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A Workplace Email-linked Website Intervention for Modifying Cancer-related Dietary and Lifestyle Risk Factors: Rationale, Design and Baseline Findings

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ABSTRACT

Introduction: The use of email and website as channels for workplace health information delivery is not fully explored. This study aims to describe the rationale, design, and baseline findings of an email-linked website intervention to improve modifiable cancer risk factors. **Methods:** Employees of a Malaysian public university were recruited by systematic random sampling and randomised into an intervention (n=174) or control group (n=165). A website was developed for the intervention and educational modules were uploaded onto the website. The intervention group received ten consecutive weekly emails with hypertext links to the website for downloading the modules and two individual phone calls as motivational support whilst the control group received none. Diet, lifestyle, anthropometric measurements, psychosocial factors and stages of change related to dietary fat, fruit and vegetable intake, and physical activity were assessed. **Results:** Participants were predominantly female and in non-academic positions. Obesity was prevalent in 15% and 37% were at risk of co-morbidities. Mean intake of fats was 31%, fruit was ~1 serving/day and vegetable was <1 serving/day. Less than 20% smoked and drank alcohol and about 40% were physically inactive. The majority of the participants fell into the Preparation stage for decreasing fat intake, eating more fruit and vegetables, and increasing physical activity. Self-efficacy and perceived benefits were lowest among participants in the Precontemplation/Contemplation stage compared to the Preparation and Action/Maintenance stages. **Conclusion:** Baseline data show that dietary and lifestyle practices among the employees did not meet the international guidelines for cancer prevention. Hence the findings warrant the intervention planned.

Keywords: Cancer, risk factors, email, website, worksite

INTRODUCTION

Cancer is the world's second biggest cause of death after cardiovascular disease and 7.6 million people globally died from this disease in 2005 with three-quarters of them in low- and middle-income countries. This figure is projected to rise to 9 million by 2015

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and increase further to 11.5 million in 2030 (WHO, 2007). In Malaysia, this disease was the fourth principle cause of death in government run hospitals in 2011 (MOH, 2012).

Epidemiological and experimental studies have established irrefutable evidence on the protective role of a healthy diet and lifestyle behaviours for non-communicable diseases prevention including cancer and other chronic diseases (WCRF/AICR, 2007). Despite the beneficial effects of healthy lifestyles, large proportions of adults fail to meet the international recommendations. In Malaysia, 73% of adults did not meet the minimum dietary guideline for fruit and vegetable intake of at least five standard servings per day and 60% were physically inactive (MOH, 2006). An unhealthy diet, physical inactivity along with other unhealthy lifestyles including smoking, excessive alcohol consumption, and related outcomes such as overweight and obesity are identified as modifiable risk factors for cancer and other chronic diseases (WCRF/AICR, 2007).

The workplace has been recognised as a key channel for delivery of health promotion among the employee population considering the huge numbers of adults involved and the long hours spent at work (WHO, 2008). Apart from the common worksite health problems faced by the employees such as mental and musculo-skeletal illnesses, unhealthy diet and lifestyles have also been identified (Abood, Black & Feral, 2003). Many workplaces are sedentary in nature and offer easy access to energy-dense food and beverages at workplace cafeterias, which contribute to the growing problem of overweight and obesity (Anderson *et al*., 2009). Hence, interventions for improving diet and lifestyle behaviours among employees at the worksite are a rational choice for a large number of captive adult population with health risks.

The use of communication technologies such as interactive computer and television programmes, mobile telephone short-message service, the Internet with its World Wide Web (WWW) and email applications at home, workplace and milieu have opened up an inexhaustible means for transmission of health information (Norman *et al*., 2007). Internet users, in particular, have increased tremendously worldwide including Malaysia in the last decade (Miniwatts International, 2011). This communication tool has prompted researchers with new impetus in promoting health behaviour change for cancer prevention through Internet technology (Norman *et al*., 2007).

Several worksite health promotion trials in developed countries have utilised the advantages of these modern communication tools in designing interventions to promote health (Block *et al.*, 2004, Norman *et al*., 2007), but there is a paucity of research on the effects of an email-linked website intervention in educating and modifying cancer-related dietary and lifestyle risk factors in the workplace context particularly in countries in economic transition.

The purpose of this article is to describe the rationale and design of an email-linked website intervention study, and report baseline findings.

METHODS

Setting and study design

A Malaysian public university with over 3000 employees and easy access to a stable Internet service was selected for the intervention. Ten faculties, purposively selected after taking into account the possibility of confounding effects towards the study's findings, were randomly assigned to intervention and control groups using a lottery method. The study was approved by the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia Medical Research Ethics Committee, the Registrar's office of the university and deans of the selected faculties.

Baseline recruitment process

In January 2011, a name list of academic and non-academic employees in the selected faculties was drawn from the University Registrar's office. Upon randomisation of the faculties into two arms, every third subject from the name list of each faculty was screened and recruited with the subject's informed consent. The inclusion criteria were employed by the university during the period of study (contract/permanent basis), able to read and understand the Malay language, having access to the Internet with a personal email address at the workplace and willing to participate in the intervention and follow-up for at least three months. Subjects were excluded if they had a history of cancer, physical disabilities, pregnant during the time of enrolment/intervention and had participated in other health-related behaviour change programmes two months prior to the study. Out of the 634 screened, only 612 subjects were found eligible to participate in this study. Finally, a total sample of 339 employees from the list was recruited. Two hundred and seventy three employees refused to participate as they were busy or were not interested. The response rate for intervention and control groups were 51.6% and 60.0%, respectively. The flow chart of the study protocol and numbers of subjects in each stage is shown in Figure 1.

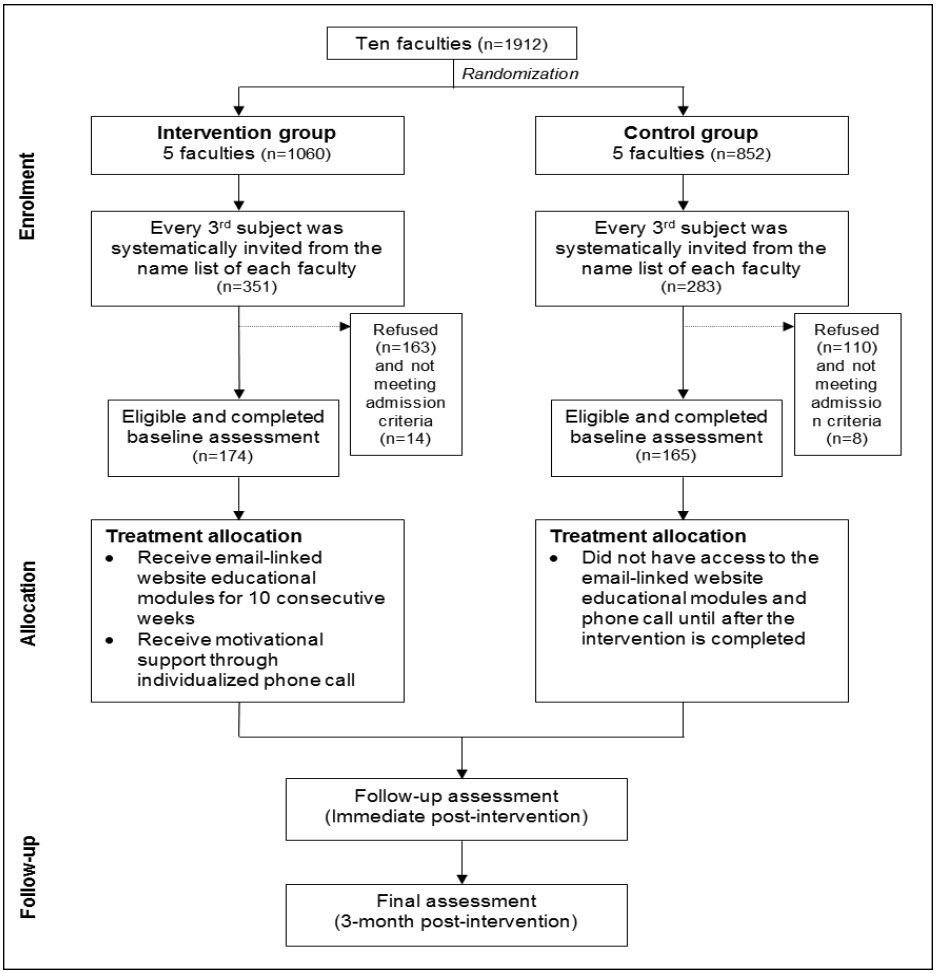

Figure 1. Flow chart of the study protocol and number of subjects in each stage

Sample size determination

The sample size was calculated using the formula with two-sided significance level of α=0.05 and 80% power suggested by Jekel *et al*. (2007). A total of 246 subjects (minimum 123 subjects in each group) were required for the study including an estimation of 30% attrition rate as observed in other nutrition and physical activity intervention studies (Norman *et al*., 2007).

Intervention design

Participants in the intervention group were given a notice on the email-linked website delivery schedule including date and time for two individual phone calls to be made by the researcher and the study website address before the commencement of the intervention. Participants in the intervention group received 10 weekly e-mails with each providing links to a website for downloading the cancer prevention educational module in PDF format. The module was included within the email-linked text window rather than as an attachment because of the concerns raised at the workplace about possible computer viruses transmitted by attachments. The number of modules downloaded and viewed by the participants was monitored through requisition of a self-report read-receipt e-mail. There was no special login for the intervention group. The intervention group received ten weekly e-mails containing links to a webpage for downloading the cancer prevention educational module in PDF format. The module was included within the email-linked text window. Using the faculty as a unit of randomisation in this study helps to minimise the potential risk of contamination among intervention and control groups. In contrast, participants in the control group did not have access to the website until after the study was completed. Participants in the intervention group were advised that the educational modules were not to be shared with colleagues and that the e-mails could be forwarded to others only after the study was completed. Participants were given a food warming jar, a print version of the cancer prevention educational modules and a certificate of appreciation as tokens of appreciation on completion of the study.

Cancer prevention educational modules

Ten educational modules that included healthful diet, physical activity, weight management and other cancer prevention elements were developed and content validated by four university nutrition and dietetics lecturers and a community nutrition graduate student in accordance with the WCRF/AICR (2007) and American Cancer Society guidelines for cancer prevention (Kushi *et al*., 2006). The modules were written in the Malay language, presented with colourful graphics in the form of key messages and goals, interesting facts and new practical tips on easily achievable actions.

Website

A website with the domain name, *http://www.nutrihealth-upm.com* was developed and its user interface followed a relatively standard model of the web. The features include introduction, evidence-based educational modules, a video-clip on cancer prevention, research committee, online forum, feedback form, and links to existing cancer resources. A web master was engaged to translate the Microsoft® Word content into web format and handle the technical difficulties such as security and statistics systems.

Phone call

Two individual phone call sessions with an average duration of 10 minutes were held in weeks four and eight as motivational support and to remind participants to read the modules. Questions based on Block *et al*. (2004) were also asked on participants'

satisfaction with the website and educational modules during the phone calls. No formal script was developed for the phone call conversations.

Baseline measurements

A self-administered structured questionnaire tested for content and face validity as well as reliability was used to assess the outcome measures at baseline, immediate post-intervention and at 3-month post-intervention. Prior appointments were made with participants for baseline data collection. Participants were visited on the appointed date and questionnaires were given with a reminder that the completed questionnaires would be collected the day after. All anthropometric measurements were conducted through face-to-face contact at the workplace except for the repeated 24-hour dietary recall interview during weekend which was made over the phone. The schedule and reliability of measurements are shown in Table 1. Neither participants nor investigators were blinded to treatment allocation, but the enumerators trained to collect the data were blinded during data collection.

Socio-demographic characteristics

Participants were asked their e-mail address, telephone number, age, gender, ethnicity, marital status, educational level, type of employment, monthly income, and family size at baseline.

Anthropometry

A SECA microtoise tape (206; Vogel and Halke GmbH & Co, Germany) was used to measure height and a TANITA electronic weighing scale (HD-312; Tanita Health Equipment LTD, Japan) was used for weight. Body mass index (BMI) was calculated using the following formula: BMI = wt in kgs/ ht in m^2. A fiberglass tape was used to measure waist and hip circumferences. Waist-hip ratio (WHR) was calculated using the following formula: WHR = waist circumference (cm)/ hip circumference (cm). All the measurements were performed as described in Gibson (2005). Duplicate measurements were recorded, and the average of the two was used for calculation. BMI and WHR were categorised using the WHO (1998) and WHO (1995) reference cut-off values, respectively.

Table 1. Schedule and reliability of measurements

Measurement	*Baseline*	*Immediate post-intervention*	*3-month post-intervention*	*Reliability (Cronbach s alpha)*
Socio-demographic measures	x			-
Psychosocial measures				
Knowledge	x	x	x	0.819
Perceived health status and cancer threat	x	x	x	-
Self-efficacy[a]	x	x	x	0.874-0.928
Perceived benefits[a]	x	x	x	0.785-0.922
Perceived barriers[a]	x	x	x	0.802-0.910
Stages of change[a]	x	x	x	-
Dietary intake	x		x	-
Lifestyle measures				
Smoking habit	x		x	-
Alcohol consumption	x		x	-
Physical activity	x		x	-
Anthropometric measurements	x		x	-

[a] Dietary fat reduction, fruit and vegetable intakes and physical activity

Dietary intake

Twenty-four hour dietary recall method was used to assess the subject's dietary intake over two non-consecutive days (1 weekday and 1 weekend). Phone calls were made on Sunday or Monday to assess subjects' dietary intake for Saturday or Sunday, respectively using the standard 24-hour dietary recall interview protocol. Household measurements were used to assist the subject in assessing portion size of food consumed. The nutrient contents of foodstuffs were analysed using the Nutritionist Pro™ Nutrition Analysis Software (First Data Bank Inc, 2003). For food items that were not available in the software, other food databases such as the Singapore Food Composition Guide and ASEAN Food Composition Tables were sought for nutrient content. Standard estimation was used to calculate amount of oils and fats in all foods taken by the participants.

Lifestyle characteristics

Information on smoking habit and alcohol consumption was recorded in dichotomous answer scale. A reliable and validated International Physical Activity Questionnaire (IPAQ, 2005) 'short-last 7 days' form was adapted to determine the physical activity level and energy expenditure of the participants. Energy expenditure and physical activity level were based on calculation of Metabolic Equivalent (METs) which is the ratio of the work metabolic rate to the resting metabolic rate. One MET is defined as 1 cal/kg/hour and is equivalent to the energy cost of sitting quietly. The energy expenditure in MET-minutes/week was calculated using the IPAQ equations and then categorised into low, moderate and vigorous physical activity levels according to the recommended IPAQ (2005) classification.

Psychosocial factors

The knowledge questions on cancer-related dietary and lifestyle risk factors comprised four subscales viz: diet (9 statements), physical activity (5 statements), weight management (4 statements) and other lifestyle (3 statements). These 21 statements were adopted and modified from the American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention (Kushi *et al*., 2006) and WCRF/AICR (2007). Each statement required one of three choices of answer: True, False or Unknown. Correct answers were given 1 point whilst incorrect or unknown answers were given zero with a higher score indicating higher knowledge.

Two items were used to assess personal perception of health status (in comparison to other men/women of the same age) and risk of having cancers. Participants rated their perceptions as lower, about the same or higher on a 3-point scale from high to low.

Self-efficacy, perceived benefits, and perceived barriers were used to assess dietary fat reduction, increasing fruit and vegetable intake and physical activity domains.

1. Dietary fat reduction
   Self-efficacy was measured using a 6-item, 5-point Likert scale ranging from 'not confident' (1) to 'very confident' (5) (Liou, 2004). Both perceived benefits and barriers were measured using four-item and 7-item with a 5-point Likert scale ranging from 'not important' (1) to 'very important' (5), respectively (Rossi *et al*., 2001).

2. Fruit and vegetable intake
   Self-efficacy was assessed using a 9-item, 5-point Likert scale ranging from 'not confident' (1) to 'very confident' (5) (Vereecken, van Damme & Maes, 2005). Both, perceived benefits and barriers, were measured using a seven-item 5-point Likert scale ranging from 'not important' (1) to 'very important' (5) (De Vet *et al*., 2006).

3. Physical activity
   Self-efficacy was measured using a 15-item, 3-point response option scale from

'very confident' (3), 'somewhat confident' (2), and 'not confident at all' (1) (University of Rhode Island Cancer Prevention Research Center, 1998). For perceived benefits (Rauh *et al*., 1992) and perceived barriers (US Center for Disease Control and Prevention, 1999), both were measured using ten items and fourteen items on 5-point and 3-point Likert scales, respectively. The scale ranged from 'very unlikely' (1) to very likely (5) with a higher score indicating greater self-efficacy, perceived benefits and perceived barriers.

Stages of change

Five stages of change (Pre-contemplation, Contemplation, Preparation, Action, and Maintenance) of the Transtheoretical Model for dietary fat, fruit and vegetable intakes and physical activity were assessed by an algorithm (Marcus *et al*., 1992; Kristal *et al*., 1999).

Statistical analyses

All data were analysed using IBM® SPSS® (Version 18.0). Independent-samples *t*-test and chi-square test were performed to determine the difference between the two study arms in the mean of the continuous and categorical variables, respectively. One-way analysis of variance (ANOVA) was used to determine the differences in psychosocial factors by stages of change with Dunnett's T3 post-hoc multiple comparison test. ANOVA using General Linear Model (GLM) repeated measures with two factors (group and time) was performed to examine the difference in psychosocial factors and anthropometric measurements as well as dietary and lifestyle risk factors between the two study arms over the period of study. It used raw score data at baseline, follow-up, and final assessment to detect difference in the changes between- and within-groups whilst controlling for potential baseline covariates. The effect size was determined to examine the magnitude of the intervention's effect and interpreted by Cohen's guidelines as follows: small (η^2=0.01), medium (η^2=0.09), and large (η^2=0.25). Alpha level of 0.05 was used for all statistical tests.

RESULTS

Overall, there were no significant differences between the intervention and control groups for all baseline characteristics except for BMI category, self-efficacy for physical activity and perceived benefits for reducing fat intake. Baseline characteristics of participants in the two study arms are presented in Table 2. The mean age of the participants was 32.2±9.5 (range =20-57 years) with a majority of them aged between 20 to 29 years. This study comprised predominantly females (59.9%), Malays (92.6%) and married (51.3%). Most of the participants had at least a degree or post-graduate qualification (55.2%) and were non-academic employees (77.0%) such as administrative officers and laboratory or research assistants. The remaining employees (23.0%) were academicians such as associate professors, senior lecturers, lecturers, and tutors. The mean monthly personal and household incomes were RM2235±1379 and RM4123±3816 respectively with the majority of the participants (30.7%) having a medium family size of about four.

The participants' mean BMI was 24.8±5.0 kg/m^2 and approximately 28% and 15% were overweight and obese, respectively. Waist and hip circumferences revealed that 37% were at risk of co-morbidities. Mean energy intake was 1545.7±493.2 kcal/day, with 30.6% from fat. The participants consumed only about a serving/day of fruit and less than a serving/day of vegetables. In terms of the participants' lifestyle, 18% and 3.2% smoked and consumed alcohol, respectively. The average MET-min/week of the participants was 1954.0±2666.8 and

Table 2. Baseline characteristics of employees in the intervention and control groups

Characteristic	*Intervention (n=174) Mean ± SD/ n (%)*	*Control (n=165) Mean ± SD/ n (%)*	*t or χ^2*	*p-value*
Socio-demographic				
Age				
20 – 29	95 (54.6)	98 (59.4)	1.911	0.591
30 -39	36 (20.7)	27 (16.4)		
40 – 49	31 (17.8)	32 (19.4)		
≥ 50	12 (6.9)	8 (4.8)		
Gender				
Male	62 (35.6)	74 (44.8)	2.994	0.084
Female	112 (64.4)	91 (55.2)		
Ethnic group				
Malay	162 (93.1)	152 (92.1)	0.120	0.729
Non-Malay	12 (6.9)	13 (7.9)		
Marital Status				
Single	82 (47.1)	83 (50.3)	0.342	0.559
Married	92 (52.9)	82 (49.7)		
Educational level				
Lower/ Upper secondary school	39 (22.4)	38 (23.0)	3.038	0.219
Pre-university/ Matriculation	45 (25.9)	30 (18.2)		
Degree/ Master/ PhD	90 (51.7)	97 (58.8)		
Type of employment				
Academic	40 (23.0)	38 (23.0)	8.352	0.993
Non-academic	134 (77.0)	127 (77.0)		
Monthly personal income (RM)				
< 1000	12 (6.9)	12 (7.3)	0.401	0.940
1000 - 1499	45 (25.9)	47 (28.5)		
1500 – 1999	37 (21.3)	32 (19.4)		
≥ 2000	80 (46.0)	74 (44.8)		
Monthly household income (RM)				
< 1000	8 (4.6)	11 (6.7)	1.404	0.705
1000 - 2499	69 (39.7)	71 (43.0)		
2500 - 4999	39 (22.4)	32 (19.4)		
≥ 5000	58 (33.3)	51 (30.9)		
Family size (person)				
< 2	54 (31.0)	45 (27.3)	0.771	0.865
2 – 3	36 (20.7)	35 (21.2)		
4 -5	53 (30.5)	51 (30.9)		
≥ 6	31 (17.8)	34 (20.6)		
Anthropometric measurements				
Weight (kg)	62.9 ± 13.5	64.5 ± 14.3	-1.073	0.284
Height (cm)	159.9 ± 8.4	160.6 ± 8.2	-0.846	0.398
BMI category				
Underweight (<18.5 kg/m^2)	15 (8.6)	11 (6.7)	17.286	0.001*

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Table 2. Continued from previous page

Normal (18.5 - 24.9 kg/m^2)	75 (43.1)	91 (55.2)		
Overweight (25.0 - 29.9 kg/m^2)	65 (37.4)	31 (18.8)		
Obese (≥30.0 kg/m^2)	19 (10.9)	32 (19.4)		
WC (cm)	81.2 ± 11.5	81.82 ± 12.7	-0.450	0.653
WC category				
Normal (M<90cm; F<80cm)	111 (63.8)	104 (63.0)	0.021	0.884
At risk of co-morbidities (M≥90cm; F≥80cm)	63 (36.2)	61 (37.0)		
Hip circumference (cm)	99.2 ± 8.6	99.7 ± 9.7	-0.501	0.617
WHR	0.82 ± 0.07	0.82 ± 0.07	-0.119	0.905
WHR category				
Normal (M<0.95; F<0.85)	145 (83.3)	143 (86.7)	0.736	0.391
At risk of co-morbidities (M≥0.95; F≥0.85)	29 (16.7)	22 (13.3)		
Dietary intake/ day				
Energy, kcal	1546.4 ± 505.0	1545.0 ± 481.9	0.026	0.979
Fat, g	53.1 ± 20.9	53.0 ± 21.2	0.027	0.978
% energy from fat	30.8 ± 5.7	30.4 ± 6.0	0.524	0.601
Fruit, servings	1.0 ± 1.2	0.9 ± 0.8	1.584	0.114
Vegetable, servings	0.7 ± 0.7	0.7 ± 0.6	0.148	0.882
F&V, servings	1.7 ± 1.5	1.6 ± 1.0	1.366	0.173
Lifestyle measures				
Smoker	31 (17.8)	32 (19.4)	0.139	0.709
Alcohol drinker	6 (3.4)	5 (3.0)	0.047	0.828
Physical activity (MET-min/wk)				
Vigorous	790.8 ± 1397.3	804.9 ± 1533.7	-0.088	0.930
Moderate	527.8 ± 780.8	537.2 ± 836.9	-0.107	0.915
Walking	553.4 ± 1397.4	698.3 ± 1622.4	-0.883	0.378
Total	1872.0 ± 2411.3	2040.4 ± 2917.0	-0.580	0.562
Physical activity level				
High (≥ 3000 MET-min/wk)	35 (20.1)	32 (19.4)	0.561	0.755
Moderate (600-2999 MET-min/wk)	67 (38.5)	70 (42.4)		
Low (< 600 MET-min/wk)	72 (41.4)	63 (38.2)		
Psychosocial measures				
Knowledge[a]	15.2 ± 3.2	14.7 ± 3.5	1.424	0.155
Perceived health status[b]				
Higher	51 (29.3)	46 (27.9)	5.551	0.062
About the same	115 (66.1)	100 (60.6)		
Lower	8 (4.6)	19 (11.5)		
Perceived cancer threat				
High	4 (2.3)	11 (6.7)	4.084	0.130
Moderate	99 (56.9)	94 (57.0)		
Low	71 (40.8)	60 (36.4)		

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Table 2. Continued from previous page

Self-efficacy				
Dietary fat[c]	20.2 ± 4.6	19.4 ± 4.5	1.572	0.117
F&V intake[c]	32.4 ± 6.9	31.2 ± 6.8	1.533	0.126
Physical activity[d]	25.3 ± 6.5	24.0 ± 5.9	2.030	0.043*
Perceived benefits				
Dietary fat[c]	17.6 ± 2.2	17.0 ± 2.4	2.159	0.032*
F&V intake[c]	30.9 ± 3.8	30.3 ± 4.0	1.466	0.144
Physical activity[c]	39.6 ± 5.1	39.0 ± 5.6	0.973	0.331
Perceived barriers				
Dietary fat[c]	19.8 ± 6.9	19.4 ± 7.0	0.495	0.621
F&V intake[c]	17.8 ± 5.4	18.9 ± 6.2	-1.770	0.078
Physical activity[d]	21.4 ± 4.5	21.5 ± 4.7	-.0293	0.770
Stages of change				
Dietary fat				
Precontemplation	11 (6.3)	16 (9.7)	4.133	0.388
Contemplation	14 (8.0)	18 (10.9)		
Preparation	124 (71.3)	112 (67.9)		
Action	5 (2.9)	7 (4.2)		
Maintenance	20 (11.5)	12 (7.3)		
F&V intake				
Precontemplation	4 (2.3)	4 (2.4)	1.288	0.863
Contemplation	7 (4.0)	6 (3.6)		
Preparation	96 (55.2)	99 (60.0)		
Action	29 (16.7)	21 (12.7)		
Maintenance	38 (21.8)	35 (21.2)		
Physical activity				
Precontemplation	7 (4.0)	10 (6.1)	5.937	0.204
Contemplation	26 (14.9)	23 (13.9)		
Preparation	88 (50.6)	84 (50.9)		
Action	26 (14.9)	13 (7.9)		
Maintenance	27 (15.5)	35 (21.2)		

[a] Score ranged from 0-21; higher score indicates greater 'amount' of knowledge
[b] Perception compared to other men/ women of the same age
[c] Scales 1-5; higher score indicates greater 'amount' of construct
[d] Scales 1-3; higher score indicates greater 'amount' of construct
* Significant difference ($p<0.05$)
RM, ringgit Malaysia; BMI, body mass index; WC, waist circumference; WHR, waist-hip ratio; F&V, fruit and vegetable; min, minutes; wk, week; M, male; F, female; SD, standard deviation

40% of them fell into the low physical activity level.

It is noteworthy that the mean scores for knowledge and self-efficacy, perceived benefits and barriers for dietary fat reduction, fruit and vegetable intake and physical activity were above the median. For stages of change, the majority of participants fell in the Preparation stage for decreasing fat consumption (69.6%), eating more fruit and vegetable intake (57.5%), and increasing physical activity (50.7%). On further analyses, results revealed that mean scores for self-efficacy, perceived benefits and barriers for dietary fat, fruit and vegetable intake and physical activity differentiated participants at different stages ($p<0.01$) except for perceived benefits for fruit and vegetable intake. Table 3 compares the self-efficacy, perceived benefits, and perceived

Table 3. Comparison of self-efficacy, perceived benefits, and perceived barriers (mean ± SD) by stages of change

Stages of change	*Dietary fat*				*Fruit and vegetable intake*				*Physical activity*			
	N	*SE*	*PBe*	*PBa*	*N*	*SE*	*PBe*	*PBa*	*N*	*SE*	*PBe*	*PBa*
Precontemplation/ Contemplation	59	18.0 ± 3.6[a]	16.2 ± 2.7[a]	20.6 ± 5.6[a]	21	26.5 ± 5.3[a]	28.6 ± 4.0[a]	20.9 ± 4.2[a]	66	22.4 ± 5.3[a]	36.7 ± 5.3[a]	22.3 ± 4.8[a]
Preparation	236	19.5 ± 4.4[b]	17.5 ± 2.2[b]	20.3 ± 6.8[a]	195	31.6 ± 6.4[b]	30.6 ± 3.7[a]	18.8 ± 5.4[ab]	172	23.3 ± 5.3[a]	39.2 ± 5.4[b]	22.3 ± 4.1[a]
Action/ Maintenance	44	24.0 ± 4.2[c]	17.3 ± 2.3[b]	14.6 ± 7.4[b]	123	33.2 ± 7.4[b]	30.8 ± 4.2[a]	17.2 ± 6.5[b]	101	28.5 ± 6.2[b]	41.2 ± 4.6[c]	19.3 ± 4.5[b]
One-way ANOVA *F* value		27.8*	8.1*	14.5*		9.2*	3.0	5.0*		32.8*	15.2*	17.5*

[a] Values in a column without a common superscript alphabet were statistically different based on Dunnett's T3 post hoc analysis
* Significant ($p<0.01$)
SE, self-efficacy; PBe, perceived benefits; PBa, perceived barriers

barriers for dietary fat, fruit and vegetable intake and physical activity by stages of change. In almost all cases, participants in Precontemplation/Contemplation stage were significantly different from participants in all other stages. Participants in Precontemplation/Contemplation stage scored the lowest for self-efficacy and perceived benefits and highest for perceived barriers compared to those in Preparation and Action/Maintenance stages.

DISCUSSION

Participation appeared higher among younger and female employees than older and male employees. These findings are in accordance with a review (Robroek *et al*., 2009) of 23 educational and multi-component nutrition and/or physical activity intervention studies with some using e-mail and website as a reinforcement tool. However, the number of employees with low socio-economic status was relatively small in this study and yet it is important to gain an insight of this specific group as unhealthy lifestyle practices are reported as being more common compared to moderate and high socio-economic status (Robroek *et al*., 2009).

Mean body weight and BMI of the participants in this study were found to be similar to the national data (MOH, 2006), but a lower prevalence of waist circumference at risk (10.9%). The prevalence of obesity in this predominantly Malay worksite sample of adults is somewhat higher than that reported for Malays (13.6%) by Rampal *et al* (2007) in a large population based cross-sectional study. In spite of the different prevalence figures, overweight and obesity is a work site health problem that has to be addressed. Overweight and obesity have been identified as a strong risk factor for cancer and other chronic diseases (WCRF/AICR, 2007). The causes of overweight and obesity are often varied and complex, but they have generally been attributed to energy imbalance and low physical activity.

The present study found lower mean energy intakes among participants compared to values reported by a nationwide nutrition survey (Mirnalini *et al*., 2008). This difference may be due to under-reporting of food intake. In addition, the sample size of the present study is relatively small and may not be representative of the total population, and hence it is difficult to compare with previous studies. The Malaysian Recommended Nutrient Intakes (RNI) suggests that total fat should contribute 20% to 30% of total calories per day for adults. In this study, the relative contribution of fat to the total energy intake was well within dietary guidelines for a healthy diet. However, in comparison to the study by Mirnalini *et al*. (2008), the employees appeared to consume higher energy from fat (27% to about 31%). Anderson *et al*. (2009) in their review reported that the workplace is usually a site highly accessible to energy-dense food and beverages. Higher energy as well as percentage of calories from fat intakes can promote weight gain which contributes to risk of cancer and other chronic diseases (WCRF/AICR, 2007). On the other hand, the number of servings of fruit, vegetable and combined fruit and vegetable intake per day by the Ministry of Health Malaysia (2006) were about two folds higher (1.8 serving of fruit, 2.1 serving of vegetable and 4.2 serving of combined fruit and vegetable/ day) compared to the present study. Low intake of fruit and vegetable (<5 servings) has been associated with certain cancers and chronic diseases (WCRF/AICR, 2007). Although the benefits of fruit and vegetable consumption are well acknowledged, studies indicate that most adults do not meet the recommended daily minimum servings (MOH, 2006).

The number of smokers and alcohol drinkers in this study was relatively low compared to the national data (MOH, 2006) with a prevalence of 25.5% and 12.2%, respectively. Less smokers and drinkers were

reported perhaps due to the greater number of females and Malay participants in this study who abstain from alcohol. This study also found a lower proportion of participants in low physical activity level compared to the national data (MOH, 2006) with 60%. A higher mean total MET-minutes/week of the participants may be due to over-reporting of physical activity. Anderson *et al*. (2009) revealed that the proportion of working adults engaged in low physical activity at work has increased tremendously. Low physical activity has been shown to have a causal relationship to cancer (WCRF/AICR, 2007).

The level of cancer prevention knowledge among participants was moderate. A certain level of knowledge about prevention is essential in order for an individual to make healthier choices. The finding of this study differs from that of Feizi *et al*. (2010) which demonstrated only a small proportion of adults with moderate to high knowledge level about cancer. This may be explained by the fact that the study sample had higher educational level, and greater female participation which have been found to be strongly correlated with a higher level of cancer knowledge.

Most of the participants rated their perception on health status and cancer threat as 'about the same compared to others of a similar age' and 'moderate', respectively. This may be due to the larger number of higher educated employees recruited and approximately 30% of the participants have family members with a history of cancer (data not shown). Family history and high education level may intensify the positive effects of reducing cancer risk and improving health status perception (Feizi *et al*., 2010). Furthermore, this study found participants had high perceived benefits, but moderate level of confidence and perceived barriers in decreasing fat intake, eating more fruits and vegetables and increasing physical activity. It appears participants at various stages of change have different degrees of self-efficacy, perceived benefits, and barriers. This suggests that people at different stages might benefit from interventions that differ in their focus based on their respective psychosocial factors. The self-efficacy, perceived benefits and barriers are about anticipated future behaviour outcomes and how desirable these outcomes are to the subjects. These perceptions cannot serve as determinants of behaviour at the present, but their representations in the employees' thinking in the present can have important causal effects on present action (Contento, 2007).

Upon pooling the baseline data, it was found that there was substantial room for improvement in cancer-related diet and lifestyle risk factors which is targeted by this intervention study. The strengths of this study are its intervention design that is simple and easy to be implemented in any workplace that provides employees with a personal computer and Internet connection. This research is set up as a short-term minimal intervention strategy in order to make it easily applicable in real-life situations. The intervention also aimed at multiple cancer risk factors such as diet, lifestyles and lifestyle-related outcome and the high response rate (55%) suggests that employees in the university are keen on new health information. Response rates in health promotion interventions at the workplaces are typically below 50% (Robroek *et al*., 2009). Additionally, the intervention modules were developed based on the international cancer prevention guidelines and contextualised into the local culture. Hence, these culturally sensitive educational modules are greatly suitable for the employees in modifying cancer-related dietary and lifestyle risk factors. However, this study had some limitations. Firstly, the high number of Malay participants did not allow for generalisation of findings to other ethnic groups. Secondly, workplaces have diverse features, settings and types of environment and therefore the findings of this study may not be generalisable to other

workplaces. The intervention modules were not grounded in any specific behaviour change models, but were based on selected constructs from several behaviour change theories such as Transtheoretical Model and Health Belief Model. Lastly, the dietary and lifestyle risk factors were self-reported by the employees. Bias such as under- or over-reporting of these risk factors (e.g., energy, fat, fruit and vegetable intake and physical activity) may be likely and thus these findings will need to be interpreted cautiously.

CONCLUSION

Baseline data from this study will provide the basis for developing an email-linked website intervention on cancer-related dietary and lifestyle risk factors among employees in university and warrant the intervention planned. These data may also be useful in planning cancer and health promotion and intervention programmes for other similar workplaces.

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CONFLICT OF INTEREST

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REFERENCES

Abood DA, Black DR & Feral D (2003). Nutrition education worksite intervention for university staff: application of the Health Belief Model. *J Nutr Educ Behav* 35(5): 260-267.

Anderson LM, Quinn TA, Glanz K, Ramirez G, Kahwati LC, Johnson DB, Buchanan LR, Archer WR, Chattopadhyay S, Kalra GP & Katz DL (2009). The effectiveness of worksite nutrition and physical activity interventions for controlling employee overweight and obesity: a systematic review. *Am J Prev Med* 37(4): 340-357.

Block G, Block T, Wakimoto P & Block CH (2004). Demonstration of an e-mailed worksite nutrition intervention program. *Prev Chronic Dis* 1(4): A06.

Contento IR (2007). Nutrition Education: Linking Research, Theory, and Practice. Jones and Bartlett Publishers, Massachusetts.

De Vet E, de Nooijer J, de Vries NK & Brug J (2006). The Transtheoretical model for fruit, vegetable and fish consumption: associations between intakes, stages of change and stage transition determinants. *Int J Behav Nutr Phys Act* 3(1): 13.

Feizi A, Kazemnejad A, Babaee G, Parsayekta Z & Monjamed Z (2010). Public awareness of risk factors for cancer and its determinants in an Iranian population. *Asia Pac J Public Health* 22(1): 76-88.

Gibson R (2005). Principles of Nutritional Assessment. Oxford University Press Inc.,New York.

International Physical Activity Questionnaire (IPAQ) (2005). Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire. From *http://www.ipaq.ki.se/scoring.pdf* [Retrieved July 15 2008].

Jekel JF, Katz DL, Elmore JG & Wild DMG (2007). Epidemiology, Biostatistics and Preventive Medicine (3rd ed). Saunders Elsevier, Philadelphia.

Kristal AR, Glanz K, Curry SJ & Patterson RE (1999). How can stages of change be best used in dietary interventions? *J Am Diet Assoc* 99(6): 679-684.

Kushi LH, Byers T, Doyle C, Bandera EV, McCullough M, Gansler T, Andrews KS & Thun MJ (2006). American Cancer Society guidelines on nutrition and physical activity for cancer prevention: reducing the risk of cancer with healthy food choices and physical activity. *CA Cancer J Clin* 56(5): 254-281.

Liou D (2004). Influence of self-efficacy on fat-related dietary behavior in Chinese Americans. *Int Electron J Health Educ* 7: 27-37.

Marcus BH, Selby VC, Niaura RS & Rossi JS (1992). Self-efficacy and the stages of exercise behaviour change. *Res Q Exer Sport* 63(1): 60-66.

Ministry of Health Malaysia (MOH) (2006). Malaysia NCD Surveillance 2006: NCD Risk Factors in Malaysia. Ministry of Health Malaysia, Putrajaya.

Ministry of Health (MOH) (2012). Health Facts 2012. Ministry of Health Malaysia, Putrajaya.

Miniwatts International (2011). Internet Usage Statistics - The Internet Big Picture: World Internet Users and Population Stats. From *http://www.internetworldstats.com/stats.htm* [Retrieved May 10 2011].

Mirnalini K, Zalilah MS, Safiah MY, Tahir A, Siti Haslinda MD, Siti Rohana D, Khairul Zarina MY, Mohd Hasyami S & Normah H (2008). Energy and nutrient intakes: findings from the Malaysian adult nutrition survey (MANS). *Mal J Nutr* 14(1): 1-24.

Norman GJ, Zabinski MF, Adams MA, Rosenberg DE, Yaroch AL & Atienza AA (2007). A review of eHealth interventions for physical activity and dietary behavior change. *Am J Prev Med* 33(4): 336-345.

Rampal L, Rampal S, Khor GL, Zain AM, Ooyub SB, Rahmat RB, Ghani SN, Krishnan J. (2007). A national study on the prevalence of obesity among 16,127 Malaysians. *Asia Pac J Clin Nutr* 16(3): 561-566.

Rauh MJ, Hovell MF, Hofstetter CR, Sallis JF & Gleghorn A (1992). Reliability and validity of self-reported physical activity in Latinos. *Int J Epidemiol* 21(5): 966-971.

Robroek S, van Lenthe F, van Empelen P & Burdorf A (2009). Determinants of participation in worksite health promotion programmes: a systematic review. *Int J Behav Nutr Phys Act* 6(1): 26.

Rossi SR, Greene GW, Rossi JS, Plummer BA, Benisovich SV, Keller S, Velicer WF, Redding CA, Prochaska JO, Pallonen UE & Meier KS (2001). Validation of decisional balance and situational temptations measures for dietary fat reduction in a large school-based population of adolescents. *Eating Behaviors* 2(1): 1-18.

University of Rhode Island Cancer Prevention Research Center (1998). Exercise: Self Efficacy. From *http://www.uri.edu/research/cprc/Measures/Exercise04.htm* [Retrieved July 15 2008].

US Center for Disease Control and Prevention (1999). Barriers to be Active Quiz. From *http://www.cdc.gov/nccdphp/dnpa/physical/life/barriers_quiz.pdf* [Retrieved July 15 2008].

Vereecken CA, van Damme W & Maes L (2005). Measuring attitudes, self-efficacy, and social and environmental influences on fruit and vegetable consumption of 11- and 12-year-old children: reliability and validity. *J Am Diet Assoc* 105(2): 257-261.

World Cancer Research Fund/American Institute for Cancer Research (WCRF/AICR) (2007). Food, Nutrition, Physical Activity, and the Prevention of Cancer: A Global Perspective. American Institute for Cancer Research, Washington DC.

World Health Organization (WHO) (1995). Physical Status: The Use and Interpretation of Anthropometry. World Health Organization, Geneva.

World Health Organization (WHO) (1998). Obesity: Prevention and Managing the Global Epidemic. Report of WHO Consultation for an Obesity. World Health Organization, Geneva.

World Health Organization (WHO) (2007). Cancer Control: Knowledge into Action: WHO Guides for Effective Programmes. World Health Organization, Geneva.

World Health Organization (WHO) (2008). Preventing Noncommunicable Diseases in the Workplace through Diet and Physical Activity: WHO/World Economic Forum Report of a Joint Event. World Health Organization, Geneva.