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WJD covers topics concerning α, β, δ and PP cells of the pancreatic islet, the effect of insulin and insulinresistance, pancreatic islet transplantation, adipose cells and obesity.

We encourage authors to submit their manuscripts to *WJD*. We will give priority to manuscripts that are supported by major national and international foundations and those that are of great clinical significance.

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ORIGINAL ARTICLE

Randomized Clinical Trial

Impact on dietary intake of a self-directed, gender-tailored diabetes prevention program in men

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Abstract

AIM

To investigate changes in dietary intake following a 6-mo randomised controlled trial of the self-directed, gender-tailored type 2 diabetes mellitus (T2DM) Prevention Using LifeStyle Education (PULSE) program in men.

METHODS

Men aged 18-65 years, with a body mass index (BMI) 25-40 kg/m^2, and at high risk for developing T2DM were recruited from the Hunter Region of New South Wales, Australia. Eligible participants were randomised into one of two groups: (1) waitlist control; or (2) PULSE intervention. Dietary intake was assessed at baseline and immediately post-program using the Australian Eating Survey food frequency questionnaire and diet quality measured using the Australian Recommended Food Score (ARFS).

RESULTS

One hundred and one participants (n = 48, control; n = 53, intervention, mean age 52.3 ± 9.7 years, BMI of 32.6 ± 3.3 kg/m^2) commenced the study. Following the active phase, differences between groups were observed for proportion of total energy consumed from healthful (core) foods (+7.6%EI, P < 0.001), energy-dense, nutrient-poor foods (-7.6%EI, P < 0.001), sodium (-369 mg, P = 0.047), and diet quality (ARFS) (+4.3, P = 0.004), including sub-scales for fruit (+1.1, P = 0.03), meat (+0.9, P = 0.004) and non-meat protein (+0.5, P = 0.03).

CONCLUSION

The PULSE prevention program's nutrition messages led to significant improvements in dietary intake in men at risk of T2DM.

Key words: Dietary intake; Diet quality; Men; Diabetes prevention program; Self-directed

Core tip: In the context of type 2 diabetes mellitus (T2DM) prevention programs, only recently has the effect on diet quality been reported. However, no studies have examined the effect on diet of a program designed exclusively for men. This study reports on the dietary outcomes following the self-directed T2DM Prevention Using LifeStyle Education (PULSE) program. Following completion of the PULSE program, men receiving the intervention significantly reduced intake of energy-dense, nutrient-poor foods and portion size. In addition, the intervention group increased overall diet quality and greater variety within healthful food groups.

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INTRODUCTION

Despite concerted public health efforts, the prevalence of diabetes continues to increase worldwide. Between 2013 to 2015, the worldwide prevalence of diabetes increased by 33 million to an estimated 415 million adults[1,2], with the prevalence expected to increase to 642 million in the next 25 years[1]. The economic burden on national health systems attributed to diabetes is significant, with USD 612 billion spent worldwide or 11% of total health expenditure[3]. In higher income countries, approximately 87%-91% of those with diabetes have type 2 diabetes mellitus (T2DM)[1]. Further, global estimates place 318 million adults at risk of developing the condition, with an additional 163 million individuals estimated to have impaired glucose tolerance by 2040[1].

Lifestyle risk factors such as a high body mass index (BMI), sub-optimal diet quality and lack of physical activity are key targets underpinning T2DM prevention programs, such as the Diabetes Prevention Program in the United States[4] and the Diabetes Prevention Study in Finland[5]. In the years following these seminal studies, many diabetes prevention programs have been evaluated including successful adaptations for various populations and different settings[6-8].

These T2DM prevention programs promote moderate weight loss by improving physical activity and dietary behaviours. Programs containing a combination of diet and physical activity components have demonstrated efficacy with regard to weight loss and improvements in glucose regulation[9,10]. Specific dietary changes following the diabetes prevention programs have included a reduction in total energy intake and favourable shifts in macronutrient composition (*e.g.*, reduction in total and saturated fat intake)[9]. Only recently have changes in diet quality or amounts of foods (as opposed to energy or nutrients) been reported both immediately following completion of the intervention[11,12], as well as over the long-term for periods of 5-10 years later[13,14]. To date, no studies have reported the effect on diet of a diabetes prevention program tailored for men. Therefore, this study examines changes in dietary intake, in particular diet quality, among Australian men following the 6-mo randomised controlled trial of the self-directed, gender-tailored Prevention Using LifeStyle Education (PULSE) program.

MATERIALS AND METHODS

The PULSE randomised controlled trial evaluated the efficacy of a self-directed, diabetes prevention program tailored for men at risk of T2DM. The study was conducted in Newcastle, Australia in 2012-2013 after receiving ethical approval (H-2012-0232) from the University of Newcastle Human Research Ethics Committee and registration with the Australian New Zealand Clinical Trials Registry (ACTRN 12612000721808).

Detailed information regarding the rationale, study design and methods are reported elsewhere[15,16]. Briefly, emerging evidence supports the use of gender-tailored approaches, in particular for weight loss[17,18]. Our previous research has found gender-tailored programs to be effective in producing weight loss in men[19-21]. However, T2DM prevention programs predominantly involve both men and women with results reported collectively[9]. Therefore, the PULSE program aimed to address this gap in the evidence through the evaluation of a T2DM prevention program designed exclusively for men.

Males aged 18-65 years, with a BMI 25-40 kg/m^2 and at high risk for developing T2DM (with a score ⩾ 12 as self-reported *via* the Australian Diabetes risk assessment tool[22]) were recruited. Men with pre-existing diabetes or other serious medical conditions, recent significant weight loss (> 5% in past 6 mo), currently participating in other weight loss programs, and without access to a mobile phone were ineligible. Study recruitment used advertisements across various modes including print and online, workplace emails and research participant registers. Participants were stratified by age and BMI, and randomised to either the intervention group or waitlist control. The active intervention period was 6 mo with the waitlist control group receiving the PULSE program at the completion of active phase.

As previously reported, the program was effective in reducing clinical risk factors of T2DM[16]. In summary, a significant mean difference favouring the intervention group over control was observed for change in body weight (-5.5 kg and -5.3%, both $P < 0.001$), BMI (-1.8 kg/m^2, $P < 0.001$), and waist circumference (umbilicus -5.4 cm, $P < 0.001$; narrowest point -6.2 cm; $P < 0.001$). In addition, significant changes were found for measures of glucose regulation in the intervention group with improvements in HbA1c (-0.2%, $P = 0.002$), fasting insulin (-3.0 mIU/L, $P = 0.002$) and measures of insulin resistance (HOMA-IR; -0.4, $P = 0.002$) and insulin sensitivity (QUICKI; +0.02, $P = 0.006$).

The PULSE program

The current paper reports the secondary dietary outcome data, and therefore the methods focus on the intervention components used to target changes in diet and eating behaviours. Underpinned by Social Cognitive Theory, the PULSE program aimed to promote modest weight loss through changes in key dietary and physical activity behaviours. The program addressed key theoretical constructs relating to goal setting and planning, positive outcome expectations, seeking social support, promoting behavioural self-monitoring, and increasing self-efficacy, as described in detail previously[15,16]. Following randomisation, participants in the intervention group were provided with information and equipment resource packs and briefly orientated to the contents by a research team member[15,16].

The PULSE handbook contained dietary information and focused on four main messages: (1) key nutrients and their role in the body; (2) dietary composition, focusing on amount and quality of carbohydrate [*i.e.*, lower glycaemic index (GI)], fat, protein and fibre, and using the plate model to represent appropriate meal portion sizes; (3) variety within core (healthful) foods, particularly vegetables; and (4) suggestions for the composition (*e.g.*, low-moderate GI) of breakfast, lunch and dinner. In addition, participants were provided with the Self-Help, Exercise and Diet using Information Technology (SHED-IT) program[19,23]. This handbook provided information on general weight loss principles including setting daily energy intake targets, goal setting for eating and activity behaviours, self-monitoring tools for tracking weight, waist circumference and step counts. In addition, participants were provided with a calorie counter[24] and instructions for the accompanying CalorieKing website (www.calorieking.com.au). Participants were encouraged to self-monitor dietary intake and physical activity (both for at least 4 d per week) and weight (once per week).

Outcome measures

Assessments occurred at baseline and following the program (6 mo). Usual dietary intake was assessed using the validated, semi-quantitative food frequency questionnaire, the Australian Eating Survey (AES)[25] at baseline and following the program completion. The AES comprises 120 food items with 15 supplementary questions on food behaviours. Standard adult portion sizes for each food item were derived from National Nutrition Survey data or from the product standard serving size (*e.g.*, slice of bread)[26]. Participants were asked to recall the frequency of food consumption over the past 3 mo, with individual responses for each food or food type. Frequency options ranged from "Never" up to "⩾ 4 times/d", but varied depending on the food, with some drinks items up to "⩾ 7 glasses/d". Nutrient intakes were computed from the most current food composition database of Australian foods, the Australian AusNut 1999 database (All Foods) Revision 17, primarily and AusFoods (Brands) Revision 5.

The validated Australian Recommended Food Score (ARFS)[27] assesses diet quality and variety within the food groups relative to the Australian Guide to Healthy Eating within the Australian Dietary Guidelines (ADGs)[28]. The ARFS uses a sub-set of 70 AES food items and comprises eight sub-scales from a range of healthful or core food groups (*e.g.*, vegetables, fruit, grains, meats, non-meat proteins, dairy) with total score ranging from 0 to 73. For most items AES frequency response options are collapsed into two categories "once per week or more" or "less than once per week or never". A higher total score is indicative

Table 1 Baseline dietary intake characteristics (n = 101)

	Control (n = 48)	Intervention (n = 53)	All participants (n = 101)
Dietary intake			
EI (kJ/d)	11761 ± 3550	11014 ± 3143	11369 ± 3346
Core foods (%EI)	56.9 ± 9.3	55.8 ± 12.1	56.3 ± 10.8
Non-core foods (%EI)	43.1 ± 9.3	44.2 ± 12.1	43.7 ± 10.8
Protein (%EI)	17.5 ± 2.4	17.3 ± 2.8	17.4 ± 2.6
Carbohydrate (%EI)	45.6 ± 7.1	44.8 ± 5.1	45.1 ± 6.1
Fat (%EI)	30.6 ± 4.6	30.5 ± 5.0	30.6 ± 4.8
Saturated fat (%EI)	12.7 ± 2.2	12.7 ± 2.6	12.7 ± 2.4
Monounsaturated fat (%EI)	11.4 ± 2.1	11.3 ± 2.1	11.4 ± 2.0
Polyunsaturated fat (%EI)	3.8 ± 1.0	3.8 ± 0.9	3.8 ± 0.9
Alcohol (%EI)	6.9 ± 5.9	7.8 ± 7.2	7.4 ± 6.6
Fibre (g/d)	31.5 ± 12.0	29.1 ± 8.9	30.2 ± 10.5
Sodium (mg/d)	2834.3 ± 975.3	2662.1 ± 865.2	2743.9 ± 918.6
ARFS (maximum score)			
Total ARFS (73)	32.2 ± 10.9	30.3 ± 7.8	31.2 ± 9.4
Vegetables (21)	12.1 ± 5.0	11.1 ± 4.2	11.6 ± 4.6
Fruit (12)	4.5 ± 3.2	3.8 ± 2.5	4.1 ± 2.9
Meats (7)	3.1 ± 1.5	2.6 ± 1.3	2.9 ± 1.4
Non-meat protein (6)	2.0 ± 1.1	1.8 ± 1.0	1.9 ± 1.1
Grains (13)	5.1 ± 2.1	5.0 ± 1.7	5.1 ± 1.9
Dairy (11)	4.2 ± 2.0	4.4 ± 1.6	4.3 ± 1.8
Sauces (2)	0.9 ± 0.7	1.1 ± 0.8	1.0 ± 0.7
Water (1)	0.3 ± 0.5	0.4 ± 0.5	0.3 ± 0.5
Portion size			
Potato[1]	1.7 ± 0.5	1.6 ± 0.6	1.7 ± 0.5
Vegetables[3]	1.1 ± 0.6	1.1 ± 0.6	1.1 ± 0.6
Casserole[3]	2.0 ± 0.5	1.9 ± 0.5	1.9 ± 0.5
Steak[2]	1.8 ± 0.6	1.8 ± 0.5	1.8 ± 0.6

Data is presented as mean ± SD. Portion size coded as per Hodge *et al*[31] as follows: Never eat = 0, less than image A = 0.4, equal to image A = 0.5, between images A and B = 0.75, equal to image B = 1.0, between images B and C = 1.5, equal to image C = 2.0, greater than image C = 2.5. [1]n = 100 participants; [2]n = 97 participants; [3]n = 99 participants. EI: Energy intake; ARFS: Australian Recommended Food Score.

of more optimal nutrient intakes[27,29], greater variety within the core food groups and alignment with ADGs.

Portion size for four common foods (potato, vegetables, steak and casserole) was assessed separately using food photographs from the Dietary Questionnaire for Epidemiological Studies, version 2[30,31]. Three photographs are displayed, representing the 25th, 50th (median), and 75th percentiles of portion sizes for adult men and women[31] to indicate the portion size typically consumed, with eight response options ranging from "not eating the food at all" up to "more than the amount represented".

Statistical analysis

Statistical analysis was conducted using Stata version 13. Between group differences in completers (those who did complete all 6-mo follow-up measures) *vs* non-completers (those who did not complete all 6-mo follow-up measures, including those lost to follow-up) were assessed using t tests for continuous data and χ^2 tests for categorical data.

Changes in dietary intake over the 6-mo intervention were analysed using linear mixed models according to the intention-to-treat principle. Outcomes were assessed for the impact of treatment (intervention compared to control), time [baseline and immediately post program (*i.e.*, 6 mo)] and group by time interaction. Models were adjusted for participant age and socioeconomic status (SES), which were specified a priori. The coefficient and P-value from the mixed model testing the difference between groups in change from baseline to 6 mo was used to determine the effect of the intervention on each outcome (significance level, P < 0.05). The statistical methods of this study were reviewed by Daniel Barker from the University of Newcastle.

RESULTS

A total of 101 participants were recruited to the study. Participant baseline dietary intakes are reported in Table 1. Nineteen participants (n = 6 control; n = 13 intervention) were lost to follow-up (not able to attend the assessment sessions or were unable to be contacted). An additional two participants in the intervention group attended the follow-up session, but did not complete the AES at 6-mo, leaving a total of 21 non-completers and 80 completers from the original 101 participants whom commenced the study. At baseline, non-completers reported lower intakes of total energy, protein and carbohydrates compared to completers. The mean age of the participants was 52.3 ± 9.7 years (range 20-66 years) and the most frequently reported highest education level was a certificate or trade qualification (60%). The mean BMI of the sample was 32.6 ± 3.3 kg/m^2, and ranged from 25.7-41.0 kg/m^2.

Changes in dietary intakes of participants are reported in Table 2. At follow-up, significant mean differences between groups favouring the intervention group were identified for %EI from healthful (core) foods (+7.6%EI; P < 0.001), energy-dense, nutrient-poor foods (-7.6%EI, P < 0.001), protein (+1.3%EI, P = 0.03), and polyunsaturated fat (-0.4%EI, P = 0.02), as well as sodium intake (-369 mg, P = 0.047). Between group differences were observed in ARFS diet quality, with the intervention group achieving a greater improvement in mean total score (+4.3, P = 0.004) and subscales of fruit (+1.1, P = 0.03), meat (+0.9, P = 0.004) and non-meat protein (+0.5, P = 0.03). Greater reductions in portion sizes were achieved in the intervention group for potato (-0.9, P = 0.002), steak (-0.9, P = 0.002) and casserole (-0.7, P = 0.01) compared to controls, however there was no change in vegetable portion size.

DISCUSSION

The PULSE self-directed T2DM prevention program for men resulted in significant improvements in usual

Table 2 Change in dietary intake by group at 6 mo (n = 101)

	Change baseline to 6 mo, mean (95%CI)		
	Control (n = 48)	Intervention (n = 53)	Diff between groups
Dietary intake			
EI (kJ/d)	-315.5 (-1412.9, 781.9)	-1618.1 (-2568.4, -667.9)[b]	-1298.5 (-2737.7, 140.6)
Core foods (% EI)	2.0 (-0.4, 4.5)	9.6 (7.0, 12.3)[d]	7.6 (4.0, 11.2)[d]
Non-core foods (%EI)	-2.0 (-4.5, 0.4)	-9.6 (-12.3, -7.0)[d]	-7.6 (-11.2, -4.0)[d]
Protein (%EI)	0.5 (-0.4, 1.4)	1.9 (1.1, 2.6)[d]	1.3 (0.1, 2.5)[a]
Carbohydrate (%EI)	-0.8 (-2.5, 0.8)	0.1.1 (-2.5, 0.4)	-0.4 (-2.6, 1.9)
Fat (%EI)	-0.5 (-1.9, 1.0)	0.06 (-1.5, 1.4)	0.4 (-1.6, 2.5)
Saturated fat (%EI)	0.004 (-0.7, 0.8)	-0.6 (-1.4, 0.08)	-0.6 (-1.7, -0.4)
Monounsaturated fat (%EI)	-0.2 (-0.8, 0.4)	0.09 (-0.5, 0.7)	0.3 (-1.0, 0.5)
Polyunsaturated fat (%EI)	-0.3 (-0.6, -0.04)[a]	0.1 (-0.1, 0.4)	0.4 (0.1, 0.8)[a]
Alcohol (%EI)	0.7 (-0.5, 1.9)	-0.9 (-2.5, 0.7)	-1.6 (-3.6, 0.4)
Fibre (g/d)	-0.2 (-3.3, 3.0)	-0.1 (-2.6, 2.4)	-0.01 (-4.0, 4.0)
Sodium (mg/d)	-151.3 (-433.2, 130.5)	-519.8 (-753.0, -286.6)[d]	-368.5 (-732.0, -4.9)[a]
ARFS (maximum score)			
Total ARFS (73)	-0.2 (-2.2, 1.7)	4.1 (2.0, 6.3)[d]	4.3 (0.1.4, 7.2)[b]
Vegetables (21)	0.5 (-0.6, 1.5)	2.0 (0.7, 3.3)[b]	1.5 (-0.1, 3.2)
Fruit (12)	-0.08 (-0.8, 0.6)	1.0 (0.3, 1.7)[b]	1.1 (-0.1, 2.1)[a]
Meats (7)	0.3 (-0.7, 0.03)	0.5 (0.1, 1.0)[a]	0.9 (0.3, 1.4)[b]
Non-meat protein (6)	0.07 (-0.3, 0.2)	0.4 (0.05, 0.8)[a]	0.5 (-0.03, 0.9)[a]
Grains (13)	0.07 (-0.5, 0.3)	0.3 (-0.3, 0.8)	0.3 (-0.4, 1.0)
Dairy (11)	-0.2 (-0.6, 0.2)	-0.2 (-0.7, 0.2)	-0.06 (-0.7, 0.5)
Extras (2)	-0.01 (-0.2, 0.2)	-0.06 (-0.3, 0.2)	-0.05 (-0.4, 0.3)
Water (1)	0.04 (-0.07, 0.2)	0.1 (-0.01, 0.3)[a]	0.1 (-0.08, 0.3)
Portion size			
Potato	-0.03 (-0.4, 0.3)	-0.9 (-1.3, -0.4)[d]	-0.9 (-1.4, -0.3)[b]
Vegetable	-0.1 (-0.5, 0.3)	-0.06 (-0.5, 0.3)	-0.04 (-0.5, 0.6)
Steak	-0.2 (-0.5, 0.2)	-1.1 (-1.6, -0.6)[d]	-0.9 (-1.5, -0.3)[b]
Casserole	-0.2 (-0.5, 0.2)	-0.9 (-1.3, -0.5)[d]	-0.7(-1.3, -0.2)[a]

Significant differences within and between groups: [a]P < 0.05; [b]P < 0.01; [d]P< 0.001. Portion size coded as per Hodge *et al*[31] as follows: Never eat = 0, less than image A = 0.4, equal to image A = 0.5, between images A and B = 0.75, equal to image B = 1.0, between images B and C = 1.5, equal to image C = 2.0, greater than image C = 2.5. EI: Energy intake; ARFS: Australian Recommended Food Score.

dietary intake, including a reduction in intakes of energy-dense, nutrient-poor foods and increased overall diet quality and variety within healthful food groups and fruit, non-meat protein and meat ARFS subscales. Of note portion sizes for potatoes, steak and casserole were significantly reduced in the intervention group *vs* the control group. Though not significant, changes in the desired direction were observed for increased vegetable variety and decreased alcohol intake (%EI).

For men in the PULSE program intervention group, the increased diet quality was accompanied by an increased percentage of total energy from healthful foods and a %EI from energy-dense, nutrient-poor foods. Despite a reduction in mean total energy intake of approximately 1300 kJ/d (P = 0.08), dietary macronutrient composition remained relatively stable, with a small but significant increase of +1.3% in %EI from protein in the intervention group. This is in contrast to the United States Diabetes Prevention Program which reported a similar reduction in total energy intake among those in the lifestyle intervention group, however total fat intake decreased by 6.6% of total energy intake following the first 6 mo[4]. Similar reductions in total energy were also observed in the Finnish Diabetes Prevention Study following the intensive phase at 1 year[32]. These findings, combined with the increases in diet quality, suggest individuals in the PULSE intervention program replaced energy-dense, nutrient-poor foods with healthful food choices.

Most studies reporting on dietary outcomes immediately following major diabetes prevention program interventions have only reported on changes in total energy and/or nutrient intakes[9]. Few studies have evaluated changes in diet quality as assessed using an a priori defined diet quality index or score, or intakes of individual food groups. Miller *et al*[12] reported significant within group improvements in overall diet quality scores (+4.6, P < 0.01) measured using the Alternative Healthy Eating Index following a 4-mo group-based diabetes prevention program. In another study, Block *et al*[11] reported changes in food habits associated with higher diet quality, such as significant changes in the consumption frequency of fruits and vegetables (increases) and sweets and refined carbohydrate foods (decreases) found among those with prediabetes who received a 6-mo automated web-based diabetes prevention program.

Findings from interventions aimed at the prevention of T2DM, including the current PULSE trial, are consistent with meta-analyses[33,34] which support a significant association between higher overall diet quality, as assessed by a score or index, and a decreased risk of T2DM. Specifically in men with a high BMI, diets of higher quality have been associated with a reduction in the incidence of T2DM[35]. Findings from the current study also add to the emerging evidence for a lower risk of developing T2DM in those with a higher diet quality[36,37]. Greater dietary diversity within core food groups has also been associated with a lower risk of metabolic syndrome[38], and to be a predictor of weight loss and reduced waist circumference within a weight loss intervention[39]. In particular, diets that are diverse in the variety of fruits and vegetables consumed are associated with a lower risk of T2DM[37]. Recent meta-analyses on the amounts of fruits and vegetables consumed in relation to T2DM risk confirm the positive relationship between higher intakes of fruits and vegetables and lower risk of developing diabetes[40,41], including a dose-response relationship with a 6% and 13% lower risk for each 1 serve increase in fruit intake and each additional 0.2 serve of green-leafy vegetables, respectively[40].

The changes in diet in those receiving the PULSE intervention program are encouraging, especially given the self-directed nature of the program and compare favourably to traditional intensive T2DM prevention programs delivered using one-on-one or group or combination approaches. Given the increasing prevalence of T2DM and associated risk factors, such as excess body weight, poor diet and physical inactivity, evidence of the effectiveness of low intensity programs are gaining momentum[7]. However, modifications to the traditional diabetes prevention programs are considered necessary for translation to non-research or "real-world" settings[42] and to promote sustainability of effective programs through delivery of these programs at scale. Delivery of programs using various media and technologies, such as DVD or web- or mobile-based platforms, have demonstrated effectiveness in terms of weight loss[6,11,43], while other diabetes prevention programs have begun to provide higher intensity interventions through the supplementation of mobile applications with remote support from a trained health coach[44,45].

The dietary changes observed by men in the PULSE intervention group support the observed improvements in weight status, waist circumference and measures of glucose regulation[16]. These findings demonstrate that participants adhered to the dietary messages contained in the PULSE program, in particular increasing variety within healthful food groups and reducing portion sizes. This indicates that a gender-tailored, self-directed program can result in desirable dietary changes that reduce T2DM risk. Despite, the benefits demonstrated by the PULSE program immediately following completion, the long-term impact on the maintenance of healthy eating behaviours remain to be established.

Although a validated food frequency questionnaire was used to measure dietary intake, the use of a self-administered measure is subject to inherent errors of self-reported dietary data[46] and is a limitation of the current study. The effect of measurement error in the context of intervention studies is an emerging area of research and recommendations to use a biomarker of dietary intake to calibrate the primary measure of intake[47] were outside the scope of the PULSE pilot study. While the dietary outcome findings should be interpreted in light of this, the use of objective measures for the anthropometric and biochemical outcomes is a strength of the current study, and improvements in these variables are likely to reflect the positive dietary changes observed for the intervention group.

In addition to reductions in anthropometric measures and improved glucose regulation, the self-directed, gender-tailored PULSE program resulted in significant improvements in dietary intake. This included a reduction in intake of energy-dense, nutrient-poor foods and portion size, increased overall diet quality and greater variety of healthful foods, especially within fruit, meat, and non-meat protein food groups.

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COMMENTS

Background

Dietary outcomes following diabetes prevention programs have primarily focused on reporting changes in energy and macronutrient intakes; effects on diet quality have only begun to be investigated. Also, most past programs have included both men and women, were not gender-tailored, and had little or no separate reporting of effects on men and women. This study investigated effects on dietary intakes and diet quality of the self-directed, gender-tailored Prevention Using LifeStyle Education (PULSE) program for type 2 diabetes mellitus (T2DM) prevention in men.

Research frontiers

Emerging evidence supported the use of gender-tailored programs for men in the context of weight loss, however no programs developed for T2DM prevention had been specifically tailored for men. The PULSE program aimed to address this gap.

Innovations and breakthroughs

The PULSE program's nutrition messages led to significant improvements in dietary intake and diet quality, as well as decreasing clinical risk factors for T2DM, in men at risk of T2DM, suggesting that gender-tailoring in this group may be important for achieving healthful dietary behaviour changes in men.

Applications

These findings offer support for the use of gender-tailored dietary messages in the context of dietary advice for the prevention of T2DM, in particular in relation to increasing variety within healthful food groups.

Terminology

Diet quality assessment provides an indication of adherence to dietary guidelines and healthy eating patterns. Diet quality can be assessed *via* indices or scores that evaluate types of foods consumed and variety within food groups, and in some instances, intakes of selected nutrients.

Peer-review

The study is very interesting from a clinical practice point of view.

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