Journal of Applied Pharmaceutical Science Vol. 12(02), pp 126-132, February, 2022
Available online at http://www.japsonline.com
DOI: 10.7324/JAPS.2021.120212
ISSN 2231-3354

Effects of short-term psyllium husk and selected mixed herbal supplementation on health indicators in healthy male subjects

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ARTICLE INFO

Received on: 02/04/2021
Accepted on: 16/07/2021
Available online: 05/02/2022

Key words:
Psyllium husk, selected mixed herbs, health indicators, healthy male subjects, short-term supplementation.

ABSTRACT

The trend of using mixed herbal supplements has increased. Psyllium husk and selected mixed herbal supplements are commercially available in the market. This study aimed to determine the effects of psyllium husk and mixed herbal supplementation on health indicators in healthy male subjects. Male subjects were chosen, as some of the mixed herbs were specifically recommended for males, such as *Eurycoma longifolia, Tribulus terrestris*, and *Ptychopetalum olacoides*. A total of 30 respondents were involved in this study and randomly assigned into control (n = 15) and supplemental (n = 15) groups. The intervention period was 1 month with a dose of 25 g daily. Subjects were required to maintain their diet and lifestyle during the intervention period. Body mass index, blood pressure, fasting blood glucose, lipid profiles, liver function, and health indicator parameters were taken at the beginning and the end of the study. The supplemental group showed improvements in health indicator parameters of "bowel movement" (p = 0.017) and "headache" (p = 0.009). Total bilirubin also showed improvement (p = 0.005) after 1-month intervention. 25 g/day of supplement with short-term intervention was not enough to demonstrate any significant effects, apart from health indicator parameters of "bowel movement" and "headache."

INTRODUCTION

Psyllium is also known as *Ispaghula* (Masoob and Miraftab, 2010) and is derived from the seed husk of *Plantago ovata* Forsk which is normally grown in India (Semeco, 2017; Yu *et al*., 2009). It is a water-soluble supplement (Blackwood *et al*., 2000). Psyllium husk can be in the form of particles or powder. It is used as a traditional dietary supplement and has been shown to be an effective adjunct to dietary intervention in the control of body weight, body composition and cholesterol, glucose, insulin, and triglycerides levels in both animal (Galisteo *et al*., 2005; Song *et al*., 2000) and human studies (Cicero *et al*., 2007; Feinglos *et al*., 2013). Not only that, but consumption of psyllium also can cause satiety effects (Brum *et al*., 2016).

Herbs include many crude plant materials such as leaves, stems, flowers, barks, fruit, seeds, roots, wood, rhizomes, or other plant parts which can be used for medicinal purpose (Ghosh and Mukherjee, 2019; Parkash *et al*., 2018). The use of herbs in daily life was pioneered in ancient times around the world. The trend of using herbs in supplements also has been increased. The ingredients claimed in the psyllium husk and selected mixed herbal supplement include *Plantago ovate*, *Withania somnifera, Tribulus terrestris, Lepidium meyenii, Serenoa repens, Eurycoma longifolia, Garcinia cambogia, Epimedium, Ptychopetalum olacoides, Tamarindus indica, Cucurbita pepo* seeds, marine collagen, and honey. There are some of the mixed herbs in the supplement specified for males, such as *E. longifolia, T. terrestris*, and *P. olacoides*. All of the herbs have their own benefits for the body. For example, *W. somnifera* has antimicrobial (Girish *et al*., 2006), cardioprotective (Hamza *et al*., 2008), antioxidant, and anti-inflammatory functions (Mehrotra *et al*., 2011); *S. repens* has the anti-inflammatory function (Anastasi *et al*., 2011); *T. indica* has the antimicrobial and antiseptic functions (Bhadoriya *et al*., 2010; Doughari, 2006); *L. meyenii* has the bioactive effects of antifatigue activity, sexual and fertility enhancement, and memory impairment (Choi *et al*., 2012; Lembe *et al*., 2012; Wang *et al*., 2007). However, herbal supplement overdose may have bad effects. For example, *W. somnifera* has many issues with toxicity, as its active ingredient called Withaferin A can cause toxicity

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when overdosed (Mensah, 2016). There are so many supplement products in the market now using mixed herbs. The market value is very high, but few studies have identified the effects of supplements on human health.

According to the National Health and Morbidity Survey in 2015, Malaysians face health problems such as hypertension and obesity at a young age (Yusof, 2018). People may take supplements to prevent disease, as a complement to conventional therapies, and also to promote well-being and health (Anastasi *et al.*, 2011). Health indicators such as lipid profiles, blood pressure, blood glucose, liver function test, and health indicator parameters can be measured to determine the effects of supplementation. Based on the Center for Disease Control and Prevention (2012), health indicators are measurable characteristics that describe the health of the population, such as disease incidence or prevalence and other health consequences.

METHODOLOGY

Research design

An unblinded simple randomized study was carried out in Universiti Malaysia Terengganu. Subject eligibility was screened through Health and Lifestyle Questionnaire. A total of 83 respondents have been screened during one and half month period. For sample size calculation, a formula from Charan and Biswas (2013) was used, where $Z_{\alpha} = 1.96$ (from Z table) at type I error of 5%, $Z_{power} = 0.842$ (from Z table) at 80% power, and SD is the standard deviation of 7.2 mg/dl from Soltanian et al. (2018). From the formula, 13 subjects per group should be recruited, and considering any dropout, the sample size was increased by 105; therefore, a total of 30 respondents were included in the study. The subject's inclusion criteria included 20–40-year-old healthy male adults (without chronic diseases and other major illnesses). Subjects also had not participated in any clinical trial for at least 3 months and were willing to make a blood donation (if related) and undergo other clinical trials. The present study was approved by the Research Management and Innovation Centre Human Ethics Committee, Universiti Malaysia Terengganu with reference number UMT/JKEPHMK/2020/43. Consent forms were signed and collected from all study participants.

The material used in the present study was a local commercially available product containing psyllium husk and selected mixed herbs in powder form. Apart from psyllium husk, the ingredients claimed for the supplement consist of psyllium husk, *E. longifolia* Jack, *T. terrestris*, *Epimedium, W. somnifera*, *L. meyenii*, *S. repens*, *G. cambogia*, *P. olacoides*, *C. pepo* seeds, *T. indica*, honey, and marine collagen. Most of the herbs used have been explicitly recommended for male use. This supplement was provided in a sealed plastic package (25 grams per packet) and the dose given to the subject was one packet per day for 1 month of intervention. Supplements were acquired as a gift from a particular local business, which has been operating for almost 20 years.

Research instrument and measurements

There were three types of measurements involved in this study: anthropometric, clinical, and biochemical measurements. For the anthropometric measurements, a portable stadiometer (SECA, Germany) and Tanita digital body fat monitor/scale model UM-026 (Tanita, UK) were used for height and body weight, respectively. The body weight and height of subjects were measured to the nearest 0.1 kg and 0.1 cm, respectively. Omron Automatic Blood Pressure Monitor HEM-7080 model was used for the blood pressure measurements. A 5–7 ml blood sample was taken from the subjects after 8–12 hours of fasting by medical personnel at the Universiti Malaysia Terengganu Health Centre. The blood was sent to an accredited lab to determine the results of the liver function test and lipid profile, while a glucose reagent test strip with Accu-Check Advantage meter (Roche Diagnostics, Germany) was used for fasting blood glucose measurements. A questionnaire was also used. There were four sections in the questionnaire and each was prepared in English and Malay. Section A collected the personal information of respondent; section B included the physical measurements of the respondent; section C included clinical and biochemical measurements; and section D consisted of the health indicator parameters of the respondent, and these subjective symptoms, such as constipation, headache, and gastric pain, were evaluated on a scale of 1–5, whereby scale 1 indicates symptoms not present; 2 rarely present; 3 sometimes; 4 often; and 5 always, using the Anti-Aging QOL Common Questionnaire (AAQol) established and validated by Yonei et al. (2004).

Data analysis

The data were analyzed using Statistical Package for the Social Science program (SPSS) version 20.0 with 95% confidence interval (version 20.0, SPSS Inc. Chicago, IL). Kolmogorov–Smirnov normality test was used for the data distribution (Ghasemi and Zahediasl, 2012). Normally distribution data were presented in mean ± standard deviation (SD). A paired *t*-test was used to analyze the baseline and end-line of each parameter within the group. The nonnormality distribution data were presented as the median and interquartile range (IQR) and tested using the nonparametric test of the Wilcoxon-signed rank test, while the Mann–Whitney test was used to compare between the control group and the supplemental group for each parameter. In all analyses, significance was indicated by a probability level of $p < 0.05$.

RESULTS

Baseline characteristics of subjects

The eligible respondents (30 respondents) were recruited to participate in the study and randomly assigned into the control and supplemental groups. Randomization was done using MS Excel function RAND. A total of 15 respondents were allocated to the control group, while another 15 respondents were allocated to the supplemental group. All of the respondents were assumed to be healthy and they were not diagnosed with any serious illness. One of the respondents from the supplemental group withdrew due to feeling uncomfortable after consuming 2 weeks' worth of supplements. Thus, a total of 29 respondents (14 respondents from the control group and 15 from the supplemental group) were included in the final data analysis. The baselines characteristics of the subjects are shown in Table 1.

Table 1. The baseline characteristics of the respondents in both the control and supplemental groups.

Category	Control (n = 15)	Supplementation (n = 14)	p-value
Age (year)	23.00 (2.00)	26.00 (12.00)	*0.015[b]
Weight (kg)	67.98 ± 8.38	69.61 ± 10.93	0.655[a]
Height (m^2)	1.70 ± 0.07	1.71 ± 0.09	0.540[a]
BMI (kg/m^2)	23.69 ± 3.03	23.58 ± 2.39	0.912[b]
SBP (mmHg)	117.00 ± 12.52	118.57 ± 11.77	0.731[a]
DBP (mmHg)	74.13 ± 8.87	76 ± 9.58	0.590[a]
FBG (mg/dl)	5.10 (0.60)	5.11 ± 0.65	0.878[b]
Weight loss	1.00 (2.00)	2.29 ± 0.83	0.119[b]
Tired eyes	2.40 ± 0.99	2.57 ± 0.94	0.636[a]
Early satiety	2.00 (2.00)	2.00 (2.00)	0.890[b]
Bowel movement	2.00 (1.00)	2.00 (1.00)	0.754[b]
Constipation	2.00 (1.00)	1.00 (1.00)	0.566[b]
Headache	2.00 (2.00)	3.00 (1.00)	0.285[b]
Joint pain	2.00 (1.00)	2.00 (1.00)	0.051[b]
Gastric pain	2.00 (1.00)	2.00 (1.00)	0.671[b]
Skin problem	1.00 (1.00)	1.50 (1.00)	0.811[b]
Feeling of useless	1.00 (1.00)	1.50 (2.00)	0.227[b]
Energetic	3.20 ± 1.01	3.64 ± 0.84	0.213[a]
Difficulty of falling asleep	3.00 (2.00)	2.50 ± 1.09	0.946[b]
Lapse of memory	2.00 (2.00)	2.00 (1.00)	0.797[b]
Ability to concentrate	2.00 (2.00)	3.50 (2.00)	0.226[b]
Albumin (g/l)	47.33 ± 2.61	47.00 (2.25)	0.577[b]
Bilirubin (µmol/l)	28.28 ± 12.49	16.13 ± 3.93	*0.002[a]
AST (U/l)	24.00 ± 7.26	22.00 (11.30)	0.844[b]
ALT (U/l)	23.00 (36.00)	20.50 (29.50)	0.710[b]
Alkaline phosphate (U/l)	83.00 ± 29.27	75.50 (17.50)	0.526[b]
GGT (U/l)	30.00 (24.00)	34.00 (45.50)	0.526[b]
Total cholesterol (mmol/l)	5.05 ± 0.92	5.35 ± 1.38	0.493[a]
Triglycerides (mmol/l)	0.97 (0.73)	1.15 ± 0.51	0.694[b]
HDL-cholesterol (mmol/l)	1.25 ± 0.16	1.15 (0.42)	0.463[b]
LDL-cholesterol (mmol/l)	3.29 ± 0.92	3.59 ± 1.21	0.459[a]

BMI = body mass index; SBP = systolic blood pressure; DBP = diastolic blood pressure; FBG = fasting blood glucose; HDL-c = high density lipoprotein cholesterol; LDL-c = low density lipoprotein cholesterol; AST = aspartate transaminase; ALT = alanine aminotransferase; GGT = gamma glutamyl transferase.

Data are presented as mean ± SD or median (IQR) and $p > 0.05$ indicated nonsignificant difference by independent t-test[a] or Mann–Whitney U-test[b].

If either one of the group shows median value, nonparametric test was done instead. Scale: 1 = symptom is not present; 2 = rarely present; 3 = sometimes; 4 = often; 5 = always.

Effect of psyllium husk and selected mixed herbal supplement on body mass index (BMI), blood pressure, and biochemical parameters

There were significant decreases ($p < 0.05$) in total bilirubin in both the supplemental group and the control group. In contrast, alanine aminotransferase (ALT) and high density lipoprotein cholesterol (HDL-c) showed significant increases. No other parameters showed any significant changes ($p > 0.05$) as shown in Table 2.

There were nonsignificant differences ($p > 0.05$) between the absolute change and percentage change of BMI, systolic blood pressure (SBP), diastolic blood pressure (DBP), fasting blood glucose, liver function test, and lipid profiles. The data are shown in Table 3.

Table 4 shows that only two parameters in the supplemental group on "bowel movement" and "headache" show significant improvement ($p < 0.05$) after 1-month intervention. However, the other parameters did not show a significant effect ($p > 0.05$).

DISCUSSION

The present study aims to investigate the effect of psyllium husk and selected mixed herbal supplement on health indicators in healthy male subjects. The parameters used were BMI, blood pressure, biochemical parameters involving lipid profile and liver function test, and subjective symptoms from AAQoL adopted from Yonei *et al.* (2008). Based on Table 1, there was a significant difference in age between groups, although the subjects were randomly assigned. However, the age difference was acceptable (23 vs. 26 years) and both are classified as young adults (aged 18 to 26 years) (Bonnie *et al*., 2015). The chance of assuming a false premise as true is high with the small sample size used (Jorge and Lilian, 2014), but the sample size used was calculated and considered adequate to seek a significant difference, if any. The baseline data of bilirubin between the groups also show a significant difference and again the values are still within the normal range. Three of the respondents (10.34%) (one subject from the supplemental group and two from the control group) reported being smokers. Cigarette smoking is one of the factors that may affect the level of total bilirubin. According to Nelofer *et al.* (2015), bilirubin levels for a current smoker are lower at 6.84–10.84 mmol/l, while those of nonsmokers are 10.84–13.68 mmol/l. Another study conducted by Jo et al. (2012) shows that the total bilirubin for nonsmokers is 16.1 ± 5.6 µmol/l; for ex-smokers is 15.9 ± 5.4 µmol/l; and for current smokers is 14.8 ± 5.3 µmol/l. Thus, it can be concluded that the total bilirubin in the control group should be low. Yet, in the present study, the total bilirubin in the control group was high, as a total of nine of the subjects' total bilirubin levels from the control group were out of the normal range (3.4–20.5 µmol/l). The reason for being over the normal range of total bilirubin in the control group is unclear, but the findings were certainly reliable as the serums were analyzed by an accredited laboratory. For other parameters, no significant differences were found between groups.

From Table 2, the total bilirubin of subjects in both groups had decreased. However, the effect is not due to the supplement as both groups showed decreased in total bilirubin. Based on Table 3, both aspartate transaminase (AST) and ALT in the control and supplemental groups were increased. The AST shows a slight increase after the intervention period. It can be said that the supplement might have some effects on human liver function tests; however, a longer intervention is necessary. Based on work by Danielsson *et al.* (2014), ALT has significant interactions between age and BMI. Those younger than 40 years old with a higher BMI will have higher values for ALT. The age

Table 2. Comparison of BMI, blood pressure, and fasting biochemical parameters in the control and supplemental groups after 1-month intervention period.

		Before	After	*p*-value
BMI (kg/m^2)	Control	23.30 ± 2.71	23.32 ± 2.79	0.821[a]
	Supplementation	23.58 ± 2.39	23.42 ± 2.13	0.589[a]
SBP (mmHg)	Control	116.71 ± 12.94	116.43 ± 7.78	0.756[a]
	Supplementation	118.57 ± 11.77	116.79 ± 12.73	0.487[a]
DBP (mmHg)	Control	73.71 ± 9.05	73.57 ± 5.42	0.822[a]
	Supplementation	76.00 ± 9.58	75.57 ± 9.81	0.893[a]
Fasting blood glucose (mmol/l)	Control	5.09 ± 0.35	4.91 ± 0.36	0.060[a]
	Supplementation	5.11 ± 0.65	5.00 (0.27)	0.395[b]
Albumin (g/l)	Control	47.43 ± 2.68	48.07 ± 2.37	0.217[a]
	Supplementation	47.00 (2.25)	46.29 ± 1.27	0.443[b]
Total bilirubin (μmol/l)	Control	27.86 ± 12.85	18.31 ± 8.08	*0.000[a]
	Supplementation	16.13 ± 3.93	12.11 ± 3.88	*0.005[a]
AST (U/l)	Control	24.07 ± 7.53	29.29 (16.75)	0.088[b]
	Supplementation	23.92 (9.46)	25.93 (9.19)	0.090[b]
ALT (U/l)	Control	21.00 (28.00)	24.00 (42.25)	*0.008[b]
	Supplementation	20.50 (29.50)	24.50 (21.00)	0.221[b]
Alkaline phosphate (U/l)	Control	82.93 ± 30.37	85.86 ± 35.04	0.524[a]
	Supplementation	75.50 (17.50)	77.50 (14.25)	0.753[b]
GGT (U/l)	Control	29.50 (16.50)	28.00 (21.25)	0.132[b]
	Supplementation	34.00 (45.50)	33.00 (37.00)	1.000[b]
Total cholesterol (mmol/l)	Control	5.07 ± 0.95	5.16 ± 0.71	0.410[a]
	Supplementation	5.35 ± 1.38	4.73 (1.85)	0.925[b]
Triglycerides (mmol/l)	Control	0.97 (0.53)	1.01 (0.29)	0.820[b]
	Supplementation	1.15 ± 0.51	1.10 ± 0.32	0.594[a]
HDL-c (mmol/l)	Control	1.28 ± 0.15	1.36 ± 0.13	*0.003[a]
	Supplementation	1.15 (0.42)	1.20 (0.20)	0.227[b]
LDL-c (mmol/l)	Control	3.30 ± 0.95	3.31 ± 0.73	0.730[a]
	Supplementation	3.59 ± 1.21	3.54 ± 1.34	0.650[a]

Data are presented as mean ± SD or median (IQR) and $p < 0.05$ indicated significant difference by paired t-test[a] and Wilcoxon-signed rank test[b].

Table 3. Comparison between absolute change and percentage change of BMI, blood pressure, and fasting biochemical parameters in the control and supplemental groups after 1-month intervention period.

		Control	Supplementation	*p*-value
BMI (kg/m^2)	Absolute change	0.03 ± 0.43	−0.17 (1.14)	0.844[b]
	Percentage change	0.06 ± 1.74	−0.76 (5.00)	0.930[b]
Systolic blood pressure (mmHg)	Absolute change	−0.67 ± 8.16	−1.79 ± 9.35	0.733[a]
	Percentage change	−0.01 ± 8.62	−1.31 ± 7.60	0.637[a]
Diastolic blood pressure (mmHg)	Absolute change	−0.40 ± 6.77	−0.43 ± 11.70	0.994[a]
	Percentage change	0.30 ± 9.16	0.51 ± 15.40	0.964[a]
Fasting blood glucose (mmol/l)	Absolute change	−0.24 ± 0.45	−0.10 ± 0.58	0.478[a]
	Percentage change	−4.16 ± 8.02	−4.13 (14.47)	0.793[b]
Albumin (g/l)	Absolute change	0.53 ± 1.60	−0.29 ± 1.86	0.213[a]
	Percentage change	1.20 ± 3.41	−0.50 ± 4.15	0.237[a]
Total bilirubin (μmol/l)	Absolute change	−9.25 ± 7.81	−4.02 ± 4.52	0.056[a]
	Percentage change	−27.72 ± 19.84	−21.73 ± 29.08	0.520[a]

Table 3. (Continued).

		Control	Supplementation	*p*-value
AST (U/l)	Absolute change	4.00 (10.00)	2.00 ± 4.10	0.540[b]
	Percentage change	6.39 (22.73)	22.22 (34.56)	0.541[b]
ALT (U/l)	Absolute change	12.40 ± 18.23	3.50 (14.25)	0.213[b]
	Percentage change	37.44 ± 43.72	29.20 ± 47.51	0.631[a]
Alkaline phosphate (U/l)	Absolute change	1.60 ± 9.49	1.57 ± 10.93	0.994[a]
	Percentage change	1.19 ± 10.32	2.41 ± 12.44	0.775[a]
GGT (U/l)	Absolute change	1.00 (4.00)	0.00 (14.75)	0.505[b]
	Percentage change	3.23 (11.76)	6.60 ± 31.83	0.646[b]
Total cholesterol (mmol/l)	Absolute change	0.11 ± 0.52	0.00 ± 0.32	0.500[a]
	Percentage change	3.39 ± 10.01	0.38 ± 6.33	0.347[a]
Triglycerides (mmol/l)	Absolute change	0.01 ± 0.33	−0.05 ± 0.33	0.628[a]
	Percentage change	10.84 ± 29.83	4.54 ± 27.86	0.563[a]
HDL-c (mmol/l)	Absolute change	0.08 ± 0.09	0.04 (0.13)	0.432[b]
	Percentage change	4.75 ± 10.65	3.79 ± 10.36	0.378[a]
LDL-c (mmol/l)	Absolute change	0.20 (0.60)	−0.04 ± 0.43	0.273[b]
	Percentage change	3.43 ± 13.64	−1.63 ± 10.11	0.270[a]

Data are presented as mean ± SD or median (IQR) and $p > 0.05$ indicated nonsignificant difference by independent *t*-test[a] and Mann–Whitney U-test[b]. If either one group of data shows median value, nonparametric test was done instead.

Table 4. Comparison of health indicator parameters of subjects in the control and supplemental groups.

		Before	After	*p*-value
Weight loss	Control	1.50 (2.00)	2.50 (2.00)	0.187
	Supplemental	2.29 ± 0.83	2.00 (2.00)	0.792
Tired eyes	Control	2.43 ± 1.02	2.50 (2.00)	1.000
	Supplemental	2.57 ± 0.94	2.00 (0.50)	0.085
Early satiety	Control	2.00 (2.00)	2.00 (2.00)	0.206
	Supplemental	2.00 (2.00)	3.00 (2.25)	0.090
Bowel movement	Control	2.00 (1.00)	2.00 (1.25)	0.527
	Supplemental	2.00 (1.00)	2.57 ± 1.02	0.017*
Constipation	Control	2.00 (1.25)	2.00 (1.25)	0.705
	Supplemental	1.00 (1.00)	1.00 (0.25)	0.161
Headache	Control	2.00 (2.00)	2.00 (2.00)	0.527
	Supplemental	3.00 (1.00)	1.50 (1.00)	0.009*
Joint paint	Control	2.00 (1.00)	1.00 (1.00)	0.257
	Supplemental	2.00 (1.25)	2.00 (1.00)	0.084
Gastric pain	Control	2.00 (1.00)	1.00 (1.00)	0.257
	Supplemental	2.00 (1.25)	1.00 (1.00)	0.102
Skin problem	Control	1.50 (1.25)	1.50 (1.00)	0.527
	Supplemental	1.50 (1.25)	1.00 (1.00)	0.336
Feeling of useless	Control	1.00 (1.00)	1.00 (1.00)	1.000
	Supplemental	1.50 (2.00)	1.00 (1.00)	0.135
Energetic	Control	3.29 ± 0.99	3.00 (1.00)	0.852
	Supplemental	3.64 ± 0.84	4.00 (1.00)	1.000
Difficulty of falling asleep	Control	3.00 (2.25)	2.21 ± 1.05	0.546
	Supplemental	2.50 ± 1.09	2.00 (1.25)	0.087
Lapse of memory	Control	2.00 (2.00)	2.00 (2.00)	1.000

Table 4. (Continued).

		Before	After	*p*-value
Ability to concentrate	Supplemental	2.00 (1.25)	2.00 (1.00)	0.480
	Control	2.50 (2.00)	2.64 ± 1.00	0.516
	Supplemental	3.50 (2.00)	4.00 (1.00)	0.106

Scale: 1 = symptom is not present; 2 = rarely present; 3 = sometimes; 4 = often; 5 = always.
Data are presented as mean ± SD or median (IQR) and $p > 0.05$ indicated nonsignificant difference by Wilcoxon-signed rank test.

range for both the control and supplemental groups was 20–40 years old. Thus, the present study's results for ALT were in line with those of a previous study, in which subjects younger than 40 years old with the higher BMI had the higher values for ALT.

According to Table 2, the significant changes of HDL-c in the control group might be due to the control diet of the subjects. Based on the self-report, two subjects (13.33%) in the control group reported that they controlled their diet during the 1-month intervention although they were advised not to change their usual diet during the intervention period. Additionally, one of the subjects in the control group was undergoing smoking cessation during the intervention month. Forey *et al*. (2013) reported that smoking cessation for 30 days can increase the HDL-c by +0.035 mmol/l. It can be summarized that the psyllium husk and selected mixed herbal supplement did not show an effect in lowering the lipid profiles as the HDL-c only showed a significant increase in the control group.

According to Erdogan *et al*. (2016), the frequency of bowel movement for the psyllium intervention group showed a significant increase from 2.76 ± 1.10 to 3.49 ± 1.40 after the 4-week intervention period with the ingestion of 10 g of psyllium per day after meals. However, another study conducted by Soltanian *et al*. (2018) found that the frequency of bowel movement did not show significant changes in 4 and 12 weeks but only showed significant changes at 8 weeks of intervention with 10 g of psyllium per day. In that study, the frequency of bowel movement at baseline was 1.5 ± 0.7, increasing to 1.7 ± 0.8 after 4 weeks, then continuing to increase to 2.0 ± 0.8 in 8 weeks, and decreasing to 1.8 ± 1.0 after 12 weeks.

The present study also found that the frequency of headaches in the supplemental group was decreased significantly. There is evidence demonstrating that the psyllium husk and selected mixed herbal supplement has a positive effect on headache. Only one of the selected mixed herbs has shown a positive effect on relieving headache, namely, maca, which is most commonly used by menopausal women. Based on the study by Meissner *et al*. (2006), the headache symptoms of postmenopausal women were improved between the first month and the second month of intervention. The mean value was reduced from 0.20 to 0.14 after the consumption of 2 g/day of vegetable hard gel capsules with pre-Gelatinized Organic Maca (Maca-GO), twice per day with meals. Thus, based on a previous report, it is postulated that maca was responsible for relieving headaches among the respondents in the present study.

CONCLUSION

The effects of psyllium husk and selected mixed herbal supplement on health indicators have not been studied by others. However, psyllium husk has been reported to have beneficial effects on BMI, fasting blood glucose, blood pressure, and lipid profile. In the present study, the supplemental group showed improvement in health indicator parameters of "bowel movement" and "headache." Total bilirubin levels also showed improvement after short-term supplementation of 1 month. Therefore, it can be concluded that the 25 g/day of psyllium husk and selected mixed herbal supplement with 1-month intervention period had shown the same benefits in health indicator parameters, specifically in improving bowel movement and reducing headache.

ACKNOWLEDGMENTS

The authors would like to express their gratitude to all the young adult respondents for their participation and full cooperation. Special thanks are due to Mrs. Hassan, Z. for providing supplemental products in this study.

AUTHOR CONTRIBUTIONS

TAll authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work. All the authors are eligible to be an author as per the international committee of medical journal editors (ICMJE) requirements/guidelines.

FUNDING

There is no funding to report.

CONFLICTS OF INTEREST

The authors report no financial or any other conflicts of interest in this work.

ETHICAL APPROVALS

The present study was approved by the Research Management and Innovation Centre Human Ethics Committee, Universiti Malaysia Terengganu with reference number UMT/JKEPHMK/2020/43. Consent forms were signed and collected from all study participants.

DATA AVAILABILITY

All data generated and analyzed are included within this research article.

PUBLISHER'S NOTE

TThis journal remains neutral with regard to jurisdictional claims in published institutional affiliation.

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How to cite this article:

Ong PW, Zakaria NS, Kamarudin KS, Ali A', Yusof HM. Effects of short-term psyllium husk and selected mixed herbal supplementation on health indicators in healthy male subjects. J Appl Pharm Sci, 2022; 12(02):126–132.