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The Impact of Front-of-Package Traffic Light (FoPTL) in the Senior High School Students' Nutrition Labels Comprehension

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Abstract

The study aimed to evaluate the impact of Front-of-Package Traffic Light (FoPTL) nutrition label on female teenagers' comprehension of nutritional values. A quasi-experimental design employing the purposive sampling method. The intervention group was given FoPTL nutrition label while the control group was given nutrition facts labels within 3 weeks. Twenty-one subjects in a control group and twenty subjects in an intervention group. Both groups taken from the two selected senior high schools at East Jakarta. Our findings confirm the significant difference in the nutrition labels comprehension between the intervention group and control group ($p < 0.05$), with the intervention group having higher scores (39.17 points) than the control group (20.63 points). It can be concluded that FoPTL can improve the nutrition labels comprehension. To mitigate the low comprehension of nutrition labels, schools are encouraged to cooperate with related partners on educating students about nutrition labels. Future studies may wish to consider examining the issue using male teenagers as the research subjects. To that degree, research on both the reading behavior of FoPTL label and the purchasing behavior of packaged food products should be performed.

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front-Of-Package Traffic Light;
Nutrition Information Labels;
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Introduction

The number of children affected by the obesity epidemic has increased in the last few years.[1] In 2013, the rates of obesity among Indonesian teenagers aged 13-15 and 16-18 years old were 2.5% and 1.6%, respectively.[2] It has long been observed that overweight teenagers will continue to carry increased weight when they enter adulthood. The impact of this epidemic starting in adolescence may be more severe as it puts adolescents at greater risk of developing degenerative diseases.[3] Poor food selection, such as those that are high in both caloric

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and fat content, has been cited as among the main factors causing obesity.[1,4,5,6] A large body of literature has demonstrated that consumers' food selection is affected by the use of nutrition labels.[7,8]

Several studies have documented how the ability to read nutrition labels enables consumers to choose foods that are low in calories,[9,10] fat, cholesterol, sodium and sugar, and vice versa.[11] A survey by Nielsen (2012) suggested that 59% of the global respondents had poor comprehension of nutrition labels and 52% partly understood what was written in the labels, while fewer (7%) had no grasp of the information contained in nutrition labels. A report by Nielsen (2012) revealed Asia-Pacific to be the region with the lowest comprehension of nutrition facts (31% comprehension rate).[12] A survey of national nutrition in America found that only 16.7% of teenagers self-reported that they always read the nutrition facts.[13] A similar finding was reported in Malaysia, where only 11% out of a total of 30,992 respondents read the nutrition labels before making a purchase.[14] In Indonesia, a study on sportsman high school students in Jakarta revealed that a mere 4.4% of the students always read nutrition labels, with 12.7% often reading them.[15] Another study, on vocational school students in Bekasi, indicated the low level of compliance with nutrition labels (14.5%).[16]

There are several factors that strongly affect the low tendency by consumers to read nutrition labels. These are, to name a few, the small label size, uninterested respondents, respondents' lack of understanding of nutrition labels, respondents' lack of trust in the label provided, difficulty in comprehending the information contained in the label, unappealing label design, and the time needed to discover and understand the label.[17,18,19,20,21] The Food Standards Agency (FSA) thus developed a nutrition label based on the traffic light (TL) format to assist consumers in making healthy food selections.[22] The TL label is focused on four nutrients, namely fat, saturated fat, sugar and salt, which are categorized according to three color indicators: red (high level), yellow (medium level) and green (low level) (FSA). The use of color-coding on front-of-package (FoP) nutrition labels has been found to be effective in improving consumers' attentiveness and reducing the time taken to read the associated nutrition information.[23,24] The TL labelling system will also benefit teenage consumers in terms of their ability to choose healthier food.[25,26,27] A study in Australia demonstrated that TL labels might serve as an effective intervention for preventing obesity.[28] This study has aimed to evaluate the impact of the Front-of-Package Traffic Light (FoPTL) format for nutrition labelling on teenage consumers' comprehension of nutrition labels.

Material and Methods

Design Study and Subject

This study utilized a quasi-experimental design by providing different formats of nutrition labels to the intervention group (n=20) and control group (n=21). In this study, we used dummy packaging labelled using the FoPTL nutrition label format for the intervention group and dummy packaging labelled with nutrition facts labels for the control group. The sample consisted primarily of female high school students from two high schools who met the following inclusion criteria: i) the respondent was between the aged of 15 and 17, and ii) the respondent had purchased packaged food products. The exclusion criterion for the sample was the respondent and/or a relative working in the health or food industries. An ethical review license for this study was obtained from the Faculty of Public Health, Universitas Indonesia. The study was performed on 20 junior high school students in each group at the first and second grades in two selected located at East Jakarta. These number of subjects taken from the two different mean test with $Z1-\alpha/2 = 0.05$ and $Z1-\beta = 0.842$. We did not take randomization process because the study design using quasi experimental.

Material

We employed three-dimensional dummy packaging comprising a intervention group dummy that displayed both nutritional facts labels and FoPTL label, and a control dummy that displayed only nutrition facts labels. Different types of food products were included in the study (milk, wafers and yoghurt). The selection of products for inclusion was based on consumption data for Indonesia, whereby dairy products came in second place, after tea products. Tea, as a product, did not meet the requirement of the study due to its lack of a fat and saturated fat content. Meanwhile, there is a high rate of consumption of wafers as a packaged food product. Each product has two variants which have

different nutritional contents. Pre-test and post-test questionnaires were used in the present studies that were designed by modifying the questionnaires.

Data Collection

Each school was assigned by purposive sampling to one group (intervention group or control group), with one class from each school subsequently being selected as the research subject. The study was conducted over a three-week period and consisted of three meetings, with a period of seven days between each meeting. Prior to the intervention, baseline data were collected covering the characteristics of the subjects (age, perception of diet, daily allowance, monthly consumption of packaged food, and nutritional knowledge), their reading compliance with regard to nutrition labels, and their comprehension of nutrition labels. The subjects were provided with educational media in the form of a booklet explaining the components of nutrition labels and how to read and use them. At the second meeting, we educated the subjects on how to read and use the nutrition labels, as well as on how to make food choices based on the information disclosed on the nutrition labels. Anthropometric measurements (weight and height) were utilized to gather data on the subjects' nutritional status. Data on the subjects' comprehension of nutrition labels after the intervention were collected at the final meeting by way of a post-test-administered questionnaire.

Data Analyses

The subjects' understanding of nutrition labels in both of the groups was objectively measured using the 18 questions contained in the questionnaires that were administered to the subjects to complete. The subjects were asked to categorize the nutritional content from the dummy packaging and select the food product(s) they perceived as being healthy. Correct answers were given 1 point, while an incorrect answer was awarded 0. A subject who answered of the questions correctly was awarded a score of 100, while a subject giving all incorrect answers received a score of 0. Data analysis was performed using SPSS and Windows. Univariate analysis was used to understand the distribution of the subjects' characteristics and their comprehension level of nutrition labels. The forms of bivariate analysis employed were i) ANOVA, to analyze the homogeneity of the two groups, ii) the Wilcoxon signed-rank test, to compare the mean difference in the comprehension of nutrition labels before and after the intervention, and iii) the Mann-Whitney U test, to compare the mean difference in the comprehension of nutrition labels between the intervention group and control group.

Results

Table 1 explains that the majority of the subjects in the intervention group had a nutritional status that was categorized as over-nourished, while most of the subjects in the control group had an optimal nutritional status. Our research subjects consisted of those whose daily allowance ranged from between IDR 20,000 and IDR 30,000, with a monthly consumption frequency of packaged food in the range of 5-15 times. In the control group, most of the subjects (66.7%) had proper knowledge of nutrition, while in the intervention group fewer than 55% of the subjects were nutrition-conscious. The nutritional label comprehension provided by reading information understanding score on the nutrition label. Scores of understanding nutritional labels were obtained from 18 questions consisting of understanding on how to read nutrition labels, information on nutritional content on labels, and comparing product nutritional content and choosing healthier products. Each correct answer to the subject was given a score of 1 and if the wrong answer was given a score of 0. At the end of study, most subjects at the two groups had increased correct answers percentage (Table 2).

However, there were some questions were still remain, that were fat content category and choosing healthier food products in the control group. Intervention group subjects had questions about the comparison of foods with less saturated fat. Table 3 contains a breakdown of the assessment of the comprehension of nutrition labels. Our results suggest that the mean difference in the reading comprehension of nutrition labels and the comparison between the elements of the nutritional composition was higher for the control group than the intervention group. By contrast, the intervention group was found to have a higher mean difference than the control group in terms of their comprehension of the nutritional composition and the selection of healthier food products elements. On the other

hand, it found an insignificant mean difference in the reading comprehension ($p>0.05$) of nutrition labels between the control group and intervention group. The study also revealed a significant difference between the intervention group and control group's comprehension of nutritional composition and the comparison of nutritional compositions ($p<0.05$). The mean difference between the two groups' comprehension of healthier food products selection was found to be insignificant ($p>0.05$). Table 4 shows the mean difference understanding on how to read nutrition label, nutrient content category, and nutrition product comparison at post study had significant difference in the two groups ($p<0.05$).

Table 1: Characteristic of subjects

Variable	Control (n=21)		Intervention (n=20)		95% CI	p value
	n	%	n	%		
Age						
15 y.o	7	33.3	10	50		
16 y.o	14	66.7	9	45	15.44 – 15.78	0.4
17 y.o	0	0	1	5		
Perception on diet						
Healthy	20	95.2	19	95	-1.42 – 1.37	0.945
Unhealthy	1	4.8	1	5		
Pocket money (IDR/day)						
< 20,000	6	28.6	1	5		
20,000 – 30,000	11	52.4	16	80	1.81 – 2.18	0.291
> 30,000	4	19	3	15		
Package food consumption frequency (times/month)						
< 5	5	23.8	4	20		
15-May	13	61.9	12	60	1.752 – 2.150	0.632
> 15	3	14.3	4	20		
Nutrition knowledge level						
Good	14	66.7	9	45	1.28 -1.60	0.168
Bad	7	33.3	11	55		

Table 2: The description of nutrition label

Variable	Control (%)		Intervention (%)	
	Pre-Test	***Post-Test***	***Pre-Test***	***Post-Test***
Was able to read nutrition label on:				
Caloric content	23.8	100	25	100
Total Fat content	23.8	100	20	100
Sodium content	95.2	85.7	100	70
Saturated fat content	23.8	100	15	100
Sugar content	90.5	81	100	75
Was able to understand nutrient content category of :				

Sugar	0	23.8	0	100
Total fat	42.9	61.9	40	100
Salt	33.3	42.9	25	100
Was able to understand nutrient product comparison:				
Food with lower saturated fat content	85.7	100	95	95
Food with lower salt content	66.7	90.5	65	90
Drink with lower saturated fat content	90.5	81	100	95
Drink with lower salt content	81	95.2	65	85
Drink with higher sugar content	81	100	80	95
Choosing healthier products:				
Healthier food	81	81	60	85
Healthier dink	57.1	90.5	60	90

Table 3: Mean understanding nutrition label

Group	Mean	DS (deviation standard)	95% CI	p value
Pre-test				
Control	53.44	11.18	42.21 – 61.79	0,682
Intervention	52.22	10.82	41.31 – 62.69	
Post-test				
Control	74.07	10.82	86.72 – 99.28	0,000*
Intervention	91.39	6.96	81.27 – 96.73	

*significance level at $p < 0.05$

Table 4: Mean difference of comprehension

Variable	Mean ± SD		p *value*	Difference score
	Pre-test	Post-test		
Understanding how to read nutrition label				
Control	51.43± 20.56	93.33± 13.16		41.90 ± 2.,49
Intervention	52 ± 22.85	89 ± 16.5	*0.000	37.0 ± 27.74
Understanding on nutrient content category				
Control	26.98 ± 16.22	38.09 ± 14.09		11.11 ± 12.17
			*0.013	
Intervention	25.83 ± 15.74	96.67 ± 6.84		70.8 ± 16.1
Understanding nutrition product comparison				
Control	80.95 ± 23.22	93.33 ± 11.55		12.38 + 24.06
Intervention	81 ± 21.98	92 ± 11.96	*0.025	11.0 ± 21.98
Choose healthier products				
Control	69.05 ± 40.24	85.71 ± 32.18		16,.67 ± 53.23
Intervention	60 ± 30.78	80 ± 34.03	0.158	20 ± 37.69

*significant level at $p < 0.05$

Discussion

On the whole, the present study conducted an objective assessment by examining the subjects' ability to identify and select healthier food products. To measure the subjects' comprehension, we asked them questions regarding nutrients at the same time as providing them with the nutrition information as displayed on the product packaging.[20] The results show that the use of nutrition information labels on the front of the package, especially when presented in the TL format, enables consumers to easily grasp the information disclosed. Both of the groups (control group and intervention group) experienced a significant change in their comprehension after the intervention. Despite the enhanced post-intervention comprehension observed for both of the groups, the intervention group had a higher comprehension score than the control group.

Among the four components of the comprehension of nutrition labels, a significant difference was found only for the nutritional composition. Hence, it is safe to assume that in comparison with other label formats, FoPTL label are more effective at facilitating consumers' comprehension. Smith and Drake (2017) reported that only 10.9% of the respondents in their study who used nutrition fact labels were able to correctly answer the questions asked. Likewise, the authors of a study on nutrition labels in Ghana found that only 38.7% of the respondents had a good comprehension of the nutrition information[28] Another study on vocational school students in Bekasi City showed that 75% of the respondents displayed a good reading ability with regard to nutrition information. The respondents correctly answered most of the questions in the section on ability to find quantitative information, whereas most of the respondents incorrectly answered the questions in the section relating to the ability to calculate quantitative information.[16] Similarly, Borgmeier and Westenhoefer (2009), in their study, showed that the subjects who were provided with nutrition labels in the TL format were better than those who were given nutrition labels in the panel and GDA formats in terms of answering questions assessing their comprehension of nutrition labels.[29]

Subjects using TL labels have also been found to record higher scores for product selection compared to those using color-coded GDA labels. Ducrot *et al.,* (2015) found that compared to labels containing a nutritional value information panel, respondents presented with TL labels performed better in answering questions on label comprehension. TL labels were ranked second, after five-color nutrient labels, in terms of improving a subject's ability to compare and sort the quality of food products.[30] Based on a study of 81 adolescents aged between 14 and 16, it was discovered that TL labels helped subjects to identify healthier products than color-free labels. By employing the TL labels, the subjects displayed better ability in selecting food products containing fewer calories and lower levels of total fat, saturated fat, sugar and salt.[26] Congruently, a study by Kelly *et al.,* (2009) on 790 adults in Australia found that those respondents who used TL labels displayed an ability to identify healthier products three times greater than that of those who used color-coded labels, and five times the ability of those who used labels with no color-coding.25

Furthermore, the respondents who were given TL labels were able to choose healthier food products in a shorter amount of time than those who used other label formats. An experimental study by Goodman *et al.,* (2012) reported similar findings, where the TL labels were more effective than other label formats in terms of assisting subjects to select food products that contained the lowest sodium content. Sacks *et al.,* (2011) found that the usage of TL labels helped consumers to select food products with a lower energy content.[27] This would lead to a corresponding decrease in energy consumption, which in the long run might be an effective and efficient obesity prevention mechanism. Conversely, De la Cruz-Gonggora *et al.,* (2017) conducted a study on the usage of nutrition labels among 135 adults and discovered a higher comprehension rate for TL labels than for either GDA or star rating labels, although it was also lower than for other labels.[31] The respondents stated they had difficulty interpreting the yellow code on the TL labels. One possible reason for the conflicting results was the employment of a qualitative method when other studies have tended to use a quantitative method. Another contributing factor was the respondents' perception that a simplified label should be easy to read and require less time to comprehend. The use of color on labels can improve the ability to evaluate a product's quality,

whereas the addition of numerical information will only confuse consumers, specifically those with a low education level. However, a simplified label reduces the amount of information that can be displayed on the label, which carries the potential to lead to a misinterpretation of nutrition contents.

Limitations

Although this research can be considered successful in terms of examining the high school student participants' comprehension of nutrition labels, several limitations were nonetheless encountered. Firstly, the study employed a quasi-experimental design and this presented a number of drawbacks, one of which was the uncontrollable confounding factors. To mitigate this, the study's sampling criteria (sex and age) were homogenized. A further limitation of the study was the unavailability of a standardized questionnaire to measure the subjects' comprehension of the nutrition labels. This study employed a modified version of a questionnaire used in previous studies. We performed a trial test of the questionnaire on a different research subject. Nonetheless, the researcher did not conduct a validation test of the questionnaire. Another limitation of the study was the absence of a negative control group, which meant it was not possible to conduct an effectiveness test on the impact of education on the subjects' comprehension of nutrition labels. Another constraint of the study was that the dummy packaging used did not meet the packaging standard as stipulated in the Indonesian regulation. In addition, two of the research subjects in the intervention group dropped out after they did not attend one of the meetings on the research agenda.

Conclusion

The study results, analysis and discussion confirmed the higher score on the acceptability of nutrition labels for the intervention group than the control group. Furthermore, the intervention was deemed effective in improving the subjects' comprehension of nutrition labels, with the intervention group experiencing a greater amelioration in their comprehension score than the control group. The findings of the present study are expected to be a new source of learning for students about the importance of comprehending nutritional information. Students are therefore strongly encouraged to look up information about nutrition and to seek those nutrition labels that are believed to positively improve their knowledge with regard to the use of nutrition facts labels. Likewise, schools must play their part in improving the situation through a collaboration with health centers, such as conducting a seminar on nutrition, most importantly on nutrition facts labels. Furthermore, we expect that schools will begin using educational media such as posters and banners in the school canteen that explain nutrition labels. This study is expected to motivate the Ministry of Health and the National Agency of Drug and Food Control of the Republic of Indonesia (*BPOM RI*) to conduct further investigations on the usage of FoPTL label. Moreover, we encourage the Ministry of Health and BPOM RI to convey information on nutrition labels and how to use them to the society via seminars or advertisements. Future studies may seek to develop the present study by utilizing different subject characteristics, such as employing males at different educational levels (e.g. junior high). Future research could also seek to employ a qualitative research methodology for the purpose of generating a more in-depth discussion on the issue of consumers' perception of nutrition labels.

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Conflict of Interest

The Author(s) declare(s) that there is no conflict of interest.

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