

Delivery of healthy lunch to worksites: a two weeks pilot study in a sample of working adults in Selangor, Malaysia

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ABSTRACT

Introduction: Lack of healthy food choices at the worksite is associated with unhealthy eating habits and poor diet quality. This study aimed to conduct a two weeks pilot study to assess the diet quality of lunch-meals delivered to worksites. **Methods:** Using a crossover study design, a total of 50 adults were purposely recruited from among university and hospital staffs in Selangor. Participants were randomised into two groups, whereby in week one, Group A was provided with the study's "healthy lunch-meals" (RD4U[®]) for 3 work days/week, while Group B consumed their usual lunch. In week two, the groups switched over with Group B receiving RD4U[®] lunch-meals for three days. Diet quality of the lunch meals was assessed using the Healthy Eating Index for Malaysian (HEI-M). Participant satisfaction for RD4U[®] service was determined using SERVQUAL. **Results:** Mean protein consumption was significantly higher (27±4 g/day) while fat consumption was significantly lower (18±5 g/day) for the RD4U[®] lunch-meals, compared to the respective levels (24±11 g/day; 22±12 g/day) for the usual lunch meals. Total HEI score of the RD4U[®] meals (61.9±9.2) was higher than that for the usual lunch meals (56.1±11.2). Nonetheless, the overall diet quality scores indicate that both RD4U[®] and usual lunch meals were in the "need improvement" category. Generally, participants were satisfied with the RD4U[®] lunch-meal service. **Conclusion:** The RD4U[®] lunch-meals showed potential in delivering healthy lunch to worksites, and feasibility studies to expand the RD4U[®] delivery service is recommended.

Keyword: Healthy food delivery service, diet quality, working adults

INTRODUCTION

Consumption of food away from home has become a norm in today's busy lifestyles. The demand for eating outside food has escalated with increased

participation of women in the work force. Long hours of work and travelling time have also limited the time to prepare home meals (Bezerra & Sichieri, 2009). This phenomenon has led to increase

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in the availability and accessibility of outside food such as kiosks, hawkers' stalls and restaurants, to cater for growing consumer demand, especially in the urban population.

The Malaysian Food Barometer showed that approximately 64.1% Malaysians consume food away from home at least one meal per day (Poulain *et al.*, 2014). The Ministry of Domestic Trade, Co-operatives and Consumerism (2017) reported that the average household monthly expenditure on eating outside the home has increased to RM470 in 2016, compared to RM194 in 2009. In China, owing to economic changes and urbanisation since the 1970s, eating away from home has increased rapidly (Dong & Hu, 2010). Studies have shown that eating outside is associated with poor diet quality (Todd, Mancino & Lin 2010).

In Malaysia, the National Health Morbidity Survey (NHMS) (IPH, 2015) reported that nutrition-related problems such as obesity, cardiovascular disease, hypertension, hypercholesterolemia and diabetes affect almost half of Malaysian adults from all socio-demographic sectors, including civil servants. As reported by Soon *et al.* (2013), the prevalence of overweight and obesity among civil servants was 50.2%. Obesity reduces work productivity, quality of life, and also increases medical costs (Shrestha *et al.*, 2016).

The Malaysian Adult Nutrition Survey (MANS) highlighted that, among the underlying factors of increased risk of obesity, are lack of time to prepare meals, and tiredness after work to prepare meals (IPH, 2014). In addition, Ng & Suzana (2011) have also reported that adult workers generally chose to eat out during lunch at least five times a week. Most of the meals were high in sugar, fat, salt, oil and low in fibre (Todd *et al.* 2010). Although there are

existing policies such Food Act 1983 (Act 281) and Food Regulations (1985) that need to be complied by food operators (i.e. providing clean and safe food, use of nutrition labeling and nutritional content) to protect the public from unhealthy nutritional practices, its effectiveness is questionable because the trend of providing unhealthy food menu still dominates the market.

While there is a positive inclination towards healthy food services, this tends to be confined to cities where the choices for healthy food may be limited (Lim, Esther & David, 2018). There are limited studies that evaluate the implementation of healthy food service at workplaces (Maes *et al.*, 2012). Thus, this study is aimed at determining the diet quality of lunch-meals delivered to workplaces and participant's satisfaction for such food delivery.

MATERIALS AND METHODS

Study design and data collection

An intervention study was conducted to determine the acceptability of a "healthy food" delivery service for lunch at selected workplaces using a cross-over intervention design. A total of 52 working adults were screened by purposive sampling at three locations selected by convenience in Bangi and Kajang, namely Universiti Kebangsaan Malaysia, Hospital Serdang and Kolej Universiti Islam Selangor (KUIS). The inclusion criteria were working adults aged 18-59 years, having lunch daily at the workplace, no known food allergies and agreed to purchase the lunch-meals provided by the researcher. Eligible participants were also required to complete a food diary during the study period. Those who did not complete the food diary were excluded from the study. Fifty participants completed the study. Information sheets of the study were

distributed and the signed consent forms were obtained from all the participants prior to this study.

The participants were randomised into two groups. In week one, Group A was provided with the study's "healthy lunch", named Right Diet For You (RD4U[®]) lunch-meals on Monday to Wednesday, while Group B was told to consume their usual lunch. In the following week, the groups switched over such that Group B received the RD4U[®] lunch-meals on Monday to Wednesday, whereas Group A consumed their usual lunch. Every participant was offered a choice of three sets out of six of the RD4U[®] lunch-meals. The RD4U[®] lunch-meals offered choices from these food groups: cereals/grains, meat/fish, vegetables, fruits and mineral water. Three sets of the RD4U[®] lunch-meal cost RM50.00 (about US\$12.25). Each RD4U[®] meal was freshly prepared and delivered to the participants at their work place.

A food diary was given to every participant to self-record his/her daily lunch-meal intake on Monday to Wednesday each week during the 2-weeks study period. The participants were asked to estimate their food intake using household measures such as plates, cups, glass, bowls, ladles and spoons. The completed food diaries were collected on the last day of the study. The researchers discussed the returned food diaries with the participants through face to face interviews to ensure the reports given were clear and accurate.

Food intake data was analysed using the Nutritionist Pro[™] (Version 4.0) by Axya System which can produce energy and macronutrients based on the Malaysia Food Composition Table (Tee *et al.*, 1997). All food and beverages data were then evaluated using the Healthy Eating Index (HEI). The study was conducted between September 2016 to April 2017.

Anthropometric assessment

Weight of the participants was measured using the calibrated TANITA (Model TBF-300, Japan) digital weighing scale, recorded to the nearest 0.1 kg. Height was obtained using SECA Stadiometer (Model SECA 213, Germany) scale, measured to the nearest 0.1 cm. The Body Mass Index (BMI) of the participants was calculated using the formula weight (kg) divided by height squared (m²).

Recruitment of healthy food delivery operators

A module called Right Diet For You (RD4U[®]) was developed and patented by the researcher as a guide for use in study. The module consisted of 10 chapters (namely introduction, healthy eating messages, food safety, hygiene, handling and delivery operation, healthy food preparation, food labelling and packaging, online business, product marketing, customer satisfaction and financial management). The contents of the module were contributed by eight professionals from four fields involving nutrition and dietetic, food quality and safety, foodservice management and food entrepreneurship.

Eight food delivery operators (known as RD4U[®] food operator) comprising housewives, low income individuals and single mothers aged 30-49 years were selected and trained by professional dietitians and chefs. The training of two weeks duration included a comprehensive theoretical and practical aspects of food handling, food quality and safety, nutrition labels, entrepreneurship and healthy food preparation of healthy lunch-meal packages. The training was conducted in a central community kitchen in Bangi, Selangor.

Healthy lunch-meals intervention

Six types of "healthy lunch-meals"

were developed based on the Malaysia Healthy Plate Model (MOH, 2016), which recommended 500-600 kcal/day for lunch or 28% of total daily calorie intake, and appropriate intake from healthful food groups. The meals were prepared and delivered by the trained operators.

Diet quality assessment

Diet quality for each participant was assessed using the Healthy Eating Index for Malaysian (HEI-M) that was developed and validated by Lee, Norimah & Safiah (2011) for adults in Malaysia. The HEI-M consists of a Food Group and a Nutrient Group. The former comprises seven components, namely cereals and grains, vegetables, fruits, milk and dairy products, meat, poultry and eggs, fish and legumes. The Nutrient Group consists of two components, namely total fat and total sodium (Table 1). Each component is given a score ranging from 0-10, which indicates the extent of compliance with recommendations. The HEI provides a composite score of 100, obtained by the formula (total score of nine components / 9 x 10) (Lee et al., 2011). Overall score of the HEI was classified into three categories of diet quality, namely <51 (poor), 51-80 (needs improvement) and >80 (good).

Participants' satisfaction assessment

The participants' satisfaction with the RD4U[®] meals, was determined using a SERVQUAL questionnaire adapted and validated by Joung et al. (2011). This questionnaire consisted of 18 questions, whereby questions 1 to 16 were about participants' satisfaction towards the food and service offered (e.g. presentation, overall taste, texture, amount of vegetables and meat/fish, food temperature, meal diversity, portion size, menu variety, service satisfaction, appearance, smile/kindness, attitude, timeliness of delivery, helpfulness and overall satisfaction). Each aspect involves a 5-point scale (1-very dissatisfied to 5-very satisfied). As for questions 17 and 18, participants were asked about when was the food consumed after the meals were received, and whether they had intention to continue with the delivery service.

Statistical analysis

Data analysis was carried out with IBM[®] Statistical Package for Social Sciences (SPSS[®]) Statistic version 20.0 software (SPSS, Inc. Chicago, IL, USA). Significance was interpreted at $p < 0.05$. Mean, standard deviation and percentage were used for descriptive data on socio-

Table 1. Healthy Eating Index for Malaysian adults based on 2000 kcal/day[†]

HEI Components	Range of score	Maximum score 10	Minimum score 0
Food Groups			
Cereals and grains	0 - 10	6 servings/day	0 serving
Vegetables	0 - 10	3 servings/day	0 serving
Fruits	0 - 10	2 servings/day	0 serving
Milk and dairy products	0 - 10	2 servings/day	0 serving
Meat, poultry and egg	0 - 10	1 serving/day	0 serving
Fish	0 - 10	1 serving/day	0 serving
Legumes	0 - 10	1 serving/day	0 serving
Nutrient Groups			
Total fat	0 - 10	≤ 30% total energy intake	≥ 35% total energy intake
Sodium	0 - 10	≤ 2000 mg	≥ 4200 mg

[†]Source: Lee et al. (2011)

demographic characteristics, energy and macronutrient intake, HEI score and service quality. The comparison in total energy and macronutrient intake were performed using paired *t*-test between (usual meals) and (RD4U® meals). Whilst, HEI scores were performed using paired Wilcoxon test as distribution was not normally distributed. The one-way ANOVA test was used to determine the relationship between HEI scores and BMI status.

This study was approved by the research ethics committee, Universiti

Kebangsaan Malaysia (UKM 1.21.3 / 244 / NN-2016-062).

RESULTS

Socio-demographic characteristics of participants

A total of 50 working adults participated in this study. Majority of the participants were Malay (98%) with a mean age of 39.4±9.7 years, with tertiary education (84%), working in the government sector (94%), and 38% earning monthly income of more than RM5000 per month. About

Table 2. Sociodemographic characteristics of participants

Characteristic	Participants (n=50)	
	n	%
Gender		
Male	10	20
Female	40	80
Age (years)		
18 – 39	24	48
40 – 59	26	52
Race		
Malay	49	98
Chinese	1	2
Religion		
Muslim	49	98
Buddhist	1	2
Marital Status		
Single	18	36
Married	32	64
Educational Status		
Secondary School	8	16
Tertiary (Diploma and above)	42	84
Employment		
Government institutions	47	94
Private institutions	1	2
Others	2	4
Income (monthly)		
≤ RM 3000	14	28
RM 3001 - 5000	17	34
> RM 5000	19	38
BMI [†]		
Underweight/Normal	19	38
Overweight	21	42
Obese	10	20

[†]BMI classification: <24.9 kg/m² (Underweight/Normal), 25 – 29.9 kg/m² (Overweight), >30 kg/m² (Obese)

two-thirds (62%) of them were overweight and obese (Table 2).

Lunch intake of calories and macronutrients

The mean energy intake from the healthy lunch-meals (RD4U[®]) was 528±86 kcal/day, while that from the participants' usual meals was 537±217 kcal/day respectively (Table 3). Protein consumption was significantly higher (27±4 g/day vs 24±11 g/day), while fat consumption was significantly lower (*p*<0.05) for the RD4U[®] meals (18±5 g/day), compared to the usual lunch meals (22±12 g/day).

Lunch diet quality

The total HEI score of the RD4U[®] meals (61.9±9.2) was higher than that for the usual lunch meals (56.1±11.2) (*p*<0.001). Nonetheless, these overall diet quality scores indicate that both the intervention and usual lunch meals were in the “need improvement” category.

The mean score of the vegetable component was higher (8.1±1.5) for the RD4U[®] meals as compared to usual lunch meals (4.8±.7) (*p*<0.001). Likewise, the mean scores of the meat (*p*<0.05) and fish components for the RD4U[®] meals were significantly higher than for the usual lunch meals. Consumption of dairy products showed the lowest score followed by the legume components, whereby both these components did not meet the dietary recommendations of two and one serving per day, respectively.

The diet quality of the lunch-meals was also compared according to the BMI status of the participants (Table 4). Participants in the normal BMI category recorded a significant higher (*p*<0.05) total mean HEI for the RD4U[®] meals. Likewise, for all categories of BMI, the participants showed a significantly higher HEI score for the vegetable component (*p*<0.001) from the RD4U[®] lunch meals, than from the usual lunch meals.

Table 3. Energy and macronutrients from usual lunch and RD4U[®] lunch meals

Components	Lunch Intake		p-value	Recommended Nutrient Intake, RNI (%)
	Usual Meals (n=50) (M±SD)	RD4U [®] Meals (n=50) (M±SD)		
Macronutrients				
Energy (kcal/day)	537±217	528±86	0.973	
% energy [†]	29.8±12.1	29.3±4.8	0.786	100%
Carbohydrate (g)	60±26	66±12	0.076	
% energy	46.0±10.9	50.3±4.5	0.015*	50 – 65%
Protein (g)	24±11	27±4	0.031*	
% energy	17.8±4.5	20.8±1.6	0.001***	10 – 20%
Fat (g)	22±12	18±5	0.042*	
% energy	35.7±9.3	29.8±5.8	0.001***	25 – 30%

[†]Based on 1800 kcal/day

p*<0.05, *p*<0.01, ****p*<0.001 significant using paired *t*-test

Table 4. Comparison of total HEI scores and components between usual lunch meals and RD4U® meals according to BMI categories

Components	Total (n=50)			Underweight/ Normal (n=19)			Overweight (n=21)			Obese (n=10)		
	M±SD	p-value	M±SD	p-value	Mean Diff (M±SD)	M±SD	p-value	Mean Diff (M±SD)	M±SD	p-value	Mean Diff (M±SD)	p-value
Total HEI Score [†]	56.1±11.2	<0.001***	52.8±13.3	0.017*	7.7±12.8	55.6±8.8	0.056	5.5±12.5	63.4±8.5	0.377	2.4±8.2	0.519
RD4U® Meals	61.9±9.2		60.6±9.4			61.1±9.4			65.8±8.0			
Cereals and grains	7.8±1.9	0.856	7.9±2.1	1.000	1.2±1.0	7.9±1.9	0.983	1.1±1.1	7.4±2.0	0.646	2.1±1.6	0.060
RD4U® Meals	7.9±1.8		7.9±1.7			7.9±2.0			7.8±1.8			
Vegetables [‡]	4.8±2.7	<0.001***	3.7±2.9	<0.001***	4.4±2.3	5.2±2.3	<0.001***	2.9±1.9	5.9±2.9	<0.021*	3.5±2.7	0.114
RD4U® Meals	8.1±1.5		8.0±1.5			7.7±1.7			9.1±1.1			
Fruits	6.7±4.0	0.320	5.8±4.1	0.795	2.9±1.9	6.6±4.1	0.632	3.5±2.9	8.5±3.4	0.128	3.5±2.7	0.741
RD4U® Meals	6.2±2.5		5.9±2.3			6.3±2.5			6.7±3.1			
Milk and dairy products	1.4±2.3	0.454	1.4±2.7	0.379	1.1±1.7	1.1±1.8	0.379	1.5±1.7	1.9±2.4	0.345	1.2±1.9	0.718
RD4U® Meals	1.3±1.9		1.4±2.1			1.2±1.7			1.1±2.2			
Meat, poultry and egg [‡]	9.0±2.6	0.033*	9.1±2.5	0.144	1.0±2.5	8.5±3.2	0.066	1.5±3.2	9.9±0.2	0.285	0.5±1.0	0.656
RD4U® Meals	9.9±0.6		9.9±0.5			10.0±0.0			9.5±1.0			
Fish [‡]	8.2±3.0	<0.001***	8.1±3.3	0.080	1.1±2.5	8.0±3.0	0.017*	1.8±2.9	8.5±2.4	0.102	1.5±2.4	0.712
RD4U® Meals	9.6±1.8		9.2±2.5			9.7±1.4			10.0±0.0			
Legumes	3.8±4.1	0.706	3.4±3.9	0.878	3.0±3.8	3.8±4.3	0.436	4.3±4.1	4.4±4.1	0.944	6.2±4.0	0.136
RD4U® Meals	3.4±4.3		3.2±4.2			2.8±3.8			5.0±5.3			
Total fat	2.7±3.6	0.139	2.2±3.4	0.221	1.4±4.9	3.0±4.1	0.381	0.7±4.6	3.2±3.4	0.779	0.6±5.7	0.879
RD4U® Meals	3.7±4.2		3.6±4.1			3.8±4.3			3.8±4.7			
Sodium	6.1±3.4	0.278	5.9±3.4	0.433	0.6±3.5	5.8±3.5	0.811	0.2±3.1	7.2±3.3	0.173	1.1±3.0	0.764
RD4U® Meals	5.6±3.0		5.4±2.4			5.6±3.5			6.2±3.2			

[†]Paired t-test analysis with significant at *p<0.05, **p<0.01, ***p<0.001

[‡]Paired Wilcoxon test analysis with significant at *p<0.05, **p<0.01, ***p<0.001

[§]One-way Anova test analysis

Participant satisfaction for the RD4U® lunch-meals and delivery service

The mean scores for all the service quality attributes were above 4, except for temperature (3.78±0.62) (Table 5). Personality attributes of the delivery staff, such as smile and kindness expressed, showed the highest mean score of 4.62±0.49. The second highest score was for attitude of delivery staff and food presentation (4.58±0.50). Overall, the results indicated that, participants were highly satisfied with the overall taste, service and satisfaction of the healthy

lunch-meal delivery services (RD4U®) with scores of 4.32±0.55, 4.52±0.54 and 4.56±0.50 respectively.

Almost all the participants (92%) were willing to continue to receive this service. Only 8% of participants said ‘no’ because of their own impending retirement plans, However, half of the participants (56%) said ‘no’ to immediately consuming the meal upon receiving it. This was due to work barriers and for the fact that the meals were delivered an hour earlier before lunch time.

Table 5. Service Quality Attributes[†]

<i>Attributes</i>	<i>Service Quality Score[‡] (M±SD)</i>
Food Quality	
Presentation	4.58±0.54
Texture	4.18±0.48
Vegetables	4.34±0.66
Meat/Fish	4.46±0.58
Temperature	3.78±0.62
Meals diversity	4.38±0.53
Portion Size	4.24±0.55
Is operator offered menu variety	4.18±0.56
Delivery staff	
Appearance	4.48±0.54
Smile and kindness	4.62±0.49
Attitude	4.58±0.50
Responsiveness	
Does food delivered on-time	4.42±0.61
Do deliverer help you (e.g. bring food to your place)	4.52±0.61
Satisfaction	
Overall taste	4.32±0.55
Overall service	4.52±0.54
Overall satisfaction	4.56±0.50
Behavioral intention	<i>n (%)</i>
Will you return to buy this product in the future? (yes/no)	
Yes	46 (92%)
No	4 (8%)
Do you eat immediately after the meal received?	
Yes	22 (44%)
No	28 (56%)

[†]Adapted: Joung *et al.* (2011)

[‡]Range of scores for the level of service quality from 1 to 5, where; 1 (very dissatisfied), 2 (dissatisfaction), 3 (moderate), 4 (satisfied), 5 (very satisfied)

DISCUSSION

Office workers are often associated with sedentary lifestyle, long working hours with heavy workload and restricted time constraint, leading to consumption of fast food and convenience food at the workplace. Office workers require better quality diet to support their work productivity, quality of life and to prevent non-communicable disease (NCDs). Thus, accessibility to healthy food at the workplace is a way for office workers to gain access to better diet quality.

More women than men expressed interest to subscribe to the healthy food delivery offered in this study. This may be due to women being generally more conscious about eating healthy, which is consistent with findings from other studies (Arganini *et al.*, 2012 & Glorioso *et al.*, 2018). In addition, lack of time during work day prevents them to prepare lunch for work (Raulio *et al.*, 2008).

While the overall quality of the RD4U[®] lunch meals was found in the “need improvement” category based on the HEI, significantly higher scores were shown for the RD4U[®] lunch meals than for the usual lunch meals, especially for the vegetables and fish components. Therefore, healthy lunch delivery may be a solution to increase the consumption of fruits and vegetables among office workers. However, the intake of fruits and vegetables among the workers in this study is still below the recommended intake of two and three servings per day respectively as recommended by Malaysian Food Pyramid (NCCFN 2010). These findings show similarities to the MANS study that reported that fruit and vegetable consumption among Malaysian adult population needs to be improved (IPH, 2014).

Convenience and ready-to-eat foods are most preferred among workers leading to poor diet quality, especially

intake of micronutrients (Blanck *et al.*, 2009; Neckerman, 2014). A comprehensive review found that delivery meals improved diet quality and increased nutrient intake among older adults (Zhu & An, 2013).

The RD4U[®] lunch meals contain less fat due to the use of healthier meal preparation methods, including use of healthy ingredients (i.e. less oil, low-fat of dairy products, and less fat from meat) and cooking by baking, grilling and steaming.

Intake of dairy products and legume components were found least satisfactory among the HEI food groups, as they did not meet the recommended servings. Incorporating dairy and legumes in the main and side dishes in the RD4U[®] lunch meals may increase workers consumption of these food components.

This present study showed that most participants were highly satisfied with the RD4U[®] food delivery service, except for the temperature of the packed food. This indicates that the participants preferred to receive their lunch meals warm. Temperature control is an important aspect in the delivery process. The use of food warmer helps to maintain the meal temperature. Food operators should give more attention and effort in controlling meal temperatures during delivery, planning routes and delivery times, and also providing clear usage instructions on the food labels to the consumers.

Limitations of the study

The limitations of this study were that there were fewer male participants and almost all participants were Malay. Thus, the HEI data could not be compared among male and female workers. Similarly, because of the small number of other main ethnic groups (i.e. Chinese and Indian), we were not able to compare the findings among the different ethnic groups. Caution should

be exercised in the interpretation of the HEI-M results as the tool is designed to calculate the entire day's diet quality based on Malaysian Food Pyramid and Malaysian Dietary Guidelines.

CONCLUSION

The RD4U[®] lunch-meals showed potential in delivering healthy lunch to worksites to promote healthy dietary habits and in improving diet quality among the workers. Feasibility studies to expand the RD4U[®] delivery service is recommended.

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Authors' contribution

MKNK, conducted the study, drafted and reviewed the manuscript; ZAM, supervised the study, advised on the data analysis and interpretation; and reviewed the manuscript; SS, supervised the study, advised on the data analysis and interpretation; and reviewed the manuscript; AFML, supervised the study, advised on the data analysis and interpretation and reviewed the manuscript.

Conflict of interest

The authors declare that they have no conflict of interest.

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