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# Benefits of Product Infographic Labeling on Meat Packaging

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## Abstract

This study examined the benefits of additional extrinsic cues on meat packaging and the influence of informative content labels on consumer's perception based on product quality. A total of 227 participants were shown various fresh meats packaging labels, termed "product infographic labeling" in the experimental stages of both design and content created as ordinary labeling. We conducted a survey, which was followed up with interviews to help analyze customer behavior and other ideas and beliefs. In addition, we conducted tests and collected and analyzed data to indicate and identify significant points showing additional extrinsic cues pertaining to product information by using repeated analysis of variance (ANOVA) and additional analysis through the eye-tracking data method. The analyzed eye-tracking data showed that visual attention was significantly devoted to an additional infographic label. When these additional data were analyzed through the ANOVA method we discovered that the infographic approach on meat packaging positively influenced consumer's perception of product quality. Furthermore, the research discovered that the proportionality ratio of an area of interest on meat packaging affects how consumers interpret and process product quality. Additionally, an infographic labeling approach for meat packaging can decrease average time consumption on consumers' purchasing behavior of meat products by 53.55%. As a result, we provide a design reference for meat product labeling and positioning placement to promote consumers' perception of product quality. These findings lend valuable data that highlight how infographic labeling design has a greater impact on general product evaluation and quality expectations.

**Keywords:** product infographic labeling, meat product quality, consumer's perception

## 1 Introduction

Product decision-making is influenced by a complex set of variables that go beyond the product's characteristics [1]. Product labeling and packaging have become critical factors, in how consumers are influenced when deciding to purchase items. For example, a consumer's buying behavior is influenced by personal preference, cultural background, social movement, and psychological factors [2]. In general, functions of packaging are categorized into two primary elements: (1) physical elements and (2) communicative elements. While the packaging's physical structures are ensuring the facility of usage, transport, storage, and disposal process, respectively [3], communication features, on the other hand, are an initial point of contact between consumers and suppliers. The product packaging's communicative element is divided into visual elements and information elements [4],[5]. Visual elements consist of colors and images, while information elements relate to particular instruction and use of the product. In many cases, consumers rely on a specific set of information on packaging labels to determine the intention of demand [6],[7]. With the development of the trading industries, product circulation has increased rapidly, therefore placing more importance on product packaging and labeling strategies.

These have been investigated not only from a marketing perspective but, also for their design elements. Packaging design has been widely studied, especially in the area of visual cues that most impact consumers' attention and attitude [8],[9], the effectiveness of presented product infographic labeling on users' attraction [10],[11], an interrelation of language characteristic with the product's value [12], the effect of proportion and ratio on packaging design [13], and the influence of packaging colors to suit the consumers' preference [14].

In general, to acquire products, consumer purchase ideas are based on factors related to the product itself, including expected quality, perception of the product's intrinsic and extrinsic cues, and personal satisfaction and product's cost [15]. In the design field, product packaging design is considered a critical element for distinguishing one from another, influencing consumers' purchasing decision. Because of the location of the label and positioning of the product, which relate to the label's size and ratio, design elements have played a significant role in a consumer's decision making [16]. This refers to a set of processes by which an individual becomes aware of and interprets information concerning meat

products. However, since relatively few studies have illustrated the relationship between the communicative elements on the product's packaging and the perception of the product's quality, a research gap exists. Consumers often locate a certain product based on their visual perception, and their interpretation focuses on the expected quality of the product in advance; the perceived product quality is usually different after consumption following their decision [17]. Foods are nondurable products, and buying groceries is an essential part of everyday life. Unlike typical food packaging, fresh food packaging is mostly designed for in-house branding products, revealing little to no influence on marketing and branding. Significant numbers of products in the market rely on extrinsic cues, and the information provided falls back on self-explanation. This study recognizes that consumer satisfaction is based on their interpretation of the product's physical characteristics, the communication around the product, or the combination of both [18]. In most countries, fresh food and pre-packaged food products require a food label that displays obligatory information including name, ingredients, quantitative declaration, and price. In many cases, a consumer's reliance on a product's visual appearance may follow from either a lack of relevant information or an overwhelming abundance of information. Under these circumstances, a product's packaging and labeling bring about certain effects influencing how consumers make purchasing decisions because they allow consumers to make an inference about the quality and type of product [19]. In a study conducted to evaluate the link between product design and consumer behavior, results showed that a creative and complex design will cause most consumers to be more willing to purchase one product over another. In contrast, additional buying behaviors of modern consumers affect the sales of goods, for example; buyers are often looking for a way to reduce time spent on food shopping and food preparation [20].

## 2 Previous Studies

In the previous experiment, a variation of fresh meat packaging prototype with a labeling design was created to be used for study as testing subjects (Figure 1). To investigate the influence of extrinsic cues that affects a consumer's perception of product quality, sets of the label samples were created under the different approach in design variation to test the influence of infographic labeling, multi-labeling, differentiation of colors printing and black and white of the label, and the orientation and alignment of the label to define the extent of visual perception of product labeling that can promote the visual perception of product quality. An analysis from the eye-tracking data of 24 participants, along with an in-depth interview regarding the participant's selection, suggested that extrinsic cues on fresh food packages are identified as an optimal influence of the consumers' perception of product quality.

The overall results revealed that multi-labeling and infographic labeling on packaging significantly affected the participant's perception of product evaluation. The extrinsic cues increased the awareness of consumer behaviors as part of

a decision-making process [21]. The packaging label allows them to distinguish one product from another. However, we realized that to discover and obtain a more comprehensive conclusion, the coordination of infographic labeling and multi-labeling will help further explain the significance of such integration. As part of this, exploration and experiment on the differentiation of infographic label design characteristics, linguistic labels, labeling size, labeling positioning, and orientation need further investigation in order to explore and provide a design reference for fresh food labeling and positioning to promote consumers' perception of product quality.



**Figure 1** Previous Experiment on Extrinsic Cues on Fresh Food Packaging

In the consumers' evaluation process of a product, it is standard practice to begin with the categorization of the product's extrinsic and intrinsic cues. The purpose of the research is to define the extent of visual perception of product labeling that can promote the visual perception of product quality more specifically, to what variation in label styles bring impact subsequences of quality aspect. As in this case, the visual and information elements are combined in compliance with regulations of food packaging industries. Generally, consumers do not regard sales packaging as separate from the food product it contains [22]. For this reason, the research explored aspects of label design, including graphics and related information, that influence consumers' perception of product quality. This study aims to explore the influence of graphical elements on fresh food packages due to the perception of product quality. More specifically, the research explored the influence of meat product labeling design with graphic information, labeling placement, ratio, and size of labeling.

It is important to note that the concept of proportion has a significant role in the art and design aspect. In food-related products industries, labeling is undoubtedly a key element to create certain ratios and define an aspect consequently describing the proportion on the package. The required obligatory information of food products must be displayed on the label as an industry regulation. The label is used to specifically identify which product matches the consumers'

needs since the label allows buyers to distinguish one product from another. A significant visual element for identifying labels is where the label overlays the product in the meat package, in the foreground. It is certain that various effects due to the placement and positioning of the labeling in relation to package size and shape exist. In addition, in the design field, the concept of proportion has a significant role in art and design aspects.

One of the most frequently used methodologies, applied to a broad range of fields, from architectural design to artistic work, is known as the "golden ratio". Evidence of 1:1.618 can trace back to the time of the ancient period. In the academic-related field, an application of the golden ratio to consumers' buying behavior has been explored and analyzed [23],[24]. However, relatively few studies have focused on applying the golden ratio to investigating the perception of product quality. For this reason, this research explored the influence of the golden ratio-based design placement and size of meat packaging labeling on the perception of product quality.

The basis of this study is formulated on previous research and literature and other recognized label design characteristics for the purpose of meat packaging and labeling, which recognize mainstream international standards and regulations. We believe that the results from this study would provide useful information to designers and producers, enabling them to determine the most effective informative elements to apply to their fresh meat products. Specifically, these findings will also help designers and manufacturers choose a suitable design that could influence consumers' perception related to products' quality, within a designated market.

# 3 Proposed Method

## 3.1 Procedures

In this research, we used a variation of fresh meat packaging prototype with labeling design created using Adobe Illustrator and Adobe Photoshop as testing subject; we intended to determine the participants' investigation procedure and perception of design differentiation, as shown in Figure 2. A testing subject is defined as a made-up meat product commonly found on the shelf of a supermarket that resembles and replicates food labeling, including imagery and information. The testing subject has been used as part of online questionnaires (200 participants: Group A) and paper format (27 participants: Group B). The questionnaire survey was conducted over a period of 21 days, (January 5 -26, 2021). An online survey questionnaire can be found at shorturl.at/GQVY1.

To investigate the influence of extrinsic cues that affects a consumer's perception of product quality, five sets of the label samples representing beef, pork, and chicken products were created under the different design approach by applying the golden ratio principle, including TA: ordinary labeling; TB: graphical labeling with 38.22 % area coverage (golden ratio proportion and placement labeling); TC: graphical labeling with 38.22 % area coverage (golden ratio proportion center placement labeling); TD: graphical labeling with 61.78 % area

coverage (contradiction of golden ratio proportion center placement labeling); and TE: graphical labeling with 100 % of area coverage (Figure 2).
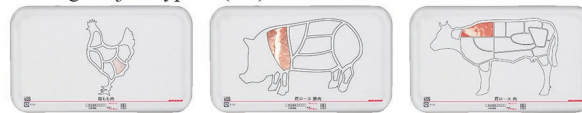


**Figure 2** Testing Samples TA, TB, TC, TD, and TE

## 3.2 Data Collection

Participant groups A and B comprised individuals from three different countries Japan, China, and Thailand in order to acquire international perceptions and views. To avoid any deviations in the results, the respondents included those who did not know Japanese characters. A total of 227 participants were asked to evaluate a testing sample composed of 108 males and 119 females. The age range of participants was between 18 and 64 years of age as they are prospective consumers that buy groceries as an essential part of everyday life. A variation of labeling design was created to test the influence of product infographic labeling, size of labeling, and placement of labeling, respectively.

### 3.2.1 Data Set (1) Collection

For the collection of data collection set (1), 200 participants (Group A) were asked to rate the extension in which the labeling design approach affects their perception in seven criteria: (1) design aspect, (2) reliable aspect, (3) recognizability aspect, (4) product value, (5) attractiveness, (6) personal satisfaction, and (7) communication ability. A Likert scale [25] was used for each sample ranging from 1 to 5 (1 being the lowest ranking and 5 being the highest ranking) in order to determine the effect of the labeling design approach and labeling placement on the consumers' perception of product quality. The data obtained from data set (1) were analyzed through a repeated measures ANOVA method and a pairwise comparison method to identify aspects of label design,

including graphics and related information that influence the consumers' perception of product quality accordingly.

## 3.2.2 Data Set (2) Collection

Data collection set (2) for Group B recorded a total of 27 evaluation processes on testing sample tasks, which were analyzed through (a) an eye-tracking device, and (b) an in-depth interview regarding the participant's selection. During the experiment, the differentiation between focusing time and visit count for each sample was recorded by the eye-tracking device and later analyzed using the visual attention method and the ANOVA method regarding the evaluation process performed by each of the participants. A proposed interview was set up as a qualitative measure after the survey responses were evaluated to expand our scope of understanding and after the initial testing was conducted using the visual detection method. The interview asked follow-up questions to ask participants more in-depth questions concerning their perception of label information and other imagery displayed. The purpose was to determine what aspects of labeling influenced them when differentiating between the levels of product quality. These responses would offer valuable support to our initial investigation of visual detection so that we could make a connection between the type of labels and the design features that were appealing and influenced our participants in the product evaluation process, thus aiding in understanding the benefits of additional extrinsic cues on meat packaging.

## 4 Results

### 4.1 Data Set (1) Group A Results

An analysis to determine preferences from the sample data preference regarding the different labeling designs on meat packaging have been categorized into seven sections included (1) design aspect, (2) reliable aspect, (3) recognizability aspect, (4) product value, (5) attractiveness, (6) personal satisfaction, and (7) communication ability. To investigate what impacted the participants' product quality perception, the result from 200 respondents (Group A) was analyzed through the repeated measure ANOVA method with significance at 0.05. On design aspect (1), the analysis of its characteristics revealed a statistical significance between all five testing samples ($p = .001 < 0.05$). These findings revealed that the different approaches on the labeling design of meat packaging are optimally affected by the participants' perception of design appreciation. The result from the analysis showed that the infographic labeling approach (TB type) had the highest mean rate at 3.950, while the ordinary design label (TA) had the lowest mean rate at 1.995 score points, as shown in Table 1. To understand the differentiation of design aspects between labeling types, the pairwise comparison method was applied to determine the difference in the design appreciation aspect. As shown in Table 2, the multiple comparisons of design appreciation rates between non-infographic label (TA) and infographic label (TB, TC, TD, and TE) indicated a significant difference in the participants' preference for a design aspect. However, the multiple comparisons between testing samples

TC, TD, and TE showed no significant differences.

**Table 1** Repeated Measures ANOVA Analysis for TA, TB, TC, TD, and TE (Participant Group A)

| Type (N) | Design (M) | Reliability (M) | Rec-ognizability (M) | Value (M) | Attractive (M) | Satisfaction (M) | Com-unication (M) |
|---|---|---|---|---|---|---|---|
| TA (200) | 1.995 | 2.960 | 2.960 | 2.665 | 2.420 | 2.875 | 3.235 |
| TB (200) | 3.950 | 3.890 | 4.070 | 3.825 | 3.985 | 3.970 | 4.255 |
| TC (200) | 3.660 | 3.570 | 3.620 | 3.605 | 3.575 | 3.365 | 3.730 |
| TD (200) | 3.770 | 3.350 | 3.555 | 3.355 | 3.500 | 3.200 | 3.450 |
| TE (200) | 3.710 | 2.665 | 3.145 | 2.960 | 3.165 | 2.615 | 2.955 |
| df | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 |
| P-value | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |

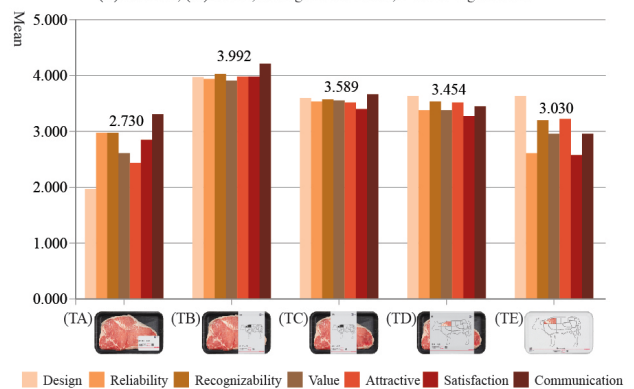(N): Number; (M): Mean; df: degree of freedom; P-value: Significance

**Figure 3** Testing Samples TA, TB, TC, TD, and TE Rating Results Presented in Bar Charts (Participant Group A)

**Table 2** Pairwise Comparison on Design Preference

| | | | | | 95% Confidence Interval for Difference | |
|---|---|---|---|---|---|---|
| (I)Type | (J)Type | Mean difference (I-J) | Std.Error | P-value | Lower Bound | Upper Bound |
| TA | TB | -1.955* | .094 | <.001 | -2.223 | -1.687 |
| | TC | -1.665* | .107 | <.001 | -1.969 | -1.361 |
| | TD | -1.775* | .124 | <.001 | -2.126 | -1.424 |
| | TE | -1.715* | .134 | <.001 | -2.096 | -1.334 |
| TB | TC | .290* | .067 | <.001 | .098 | .482 |
| | TD | .180 | .088 | .426 | -.070 | .430 |
| | TE | .240 | .107 | .258 | -.063 | .543 |
| TC | TD | -.110 | .083 | 1.000 | -.346 | .126 |
| | TE | -.050 | .095 | 1.000 | -.319 | .219 |
| TD | TE | .060 | .094 | 1.000 | -.207 | .327 |

P-value: Significance; *.The mean difference is significant at the .05 level.

In the scope of reliability (2), the analysis result on product reliability is showed in Table 1, revealing a statistical significance in the different design approaches to meat packaging labels. The highest mean rate score from the 200 participants belonged to labeling design type TB at 3.890 scale points. The multiple comparisons of product reliability were significant between TA -TB, TA -TC, and TA -TD ($p = .001 < 0.05$). However, the comparison between ordinary meat packaging's labeling designs (TA) and the 100% coverage labeling approach (TE) showed no significant difference ($p$

= .135 < 0.05). This finding suggests that infographic labeling on a meat product can promote the products' reliability. However, the limitation of the visual field where the labeling stamp placement covered most of the packaging's surface area (TE) dramatically decreases the reliability of the product with the lowest mean rate score points of evaluation at 2.665. The multiple comparison results, as shown in Table 3, indicated the descending order of the reliability of the design method for meatpacking labels, which can be placed in order as TB, TC, and TD, while TA and TE are the least reliable labeling design approaches.

**Table 3** Pairwise Comparison on Product Reliability

| Reliability | | | | | | |
|---|---|---|---|---|---|---|
| | | Mean difference | | | 95% Confidence Interval for Difference | |
| (I)Type | (J)Type | (I-J) | Std.Error | P-value | Lower Bound | Upper Bound |
| TA | TB | -.930* | .084 | <.001 | -1.168 | -.692 |
| | TC | -.610* | .097 | <.001 | -.885 | -.335 |
| | TD | -.390* | .120 | .013 | -.730 | -.050 |
| | TE | .295 | .118 | .135 | -.041 | -.631 |
| TB | TC | .320* | .066 | <.001 | .133 | .507 |
| | TD | .540* | .091 | <.001 | .282 | .789 |
| | TE | 1.125* | .199 | <.001 | .944 | 1.506 |
| TC | TD | .220* | .068 | 0.14 | .027 | .413 |
| | TE | .905* | .089 | <.001 | .652 | 1.158 |
| TD | TE | .685* | .090 | <.001 | .429 | .941 |

P-value: Significance; *.The mean difference is significant at the .05 level.

The further analysis on the influence of extrinsic cue affecting the perception of product quality was focused on the scope of product recognizability dimension (3). In this study, five different label design methods were tested, as shown in Figure B. The results of the repeated measures ANOVA analysis (Table 1) showed that, the highest mean rate of product recognizability aspect appertained to the TB sample, scoring an average of 4.070, and the lowest score appertained to the TA sample at 2.960 score points. The multiple comparison results shown in Table 4 allege the design approach of a TB sample to the product recognizability aspect. The recognizability rate between label TB to TA, TC, TD, and TE were statically significant ($p = .001 < 0.05$). The further analysis on the multiple comparison results indicated that the TB label acquires the highest rate in the recognizability aspect, followed by TC. However, no significant difference was detected in the multiple comparisons between TA, TD, and TE.

The continual analysis of the repeated measures ANOVA results displayed in Table 1 illustrated the different perception aspects of the product value (4). The evaluation of results on product value reached a top rate of 3.825 score points on labeling type TB, followed by TA (3.665), TC (3.605), TD (3.355), TE (2.960), and TA (2.665), respectively. The results from cross-analysis between samples are shown in Table 5; it was suggested that the descending sort of design approach on consumers' perception of product value can be defined as TB, TC, and TD, respectively, although the comparison on testing subjects TA and TE showed no significant difference (Md = -.295, $p = .107 > 0.05$). The overall results suggested the benefits of an infographic labeling approach to meat products with regards to the perception of product value. However, in a specific approach to TE, where the participants' perception of

the contained products was limited to the size of the attached label, the perception of product value consequently subsided.

**Table 4** Pairwise Comparison on Product Recognizability

| Recognizability | | | | | | |
|---|---|---|---|---|---|---|
| | | Mean difference | | | 95% Confidence Interval for Difference | |
| (I)Type | (J)Type | (I-J) | Std.Error | P-value | Lower Bound | Upper Bound |
| TA | TB | -1.110* | .118 | <.001 | -1.444 | -.776 |
| | TC | -.660* | .124 | <.001 | -1.012 | -.308 |
| | TD | -.395* | .136 | .042 | -.782 | -.008 |
| | TE | -.185 | .143 | 1.000 | -.591 | .221 |
| TB | TC | .450* | .108 | <.001 | .143 | .757 |
| | TD | .715* | .109 | <.001 | .405 | 1.025 |
| | TE | .925* | .124 | <.001 | .574 | 1.276 |
| TC | TD | .265* | .078 | 0.08 | .043 | .487 |
| | TE | .475* | .108 | <.001 | .169 | .781 |
| TD | TE | .210 | .092 | .236 | -.051 | .471 |

P-value: Significance; *.The mean difference is significant at the .05 level.

**Table 5** Pairwise Comparison on Product Value

| Value | | | | | | |
|---|---|---|---|---|---|---|
| | | Mean difference | | | 95% Confidence Interval for Difference | |
| (I)Type | (J)Type | (I-J) | Std.Error | P-value | Lower Bound | Upper Bound |
| TA | TB | -1.160* | .085 | <.001 | -1.403 | -.917 |
| | TC | -.940* | .097 | <.001 | -1.214 | -.666 |
| | TD | -.690* | .101 | <.001 | -.976 | -.404 |
| | TE | -.295 | .114 | .107 | -.620 | .030 |
| TB | TC | .220* | .057 | .002 | .058 | .382 |
| | TD | .470* | .078 | <.001 | .248 | .692 |
| | TE | .865* | .094 | <.001 | .598 | 1.132 |
| TC | TD | .250* | .070 | 0.04 | .052 | .448 |
| | TE | .645* | .086 | <.001 | .402 | .888 |
| TD | TE | .395* | .087 | <.001 | .149 | .641 |

P-value: Significance; *.The mean difference is significant at the .05 level.

The results in Table 1 show that, the visual appeal has been measured and displayed under an attractive category (5). The order of attractive mean rates is 3.985 for the TB design, 3.575 for TC, 3.500 for TD, 3.165 for TE, and 2.420 for TA. The analysis through the pairwise comparison method in Table 6 highlighted that the infographic label on meat packaging design has a significant role in a visual perception aspect. The comparison between ordinary labels (TA) to infographic labels (TB, TC, TD, and TE) showed a significant difference ($p = 0.001 < 0.05$). The analysis noted an important aspect of infographic label design in the perception of attractiveness. To determine which approach for meat product labeling is the most appealing, these results suggested that the golden ratio proportion label placement on TB had a significantly higher attractive rate of appreciation than TC, TD, and TE ($p = 0.001 < 0.05$). However, the center placement of the labeling design approach in TC and TD showed no significant difference ($p = 1.000 > 0.05$). This finding suggested that the label design approach proceeding from the principle of the golden ratio in both size and placement will most likely promote an appreciation of visual perception. The critical finding in label placement in the comparison of TB and TC showed that both labels are identical in size; however, the center placement of the TC sample decreases one's appreciation of product attractiveness, and the comparison of TB and TC on product attractiveness showed a significant difference (Md = .410, $p = .001 < 0.05$). The multiple comparison results, as shown in Table 6, indicated that the descending order of product

attractiveness to the design approach taken for meat packaging labels is TB, TC, TD, TE, and TA.

**Table 6** Pairwise Comparison on Product Attractive

| | | Attractive | | | | |
|---|---|---|---|---|---|---|
| | | | | | 95% Confidence Interval for Difference | |
| (I)Type | (J)Type | Mean difference (I-J) | Std.Error | P-value | Lower Bound | Upper Bound |
| TA | TB | -1.565* | .086 | <.001 | -1.810 | -1.320 |
| | TC | -1.155* | .091 | <.001 | -1.414 | -.896 |
| | TD | -1.080* | .114 | <.001 | -1.404 | -.756 |
| | TE | -.745* | .121 | <.001 | -1.088 | -.420 |
| TB | TC | .410* | .068 | <.001 | .218 | .602 |
| | TD | .485* | .086 | <.001 | .242 | .728 |
| | TE | .820* | .107 | <.001 | .515 | 1.125 |
| TC | TD | .075 | .082 | 1.000 | -.159 | .309 |
| | TE | .410* | .104 | <.001 | .113 | .707 |
| TD | TE | .335* | .090 | .003 | .079 | .591 |

P-value: Significance; *.The mean difference is significant at the .05 level.

The repeated measures ANOVA method for the testing samples showed the highest satisfaction mean rate at 3.97 score points for the label design type TB and the lowest rate for type TA at 2.875 score points. The cross-comparison between subjects indicated that label design types TB, TC, and TD promoted more significant product satisfaction compared to the ordinary label (TA). However, in the design approach, where most visual ability of the contained product was obstructed by the labeling tag (TE) the satisfaction rate compared showed no significant difference with the ordinary labeling design (TA -TE: Md = .260, $p$ = .106 > 0.05).

**Table 7** Pairwise Comparison on Product Satisfaction

| | | Satisfaction | | | | |
|---|---|---|---|---|---|---|
| | | | | | 95% Confidence Interval for Difference | |
| (I)Type | (J)Type | Mean difference (I-J) | Std.Error | P-value | Lower Bound | Upper Bound |
| TA | TB | -1.095* | .076 | <.001 | -1.311 | -.879 |
| | TC | -.490* | .093 | <.001 | .755 | -.225 |
| | TD | -.325* | .107 | .028 | .630 | -.020 |
| | TE | .260 | .101 | .106 | -.026 | .546 |
| TB | TC | .605* | .069 | <.001 | .408 | .802 |
| | TD | .770* | .088 | <.001 | .521 | 1.019 |
| | TE | 1.355* | .097 | <.001 | 1.079 | 1.631 |
| TC | TD | .165 | .073 | .254 | -.043 | .373 |
| | TE | .750* | .092 | <.001 | .489 | 1.011 |
| TD | TE | .585* | .090 | <.001 | .329 | .841 |

P-value: Significance; *.The mean difference is significant at the .05 level.

One of the essential factors in the existence of packaging labels is to communicate between suppliers and consumers; for this reason, the study measured product communication ability (7), as shown in Table 1. The result indicated that info graphic label design label (TB) received the highest score point rate in a product communication evaluation, with a mean rate of 4.255 score points and with an average mean of 18.26% above another testing subject. The pairwise comparison of product communication (Table 8) displays the mean difference between each type. The results suggested that the info graphics on label design types TB and TC had a significantly higher mean average in product communication than TA ($p$ = 0.001 < 0.05). However, the comparison of the ordinary label (TA) with the enlarged graphic label samples TD (61.78% of surface area coverage) and TE (100% of surface area coverage) was not statically significant (TA-TD, $p$ = .905 > 0.05; TA-TE, $p$ = .382 > 0.05). This finding indicated

a transformation of the product's information into a form of graphics promoting an ability to understand the contained product. However, the participants' perception of the product did not only rely on the information of products but also cohesively with the actual product itself.

**Table 8** Pairwise Comparison on Product Communication

| | | Communication | | | | |
|---|---|---|---|---|---|---|
| | | | | | 95% Confidence Interval for Difference | |
| (I)Type | (J)Type | Mean difference (I-J) | Std.Error | P-value | Lower Bound | Upper Bound |
| TA | TB | -1.020* | .098 | <.001 | -1.297 | -.743 |
| | TC | -.495* | .108 | <.001 | -.803 | -.187 |
| | TD | -.215 | .126 | .905 | -.574 | 144 |
| | TE | .280 | .134 | .382 | -.101 | .661 |
| TB | TC | .525* | .072 | <.001 | .321 | .729 |
| | TD | .805* | .093 | <.001 | .541 | 1.069 |
| | TE | 1.300* | .112 | <.001 | .982 | 1.618 |
| TC | TD | .280* | .076 | .003 | .064 | .496 |
| | TE | .775* | .094 | <.001 | .508 | 1.042 |
| TD | TE | .495* | .093 | <.001 | .232 | .758 |

P-value: Significance; *.The mean difference is significant at the .05 level.

## 4.2 Data Set (2) Group B Results

The testing results from 27 participants (Group B) were analyzed by the visual detection method to identify whether a significant point related to a design reference noticeably affected the participants in their evaluation process. In addition, 27 subjects were measured and interviewed using the eye-tracking device, and the findings show the usefulness of infographic design. The ViewTracker3 eye-tracking device developed by DITECT was equipped in this particular experiment. The priority function of the eye-tracking device is to detect and track the movements of the eyes. The basic concept is to use infrared light to illuminate the eye causing a reflection (Dark pupil with 3D model), and a camera to capture an image of the eye showing these reflections. Through analysis performed by ViewTRacker3 software program, eye-tracking data displayed the focus point and the time length of focus time on the testing subjects respectively. These findings identified such points and revealed that visual attention and the areas of interest were significantly devoted to the packaging's infographic labeling. An additional in-depth interview and a comparison of survey data suggested that graphic labeling approaches contribute to how consumers are influenced and perceive a product's quality. In general, information on the food product label is presented in the form of text and explanation wordings. In this study, infographic labeling representing important information on the contained product was tested and is shown in Figure B. The result illustrated the importance of infographic labeling design on the participants' level of attention. In this experiment, the focused time span for each product's evaluation and the visit count on the area of interest were recorded.

Figure 4 shows the, comparison of the visual attention time span and visit count areas between the contained product and labels. In this experiment, different kinds of graphic-label design approaches were displayed on the product package, showing a difference between infographic labeling packaging types and ordinary packaging types. Throughout the procedure analyzing the eye-tracking data of 27 participants, the average focused time durations for infographic labeling were 32.1,

29.3, 28.7, and 27.9 seconds for types TB, TC, TD, and TE, respectively, while the ordinary label recorded an average of 45.3 seconds.
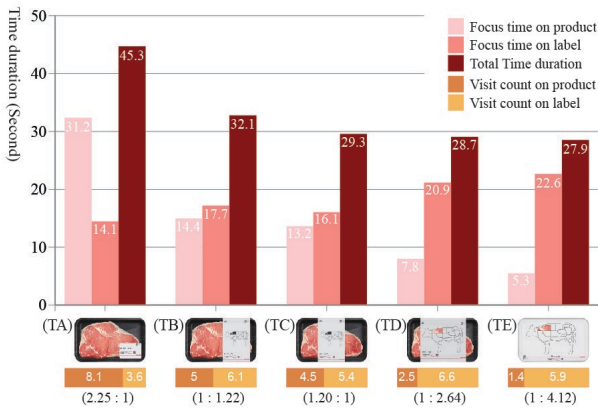


**Figure 4** Comparison of Time Participants Focused on

Ordinary Label to Info-graphical Labels and Visit Count

These results indicated that the span of attention on packaging represented with infographic labeling was significantly lower, with an average of 15.8 seconds throughout the evaluation process. In addition, it was shown that transforming the product's information into graphic form is more efficient to convey a piece of essential information to the participants. The analysis on eye-tracking data revealed the recorded visit count, which refers to the fixation area on the package samples, where participants focused their attention.

As shown in figure C, the ordinary label (TA) participants focused on the contained product in an average of 8.1 time counts and 3.6 times on the product label. In product sample type TB, an average visit count on the product to label is 5 -6.1 times, 4.5 -5.1 times for TC, 2.5 -6.6 times for TD, and 1.4 -5.9 times for TE, respectively. The comparison of data from visual attention (Figure C) and the responses of participants in group B, as shown in Table 9, revealed important findings on the product infographic labeling approach for meat packaging design. The statistical results indicate that visit counts on the contained product to the packaging label are comprehensively related to the perception of product quality interpretation. The results from the average visit count ratio of product and label for testing sample type TB (1:1.22) and TC (1.20:1) were optimally obtained from the highest mean rate scores at 3.952 and 3.660 respectively. Regarding the graphical-labeling types TD and TE, the scores for visit counts favor labeling rather than the product, with 1:2.64 for TD and 1:4.12 for TE, for which the mean rate scores were 3.327 and 3.354, respectively. With regard to ordinary labeling design (TA), the analysis shows that the majority of fixation areas focused on the contained product at 2.25:1, with a mean rate score of 3.163. This finding suggested a similarity of visit counts for contained product and labels ratio in TA and TB that was most appealing to the participants' perception of product quality. However, in the case that the area of interest on labeling is significantly greater than the product found in TC and TD, the average mean rate

for seven dimensions droped by 16.19%, as shown in Figure 5. As for the ordinary label design, the participants' visual attention was focused on the contained product, and this type of design showed the lowest mean rate at 3.163 score points.

An in-depth interview regarding their evaluation process revealed that infographic labeling packaging significantly enhanced the participants' perception of the product's originality and trustworthiness. Moreover, the statistical results indicating that additional extrinsic cues labeling can increase the value of the product, consumer's trustworthiness, personal preference, product quality, and increase product appearance, affecting their decision. In addition, an interview confirmed the finding related to the size and placement of labeling on meat packaging. Regarding, both the TB and TC's labeling approaches with 33.28% of coverage were the most appealing to participants.

**Table 9** Repeated Measures ANOVA Analysis for TA, TB, TC,

TD, and TE (Participant Group B)

| Type (N) | Design (M) | Reliability (M) | Rec-ognizability (M) | Value (M) | Attractive (M) | Satisfaction (M) | Com-unication (M) |
|---|---|---|---|---|---|---|---|
| TA (27) | 2.629 | 3.370 | 3.518 | 3.000 | 2.888 | 3.185 | 3.555 |
| TB (27) | 4.074 | 3.888 | 3.963 | 3.777 | 3.703 | 4.037 | 4.222 |
| TC (27) | 3.925 | 3.777 | 3.518 | 3.555 | 3.518 | 3.518 | 3.814 |
| TD (27) | 3.740 | 3.222 | 2.925 | 3.370 | 3.370 | 3.296 | 3.370 |
| TE (27) | 4.185 | 3.370 | 3.074 | 3.222 | 3.444 | 3.000 | 3.185 |
| df | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 |
| P-value | < 0.01 | .049 | .048 | .036 | .080 | .013 | .046 |

(N): Number; (M): Mean; df: degree of freedom; P-value: Significance
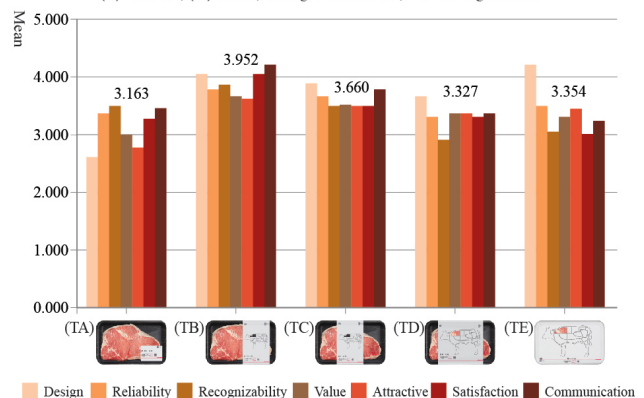


**Figure 5** Testing Samples TA, TB, TC, TD, and TE Rating

Results Presented in Bar Charts (Participant Group B)

# 5 Discussion

The study purpose was to investigate label design and more specifically, particular design aspects influencing consumer perception of product quality, and to establish whether or not there were any noticeable links or connections. The study results and significant findings have provided valuable data, leading to greater in-depth understanding of the benefits of the infographic label approach for meat packaging and the influence of infographic labels on consumers' perception of product quality. The overall results revealed that the influence

of the infographic label approach for meat packaging significantly affected the participant's perception of product quality. An important component of this study included an experiment conducted on infographic labeling and labeling proportion for meat packaging. Our finding suggests that labeling proportion and ratio significantly affect the perception of product quality. The survey results indicated that the golden ratio principle applied to labeling is the most effective approach given its optimal benefits, which influenced consumers' perception of all measured dimensions, including design appreciation, product reliability, product recognizability, product value, attractiveness, satisfaction, and communication ability. As a result of the analysis of variance (ANOVA) and the eye-tracking data analysis, the product infographic labeling design with golden ratio proportion (TB) is one of the optimal benefits influencing consumers' perception of the importance of product quality. In relation to this, infographic elements can further enhance consumers' interpretation of product quality.

## 6 Conclusions

The product infographic labeling approach design increases our awareness of consumer behaviors as part of a product evaluation process, therefore recognizing consumer ideas and beliefs. It ensures that the product is certified and increases the reliability of the products in the areas of design appreciation, product reliability, product recognizably, product value, product attractiveness, consumers' satisfaction, and communication ability, respectively. In addition, the infographic label represents the product's identity, which matches the consumers' needs as the label allows them to distinguish one product from another. Furthermore, infographic labeling can undeniably decrease consumption time in the product purchasing process compared to the ordinary label. However, an infographic labeling approach to fresh meat packaging is not compensated by the appearance of the contained product. Infographic labeling has a cohesive function to enhance product evaluation and quality expectation. This leads to and provides a design reference for fresh food labeling and positioning placement to promote consumers' perception of product quality. In addition, the findings indicated that infographic labeling design further impacts general product evaluation and quality expectation, and we expect to conduct further research on the matter.

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