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# Whether Children Aged 10-12 React to FOP Nutri-Score Labels on the Children's Snack Packaging During the Period of Purchase in China

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## ABSTRACT

*Numerous studies have found that there are many visual design elements on children's food packaging that influence children's tasty, including color, shape, font, size, material, and brand. In recent years, more and more research has found that the role of labeling in food packaging cannot be ignored and is increasingly influencing purchasing behavior to some degree. In addition, there is a gradual upward trend regarding labeling for the improvement of healthy dietary intake of children. This study aims to analyze whether front of packaging (FOP) nutrition labeling on children's snack packaging has a positive effect on the purchasing behavior in China.*

***Keywords:*** *FOP nutria-score label, purchasing behavior.*



## 1 INTRODUCTION

Numerous food product scandals have erupted in China and have since remained in the spotlight in both local and international societies. As a consequence, trust in the Chinese food industry has plummeted, and consumers have little confidence in the quality of food products produced or manufactured in China (Wang, Tao, & Chu, 2020). Besides, with many consumers struggling with health problems related to food consumption, including obesity, diabetes, and heart and coronary problems (Organization, 2018), tackling nutrition- and diet-related health issues has become a major concern for both food marketers and policymakers around the world. One commonly suggested approach to nudging consumers toward healthier food consumption is providing clearer information about the nutritional content of food products (Ikonen, Sotgiu, Aydinli, & Verlegh, 2020). It is not difficult to find that some developed countries are already aware of this problem and have made corresponding countermeasures. For example, it is well known that Chile has been one of the countries with the highest sales of processed foods and beverages (Moubarac, 2015; Popkin & Hawkes, 2016). To confront these trends, the Chilean Law of Food Labeling and Advertising (Law 20.606) was passed in 2012 to improve nutrition information at point of purchase via "easy-to understand" front-of-package (FOP) warning labels4 for packaged food and beverage products with high levels of critical nutrients (sodium, total sugars, and saturated fats) and energy (Kanter, Reyes, Vandevijvere, Swinburn, & Corvalán, 2019). Furthermore, the Nutrition Labeling and Education Act of 1990 provided the U.S. Food and Drug Administration (FDA) with the authority to require U.S. food manufacturers to convey nutrition information on food packaging via a so-called Nutrition Facts Panel (NFP) (Boon, Lichtenstein, & Wartella, 2010). The aim was to improve consumers' ability to access and process all the nutrition information they needed to make health- conscious food choices

(Balasubramanian & Cole, 2002). To help governments and the European Commission make an informed decision when selecting an existing or new FOP labels in Europe, it appears of major importance to investigate in different European countries the relative effectiveness of FOP labels, because the Nutri-Score is being considered in a growing number of countries and is supported by consumers associations and a growing number of food retailers and food manufacturers(Dereń et al., 2021). However, by greatly simplifying nutritional quality into a single score, some important information (e.g., salt for people with high blood pressure) is lost (Temple, 2020). In recent years, a growing number of studies have reported on the negative effects of nutrition labeling. From the experiment of Harris, Hyary, & Schwartz, they found out that label element is another aspect that can be deceptive to influence adults' and children's health and taste perceptions of packaging food (Harris, Hyary, & Schwartz, 2021). Tanemura & Hamadate (Tanemura & Hamadate, 2022) suggesting that too much health information on label can negatively impact consumers' perceptions of food. In addition, food waste at the consumer level is often caused by poor purchasing habits, confusion over labels, excess buying, and poor storage (Dongyu, 2019).

Concern over the negative effects of food marketing on children's health has been steadily climbing since the first systematic review on the topic was published in 2000(Elliott & Truman, 2020). In February 2020, a team of global experts released "A Future for the World's Children"—a report jointly produced by the World Health Organization, UNICEF and The Lancet that outlined "urgent and actionable agendas" to support child health and well-being (Clark et al., 2020). Unhealthy diets are a major burden of disease among children, impeding optimal growth and development (Kupka, Siekmans, & Beal, 2020). Although children's diets are the result of complex interaction of several factors, the role of food environment is increasingly recognized (Downs & Demmler, 2020). It is worth highlighting that children are the most vulnerable audience to the effects of food packaging given that their food choices are mainly driven by pleasure (Pearce et al., 2020). The aim of this study was to find out whether FOP nutria-score label on children's snack packaging has a positive or negative effect on the purchasing behavior of children aged 10-12 years old. Front-of-Pack nutrition Labels (FoPL) have been identified as potential tools to improve the dietary habits of populations and thus help prevent obesity and noncommunicable diseases (Organization, 2004). After examined, Harris, Hyary, & Schwartz state that "Smart Snacks" with label on the package as being healthier but less tasty than the originally packaged "Smart Snacks (Harris et al., 2021). Therefore, it is worth exploring whether adolescents would perceive food packages with nutrition labels as unpalatable and thus reduce their purchasing behavior.

# 2 LITERATURE REVIEW

Children have more buying power than ever and are participating in family decision making to a greater extent than they have in the past (Boland, Connell, & Erickson, 2012). Children under 12 years old constitute a powerful market segment in their own right and are influential in their families' purchase decisions (Darley & Lim, 1986). And McNeal (James Utah McNeal, 1992) also found out that children beyond 9 years old can make their independent purchases using their pocket money. Valkenburg and Cantor (Valkenburg & Cantor, 2001) analyzed the behaviors of children and found out that children aged 8-12 years old is realistic and incisive. Thus, the participants of this study mainly focus on children aged 10-12 years old. Child-appealing marketing for foods and beverages of poor nutritional quality is pervasive (Garton, Swinburn, & Thow, 2021). These marketing practices have been shown to influence children's taste preferences, purchase requests, and consumption patterns (Cairns, Angus, Hastings, & Caraher, 2013). So, child-appealing marketing is contributing to poor diet quality and the growing burden of childhood obesity and diet-related chronic disease (Boyland & Whalen, 2015). At the same time, snacking constitutes a key element of adolescents' food consumption patterns and daily life because snacks are among the first product that youths buy with their own money outside their family environment (Grunert et al., 2016; Nicklaus, Boggio, Chabanet, & Issanchou, 2004) and there has been a noticeable upward trend in snacking over the past decades (Njike et al., 2016). In the US, snacking contributes more energy to young children's diets than any other single meal–currently 29% of daily energy (US Department of Agriculture, 2020) which are

harmful because excessive consumption is associated with increased risk of negative health outcomes (e.g., obesity, hypertension, and cancer) (Chen et al., 2020). Nonetheless, how do adolescents make snack choices during their purchasing behavior? As we know, information and packaging are the most effective way to transmit food healthiness (Festila & Chrysochou, 2018), both have influence on consumers' perceptions and choices (Aagerup, Frank, & Hultqvist, 2019). Especially packaging design elements have an influence on choosing, getting attracted, like, purchase the product and considering packaging as a brand promotion vehicle (Vyas, 2015). In other words, packaging design is the window that speaks to adolescents and conveys messages to them through these designs. Graphic designers can apply design principles in terms of images, color, and typography to create appealing packaging, to illustrate product benefits, and to create a personality for the product. In addition, packaging also needs to establish brand recognition with consumers, who are the target group (Maleki, Amiri Aghdaie, Shahin, & Ansari, 2020). But consumers do not always read all the product information on packaging (e.g., nutrition box, ingredients), whether because they face time pressures or struggle to understand the meaning of the nutrition information (Bartels, Tillack, & Jordan Lin, 2018). To meet the needs of the current market, which cites the increasing importance of easier-to- understand product information (Gomez, Werle, & Corneille, 2017), many countries require FOP labels, and several designs are currently in use (Food & Nations, 2016). Defined as "simplified information about the most important nutritional aspects and characteristics of food" (L'Abbé, McHenry, & Emrich, 2012), FOP labels represent a combined initiative of governments, product manufacturers, and retailers to direct consumers toward healthier food choices (Kelly & Jewell, 2019). FOP labelling must be relevant, clear, and easily understandable to empower consumers to make healthier food choices (Newman, Howlett, & Burton, 2014). The European Union requires the use of FOP nutrition labelling that provides easy information on the nutritional properties and helps consumers to make healthy food choices (Medina-Molina & Perez-Gonzalez, 2021). In Spain, the nutritional information of packaged food labels is established according to the Regulation (EU) No 1169/2011 of the European Parliament and the Council of 25 October 2011, on the provision of food information to consumers (Parliament & Council, 2011).

Food labels are an essential tool for consumers to know the nutritional content and to make better food choices (Kumar & Kapoor, 2017). Specifically, FOP nutritional labelling includes symbols and classifications systems, which summaries the key nutritional attributes of the products in more understandable formats (Bauer & Reisch, 2019). The increased uptake of FOP labeling is concomitant with the increasing amount of research being conducted across different fields about a range of different consumer-relevant outcomes, including the attention consumers pay to the Nutrition Facts Panel, healthfulness and tastiness perceptions, product attitude, identification of healthier options, making healthy choices, purchase intentions of FOP labeled products (Ikonen et al., 2020). In response to this development, a wide variety of FOP labels have been generated, such as Guideline Daily Amounts (GDAs), traffic lights (multiple) (MTL) or their simple version Traffic Light, the International Choices logo, Reference Intakes (RI), Warning symbol, Israeli Warning Label, Health Star Rating (HSR), nutrition grade, keyhole, healthy choice tick and NutriScore(Acton, Jones, Kirkpatrick, Roberto, & Hammond, 2019; Bauer & Reisch, 2019; Crosetto, Muller, & Ruffieux, 2016; Egnell, Talati, Hercberg, Pettigrew, & Julia, 2018; Muller & Prevost, 2016; van der Bend & Lissner, 2019). Compared with the Reference Intakes, the Nutri-Score was the most effective FOP labels in helping consumers identify the foods' nutritional quality in Deren's search (Dereń et al., 2021). Front-of-Pack nutrition Labels (FoPL) have been identified as potential tools to improve the dietary habits of populations and thus help prevent obesity and noncommunicable diseases (Organization, 2004). Yet there has another voice suggests that FOP labels can sometimes mislead consumers and induce an inaccurate assessment of the product's healthfulness, which could result in higher consumption of unhealthy food (Orquin & Scholderer, 2015). As we all know, snacking constitutes a key element of adolescents' food consumption patterns and daily life because snacks are among the first product that youths buy with their own money outside their family environment(Grunert et al., 2016) and the extent to which snack foods have influenced the childhood obesity epidemic is well established(Odoms-Young, Singleton, Springfield, McNabb, & Thompson, 2016) because snacking contributes more energy to young children's diets than any other single meal–currently 29% of daily energy(US Department of Agriculture, 2020). We found that children are becoming more focus target

market for many advertisers, and they are putting their extreme efforts to capture this valuable target market. Most of the advertisers are advertising those foods products which have above the standard level fats, more calories and salt such as confectionery, soft drinks, crisps and savory snacks, fast food and pre-sugared breakfast cereals are included in the daily lives of the children (Haroon, Qureshi, Zia-ur-Rehman, & Nisar, 2011). In fact, “A Future for the World’s Children” joins many other reports, initiatives and policies that affirm the need to protect children from the marketing of foods high in sugar, fat and/or salt (Organization, 2020; Taillie, Busey, Stoltze, & Dillman Carpentier, 2019). Currently, 16 countries have statutory regulations on unhealthy food marketing to children (Taillie et al., 2019). Yet food packaging—a powerful form of advertising to children—requires further attention. Child-targeted food packaging is prevalent, and the nutritional quality of these foods is generally lacking (Elliott & Truman, 2020). Food packages are one of the most important components of the marketing mix of food companies, being the central strategy to target products at children (Ares, Velázquez, Vidal, Curutchet, & Varela, 2022). We can't stop manufacturers from not producing snacks, and we can't stop consumers from not buying snacks, then we can make consumers reduce the frequency of unhealthy snacks through some measures. Such as increasing nutrition score labeling because there has evidence to show that the Nutri-Score label emerged as the most effective FoPL in terms of helping European consumers assess the nutritional quality of products and potentially encouraging them towards healthier food choices (Egnell et al., 2020). But there is little research on the relationship between Nutir- Score label and purchase behavior among children 10–12-year-olds. So, this paper aims to find out whether snacks with nutrition score labels make children feel tasty? Would it make them feel healthy? Whether it affects their purchasing behavior. The impact of FOP Nutri-Score labels on adolescent buying behavior is a research gap that needs to be explored. In this sense, we establish the following hypothesis:

H1: The snack packaging with FOP nutrition score labelling has positive effect on purchase behavior for 10-12 years old children.

According to the experiment of Jianhua Wang, Junying Tao and May Chu, they summarized that the standardized path coefficients for perceived quality, behavioral attitudes, subjective norms, and perceived behavioral control towards behavioral intentions were all positive (Wang et al., 2020). Among them, perceived quality and behavioral attitudes had the most significant effect on consumers' purchase intentions, and subjective norm variables had the least effect on consumers' purchase intentions. This is consistent with previous studies (Dong & Fuller, 2010; Li & Mattsson, 1995; Sweeney & Soutar, 2001). In this research, perceived quality refers to the quality of a product or a service perceived, with the potential for eventually influencing consumers' purchasing decisions (Armstrong & Kotler, 2003; Jin & Gu Suh, 2005). As recommended by other academics (Cronin, Brady, & Hult, 2000), perceived quality (PQ) is a precursor to satisfaction and behavioral intention with potential cues to purchase decisions. Perceived quality, as its name implies, is not necessarily equivalent to the true quality of an object (Garvin, 1983; Rowley, 1998) and is more about perception than fact. On the other hand, "perceived quality" refers not only to consumers' subjective perceptions, but also to the intrinsic quality of the product or service that attracts consumers and ultimately produces results in their purchase decisions (Armstrong & Kotler, 2003; Jin & Gu Suh, 2005)Given that the purpose of this study is to investigate how nutrition score label influence the purchase intentions of 10-12-year-old children's purchase intentions. Specifically, it needed to explore how nutrition score labels affect 10–12-year-old children perceived quality of snacks and thus their purchase intentions.

H2: The snack packaging with nutrition score label on the front have positive effect on perceived quality for 10–12-year-old children.

Perceived behavioral control is the second most influential latent variable towards consumers' intention of purchasing pork with certified labels (Wang et al., 2020). In their tests, it is known that convenience of purchase, consumers' understanding of certification, purchase terms and costs, and their past consumer experiences influence the perceived behavior significantly control, and ultimately purchase intention. According to Li and Zhu (2017), freshness, nutritional value and taste are intrinsic

indicators of perceived quality. In Chen's (2007) study, "taste" and "nutrition" were used to represent "sensory appeal" and "health" factors, respectively. " The present study attempts to examine the role of these three distinct variables in influencing children's purchase intentions.

Regarding the theory of planned behavior, behavioral attitude refers to the positive or negative attitude of an individual towards a specific product, service, or behavior. Behavioral attitude (BA), subjective norms (SN), and perceived behavioral control (PBC), are expected to influence individuals' behavioral intention (Ajzen, 1985). Besides, subjective norms are the interpersonal or social pressure that an individual is exposed to when deciding whether to adopt a certain action. Such as the influence from social groups or significant others (e.g., family, friends and colleagues, and sales promotions) towards consumers when they are making consumption decisions (Wang et al., 2020). This study mainly aims to analyzing the effect of nutrition score labels on children aged 10-12 years, so subjective norms variables are not considered at this time. We can, therefore, assume the following hypothesis:

H3: The snack packaging with nutrition score label on the front have positive effect on behavioral attitude for 10–12-year-old children.

H4: The snack packaging with nutrition score label on the front have positive effect on perceived behavioral control for 10-12-year-old children.

# 3 METHOD

The study involves quantitative research method to investigate the attitude of children10-12 during their purchase snacks with Nutir-Score label on packaging. A sample size of 485 cases was calculated by selecting $\alpha$=0.05 (two-sided test), a certainty=1- $\beta$=0.8, and a smaller effect value of f2 as 0.02 by using Gpower 3.1.9.7 software. An online survey was conducted with children aged 10-12 years old. The researchers showed participants a series of pictures of snacks with and without nutrition score labels, and participants were asked to rate each product based on its perceived quality, behavioral attitudes, and perceived behavioral control (Conner & Norman, 2015). All snack images will be blurred with iconic information such as logos, numbers, ingredients, etc. Participants were asked to rate different types of snack packages on a Likert scale from 1 to 5 where 1 means strongly disagree and 5 strongly agree. Pre-testing was performed according to the original design to ensure that the problem was properly understood and to determining reliability and validity.

# 4 RESULT

**Table 1** Total Variance Explained

| Components | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 5.852 | 39.014 | 39.014 | 5.852 | 39.014 | 39.014 | 4.512 | 30.080 | 30.080 |
| 2 | 2.793 | 18.619 | 57.633 | 2.793 | 18.619 | 57.633 | 3.594 | 23.963 | 54.044 |
| 3 | 1.709 | 11.396 | 69.029 | 1.709 | 11.396 | 69.029 | 2.248 | 14.985 | 69.029 |
| 4 | 0.626 | 4.174 | 73.203 | | | | | | |
| 5 | 0.519 | 3.459 | 76.662 | | | | | | |
| 6 | 0.466 | 3.107 | 79.769 | | | | | | |
| 7 | 0.431 | 2.872 | 82.640 | | | | | | |
| 8 | 0.416 | 2.771 | 85.411 | | | | | | |
| 9 | 0.399 | 2.662 | 88.073 | | | | | | |
| 10 | 0.356 | 2.374 | 90.447 | | | | | | |
| 11 | 0.343 | 2.285 | 92.732 | | | | | | |
| 12 | 0.327 | 2.179 | 94.911 | | | | | | |
| 13 | 0.285 | 1.901 | 96.811 | | | | | | |
| 14 | 0.272 | 1.815 | 98.627 | | | | | | |
| 15 | 0.206 | 1.373 | 100.000 | | | | | | |

According to the principle of eigenvalues greater than 1, three main factors can be extracted from the scale. The cumulative variance contribution rate of these three main factors reached 69.029%, indicating that the amount of information removed was very small and the factor analysis results were reliable.

**Table 2** Rotated Component Matrix

| | Component | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| PQ1 | 0.202 | 0.145 | **0.840** |
| PQ2 | 0.185 | 0.105 | **0.819** |
| PQ3 | 0.067 | 0.179 | **0.841** |
| BA1 | **0.812** | 0.092 | 0.120 |
| BA2 | **0.791** | 0.076 | 0.060 |
| BA3 | **0.753** | 0.072 | 0.165 |
| BA4 | **0.824** | 0.153 | 0.056 |
| BA5 | **0.780** | 0.111 | 0.112 |
| BA6 | **0.722** | 0.172 | 0.168 |
| BA7 | **0.832** | 0.118 | 0.068 |
| PBC1 | 0.173 | **0.798** | 0.056 |
| PBC2 | 0.127 | **0.848** | 0.171 |
| PBC3 | 0.092 | **0.787** | 0.115 |
| PBC4 | 0.107 | **0.862** | 0.134 |
| PBC5 | 0.123 | **0.844** | 0.085 |

Table 2 is a table of rotating factor loads. It can be seen from the table that PQ1-PQ3 has a large load on factor 3, which can be named as perceived quality factor. BA1-BA7 has a large load on factor 1, which can be named Behavioral attitudes factor. PBC1-PBC5 has a larger load on factor 2, which can be named perceived behavioral control factor. The load of each factor is greater than 0.5, and there is no serious cross-load of each item, and each measurement item is clustered under the corresponding factor, which indicates that this scale has good structural validity.

**Table 3** Results of model fitting indicators of the scale

| index | Absolute Fit Index | | Relative Fit Index | | | Parsimony Fit Index | |
|---|---|---|---|---|---|---|---|
| Specific classification | X2/df | RMSEA | IFI | TLI | CFI | PGFI | PNFI |
| Recommended value | <3 | <0.08 | >0.9 | >0.9 | >0.9 | >0.5 | >0.5 |
| Observed value | 2.143 | 0.050 | 0.974 | 0.968 | 0.973 | 0.686 | 0.789 |

Table 3 shows that in terms of the absolute fitting index, the X2/df value is 2.143, which is less than 3. The value of RMSEA is 0.050, less than 0.08. The absolute fit index fits well. From the value-added fitting index the value of IFI is 0.974, which is greater than 0.9. The value of TLI is 0.968, which is greater than 0.9. The value of CFI is 0.973, which is greater than 0.9. The value-added fitting index fits well. From the point of view of reduced fitting index, the value of PGFI is 0.686, which is greater than 0.5. The value of PNFI is 0.789, which is greater than 0.5. The reduced fit index fits well. In general, the indicators of the scale fit well.

**Table 4** Convergence validity of the scale

| Scale | Item | Standardized factor load | CR | AVE |
|---|---|---|---|---|
| Perceived quality | PQ1 | 0.837 | 0.825 | 0.611 |
| | PQ2 | 0.750 | | |
| | PQ3 | 0.755 | | |
| Behavioural attitude | BA1 | 0.792 | 0.909 | 0.588 |
| | BA2 | 0.749 | | |
| | BA3 | 0.726 | | |
| | BA4 | 0.810 | | |
| | BA5 | 0.756 | | |
| | BA6 | 0.716 | | |
| | BA7 | 0.813 | | |
| Perceived behavioural control | PBC1 | 0.756 | 0.901 | 0.646 |
| | PBC2 | 0.855 | | |
| | PBC3 | 0.730 | | |
| | PBC4 | 0.855 | | |
| | PBC5 | 0.814 | | |

Table 4 shows the convergence validity table of the scale. There are three criteria for evaluating the convergence validity: (1) All standardized factor loads should be greater than 0.5; (2) Composition reliability (CR) should be greater than 0.6; (3) The mean variation withdrawal (Ave) was greater than 0.5. It can be seen from the table that the standardized load value of each item in the scale is greater than 0.5, which meets the standard. CR values of perceived quality, Behavioral attitudes and perceived behavioral control are 0.825, 0.909 and 0.901, which are all greater than 0.6. The AVE values were 0.611, 0.588, and 0.646, respectively, which were all greater than 0.5, indicating that the convergence validity of the scale reached the standard.

**Table 5** Discriminant validity test results

| | PQ | BA | PBC |
|---|---|---|---|
| PQ | 1 | | |
| BA | 0.372 | 1 | |
| PBC | 0.372 | 0.325 | 1 |

Note: The bold font on the diagonal is the square root of AVE, and below the diagonal is the correlation coefficient between the latent variables

The correlation coefficients between latent variables are all smaller than the square root of AVE on the corresponding diagonal, indicating that the discriminant validity between variables is good.

**Table 6** Descriptive Statistics

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Perceived quality | 452 | 1 | 5 | 3.769 | 0.796 |
| Behavioral attitudes | 452 | 1 | 5 | 3.867 | 0.807 |
| perceived behavioral control | 452 | 1 | 5 | 3.735 | 0.814 |

Table 6 is a descriptive analysis table. The mean values of perceived quality, Behavioral attitudes and perceived behavioral control are 3.769, 3.867 and 3.735 respectively, all of which are greater than the theoretical median value 3. It shows that the scores of these variables are high.

**Table 7** Correlation analysis

| | PQ | BA | PBC |
|---|---|---|---|
| PQ | 1 | | |
| BA | 0.325*** | 1 | |
| PBC | 0.318*** | 0.300*** | 1 |

Note: ***, ** represent P<0.001 and P<0.05 respectively

Table 7 is the correlation analysis table, PQ and BA showed significant positive correlation (r=0.325, P<0.001), PQ and PBC showed significant positive correlation (r=0.318, P<0.001), BA and PBC showed significant positive correlation (r=0.300, P<0.001).

**Table 8** Difference analysis of Nutrition score label or not for each variable

| | Nutrition score label or not | N | Mean | Std Deviation | t | P |
|---|---|---|---|---|---|---|
| Perceived quality | NO | 194 | 3.411 | 0.827 | -8.726 | 0.000 |
| | YES | 258 | 4.039 | 0.654 | | |
| Behavioral attitude | NO | 194 | 3.577 | 0.944 | -6.543 | 0.000 |
| | YES | 258 | 4.084 | 0.602 | | |
| Perceived behavioral control | NO | 194 | 3.552 | 0.861 | -4.148 | 0.000 |
| | YES | 258 | 3.873 | 0.751 | | |

Table 8 is the difference analysis table of each variable with Nutrition score label or not. Independent sample T-test method is adopted, and the test statistic is t statistic. There is a significant difference in perceived quality (t=-8.726, P<0.001). Specifically, the mean perceived quality without Nutrition score label is 3.411. The mean perceived quality of nutrition label is 4.039, while the perceived quality score of nutrition label without nutrition label is significantly lower than that of nutrition label.

Nutrition score label or not had significant differences in Behavioral attitudes (t=-6.543, P<0.001). Specifically, the mean value of Behavioral attitudes without nutrition label was 3.577. The average score of Behavioral attitudes with nutrition labels is 4.084, and the score of Behavioral attitudes without nutrition labels is significantly lower than that with nutrition labels.

Nutrition score label or not has significant difference in perceived behavioral control (t=-4.148, P<0.001). Specifically, the mean perceived behavioral control without nutrition labels is 3.552, while the mean perceived behavioral control with nutrition labels is 3.873. The perceived behavioral control score without nutrition labels is significantly lower than that with nutrition labels.

**Table 9** Analysis of differences between Gender variables

| | N | Mean | Std. Deviation | t | P |
|---|---|---|---|---|---|
| Perceived quality | 212 | 3.921 | 0.819 | 3.881 | 0.000 |
| | 240 | 3.635 | 0.751 | | |
| Behavioral attitudes | 212 | 3.967 | 0.824 | 2.500 | 0.013 |
| | 240 | 3.778 | 0.782 | | |
| Perceived behavioral control | 212 | 3.929 | 0.831 | 4.886 | 0.000 |
| | 240 | 3.563 | 0.761 | | |

Table 9 shows the difference analysis of variables by Gender. It can be seen from the table that Gender has significant difference on perceived quality (t=3.881, P<0.001). Specifically, the mean perceived quality of Girl is 3.921. The mean perceived quality of Boy is 3.635, while the perceived quality score of Girl is significantly higher than that of Boy.

**Table 10** Difference analysis of variables at different ages

| | | N | Mean | Std deviation | F | P |
|---|---|---|---|---|---|---|
| Perceived quality | 10 | 124 | 3.737 | 0.810 | 0.366 | 0.694 |
| | 11 | 200 | 3.805 | 0.808 | | |
| | 12 | 128 | 3.745 | 0.765 | | |
| Behavioral attitudes | 10 | 124 | 3.883 | 0.849 | 0.077 | 0.926 |
| | 11 | 200 | 3.850 | 0.824 | | |
| | 12 | 128 | 3.877 | 0.742 | | |
| Perceived behavioral control | 10 | 124 | 3.711 | 0.779 | 0.097 | 0.908 |
| | 11 | 200 | 3.752 | 0.872 | | |
| | 12 | 128 | 3.731 | 0.759 | | |

Table 10 shows the difference analysis of variables at different ages. One-way analysis of variance is adopted, and the test statistic is F statistic. As can be seen from the table, there is no significant difference in perceived quality, Behavioral attitudes, and perceived behavioral control among different ages.

**Table 11** Analysis of the difference between different variables caused by label types

| | | N | Mean | Std. Deviation | F | P | LSD |
|---|---|---|---|---|---|---|---|
| Perceived quality | ① Untasty and unhealth | 57 | 3.427 | 0.766 | 5.620 | 0.001 | ①<②、③、④，②<④ |
| | ② Untasty and health | 187 | 3.777 | 0.703 | | | |
| | ③ Tasty but unhealth | 143 | 3.788 | 0.926 | | | |
| | ④ Tasty and health | 65 | 4.005 | 0.671 | | | |
| Behavioral attitudes | ① Untasty and unhealth | 57 | 3.870 | 0.688 | 2.374 | 0.070 | |
| | ② Untasty and health | 187 | 3.753 | 0.826 | | | |
| | ③ Tasty but unhealth | 143 | 3.966 | 0.871 | | | |
| | ④ Tasty and health | 65 | 3.974 | 0.660 | | | |
| Perceived behavioral control | ① Untasty and unhealth | 57 | 3.554 | 0.818 | 2.465 | 0.062 | |
| | ② Untasty and health | 187 | 3.674 | 0.793 | | | |
| | ③ Tasty but unhealth | 143 | 3.848 | 0.852 | | | |
| | ④ Tasty and health | 65 | 3.822 | 0.758 | | | |

Table 11 is the difference analysis of label type on each variable. It can be seen from the table that label type has significant difference on perceived quality (F=5.620, P<0.01). The perceived quality scores of untasty and unhealth are significantly lower than those of untasty and health, Tasty but unhealth, Tasty and health. The score of untasty and health is significantly lower than that of Tasty and health.

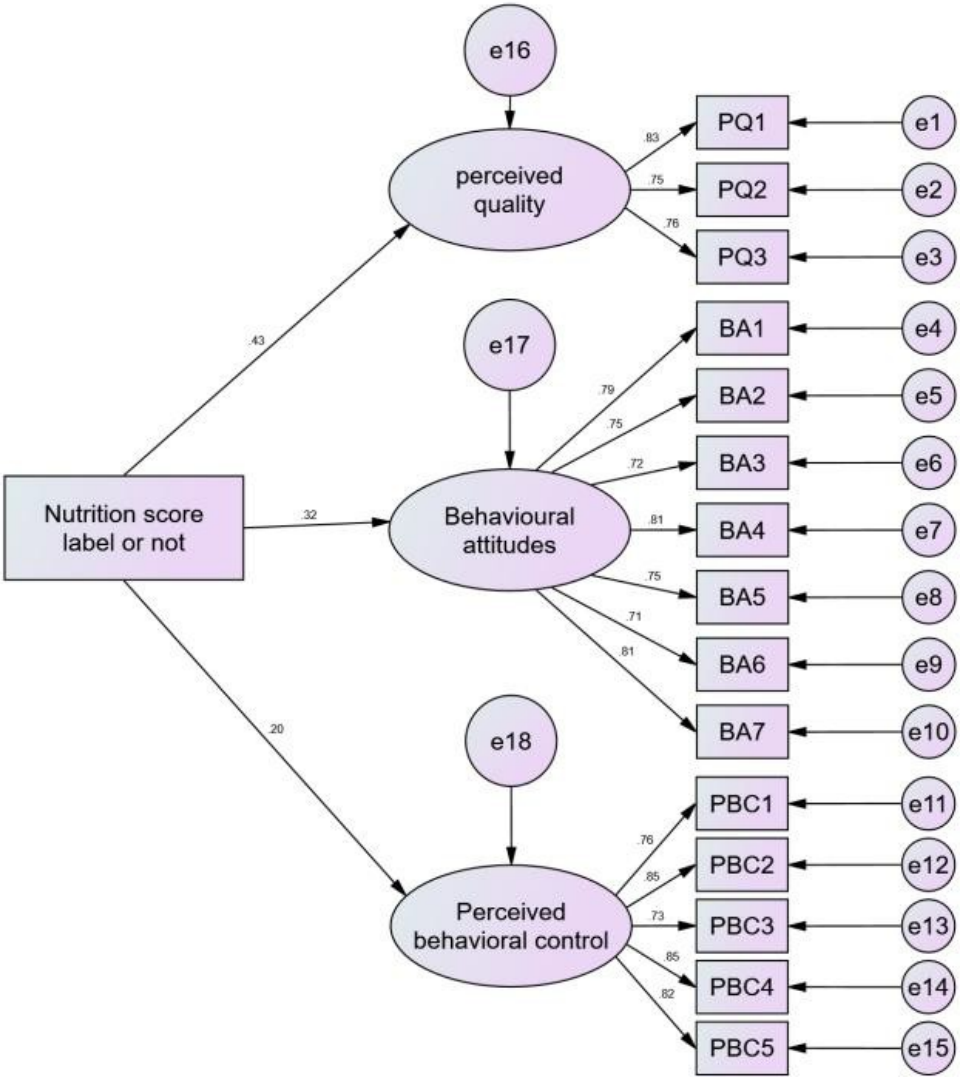


**Figure 1** Structural equation model

**Table 12** Results of fitting indicators of the model

| index | Absolute fit index | | Relative fit index | | | Parsimony fit index | |
|---|---|---|---|---|---|---|---|
| Specific classification | $X^2$/df | RMSEA | IFI | TLI | CFI | PGFI | PNFI |
| Recommended value | <3 | <0.08 | >0.9 | >0.9 | >0.9 | >0.5 | >0.5 |
| Observed value | 2.742 | 0.062 | 0.954 | 0.946 | 0.954 | 0.695 | 0.790 |

Table 12 is the model fit table. It can be seen from the table that, in terms of absolute fitting index, X2/df value is 2.742, which is less than 3. The value of RMSEA is 0.062, less than 0.08. The absolute fit index fits well. From the value-added fitting index, the value of IFI is 0.954, which is greater than 0.9. The value of TLI is 0.946, which is greater than 0.9. The value of CFI is 0.954, which is greater than 0.9. The value-added fitting index fits well. In terms of the parsimony fitting index, the value of PGFI is 0.695, which is greater than 0.5. The value of PNFI is 0.790, which is greater than 0.5. The reduced fit index fits well. In general, the indicators of the scale fit well.

**Table 13** Path analysis

| path | | | estimate | S.E | C.R | P | β |
|---|---|---|---|---|---|---|---|
| Perceived quality | ← | Nutrition label or not | 0.678 | 0.078 | 8.718 | *** | 0.430 |
| Behavioral attitude | ← | Nutrition label or not | 0.525 | 0.078 | 6.714 | *** | 0.324 |
| Perceived behavioral control | ← | Nutrition label or not | 0.283 | 0.069 | 4.090 | *** | 0.201 |

The path coefficient of Nutrition label or not on perceived quality is significantly positive ($\beta$=0.430, P<0.001(Table 13), which proves hypothesis H2: The snack packaging with nutrition score label on the front have positive effect on perceived quality for 10–12-year-old children was founded.

The path coefficient of Nutrition label or not toward Behavioral attitudes was significantly positive ($\beta$=0.324, P<0.001), proving hypothesis H3: The snack packaging with nutrition score label on the front have positive effect on behavioral attitude for 10–12-year-old children was founded.

The path coefficient of Nutrition label or not on perceived behavioral control is significantly positive ($\beta$=0.201, P<0.001), proving hypothesis H4: The snack packaging with nutrition score label on the front have positive effect on perceived behavioral control for 10–12-year- old children are established.

# 5 DISCUSSION

We can conclude from the experiment that children are also becoming concerned about the healthiness of snacks. They will use the nutrition score label to determine whether the snack is healthy or not, so that they can choose delicious and healthy snacks. Specifically, the nutrition score label has the most significant effect on children's perceived quality, followed by the influence on children's behavioral attitudes and behavioral intentions, which increases children's purchase behavior. In other words, when a snack package has a nutrition score label, children will consciously buy the snack thinking it is healthy, even though it is not as healthy as they think it is. Therefore, it is necessary for food regulators to strengthen and improve the eligibility of snack packaging containing nutrition score labels. The conclusions also showed that girls scored higher than boys on all three variables, meaning that girls were more likely to be influenced by labels and thus make purchases. For children who are just starting to have their own pocket money (10-12 years old), it is seen that different variables such as age, education level, and frequency of snack purchases do not have a significant effect.

# LIMITATION

This study was conducted on the effect of nutrition score labels on children's snack purchasing behavior, so the effect of subjective norms was not considered in this analysis. This limitation could be analyzed in future studies to gain a more comprehensive understanding of the effects of labeling on children.

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## AUTHOR CONTRIBUTIONS

All authors played equal contributions to the production of this paper.

## CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest with any individuals or organizations that could potentially influence the findings, or the interpretation of the results presented in this publication.

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