Preventive Medicine Reports 29 (2022) 101919

Contents lists available at ScienceDirect

Preventive Medicine Reports

journal homepage: www.elsevier.com/locate/pmedr

Effect of NUTRI-SCORE labeling on sales of food items in stores at sports and non-sports facilities

Chiyoung Ahn [a], Chung Gun Lee [a,b,*]

[a] Department of Physical Education, College of Education, Seoul National University 71-1, Seoul 08826, South Korea
[b] Institute of Sport Science, Seoul National University, 1 Gwanak-ro, Gwanak-gu, Seoul 08826, South Korea

ARTICLE INFO

Keywords:
Diet and nutrition
Food intake and habits
Health promotion
Healthy behavior and well-being
Preventive health education
Behavioral change
Time series analysis
Front of pack labelling
Sports facilities

ABSTRACT

NUTRI-SCORE is a front-of-pack labeling method that relies of the computation of a nutrient profiling system by reconstructing and presenting nutritional information about food items. In particular, different scores are assigned to harmful (energy, sugars, saturated fatty acids, and salt) and beneficial (proteins, fibers, fruits, vegetables, nuts, rapeseed oil, walnut oil, and olive oil) nutrients. These scores are combined to assign a final five different 'NUTRI-SCORE' to the food item from healthiest A to most harmful E. This study examined the effect of NUTRI-SCORE labeling on the sales of food items in stores at sports and non-sports facilities. The NUTRI-SCORE label was attached to the price tag of food items sold in two food stores of Seoul National University (sports-related and non-sports-related facilities) for 5 weeks. Baseline sales data from the previous 2 years were obtained from the food stores. The predicted data based on baseline sales were compared to the new sales data during the study period. The data trends were analyzed using interrupted time-series analysis, which showed significant group differences. In the sports-facility store, sales were higher for relatively healthy food items than for less-healthy food items. Conversely, mixed results were observed for sales in the non-sports-facility store. First, sales of Grade A foods decreased but sales of Grade B and Grade E foods increased. Therefore, the results imply that NUTRI-SCORE labeling positively affected sales of healthy foods only in the sports facilities because few people in non-sports facilities sought to purchase healthy foods. These results will help to improve the nutrition-related behavior of food consumers and point to the differences in cognitive consumption patterns between consumers at sports and non-sports facilities.

1. Introduction

Young adults are at a crucial stage of development, and forming lifelong eating habits (Abraham, Noriega, & Shin, 2018). Nevertheless, Korean college students have inadequate daily caloric values due to poor dietary habits (Lee & Kim, 1997), including excessive consumption of sugar-based, carbohydrate-rich, and fast foods. Moreover, Korean college students have excessive consumption of certain food types and frequently skip meals, which adversely affect their health in the long term (Choi, 2020). Therefore, it is important to develop effective strategies to promote healthy eating.

A front-of-pack (FOP) food label helps consumers to evaluate the nutritional characteristics of food items quickly by providing a categorized and abbreviated representation of the nutritional quality. In 2012, the UK government emphasized the importance of FOP labels in choosing healthy foods, which prompted many food retailers and manufacturers to adopt FOP labels (Scarborough et al., 2015). Among the various FOP labeling formats (e.g., NUTRI-SCORE, Traffic Light System, and Recommended Daily Intake), the most effective label is the Traffic Light Label, which was applied at restaurants in large hospitals for 6 months, leading to improved food choices and avoidance of unhealthy foods (Thorndike, Sonnenberg, Riis, Barraclough, & Levy, 2012). However, a recent study of FOP labels reported that the Traffic Light Label does not accurately reflect the nutritional content of food. Furthermore, the coding of food items using three colors indicates only the contents of the main ingredients and has poor visibility due to the small font size of the label. Therefore, customers find it difficult to identify the label (Seyedhamzeh et al., 2020).

Unlike other FOP systems, NUTRI-SCORE is a profiling system based on the nutritional content of food items. In a comparative study of various FOP labeling formats conducted between 2014 and 2017, NUTRI-SCORE was the most effective label for enabling young

* Corresponding author at: Department of Physical Education, College of Education, Seoul National University 71-1, Seoul 08826, South Korea.
E-mail address: cgl81@snu.ac.kr (C.G. Lee).

https://doi.org/10.1016/j.pmedr.2022.101919
Received 28 February 2022; Received in revised form 9 July 2022; Accepted 18 July 2022
Available online 21 July 2022

consumers to choose healthy foods and was superior to other labels (Chantal, Hercberg, & Organization, 2017).

A recent study of NUTRI-SCORE labels showed that children and mothers who had poor ability to identify junk food before the NUTRI-SCORE was attached were able to do so with the use of NUTRI-SCORE labels. However, this study was conducted in a laboratory, instead of a food store. The authors of this study concluded that these results should be verified in studies conducted in a food store (Poquet et al., 2019). The present study used the NUTRI-SCORE to overcome the limitations of previous studies of FOP labels. This study was conducted in food stores to reflect the real environment, as opposed to previous studies that were conducted in laboratories.

Previous studies reported on the use of conventional FOP labels in sports facilities because sports facilities encourage exercise and promote healthy behavior, thereby increasing the likelihood of eating healthy food (Olstad, Vermeer, McCargar, Prowse, & Raine, 2015). In the present study, we therefore compared the effects of NUTRI-SCORE labeling on sales of healthy foods in stores at sports and non-sports facilities.

Hypothesis 1: NUTRI-SCORE will have a static (+) effect on the sales of Grade A–C foods in both stores.

Hypothesis 2: NUTRI-SCORE will have an adverse (−) effect on the sales of Grade D and Grade E foods in both stores.

Hypothesis 3: In food stores, in sports facilities, the actual sales of Grade A foods will be higher than the expected sales throughout the time series. In contrast, the actual sales of Grade E foods will be lower than the predicted sales throughout the time series.

Hypothesis 4: In food stores in non-sports facilities, the difference in the ratio between the actual and predicted sales will be less than that in 'Hypothesis 3′.

2. Methods

2.1. Data collection

Data were collected from two food stores at Seoul National University, located in the sports and non-sports facilities, with identical conditions (products and prices). Data on the baseline food sales were collected from the store owners between 2018 and 2019, as well as 5 weeks after the intervention. The study was approved by the relevant authorities. College students and non-students were allowed to shop at the food stores; however, the majority of consumers at these food stores were college students. The Internal Review Board at Seoul National University approved the study protocol on October 4, 2019 (IRB No. E1911/003–004). This study was exempt from ethical compliance because only sales data excluding personal information was used without any direct interaction with participants.

2.2. Intervention

We coordinated with the food stores and administration to administer the intervention. We rated the nutritional content displayed on the food package as A–E. The foods were analyzed on the basis of quantities of sugar, saturated fat, sodium, protein, fruits, vegetables, nuts, beans, and plants. Some food packages lacked the complete required information, for which the manufacturer's website was accessed. Subsequently, the foods were graded using the NUTRI-SCORE evaluation system.

Stickers marked with prominent alphabets (A–E) were attached to the front of all food packages in both stores. The sticker was placed next to the price mark to increase its visibility to the consumers. Stickers with the NUTRI-SCORE were used to label the foods for 5 weeks between November 18, 2019 and December 20, 2019. Consumers could read the food grade and detailed explanation of the grade on the store bulletin board. The store staff was allowed to explain the meaning of the sticker.

2.3. Statistical analysis

This study conducted autoregressive integrated moving average (ARIMA) analysis following the procedure used by previous studies. The time series analysis assumes that the stochastic characteristics of time series data remain constant over time, i.e., the mean and variance should remain constant regardless of the time, and covariance between two time points should be irrelevant to other time points (Rao & Gabr, 1980). Several procedures are required to maintain stationary time series data and allow ARIMA prediction.

Step 1: An augmented dickey-fuller (unit root) test was used to stabilize the time series data by transforming a non-stationary time series to stationary data (Harris, 1992).
Step 2: For Auto Regression (AR), Moving Average (MA), and Auto Regression and Moving Average (ARMA) models, the time series data were assumed to be stationary. The goal of the ARIMA model was to improve the predictions for non-stationary situations using the concept of difference. Figures that have undergone statistical difference appear white. Therefore, the completion of difference can be assessed using the white noise check, which is statistically stationary. Therefore, the existence of white noise indicates a pure random time series (Li & McLeod, 1981). Moreover, data must also be checked for 'residuals' at this step.
Step 3: The ARIMA model fixes the time series by applying the ARMA (p, q) model to the difference of "d", resulting in the ARIMA (p, d, q) time series. The ARIMA model requires a stationary time series or a time series that becomes stationary after taking one or more differences. The ARIMA methodology consists of four stages: identification, estimation, diagnostic testing, and prediction. The appropriate values of the parameters p, q, and d must be identified in the first step. The main tools for identifying these parameters are autocorrelation-function (ACF), partial-autocorrelation-function (PACF) and correlation plots, which plot ACF and PACF with the delay length (Erdogdu, 2007). The ARIMA model was used to predict the data over two years, and compare it with the data from the intervention period.
Step 4: The final procedure was implemented to verify the difference between the predicted sales rate from ARIMA analysis based on 2 years of data and the sales rate for 5 weeks after the 5 weeks of intervention. T-test showed that the mean of the two groups was significantly different (Livingston, 2004). Data analyses were conducted using SAS 9.4 and STATA 14 software.

3. Results

The Augmented Dickey-Fuller (ADF) test stabilizes the unstable time series based on previous data. This process is inseparable from 'Lagged Differences', which involves transforming an abnormal time series into a standard time series for use (Harris, 1992). Table 1 presents the results of the Augmented Dickey-Fuller test with the actual percentage, performed using SAS 9.4. After going through the first general difference in the 20 time series, Pr < Rho 0.0001, which confirms the normality of the time series, was satisfied through the ADF test process.

The next steps are white noise and residual checks. The time series can only be confirmed to be random if white noise exists (Li & McLeod,

Table 1
Augmented Dickey-Fuller test result of E-rated beverage in the sports facility store.

Dickey-Fuller Unit Root Tests			
Type	Lags	Rho	Pr < Rho
Zero Mean	0	−764.382	0.0001
Single Mean	0	−764.383	0.0001
Trend	0	−764.393	0.0001

1981). The p-value of white noise was <0.05 until the end of Lag, implying significant white noise (Table 2). Autocorrelation in the time series value is confirmed by the presence of residual in the time series. In case of no autocorrelation, the residual is assumed to follow white noise. The p-value of the residual at this time should be >0.05. Since the 20 time series satisfied the corresponding values, it can be assumed that the residual follows the white noise. In other words, since the value up to lag 36 of the residual was sufficiently greater than 0.05, the value of the white noise was sufficient (Table 3).

Data for the 5-week intervention period were predicted based on the sales data from the previous 2 years.

In Fig. 1, black lines represent the actual sales, blue lines represent the sales predicted through ARIMA calculations, pink lines represent the upper and lower bounds of the predicted values, and the blue dotted line represents the timing of the intervention.

The predicted sales values showed a rise and continuous fall after the intervention, whereas the actual values fluctuated between a slight decline and a high rise. The average ratio for 5 weeks of the intervention was 26.89 % for the predicted values and 28.41 % for the actual values; therefore, actual values were almost 1.52 % higher than the predicted values (Fig. 2).

The predicted values showed a similar pattern to the actual values (almost 3 days), but without a decline. The actual values showed a decline whereas the predicted values showed a continuous increase. For the sale of Grade E beverages in the sports-facility store, the average ratio for 5 weeks was 34.57 % for the predicted values and 33.28 % for the actual values; therefore, the actual values were 1.29 % less than the predicted values (Fig. 3).

Table 4 shows the sales rates and proportions of the sports and non-sports-facility stores, and compares the average actual sales for the 5 weeks after the intervention and average predicted sales for the 5 weeks based on 2 years of data assuming that there was no intervention. In addition, the sales values were displayed by food type (i.e., food or beverage) and grade.

For Grade B foods, the average predicted and actual values were 4.78 % and 6.26 %, respectively ($p < 0.01$). For Grade C foods in the sports-facility store, the average predicted and actual values were 8.96 % and 10.52 %, respectively ($p < 0.01$). These results indicate that the intervention was effective in the sports-facility store. For Grade A foods in the non-sports-facility store, the average predicted and actual values were 32.04 % and 28.43 %, respectively ($p < 0.01$), implying that the sales of Grade A foods decreased, which was the opposite of the effect of the intervention on foods of other grades. For Grade B foods in the non-sports-facility store, the average predicted and actual values were 9.37 % and 11.37 %, respectively ($p < 0.001$), indicating that the intervention had an effect on the sales of Grade B foods even in the non-sports-facility store. Finally, for Grade E foods, the average predicted and actual values were 17.14 % and 18.77 %, respectively, indicating that the intervention had opposite effects on Grade E foods, which were similar to those on Grade A foods in the non-sports-facility store ($p < 0.05$).

4. Discussion

Previous studies have evaluated strategies to improve the eating habits of college students through FOP labeling and found that women and athletes were more likely to consider nutritional information than were other individuals (Seward, Block, & Chatterjee, 2016). The present study targeted specific groups and locations to overcome the limitations of previous studies. We assumed that the characteristics of consumers would vary by setting, and that this would modify the effects of the intervention on sales rates. Previously, only a mid-term study had evaluated the relationship between food labeling for 4 weeks and dietary choices (Mhurchu, Eyles, Jiang, & Blakely, 2018). Therefore, we conducted an intervention for 5 weeks to verify the results obtained from the 2018 study. Another study, conducted in 2016 and published in 2020, evaluated the effects of NUTRI-SCORE for more than 5 weeks (Dubois et al., 2021); however, it was published while our study was underway.

NUTRI-SCORE involves the profiling calculation method. The methods used to calculate the scores for food (energy per g) and beverages (energy per ml) vary due to differences in units (Deschasaux et al., 2018). The present study also analyzed food and beverages separately, but did not find significant results for beverages. Therefore, it is likely that there is no meaningful impact of FOP labeling in the beverage industry, despite the increasing use of FOP labels. A previous study showed that most soft drinks have inadequate nutrients (Kim, House, Rampersaud, & Gao, 2012). In the present study, significant results were obtained for Grade B foods in the sports-facility store. Group B foods are rich in protein and dietary fiber. Foods containing large amounts of sugar or sodium were not included in Grade A or Grade B. In the sports-facility store, the increase in sales of Grade B foods after the intervention may have improved the food quality consumed by customers. Grade C included foods with higher contents of sugar, sodium, and carbohydrates compared to Grade B foods. Although excessive intake of Grade C foods can be harmful, they are not extremely harmful like Grade D and Grade E foods. Therefore, the increase in the sales of Grade C foods after the intervention was not a bad sign. These results are similar to those of previous studies that concluded that the use of NUTRI-SCORE significantly affects the purchase of healthy foods by consumers (Dubois et al., 2021). In contrast, sales of Group A and Group E foods at the non-sports-facility store showed opposite effects in response to the NUTRI-SCORE intervention. In particular, sales of the healthy (Grade A) foods were reduced, whereas those of the harmful (Grade E foods) were increased. These results show the effects and direction of intervention, which were opposite to the predicted effects. Additionally, Grade B food sales were increased after the intervention. Based on our results from the non-sports-facility store, consumers may not purchase foods with health concerns in mind. The conflicting results may be explained by the existing food preferences of consumers. In both stores, some grades showed no significant effects on outcomes. It is important to remember that consumers purchase food for different purposes, which should be investigated further.

Thus, these findings reflect the characteristics of customers visiting stores located at a sports facility and elsewhere at a university. Based on the results of this study, the consumers' characteristics can be detailed as follows. Those who visited the sports-facility store were likely to have done so before or after exercise. In the sports-facility store, the intervention may have affected sales of Grade B and Grade C foods; therefore,

Table 2
White noise test of A-rated general foods in the sports-facility store.

Autocorrelation Check for White Noise			
To Lag	Chi-Square	DF	Pr > ChiSq
6	104.37	6	<0.0001
12	110.60	12	<0.0001
18	119.79	18	<0.0001
24	146.74	24	<0.0001

Table 3
Residual test of A-rated general foods in the sports-facility store.

Autocorrelation Check of Residuals			
To Lag	Chi-Square	DF	Pr > ChiSq
6	3.04	4	0.5505
12	9.02	10	0.5297
18	16.16	16	0.4419
24	28.86	22	0.1488
30	41.03	28	0.0533
36	45.59	34	0.0884
42	56.77	40	0.0414
48	66.65	46	0.0249

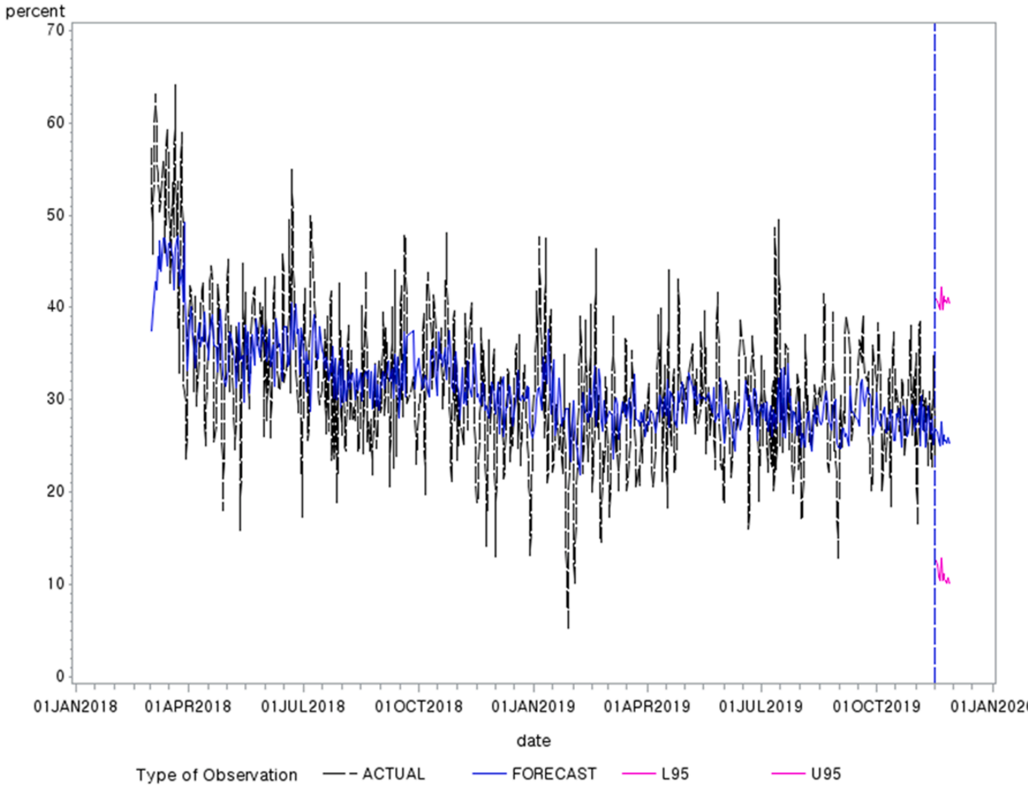

Fig. 1. Grade A beverages: Prediction through ARIMA analysis.

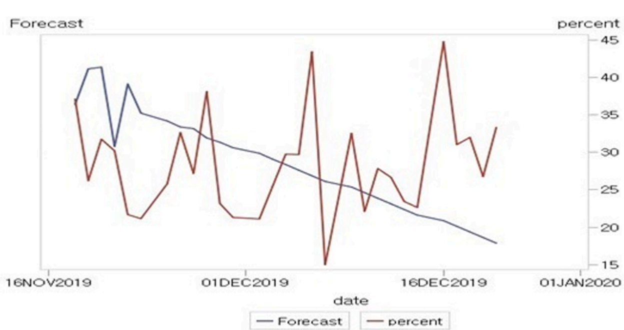

Fig. 2. Predicted and actual sales of Grade A beverages at the sports-facility store.

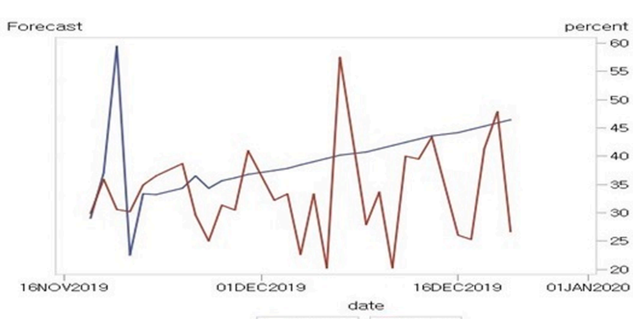

Fig. 3. Predicted and actual values of Grade E beverages at the sports-facility store.

Table 4
Comparison of predicted and actual values over the 5-week intervention.

Comparison of predicted and actual values with *t*-test				
Type of Food Store	Food or Beverage	Food Grade	Predicted Value (%)	Actual Value (%)
Sports facility	Food	A	72.31	70.80
	Food	B**	4.78	6.26
	Food	C**	8.96	10.52
	Food	D	1.97	2.64
	Food	E	12.80	12.20
	Beverage	A	26.89	28.41
	Beverage	B	22.77	22.44
	Beverage	C	11.54	12.30
	Beverage	D	4.09	3.53
	Beverage	E	34.57	33.28
Non-sports facility	Food	A**	32.04	28.43
	Food	B***	9.37	11.37
	Food	C	36.24	37.05
	Food	D	3.71	4.46
	Food	E*	17.14	18.77
	Beverage	A	22.59	20.28
	Beverage	B	16.90	16.70
	Beverage	C	9.66	10.09
	Beverage	D	4.39	4.12
	Beverage	E	46.44	48.69

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

if appropriate interventions are designed, the sales of Grade A foods may also be affected.

This study had several limitations. First, it did not include the demographic data of consumers and assumed that they differed only on the basis of visiting sports facility or non-sports-facility stores. The demographic data were not obtained because of a lack of approval from the store managers, as the collection of demographic data may positively or negatively affect sales. Therefore, future studies should include a large sample size and record the demographic data of consumers. Furthermore, diverse populations of different countries which have various sociodemographic characteristics need to be investigated to overcome the limitation of this study. Second, the calculation system differed between NUTRI-SCORE and the food-labeling system generally used in Korea. The NUTRI-SCORE was based on total calories, fats, saturated fats, sugars, proteins, dietary fibers, and sodium. However, the NUTRI-SCORE does not reflect the trans fats or cholesterol contents, which are important components of foods and beverages sold at Korean food stores. Therefore, an accurate labeling system is required. Third, although this study included data for 2 years, a study with a longer follow-up duration is needed. Longer periods of intervention and monitoring may enhance the validity of the results. Therefore, it is necessary to improve cooperation between school departments and related facilities. This study showed valid statistical data for Grade B and Grade C foods at the store in a sports facility. It is essential to evaluate other factors that could affect these results. In addition, further studies are required to understand why Grade A and Grade E foods in non-sports facilities showed the opposite effect to the predicted values. The intervention used in this study may not have been able to affect the consumption of unhealthy foods in non-sports facilities because fewer people in the non-sports facilities intended to purchase healthy foods.

5. Conclusion

Despite these challenges, this study implies that providing nutritional information on food packaging may improve the nutritional habits of consumers and affect their health. Therefore, analyzing the nutritional composition of food items and indicating this information on the package is important. Furthermore, government or public companies may use our results to improve the national health policy or healthcare system. Food companies can also develop sales and marketing tools based on this study. For example, to promote healthy food intake, manufacturers could promote the consumption of healthy food by displaying nutritional information at food stores near sports facilities, rather than at non-sports-facility stores.

CRediT authorship contribution statement

Chiyoung Ahn: Conceptualization, Methodology, Software, Formal analysis, Writing – original draft. **Chung Gun Lee:** Visualization, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (Dept. of Physical Education in Seoul National University).

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

Abraham, S., Noriega, B.R., Shin, J.Y., 2018. College students eating habits and knowledge of nutritional requirements. J. Nutrition Human Health 2 (1).
Chantal, J., Hercberg, S., Organization, W.H., 2017. Development of a new front-of-pack nutrition label in France: the five-colour Nutri-Score. Public Health Panorama 3 (04), 712–725.
Choi, J., 2020. Impact of stress levels on eating behaviors among college students. Nutrients 12 (5), 1241.
Deschasaux, M., Huybrechts, I., Murphy, N., Julia, C., Hercberg, S., Srour, B., Kesse-Guyot, E., Latino-Martel, P., Biessy, C., Casagrande, C., Jenab, M., Ward, H., Weiderpass, E., Dahm, C.C., Overvad, K., Kyrø, C., Olsen, A., Affret, A., Boutron-Ruault, M.-C., Mahamat-Saleh, Y., Kaaks, R., Kühn, T., Boeing, H., Schwingshackl, L., Bamia, C., Peppa, E., Trichopoulou, A., Masala, G., Krogh, V., Panico, S., Tumino, R., Sacerdote, C., Bueno-de-Mesquita, B., Peeters, P.H., Hjartåker, A., Rylander, C., Skeie, G., Ramón Quirós, J., Jakszyn, P., Salamanca-Fernández, E., Huerta, J.M., Ardanaz, E., Amiano, P., Ericson, U., Sonestedt, E., Huseinovic, E., Johansson, I., Khaw, K.-T., Wareham, N., Bradbury, K.E., Perez-Cornago, A., Tsilidis, K.K., Ferrari, P., Riboli, E., Gunter, M.J., Touvier, M., Zheng, W., 2018. Nutritional quality of food as represented by the FSAm-NPS nutrient profiling system underlying the Nutri-Score label and cancer risk in Europe: Results from the EPIC prospective cohort study. PLoS Med. 15 (9), e1002651.
Dubois, P., Albuquerque, P., Allais, O., Bonnet, C., Bertail, P., Combris, P., Lahlou, S., Rigal, N., Ruffieux, B., Chandon, P., 2021. Effects of front-of-pack labels on the nutritional quality of supermarket food purchases: evidence from a large-scale randomized controlled trial. J. Acad. Mark. Sci. 49 (1), 119–138.
Erdogdu, E., 2007. Electricity demand analysis using cointegration and ARIMA modelling: A case study of Turkey. Energy policy 35 (2), 1129–1146.
Harris, R.I., 1992. Testing for unit roots using the augmented Dickey-Fuller test: Some issues relating to the size, power and the lag structure of the test. Economics letters 38 (4), 381–386.
Kim, H., House, L.A., Rampersaud, G., Gao, Z., 2012. Front-of-Package Nutritional Labels and Consumer Beverage Perceptions. Applied Economic Perspectives and Policy 34 (4), 599–614.
Lee, K.S., Kim, K.N., 1997. Effects of nutrition education on nutrition knowledge, dietary attitudes, and food behavior of college students. Korean J. Community Nutr. 2 (1), 86–93.
Li, W., McLeod, A., 1981. Distribution of the residual autocorrelations in multivariate ARMA time series models. J. Roy. Stat. Soc.: Ser. B (Methodol.) 43 (2), 231–239.
Livingston, E.H., 2004. Who was student and why do we care so much about his t-test? 1. J. Surg. Res. 118 (1), 58–65.
Mhurchu, C.N., Eyles, H., Jiang, Y., Blakely, T., 2018. Do nutrition labels influence healthier food choices? Analysis of label viewing behaviour and subsequent food purchases in a labelling intervention trial. Appetite 121, 360–365.
Olstad, D.L., Vermeer, J., McCargar, L.J., Prowse, R.J., Raine, K.D., 2015. Using traffic light labels to improve food selection in recreation and sport facility eating environments. Appetite 91, 329–335.
Poquet, D., Ginon, E., Goubel, B., Chabanet, C., Marette, S., Issanchou, S., Monnery-Patris, S., 2019. Impact of a front-of-pack nutritional traffic-light label on the nutritional quality and the hedonic value of mid-afternoon snacks chosen by mother-child dyads. Appetite 143, 104425.
Rao, T.S., Gabr, M., 1980. A test for linearity of stationary time series. J. Time Ser. Anal. 1 (2), 145–158.
Scarborough, P., Hodgkins, C., Raats, M.M., Harrington, R.A., Cowburn, G., Dean, M., Doherty, A., Foster, C., Juszczak, E., Matthews, A., Mizdrak, A., Ni Mhurchu, C., Shepherd, R., Tiomotijevic, L., Winstone, N., Rayner, M., 2015. Protocol for a pilot randomised controlled trial of an intervention to increase the use of traffic light food labelling in UK shoppers (the FLICC trial). Pilot and feasibility studies 1 (1), 1–11.
Seward, M.W., Block, J.P., Chatterjee, A., 2016. A traffic-light label intervention and dietary choices in college cafeterias. Am. J. Public Health 106 (10), 1808–1814.
Seyedhamzeh, S., Nedjat, S., Shakibazadeh, E., Doustmohammadian, A., Hosseini, H., Dorosty Motlagh, A., 2020. Nutrition labels' strengths & weaknesses and strategies for improving their use in Iran: A qualitative study. PLoS ONE 15 (10), e0241395.
Thorndike, A.N., Sonnenberg, L., Riis, J., Barraclough, S., Levy, D.E., 2012. A 2-phase labeling and choice architecture intervention to improve healthy food and beverage choices. Am. J. Public Health 102 (3), 527–533.