



Nutritional Composition of Meal Replacement Recipes for Body Weight Reduction Interventional Program (My Body is Fit and Fabulous at Work, MyBFF@Work)

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Abstract

The development of meal replacement recipes is emphasized based on the replacement of white rice-based ingredient with non-white rice-based ingredient which commonly consumed among Malaysian. This study aimed to determine nutrient composition of fifty selected menu of replacement meal. Fifty selected menu of replacement meal were distributed to intervention group for six months at lunch break during working days. Analysis was conducted for the determination of protein, fat, carbohydrate and energy according to AOAC method. The prepared meals were then palatably tested by 10 untrained panelists who judged the appearance aroma, colour, flavour and overall acceptability. Nutrient content of meal were ranged from 3.8 to 43.3 g for fat, 5.8 to 47.4 g for protein and 40.0 to 106.6 g for carbohydrate. Energy values of these meals were in the range from 494.2 to 698.5 kcal. Creation of replacement meals may provide wider range of alternative menus to be chosen by any health professionals to plan their healthy diet plan. Individual and health conscious consumers can adopt these unique alternative recipes in preparing their routine meals for interventional program of body weight reduction.

Keywords: Meal replacement, nutrient composition, sensory evaluation

1. Introduction

Presently, the prevalence of obesity is skyrocketing in Malaysia at an alarming rate. An estimated 47.7 percent Malaysian adults are overweight or obese, with higher prevalence in ethnic minorities (NHMS, 2015). Overweight and obesity increase the risk of diabetes, dyslipidaemia, cardiovascular mortality, hypertension and sleep-disordered breathing. In addition, the economic cost in combatting obesity and overweight in Malaysia is progressively escalating. The rising trend may be due to obesity, high-intake of alcoholic beverages, physical inactivity as well as unhealthy dietary practices such as low dietary fibre and high sugar consumption (Habib & Saha, 2011).

Rhetorically, standard obesity control strategies, which commonly targeted individuals to their daily diet intake and physical activity behaviours, often unsuccessful and only a small percentage of Malaysian adults are able to sustain weight loss on a long-term basis. However, Heymsfield and colleagues (2003) have shown evidences that weight management by using partial meal replacement (PMR) plans as intervention would be safe and effective in producing significant sustainable weight loss and improve weight-related risk factors of many diseases. Meal replacement diet plan was an effective strategy to produce robust initial weight loss and improved health related parameters including inflammation and oxidative stress (Davis et al, 2010). Partial meal replacement

(PMR) is defined as prescribes one or two portion controlled, vitamin/mineral fortified meal replacement along with traditional reduced calorie meals and snacks (Geliebter, Funkhauser & Heymsfield, 2000). In this study meal replacement consisted of food based strategy which prescribes two portion control, enhanced vitamin/mineral through high vegetables intake, high quality of carbohydrate along with traditional reduced calorie to 450 kcal per serving into one of three main meals daily. Food provision was implemented during lunch daily except weekend for 6 months.

Meal replacement is one of the smart nutritional modification efforts in planning interventional program to combat obesity among Malaysian civil servants in Kelantan state of Peninsular Malaysia. The development of meal replacement recipes is emphasized based on the replacement of rice-based ingredient with non-rice-based ingredient which commonly consumed among Malaysian.

2. Materials and Methods

2.1 Meal Replacement Preparation

Fifty selected recipes commonly consumed meals were identified from various locally available recipes book with modification. Preparation of meal replacement meals were done where rice or

rice-based ingredient being replaced with non-rice or non-rice-based ingredients. The prepared meals were then palatably tested by 10 panellists who judged the appearance aroma, colour, flavour and overall acceptability. The finished products were then sampled for nutrient analyses.

2.2 Purchasing of Raw Materials

Raw materials were purchased daily every morning from local wet market and hypermarket near Kubang Kerian and Kota Bharu Town, Kelantan state of Peninsular Malaysia. All fresh raw materials including vegetables and fruits were selected and purchased. Other ingredients were bought and immediately stored in proper storage conditions (Functional Food laboratory, School of Health Sciences USM) while waiting for preparation and cooking.

2.3 Preparation of Ingredient

All ingredients were immediately prepared (cleaning/chopping/mincing etc.) upon arrival at Functional Food Laboratory in the School of Health Sciences, Universiti Sains Malaysia.

2.4 Cooking

Moist-heating methods involving roasting, grilling, stewing, baking and sautéing are applied for cooking of MyBFF products. Dry-heating methods (shallow frying and deep fat frying) are also applied but at lesser frequency.

2.5 Presentation/Plating

The serving size is iso-calorically set at 450 kcal. Careful food plating with standardized/equal portion size is vital to avoid reduction of quality and texture of MyBFF meals. Coding of MyBFF meals is mandatory to facilitate the management of delivery and tracking of individual subject in ensuring they return the MyBFF container for the next delivery purpose. During lunch, prepared meals were provided to all participants by using food coupon.

2.6 Nutrient Analysis

All prepared foods were sampled for the determination of fat, protein, carbohydrate and calorific value according to AOAC method (2005).

3. Results and Discussion

Nutrient content of meal were ranged from 3.8 to 43.3 g for fat, 5.8 to 47.4 g for protein and 40.0 to 106.6 g for carbohydrate. Energy values of these meals were in the range from 494.2 to 698.5 kcal (Table 1). Creation of replacement meals may provide wider range of alternative menus to be chosen by any health professionals to plan their healthy diet plan.

Protein is the main constituent of body tissue after water. It is vital nutrient for growth. The recommended protein intake for adults men of 19 – 59 years are 62 g/day whereas for adults women in the same age are 55 g/day. High protein intakes have been associated with prevalence of chronic illnesses such as cancer, coronary heart disease, renal stones, renal insufficiency and not forgetting obesity. Yet, the current state of literature does not permit any recommendation of the upper level for protein to be made on the basis of chronic disease risk.

Carbohydrates are a vital source of energy in human diets comprising some 40 – 70% of total energy intake (FAO/WHO, 1998). In addition, dietary carbohydrate is important to sustain glycemic homeostasis and for gastrointestinal integrity and function. Unlike fat and protein, high amounts of dietary carbohydrate, provided it is obtained from a variety of sources, is not associated with adverse effects. According to Recommended Nutrient Intake Malaysia carbohydrate should comprise 55-70% of daily energy intake (Ministry of Health Malaysia, 2005).

Fat is the foremost determinant of the energy density of diets, providing high 9.0 kcal/g compared with the much lower 4.0 kcal/g for protein and carbohydrate (FAO 1991). Moist-heating methods involving roasting, grilling, stewing, baking and sautéing are commonly applied for cooking of MyBFF products. These methods are frequently chosen to control calorific values of finished MyBFF meals.

Dry-heating methods (shallow frying and deep fat frying) are less frequently applied during cooking of MyBFF recipes before further analyses. These techniques will enhance the foods' flavor while at the same time controlling the colour and appearance of finished cooked meals (Delgado-Andrade et al. 2007). These methods also causing the food items to be involved in Maillard reactions and becomes somewhat more porous from the water being driven out of the food by the frying heat (Brown, 2015).

Table 1: Nutrient composition of recipe replacement meals

Recipes	Weight (g)	Fat (g)	Protein (g)	Carbohydrate (g)	Calorie (kcal)
Hainan chicken couscous	320	22.0	34.4	60.6	578.0
Sweet potato burger with breaded chicken	280	43.3	20.3	56.9	698.5
Oyster chicken egg wrapped with lasagna	270	22.4	33.6	60.9	579.6
Sweet sour dory kebab with pita bread	270	22.8	19.4	78.3	596.0
Pineapple steam chicken with brown rice	270	4.1	32.4	86.5	512.5
Spaghetti tuna <i>mamak</i> style	300	7.5	5.9	106.6	517.5
Chicken <i>kerutuk</i> served with chapatti	260	16.1	31.5	70.9	554.5
Chicken yogurt served with puree	280	18.9	23.3	77.3	572.5
Pepper chicken roll with whole grain tortillas	220	16.6	35.6	67.3	561.0
Sizzling egg tofu served with brown rice	270	22.4	28.0	70.4	595.2
Fish curry served with <i>benggali</i> bread	300	27.0	30.6	61.1	611.8
<i>Kurma</i> served with crepe suzette	260	15.0	35.0	69.0	551.0
Spaghetti <i>soto</i>	280	20.0	34.4	63.1	570.0
<i>Taucu</i> chicken with brown rice	310	10.0	5.8	104.3	530.4
<i>Yee Mee Kungfu</i>	270	39.0	32.9	46.5	668.6
BBQ mince beef with brown rice	270	18.8	23.9	78.6	579.2
Grill Thai chicken with sauté brown rice vermicelli and salad	270	22.1	47.4	51.1	592.9
Dory fish casserole top with mashed potato and mozzarella cheese	310	32.4	36.4	46.9	624.8
Baked <i>pattaya</i> brown rice	310	17.5	22.5	81.3	572.7
Fish and chips	280	36.3	20.0	63.8	661.9
<i>Roti canai</i> served with <i>asam pedas</i>	380	35.5	25.5	58.9	657.1

Fried Singapore brown rice vermicelli	270	30.3	27.3	61.4	627.5
Spaghetti aglio olio	320	6.3	10.0	106.3	521.9
Pan fried dory with potato croquette and mixed salad	270	19.6	47.0	50.3	565.6
Roti jala with green chicken curry	240	23.3	28.8	68.5	598.9
Yong chow fried brown rice	300	30.0	22.5	70.0	640.0
Mee wantan soy sauce	270	3.8	10.0	105.0	494.2
Yee mee soup	320	19.5	32.0	67.6	573.9
Moi soup	300	10.6	33.4	73.5	523.0
Healthy spaghetti	380	10.0	32.5	76.3	525.2
Meatball BFF with cream sauce and vegetable	320	39.5	34.1	45.0	671.9
Pizza rending	370	15.0	28.6	77.6	559.8
Sandwich meatball	330	25.0	23.0	69.5	595.0
Pita bread stuffed with chicken ala Thai	270	26.3	22.5	72.5	616.7
Pan fry dory with little shell	310	9.4	21.6	87.8	522.2
Grilled steak sandwich	310	12.5	40.0	66.3	537.7
Roasted paprika chicken	330	30.0	46.3	40.0	615.2
Chicken enchiladas	220	17.5	30.0	70.0	557.5
Grilled chicken salad with baked potato	330	30.0	28.8	60.0	625.2
Pancake chicken curry	325	11.3	12.5	96.3	536.9
Paprik pie	220	22.5	13.8	81.3	582.9
Spinach wanton with shrimp gravy	350	21.3	21.6	76.6	584.5
Laksa Johor	450	11.3	26.3	83.8	542.1
Shawarma ayam percik	280	17.5	14.6	86.6	562.3
Nan cheese pizza	260	19.8	28.1	70.9	574.2
Chicken parmigiana with potato croquette and garden salad	320	33.1	33.0	53.8	645.1
BBQ chicken wrapped salad and paratha	270	31.8	27.1	62.5	644.6
BFF mushroom burger	190	35.0	21.3	63.8	655.4
Grilled mackerel with couscous salad	220	17.3	32.6	67.1	554.5
Grilled chicken served with spiral pasta	280	15.9	39.8	63.9	557.9

4. Conclusion

Fifty meal replacement recipes which based on the replacement of white rice-based ingredient with non-white rice-based ingredient which commonly consumed among Malaysian were successfully developed. Individual and health conscious consumers can adopt these unique alternative recipes in preparing their routine meals for interventional program of body weight reduction. Indeed, ingestion of healthy meal replacement meals prepared coupled with regular physical activity daily will ensure the effectiveness of interventional body weight reduction program for at least 6 month of duration time.

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References

- [1] AOAC. Official methods of analysis 391 of AOAC international. In W. Horwitz, 392 & G. Latimer (Eds.) (18th ed.). Gaithersburg, MD: AOAC International, 2005.
- [2] Brown, A. C. Understanding Food: Principles and Preparation 5th Edition. Wadsworth Cengage Learning USA, 2015.
- [3] Davis, L.M., Coleman, C., kiel, J., Rampolla, J., Hutchisen, T., Ford, L., Andersen, W.S., Hanlon-Mitola, A. Efficacy of meal replacement diet plan compared to a food-based diet plan after a period of weight loss and weight maintenance: a randomized controlled trial. Nutrition Journal, 2010.p. 9:11-20.
- [4] Delgado-Andrade, C. Seiquer, I. Navarro, M. P. & Morales, F. J. Maillard reaction products in diets usually consumed by adolescent population. Mol Nutr Food Res, 2007.p. 51: 341-351.

- [5] FAO. Energy and Protein Requirements: Agriculture and Consumer Protection. World Health Organization Technical Report Series 724, 1991.
- [6] FAO/WHO Food and Nutrition Paper. Carbohydrates in human nutrition. Report of a Joint FAO/WHO Expert Consultation. 1998; 66:1-140.
- [7] Geliebter A, Funkhauser A, Heymsfield, S.B. Meal replacement products and fat substitutes in weight control and maintenance In Primary and Secondary Preventive Nutrition, edited by Andrienne Bendich & Richard Deckelbaum. Humana Press Inc, New York, 2000.
- [8] Habib SH & Saha S. Burden of noncommunicable diseases: Global overview, 2011.
- [9] Heymsfield S.B., van Mierlo, C.A.J., van der Knaap, H.C.M., Heo, M. & Frier, H.I. Weight management using a meal replacement strategy: meta and pooling analysis from six studies. International Journal of Obesity, 2003. p.27:537-549
- [10] Diabetes Metabol Syndrome: ClinResRev 4(1): 41-47.
- [11] Ministry of Health Malaysia. RNI. Recommended Nutrient Intakes for Malaysia. National Coordinating Committee on Food and Nutrition (NCCFN). A Report of the Technical Working Group on Nutritional Guidelines, 2005.
- [12] NHMS. National Health & Morbidity Survey. Non-communicable disease, risk factors & other health problem. Volume II. Institute for Public Health, Ministry of Health Malaysia, 2015.
- [13] Zin, C. A. J. C. M., Robert, S. D. & Ishak, W. R. W., 2014. Effect of biscuits and muffins added with cornlettes powder on the glycaemic responses of healthy individuals. Food and Nutrition Sciences, 5(22): 2195-2202.