



ASSOCIATION OF DIFFERENT FOOD LABEL FORMATS WITH HEALTHINESS EVALUATION AND CONSUMER FOOD CHOICES: A STUDY IN KESBEWA, SRI LANKA

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Food labels play an essential role in enabling consumers to make informed food choices and ensuring fair trade in the food industry. In Sri Lanka, numerous studies have explored the Traffic Light System, creating a notable gap in understanding the associations of different food label formats with healthiness evaluation and consumer choices. This study explored the variations in consumer awareness, knowledge, attitudes and food label utilization across different demographic factors. Further, determined how consumer awareness, knowledge, attitudes, and label utilization relate to their evaluation of foods and their food choices. Finally, the associations of different food label formats with consumers' healthiness evaluation and their food choices during purchasing were evaluated. The study involved 383 participants from the Kesbewa area using an interviewer administered questionnaire in the Sinhala language, and a consumer study comprising a choice task and a rank task comparing four label formats, including the Traffic Light System, Nutrition Fact Panel, Nutrition Fact Panel with Daily Values and Simple Statements. Statistical analysis was conducted using R Studio. Results indicated that consumer awareness, knowledge, attitudes and label utilization varied with gender, education level, income level, and health conditions. Both healthiness perception and consumer food choices were strongly and positively correlated with consumer knowledge, attitudes, and food label utilization. The Traffic Light System and Nutrition Fact Panel with Daily Values showed potential positive associations with improved nutritional choices, but lacked statistical significance. The Traffic Light System and Simple Statements were more effective than the Nutrition Fact Panel in enhancing the correct nutritional ranking of food. Educational and intervention strategies addressing the above demographic differences could promote better understanding and food label utilization for healthier choices. Descriptive front of pack food labels are more effective than numerical back of pack food labels in assisting consumers' healthier purchasing. Therefore, the government, relevant authorities, together with the food industry, should prioritize introducing and implementing descriptive food labels to enable consumers to make healthier food choices.

Keywords: consumer food choices, food label formats, food label utilization, healthiness evaluation, nutritional quality

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INTRODUCTION

Food labels (FLs) have become a prominent subject in the food industry due to the growing consumer interest in healthy purchasing behaviors. International studies indicate that interpretive front of pack labels (FoPL), including the Nutri-Score and Multiple Traffic Lights, can help rank healthiness more accurately and make healthier nutritional decisions by consumers (Fialon et al., 2020a; Egnell et al., 2019; Packer et al., 2021). In the Sri Lankan context, the focus of was largely based on the Traffic Light System (TLS), which generates a gap in understanding related to the other food label formats (FLFs). Therefore, this research comprehensively studied how consumer awareness, knowledge, attitudes and utilization of FLs vary across different demographic factors. Further, determined how consumer awareness, knowledge, attitudes, and label utilization relate to consumers' healthiness evaluation of foods and their food choices. Finally, evaluated how different FLFs are associated with consumers' healthiness evaluation and their food choices during purchasing to provide evidence based insights for food manufacturers and the public health sector to design and introduce effective labelling policies in the country, promoting healthier food habits.

METHODOLOGY

The study was conducted on a sample population of 255,175 residents of the Kesbewa area of the Colombo District of Sri Lanka as per 2012 Census of Population and Housing. A purposive and quota sampling method was used to recruit 383 respondents, aged 20-60 years with a monthly income that is greater than LKR 20,000, as proportionately representing both the genders and the age groups. People who work in the health or food industry and those who were known to be color blind were specifically excluded. The data were collected through interviewer administered Sinhalese questionnaire that assessed consumer awareness, the knowledge, attitudes as well as use of FLFs. Since the responses were ordinal and non-normal, the non-parametric statistical methods were used in R Studio. Kruskal-Wallis tests with Dunn post-hoc analyses were used to test differences in demographics, Kendall correlation was used to test relations between healthiness evaluation and food choice behaviors.

Then, the consumer study with choice and ranking tasks was introduced based on (Fialon et al., 2020a; Egnell et al., 2019; Packer et al., 2021). The test compared four different FLFs including the TLS, Nutrition Fact Panel (NFP), the Nutrition Fact Panel with the Daily Values (NFP with DV) and Simple Statements (SS) placed on the mock packaging of soft drinks and biscuits. The NFP was the reference group

used in the fitted ordinal logistic regression model, controlling demographic covariates and interaction terms.

No labelling (for the two categories successively)	With a label (for the two categories successively)																		
1. Choice task Assuming you were interested in purchasing this type of food, which food would you buy? 	1. Choice task Assuming you were interested in purchasing this type of food, which food would you buy? 																		
2. Ranking task Please rank these products according to their relative nutritional quality, from lowest to highest nutritional quality.  <table><tr><td>Highest -</td><td>Highest -</td><td>Highest -</td></tr><tr><td>Medium -</td><td>Medium -</td><td>Medium -</td></tr><tr><td>Lowest -</td><td>Lowest -</td><td>Lowest -</td></tr></table>	Highest -	Highest -	Highest -	Medium -	Medium -	Medium -	Lowest -	Lowest -	Lowest -	2. Ranking task Please rank these products according to their relative nutritional quality, from lowest to highest nutritional quality.  <table><tr><td>Highest -</td><td>Highest -</td><td>Highest -</td></tr><tr><td>Medium -</td><td>Medium -</td><td>Medium -</td></tr><tr><td>Lowest -</td><td>Lowest -</td><td>Lowest -</td></tr></table>	Highest -	Highest -	Highest -	Medium -	Medium -	Medium -	Lowest -	Lowest -	Lowest -
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Figure 29- Procedures of the choice and the ranking tasks for the soft drink category.

RESULTS AND DISCUSSION

Results of the Kruskal Wallis test, which determined the consumer awareness, knowledge, attitudes, and usage of FLFs across demographic factors (gender, age, education, income, ethnicity, household composition and disease prevalence), are given in Table 1.

Table 17- Consumer awareness, knowledge, attitudes and utilization of FLs across demographic factors.

Demographic	Awareness of FL	Knowledge on FL	Attitudes towards FL	FL utilization
Gender	$X^2 = 10.204$, $df = 1$, $p = 0.0014$	$X^2 = 7.0983$, $df = 1$, $p = 0.0077$	$X^2 = 8.380$, $df = 1$, $p = 0.0038$	NS (NOT SIGNIFICANT)
Income	$X^2 = 7.2313$, $df = 2$, $p = 0.0269$	$X^2 = 7.326$, $df = 2$, $p = 0.0257$	NS	NS
Education level	$X^2 = 20.142$, $df = 5$, $p = 0.0012$	$X^2 = 20.142$, $df = 5$, $p = 0.0012$	NS	NS
Disease	NS	$X^2 = 6.0983$, $df = 2$, $p = 0.0474$	$X^2 = 16.312$, $df = 2$, $p\text{-value} = 0.000$	$X^2 = 8.2381$, $df = 2$, $p = 0.0163$



Dunn's post-hoc test results, which detected the differences within demographic groups, are given in Table 2.

Table 18- Post hoc differences in consumer awareness, knowledge, attitudes and utilization of FLs within demographic groups

Dependent Variable	Group Comparison	Z-statistic	Adjusted p-value
Awareness (Education)	Graduate – Ordinary	3.065	0.0163
Awareness (Education)	Advanced – Ordinary	3.95	0.0006
Awareness (Income)	Between LKR 50 K – LKR 100 K – Above LKR 100K	-2.35	0.0281
Attitudes (Diseases)	No diseases – NCDs	3.834	0.0002
Knowledge (Education)	Graduate – Ordinary	3.065	0.0163
Knowledge (Education)	Advanced – Ordinary	3.95	0.0006
Knowledge (Income)	Between LKR 50K- LKR 100 K – Above LKR 100K	-2.641	0.0124
Knowledge (Disease)	No diseases – NCDs	2.34	0.0289
Use (Diseases)	No diseases – NCDs	2.866	0.0062

The level of food label awareness varied significantly with respect to gender, education level, and level of income with the level of awareness being high among women, those who have better education levels and those who belong to the higher income brackets. These findings are consistent with the existing global market research that has linked high educational attainment to better label recognition and hypothesized that lower income limits the participation (Sulong et al., 2019; Vargas-Meza et al., 2019). The knowledge of foods was different depending on the education, income level, and disease prevalence with more knowledge being recorded on those with high educational level, middle income bracket, and those who had been diagnosed with non communicable diseases (NCDs). There have been numerous studies that depict consistent relationships between education and label comprehension (Adesina et al., 2022; Koen et al., 2018; Nieto et al., 2019; Teran et al., 2019). There was a variation in attitudes towards FLs depending on gender and prevalence rates of the disease with individuals with higher socioeconomic status and younger age groups of the population reporting more positive attitudes. (Egnell, Galan, et al., 2020). The consumption of FLs varied solely based on prevalence of various diseases with a high utilization of the product by persons with NCDS. This fact is consistent with both Sri Lankan and foreign data, which links increased utilization to health outcomes, education, and income levels. (Bandara et al., 2016; Bryla, 2020; Donga and Patel, 2018; Somavarapu and Jadapalli, 2018).

Kendall's test results, which determined the relationships of consumer awareness, knowledge, attitudes, and label utilization, relate to their healthiness evaluation of foods and with food choices are given in Table 3.



Table 19- Relationships of consumer awareness, knowledge, attitudes, and label utilization, relate to their healthiness evaluation of foods and with food choices.

Variable	Awareness τ	Knowledge (τ)	Attitudes (τ)	Utilization (τ)
Healthiness Evaluation	$\tau = 0.311$, $z = 8.077$, $p < 0.001$	$\tau = 0.516$, $z = 13.636$, $p < 0.001$	$\tau = 0.575$, $z = 15.159$, $p < 0.001$	$\tau = 0.529$, $z = 13.924$, $p < 0.001$
Consumer Food Choices	$\tau = 0.314$, $z = 8.030$, $p < 0.001$	$\tau = 0.535$, $z = 13.939$, $p < 0.001$	$\tau = 0.586$, $z = 15.235$, $p < 0.001$	$\tau = 0.577$, $z = 14.984$, $p < 0.001$

Consumer awareness of FLs showed a moderate positive association with healthiness evaluation and food choices, whereas consumer knowledge, attitudes, and food label utilization demonstrated strong positive associations with both outcomes.

Table 20- Associations between FLFs and change in the nutrition quality of food choices

Food Label	OR - 95 CI	p Value
TLS	2.41 (0.33- 1.44)	0.3782113
NFP with DV	2.44 (0.32 – 1.46)	0.3718853
SS	1.01 (-0.56 – 0/57)	0.9946028

Ordinal logistic regression showed that the TLS, as well as the NFP with DV, was positive, but insignificantly, correlated with better nutritional quality of food preferences, and no FoPL showed significant effect in comparison with reference intakes. Similar results have been obtained globally, where the interpretive FLFs are associated with healthier choices, but consistently not significant. (Aguenaou et al., 2021; Egnell, Galan, et al., 2020).

Table 21- Associations between FLFs and the ability to correctly rank products according to nutrition quality

Food Label	OR - 95 CI	p Value
TLS	4.60 (2.55 – 8.37)	0.1267484
NFP with DV	1.13 (0.63 – 2.01)	0.9054334
SS	2.21 (1.24 – 3.97)	0.4276408

FoPL had a strong effect on the ability of the participants to rank products correctly on basis of their nutritional value. TLS were 4.6 times more associated with improving participants' ability to correctly rank products according to their nutritional quality compared to the NFP, demonstrating a strong and significant effect. SS significantly improved participants' ability to correctly rank products according to their nutritional quality 2.2 times more compared to the NFP. Similarly European studies evidence that the interpretive labels like Nutri-Score are the most effective nutritional assessment tools, and the same trend is observed with the Mediterranean dietary setting where descriptive graded summary labels ease cognitive load and are better than numerically specific forms of nutrient presentation. (Egnell, Galan, et al., 2020; Hagmann & Siegrist, 2020; Khandpur et al., 2018; Vargas-Meza et al., 2019). The strengths of the study include the large sample size that is socio demographically heterogeneous and a randomized experimental design,



which makes it possible to compare food label types with high sensitivity. Limitations include the fact that only two types of products were used, no real life purchasing situations and the impact of prices were not considered, possible bias based on language related issues as only Sinhala data was collected, and the use of interviewer administered questionnaires. The multilingual data collection, increased proportion of food categories, improved sample sizes, and realistic stages of purchasing should be included in the future studies to achieve better levels of external validity and statistical power.

CONCLUSIONS/RECOMMENDATIONS

Educational and intervention strategies developed, addressing these demographic differences, could be effective in promoting better understanding and food label utilization for healthier choices. Descriptive FoPL assists consumers in making healthier food choices compared to numerical back of pack FLs. Thus, the government and the relevant authorities, along with food processors, should initiate the introduction and implementation of descriptive food labels to enable consumers to make healthier food choices.

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