

**EFFICACY OF AN ONLINE NUTRITION
EDUCATION INTERVENTION AND ITS IMPACT ON
NUTRITION KNOWLEDGE, ATTITUDE, PRACTICE
AND NUTRITIONAL STATUS AMONG STUDENTS
OF UNIVERSITI MALAYSIA SABAH**

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DECLARATION

I hereby declare that the material in this thesis is my own except for quotations, equations, summaries, and references, which have been duly acknowledged.

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ABSTRACT

Nutrition education is imperative because healthy eating and physical activity are known modifiable risk factors for non-communicable diseases (NCDs), especially among young adults or university students who are prone to unhealthy eating habits and sedentary lifestyles. Lack of nutrition knowledge and motivation could lead to unhealthy eating habits and a sedentary lifestyle, increasing the risk of developing NCDs such as obesity, hypertension, and high cholesterol levels. This warrants nutrition intervention but information on the efficacy and impact of online nutrition education intervention in a university setting in Malaysia is limited. The main purpose of this study is to determine the efficacy of an online nutrition education intervention and its impact on nutrition knowledge, attitude, practice, and nutrition status parameters among students of Universiti Malaysia Sabah. The online nutrition education intervention was pilot tested on 32 university students to ascertain the feasibility of the larger study. This study was a 10-week online nutrition education intervention of randomized pre- and post-design and a control group. The modules used in the intervention were sourced from Malaysia Government nutrition-related publications such as The Malaysian Dietary Guidelines 2020, Recommended Nutrient Intakes for Malaysia, Clinical Practice Guidelines on Obesity and *Pengurusan Fit & Trim*. Selected contents of these modules were adapted into materials that were delivered online (PowerPoint, video, and infographic). The intervention was delivered using Microsoft Team (E-learning platform), WhatsApp and Facebook. A total of 177 university students participated in this study. Participants were grouped into the normal weight (n=81) or overweight/obese group (n=96) according to their body mass index. This study conducted non-blinded simple randomization to assign participants to either a control or intervention group. The normal weight participants (n=81) were randomly assigned to either the Intervention Knowledge (IK) group (n=46) to receive nutrition education intervention or the Control Knowledge (CK) group (n=35) that did not receive nutrition education intervention. The overweight/obese participants (n=96) were assigned to either the Intervention Weight Loss (IWL) group (n=50) to receive nutrition education intervention or the Control Weight Loss (CWL) group (n=46) that did not receive the nutrition education intervention. Information such as height, weight, waist circumference, body fat composition, and clinical parameters (blood pressure, fasting blood glucose, lipid

profile, iron profile) were obtained using standard methods. Participants' self-reported dietary intakes were obtained through three-day food diary. Nutrition knowledge, attitude, and practice (KAP) were obtained through a questionnaire. Physical activity level was determined from the International Physical Activity Questionnaire (IPAQ). Step counts were measured using pedometers. Participants' anthropometric data (height, body weight, body mass index, waist circumference, body fat and visceral fat), clinical parameters (blood pressure, fasting blood glucose, lipid profile and iron profile), dietary intake (three-day food diary), physical activity (IPAQ and three-day step counts) and nutrition knowledge, attitude, and practice (KAP) were obtained at pre and post-intervention. Statistical analysis was conducted using IBM SPSS 28. Results showed that IWL had lower post-intervention vigorous physical activity (510.0 ± 827.2 Met-Minute/Week $< 2807.3 \pm 3554.5$ Met-Minute/Week, $p=0.024$) compared to CWL. IWL showed significantly higher post-intervention than pre-intervention values for diastolic blood pressure ($p=0.036$, mean diff: 7.2 mmHg), 3-day step counts ($p=0.016$, Mean diff =1961.1) and nutrition knowledge ($p=0.007$, mean diff=1.8). IWL showed significantly lower post-intervention than pre-intervention values for energy intake ($p<0.001$, Mean Diff= -443.2 Kcal), fat intake ($p<.001$, Mean Diff= -21.2 g), carbohydrate intake ($p=0.001$, Mean Diff= -58.2 g), dietary fibre intake ($p=0.001$, Mean Diff= -4 g), cholesterol intake ($p=0.044$, Mean Diff= -49.6 g), sugar intake ($p<0.001$, Mean Diff= -39.4 g), EI: BMR ($p<0.001$, Mean Diff= -0.3), HDL-cholesterol ($p <.001$, Mean Diff=-0.3 mmol/L), iron ($p=0.009$, Mean Diff=-5.1 umol/L), vigorous physical activity ($p=0.013$, mean diff= -596.0 Met-Minute/Week) and IPAQ score ($p=0.031$, mean diff= -1062.0 Met- Minute/Week). IK showed post-intervention values that were significantly higher than that of CK for a majority of parameters such as body weight (50.1 ± 5.4 kg $> 47.3 \pm 3.9$ kg, $p=0.043$), hours being sedentary (7.1 ± 6.2 Hour/day $> 1.1 \pm 2.5$ Hour/day, $p=0.007$), nutrition knowledge ($35.8 \pm 3.3 > 25.4 \pm 11.0$, $p=0.002$), nutrition attitude ($41.2 \pm 4.8 > 39.8 \pm 4.3$, $p=0.009$), energy intake (1475.7 ± 481.6 kcal $> 1224.5 \pm 425.2$ kcal, $p=0.008$), fat intake (50.5 ± 21.3 g $> 46.6 \pm 21.8$ g, $p=0.008$), carbohydrate intake (185.0 ± 65.2 g $> 143.3 \pm 52.6$ g, $p=0.023$), dietary fibre intake (8.4 ± 3.1 mg $> 4.8 \pm 3.5$ mg, $p=0.001$), sodium intake (2255.4 ± 957.9 mg $> 1792.1 \pm 561.5$ mg, $p=0.016$), potassium intake (1288.3 ± 440.4 mg $> 1161.8 \pm 570.4$ mg, $p=0.019$) and EI: BMR ($1.3 \pm 0.4 > 1.1 \pm 0.4$, $p=0.008$). IK showed values that were significantly higher at post-intervention

than at pre-intervention for systolic blood pressure ($p=0.018$, Mean Diff=5.9 mmHg), diastolic blood pressure ($p=0.002$, Mean Diff=5.7 mmHg), dietary fibre intake ($p=0.030$, Mean Diff= 2.2 g), 3-day step count ($p=0.002$, Mean Diff=2080.9), nutrition knowledge ($p=0.006$, mean diff=1.7), nutrition attitude ($p=0.016$, mean diff=2.8). However, IK showed lower nutrition practice ($p=0.008$, mean diff= -6.5) post-intervention. In conclusion, the online nutrition education intervention resulted in lower dietary intake (energy intake) and improvement in nutrition knowledge among the overweight intervention group (IWL), improvement in nutrition knowledge and attitude among the normal weight intervention group (IK) as well as increased step counts in both of these groups.



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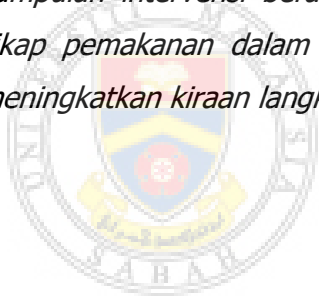
ABSTRAK

KEBERKESANAN PENDIDIKAN PEMAKANAN DALAM TALIAN DAN IMPAK TERHADAP PENGETAHUAN PEMAKANAN, SIKAP, AMALAN DAN STATUS NUTRIEN DALAM KALANGAN PELAJAR UNIVERSITI MALAYSIA SABAH

Pendidikan pemakanan adalah penting disebabkan pemakanan sihat dan aktiviti fizikal adalah faktor risiko pemboleh ubah bagi penyakit tidak berjangkit terutamanya dalam kalangan awal dewasa atau pelajar universiti yang lebih cenderung kepada pemakanan yang tidak sihat dan gaya hidup sedentari. Kekurangan pengetahuan pemakanan dan motivasi menyumbang kepada pemakanan tidak sihat dan gaya hidup sedentari, meningkatkan risiko penyakit tidak berjangkit seperti obesiti, hipertensi dan aras kolesterol yang tinggi. Hal ini menunjukkan keperluan intervensi pendidikan pemakanan, namun maklumat mengenai keberkesanan dan impak pendidikan pemakanan dalam persekitaran universiti adalah terhad. Tujuan utama kajian ini adalah untuk menentukan keberkesanan intervensi pendidikan pemakanan dan impak terhadap pengetahuan, sikap dan amalan pemakanan dan parameter status nutrien dalam kalangan pelajar di Universiti Malaysia Sabah. Kajian rintis pendidikan pemakanan dalam kalangan 32 pelajar universiti bagi menentukan kebolehlaksanaan dalam kajian yang lebih besar. Intervensi pendidikan pemakanan dijalankan selama 10 minggu dan berbentuk pra dan pasca secara rawak dengan kumpulan kawalan. Modul yang digunakan dalam intervensi merujuk kepada sumber penerbitan berkaitan pemakanan kerajaan Malaysia seperti Malaysia Dietary Guidelines 2020, Malaysia Recommended Nutrient Intake, Clinical Practice Guidelines on Obesity dan Pengurusan Fit & Trim. Kandungan Modul yang terpilih diadaptasi ke penyampaian bahan dalam talian (Powerpoint, video, dan infografik). Intervensi pendidikan pemakanan dalam talian disampaikan melalui Microsoft Team (laman E-learning), WhatsApp dan Facebook. Sebanyak 177 pelajar universiti menyertai kajian ini. Peserta dikelaskan kepada berat normal (n=81) atau berat berlebihan/obes (n=96) berdasarkan indeks jisim badan. Kajian ini menjalankan perawakan secara mudah tidak bertutup untuk menentukan peserta kepada kumpulan kontrol atau kumpulan intervensi. Kumpulan berat normal (n=81) telah dibahagikan secara rawak kepada kumpulan Intervensi Pengetahuan (IK) (n=46) yang menerima pendidikan pemakanan dalam talian atau kumpulan Kontrol Pengetahuan (CK) (n=35) yang tidak menerima pendidikan pemakanan dalam talian. Kumpulan berat berlebihan/obes

(n=96) telah dibahagikan secara rawak kepada kumpulan Intervensi Pengurangan Berat Badan (IWL) (n=50) yang menerima pendidikan pemakanan dalam talian atau kumpulan Kontrol Pengurangan Berat Badan (CWL) (n=46) yang tidak menerima pendidikan pemakanan dalam talian. Maklumat seperti tinggi, berat, ukur lilit pinggang, komposisi lemak badan dan parameter klinikal (tekanan darah, glukosa darah puasa, profil lipid, profil besi) diperolehi melalui kaedah standard. Laporan pengambilan diet sendiri peserta diperolehi menggunakan tiga hari diari makanan. Pengetahuan, sikap dan amalan pemakanan diperolehi melalui borang soal selidik. Aras aktiviti fizikal ditentukan melalui International Physical Activity Questionnaire (IPAQ). Kiraan langkah ditentukan menggunakan pedometer. Maklumat antropometri peserta (tinggi, berat badan, indeks jisim badan, ukur lilit pinggang, lemak badan dan lemak visceral), parameter klinikal (tekanan darah, glukosa darah puasa, profil lipid, profil besi), pengambilan diet (tiga hari diari makanan), aktiviti fizikal (IPAQ dan tiga hari kiraan langkah) peserta dikumpulkan pada pra- dan pasca-intervensi. IBM SPSS 28 digunakan dalam analisis statistik. Hasil kajian menunjukkan IWL mempunyai aktiviti fizikal lasak (510.0 ± 827.2 Met-Minute/Week $< 2807.3 \pm 3554.5$ Met-Minute/Week, $p=0.024$) yang lebih rendah dari CWL pada pasca-intervensi. IWL menunjukkan nilai pasca-intervensi yang lebih tinggi dibandingkan pra-intervensi bagi tekanan darah ($p=0.036$, Beza min: 7.2 mmHg), tiga hari purata kiraan langkah ($p=0.016$, Beza min= 1961.1) dan pengetahuan pemakanan ($p=0.007$, Beza min=1.8). IWL menunjukkan nilai pasca-intervensi yang lebih rendah dibandingkan pra-intervensi bagi pengambilan tenaga ($p<0.001$, Beza min= -443.2 Kcal), pengambilan lemak ($p<.001$, Beza min= -21.2 g), pengambilan karbohidrat ($p=0.001$, Beza min = -58.2 g), pengambilan serat diet ($p=0.001$, Beza min= -4 g), pengambilan kolesterol ($p=0.044$, Beza min= -49.6 g), pengambilan gula ($p<0.001$, Beza min= -39.4 g), EI: BMR ($p<0.001$, Beza min= -0.3), kandungan HDL-kolesterol ($p <.001$, Beza min= -0.3 mmol/L), kandungan besi ($p=0.009$, Beza min= -5.1 umol/L), aktiviti fizikal lasak ($p=0.013$, Beza min= -596.0 Met-Minute/Week) dan IPAQ ($p=0.031$, Beza min= -1062.0 Met- Minute/Week). IK menunjukkan nilai pasca-intervensi yang lebih tinggi dibanding CK bagi kebanyakan parameter seperti berat (50.1 ± 5.4 kg $> 47.3 \pm 3.9$ kg, $p=0.043$), waktu semasa sedentari (7.1 ± 6.2 Hour/day $> 1.1 \pm 2.5$ Hour/day, $p=0.007$), pengetahuan pemakanan ($35.8 \pm 3.3 > 25.4 \pm 11.0$, $p=0.002$), sikap pemakanan ($41.2 \pm 4.8 > 39.8 \pm 4.3$, $p=0.009$), pengambilan tenaga (1475.7 ± 481.6 kcal $> 1224.5 \pm 425.2$ kcal, $p=0.008$),

pengambilan lemak ($50.5 \pm 21.3 \text{ g} > 46.6 \pm 21.8 \text{ g}$, $p=0.008$), pengambilan karbohidrat ($185.0 \pm 65.2 \text{ g} > 143.3 \pm 52.6 \text{ g}$, $p=0.023$), pengambilan serat diet ($8.4 \pm 3.1 \text{ mg} > 4.8 \pm 3.5 \text{ mg}$, $p=0.001$), pengambilan natrium ($2255.4 \pm 957.9 \text{ mg} > 1792.1 \pm 561.5 \text{ mg}$, $p=0.016$), pengambilan kalium ($1288.3 \pm 440.4 \text{ mg} > 1161.8 \pm 570.4 \text{ mg}$, $p=0.019$) dan EI: BMR ($1.3 \pm 0.4 > 1.1 \pm 0.4$, $p=0.008$). IK menunjukkan nilai yang lebih tinggi pasca-intervensi dibandingkan pra-intervensi bagi tekanan darah sistolik ($p=0.018$, Beza min=5.9 mmHg), tekanan darah diastolik ($p=0.002$, Beza min =5.7 mmHg), pengambilan serat diet ($p=0.030$, Beza min = 2.2 g), 3-hari purata kiraan langkah ($p=0.002$, Beza min =2080.9), pengetahuan pemakanan ($p=0.006$, Beza min =1.7), sikap pemakanan ($p=0.016$, Beza min =2.8). Namun, IK menunjukkan amalan pemakanan ($p=0.008$, Beza min= -6.5) yang lebih rendah pada pasca-intervensi dibandingkan pra-intervensi. Kesimpulannya, pendidikan pemakanan dalam talian menghasilkan pengambilan dietari (tenaga) yang lebih rendah dan penambahbaikan pengetahuan pemakanan dalam kalangan kumpulan intervensi berat berlebihan (IWL), penambahbaikan pengetahuan dan sikap pemakanan dalam kalangan kumpulan intervensi berat normal (IK), dan meningkatkan kiraan langkah bagi kedua-dua kumpulan ini.



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LIST OF ABBREVIATIONS

SD	-	Standard deviation
P	-	P-value
Mean Diff	-	Mean difference
E	-	Effect Size
CI	-	Confidence Interval
IPAQ	-	International Physical Activity Questionnaire
EI	-	Energy intake
BMR	-	Basal Metabolic Rate
BMI	-	Body Mass Index
LDL-C	-	Low Density Lipoprotein Cholesterol
HDL-C	-	High Density Lipoprotein Cholesterol



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CHAPTER 1

INTRODUCTION

1.1 Introduction

Non-communicable diseases are leading causes of premature death (Li *et al.*, 2023; WHO, 2022). Obesity, hypertension, hyperglycaemia, and hyperlipidaemia are metabolic risk factors for non-communicable disease (WHO, 2022). The National Health and Morbidity Survey (NHMS) 2019 found that the prevalence risks for anaemia, high cholesterol, diabetes, hypertension, and abdominal obesity were 50%, 30%, 18.3%, 38%, and 21.3% (NIH, 2020). An estimated one in two persons is overweight or obese (NIH, 2020). Overweight and obesity rates are related to a country's economic development, industrialization, urbanisation, globalisation, and westernisation (Tan *et al.*, 2019). Physical inactivity, smoking, excessive alcohol use, and bad food habits are modifiable lifestyle risk factors for non-communicable disease (Li *et al.*, 2023). The prevalence of physical inactivity, smoking, and current drinker rates in Malaysian adults were 25 %, 21 %, and 11.8 %, respectively, in 2019 (NIH, 2020). Young adults are susceptible to non-communicable diseases because of their childhood unhealthy dietary intake, low physical activity, and exposure to alcohol and tobacco (childhood conditions and behaviours, and behaviour) (WHO, 2019). The prevalence of obesity among university students between the age of 18 to 29 is 20.8% to 27.8% (MOH, 2015). They are at risk of higher rates of chronic diseases, including high blood serum cholesterol, increased blood pressure, and greater body mass index (Spencer, 2002).