (Table **2**).

Table 1. Baseline Characteristics of the Intervention and Usual Care Groups

	Intervention N = 40	**Usual care N = 38**
Age (years) [a]	41.0 ± 3.0	40.2 ± 2.8
Body mass index (Kg/m^2) [a]	30.2 ± 7.0	28.3 ± 5.1
Weight gain since aged 20 (kg) [a]	22.5 ± 14.1	17.2 ± 7.3
Ethnicity (% Caucasian)	90	97
Smoking:		
Current	0	0
Never	90	82
Ever	10	18
Predicted lifetime breast cancer risk (%) [b]	21 ± 5	27 ± 7
Perceived lifetime breast cancer risk (%) [c d]	20 (10 – 100)	33 (1 – 50)
Accuracy of personal risk estimation (%)		
Underestimate	25	26
Accurate	39	32
Overestimate	18	21
No estimates	18	20

[a] mean ± SD
[b] from Tyrer Cuzick model [21]
[c] median (range)
[d] Risk perception questionnaire [26]

Table 2. Changes in Weight, Adiposity, Cancer Worry and Quality of Life Over 12 Months in the Intervention and Usual Care Group

	Baseline	Change at 6 months	P value [3]	Change at 12 months	P value[3]
Weight (kg) [1]					
Intervention	80.1 (74.3 to 85.9)	-4.0 (-5.1 to -2.0)	<0.0001	-3.9 (-5.2 to -2.2)	<0.0001
Usual Care	75.1 (71.5 to 80.4)	-0.4 (-1.3 to 1.6)		0.1 (-1.1 to 1.2)	
Body fat (DXA) (kg) [1]					
Intervention	30.8 (27.2 to 34.4)	-2.9 (-4.1 to -1.8)	<0.0001	-4.0 (-5.2 to -2.7)	<0.0001
Usual Care	28.1 (25.0 to 31.1)	-0.1 (-0.8 to +0.5)		0.0 (-1.6 to 3.5)	
Body fat (BI) (kg) [1]					
Intervention	31.7 (27.6 to 35.8)	-2.4 (-3.6 to -1.2)	0.01	-2.7 (-3.7 to -1.6)	<0.0001
Usual Care	29.4 (25.4 to 33.6)	-0.4 (-1.6 to 0.5)		0.5 (-1.6 to 0.7)	
Intra abdominal fat (cm^2) [2]					
Intervention	85.1 (66.3 to 106.2)	0.88 (0.79 to 0.97)	0.04	0.75 (0.61 to 0.92)	0.03
Usual Care	70.4 (58.3 to 85.2)	1.04 (0.92 to 1.18)		0.95 (0.84 to 1.07)	
Waist circumference (cm) [1]					
Intervention	99.2 (94.2 to 104.2)	-4.0 (-6.7 to -2.2)	0.02	-4.0 (-6.8 to -2.0)	0.03
Usual Care	95.5 (91.6 to 99.4)	-0.1 (-1.6 to 1.5)		0.4 (-2.4 to 1.6)	
Quality of life					
Physical aggregate score [1]					
Intervention	53.2 (51.4 to 53.5)	1.3 (-0.8 to 3.4)	0.78	3.0 (0.7 to 5.2)	0.05
Usual Care	54.1 (52.1 to 56.1)	1.1 (-1.2 to 3.5)		-0.4 (-3.4 to 2.6)	
Quality of life					
Mental aggregate score [1]	44.0 (40.8 to 47.2)	0.2 (-4.3 to 4.7)	0.96	3.2 (-1.4 to 7.8)	0.99
Intervention	47.2 (44.4 to 51.0)	-0.9 (-4.2 to 2.4)		-0.4 (-3.4 to 2.6)	
Usual Care					
Cancer worry [1]					
Intervention	11.3 (10.3 to 12.4)	-0.2 (-1.0 to 0.6)	0.62	0.0 (-0.9 to 0.9)	0.50
Usual Care	10.4 (9.4 to 11.3)	0.3 (-0.5 to 1.1)		-0.7 (-1.6 to 0.3)	

BI = bioelectrical impedance, DXA = dual-energy x-ray absorptiometry

[1] Mean (95% CI) for baseline values and mean (95% CI) change in LOCF value at 6 and 12 months.

[2] Geometric mean (95% CI) for baseline values and mean (95% CI) ratio of change in LOCF natural log values at 6 and 12 months.

[3] P value for analysis of variance comparing women in intervention and usual care groups adjusted for baseline value

Baseline: Intervention 40 Usual care 39 6 months: Intervention 38 Usual care 38 12 months: Intervention 37 Usual care 38

We were able to reassess weight and body fat and waist in the majority of women at 24 months (36 intervention, 35 usual care), but fewer at 54 months (20 intervention, 17 usual care). Predictably both groups experienced increases in weight and body fat in the 12 months following the intervention although waist remained static in the intervention group. Weight and waist increased above baseline measurements in the usual care group. Analysis of variance (ANOVA) using last observation carried forward values at 24 months adjusted for baseline level showed significant reductions in weight and waist were sustained in the intervention compared to the usual care group (P<0.01) (Fig. **2**). Impedance measurements showed a non-significant reduction in body fat in the intervention compared to the usual care group, which reflects the variation in body fat measurements assessed with impedance (P=0.09) (Fig. **2**). Mean difference in body fat mass by BI and DXA in our population was 0.36 kg. The limits of agreement (mean ± 2SD) between the two methods were -3.8 to +4.5 kg (-11 to +14%).

Target weight loss (≥5%) was achieved by 55% of the intervention group at the end of the 12 month intervention period with fewer maintaining this at 24 (39%) and 54 months (LOCF 32% BOCF 21%). A small proportion of the usual care group receiving standard written advice lost and maintained (≥5%) of their weight at 6 (16%, P=0.03), 12 (11%, P<0.0001), 24 (11%, P=0.01), and 54 months (LOCF 17% BOCF 13%) (P=0.32).

We were unable to identify any psychological predictors of successful weight loss and maintenance. There was no difference in baseline cancer worry (P=0.55), personal risk perception score (P=0.28), or accuracy of risk perception

Table 3. Changes in Dietary Intake and Physical Activity Over 12 Months in the Intervention and Usual Care Group

	Baseline	Change at 6 months	P value [2]	Change at 12 months	P value[2]
Energy (kcal) [1]					
Intervention	2192 (1991 to 2393)	-536 (-743 to -329)	<0.0001	-600 (-800 to -396)	<0.0001
Usual Care	2041 (1890 to 2192)	-85 (-210 to 40)		-81 (-240 to 76)	
Total fat (g) [1]					
Intervention	83.4 (73.4 to 93.6)	-25.0 (-34.1 to -15.2)	<0.0001	-26.0 (-34.0 to -17.0)	<0.0001
Usual Care	76.7 (68.2 to 85.1)	-3.2 (-10.7 to 4.2)		-4.0 (-13.0 to 5.0)	
Saturated fat (g) [1]					
Intervention	29.4 (25.0 to 33.8)	-9.2 (-14 to -5.4)	0.001	-9.2 (-13.9 to -4.5)	0.001
Usual Care	28.9 (24.9 to 33.0)	-3.2 (-6.0 to 0.2)		-3.2 (-6.9 to 0.6)	
Alcohol (g) [1]					
Intervention	15.9 (10.8 to 21.0)	-6.1 (-10.5 to -1.8)	0.005	-7.7 (-11.7 to -3.7)	0.004
Usual Care	13.5 (9.0 to 18.3)	1.6 (-1.9 to 5.0)		1.5 (-3.7 to 6.7)	
Total kcal/kg/day[13]					
Intervention	33.2 (32.7 to 33.7)	1.0(0.3 to 2.1)	0.024	1.8 (0.5 to 2.9)	0.05
Usual Care	33.6 (32.9 to 34.3)	0.4(0.0 to 0.7)		0.4 (-0.3 to 2.5)	
Distance walked in 6 minutes[1 4]					
Intervention	570 (549 to 591)	35.9 (22.2 to 49.6)	0.34	39.8 (22.2 to 57.4)	0.03
Usual Care	573 (549 to 598)	26.6 (11.8 to 41.4)		10.7 (-11.7 to 33.1)	

[1] Mean (95% CI) for baseline values and mean (95% CI) change in LOCF value at 6 and 12 months.
[2] P value for analysis of variance comparing women in intervention and usual care groups adjusted for baseline value
[3] 7 – day activity recall [24]
[4] 6 minute walk test [25]
Baseline: Intervention 40 Usual care 39 6 months: Intervention 38 Usual care 38 12 months: Intervention 37 Usual care 38

(P=0.38) between women who had lost and maintained >5% weight loss at 24 months and women who did not lose weight.

DISCUSSION

Main Findings

This is the first study to report uptake and adherence to a weight loss intervention for breast cancer risk reduction amongst women at increased risk of breast cancer attending a Family History Clinic. Fifty–five percent of the intervention group achieved a clinically significant weight loss (>5%) by the end of 12 months, with an estimated 21 % maintaining this in the longer terms (54 months). In comparison a small proportion receiving usual care and standard written advice lost weight at 12 (11%) and 54 months (13 %). The intervention reduced general and central adiposity and increased physical well being, but had no measurable effect on mental well being or cancer worry.

Strengths of Study

We used a comprehensive range of valid measures to assess changes in general and central adiposity (DXA, BI, MRI), dietary intake (food diaries), physical activity (7-day recall), quality of life and cancer worry during the 12 month intervention. Excellent retention to both the intervention (94%) and usual care groups (94%) up to 24 months, and assessment of actual rather than self reported weights at all time points [31] allowed us to accurately assess long-term weight loss maintenance and the likely impact of the intervention for cancer risk reduction. However, the predictable larger drop out by 54 months limits the validity of our findings at this time point. We assessed long-term changes in body fat using bioelectrical impedance which is known to be a valid measure of changes in body fat with weight loss in women [32].

Study Limitations

We have not examined the effects of a diet and exercise weight loss programme compared to usual care in the context of a randomised controlled trial. In common with previous research we found randomisation to a no treatment group to be unacceptable in this group of women [33]. Groups were mainly comparable at baseline, the slightly higher starting BMI and lower actual and perceived breast cancer risk in the intervention group is unlikely to have affected our findings. We studied premenopausal, non smoking women. Adherence to the intervention and their effects may differ in different groups. For example adherence to chemoprevention has shown to be lower amongst smokers [34]. We focused on premenopausal women, however, weight loss is also likely to reduce risk amongst postmeno-

pausal women [35]. We did not include women at higher levels of risk (60-80% lifetime risk) who are known to carry BRCA mutations. We cannot predict adherence and uptake in this higher risk group who are likely to benefit from future weight control interventions [11].

Although we used a validated self-report questionnaire to assess physical activity of the participants, such methods are subject to the potential errors associated with over-estimation of behaviour and future studies would be improved by use of objective monitoring of physical activity. Assessment of weight and anthropometrics was conducted by the study dietitian who was not blinded regarding study group assignment.

COMPARISON WITH OTHER STUDIES

The modest uptake to the intervention (13%) reflects the usual response to mailed invitations [36]. The estimated 24% uptake amongst eligible women is considerably less than uptake to our recent red clover nutritional supplement trial (85%) [37] but more than the 11% recruited to chemoprevention trials in our high risk women [33].

Approximately 55% of our high risk women achieved the target weight loss for risk reduction at 12 months, with 32% achieving long-term success. This compares to the 65-70% of high risk women who have been shown to comply with 5 years of chemoprevention [34].

Previous reports amongst women with a family history have focused on dietary modification and increasing exercise and have not aimed to reduce weight. Djuric *et al.* reported good long-term adherence to a low fat (< 20%) and increased fruit and vegetable (9 portions/day) intervention. After 12 months, average daily fruit and vegetable intake increased from 4 to 10 portions, whilst fat intake (as percentage of energy) decreased from 34% to 16%. Adherence reduced at 24 months to 7 portions of fruit and vegetables/day and 27% of energy from fat [38]. Likewise, 6 months of telephone counseling amongst sisters of young women recently diagnosed with breast cancer increased the numbers achieving targets for physical activity (at least 90 minutes of moderate exercise/week) by 14% and for fruit and vegetable intake (>5 portions of fruit and vegetables/day) by 12% [39].

The proportion of our intervention group achieving short- and long-term weight loss is comparable with those seen in other patient groups at 20-30% [16, 40, 41]. Interestingly, a number receiving written advice only (11%) achieved weight loss through self management as also reported in the general population [41]. Our study population of women at increased risk of breast cancer does not appear to be more motivated to adhere to a weight loss intervention than other groups of women, but this would need to be confirmed in other studies. However, the significant reductions in general (-13%) and particularly central (-25%) adiposity may be beneficial amongst these high risk women who have increased central fat distribution [42, 43].

Participants in our study had comparable cancer worry and risk perception scores to those previously reported seen in our population at increased breast cancer risk [44]. Weight loss and adherence to the diet and exercise recommendations did not appear to impact on cancer worry. Cancer worry is known to decrease with interventions which substantially decrease risk, such as bilateral prophylactic mastectomy [45], but not with previous lifestyle interventions [39], perhaps because women with genetic risk do not perceive lifestyle interventions to reduce risk.

Neither cancer worry nor risk perception appeared to influence adherence to the intervention. Moderate, but not high levels of worry can motivate attendance at mammographic screening, but little is known about the effect on other behaviours [46, 47]. A previous analysis in our population did not link level of risk to adherence to chemoprevention agents [34]. Weight loss was linked to improvements in the physical, but not mental well being, quality of life measures, which has recently been reported amongst participants losing weight in the Diabetes Prevention Programme [48].

CONCLUSION

We have shown that weight loss is achievable within in a population of women at increased risk of breast cancer but not more than reported in other groups of women. The null associations between weight loss, cancer worry and risk perception discounts breast cancer risk reduction as a major motivator for lifestyle adherence in this group. Further psychosocial studies are required to better understand the reasons for low uptake/poor compliance in such studies and behavioural factors which promote compliance in this population. Such studies should be grounded in one of the psychological theories of behaviour change. Novel dietary approaches and modes of delivery for weight loss for cancer risk reduction are required. Future trials may test alternative approaches, such as intermittent energy restriction [49], or use of emerging technologies to communicate information, provide feedback and support to populations attending high risk clinics [50].

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