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Effects of packaging design on sensory liking and willingness to purchase: A study using novel chocolate packaging

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ABSTRACT

Packaging is the first impression consumers have of food products which determines likelihood of purchasing. Therefore, the objective of this study was to evaluate the effect of chocolate packaging design on sensory liking and willingness to purchase (WTP) of consumers (n = 75) under three conditions:(1) blind [product], (2) packaging, and (3) informed [product and packaging]. The same chocolate tasted in (1) was wrapped in six different packaging concepts (bold, fun, every day, special, healthy, premium) developed based on TNS Need-Scope™ model for (3). There were significant differences in liking towards taste based on packaging. Liking scores for (3) reduced when expectations created by packaging were not met. Regression analysis explained, taste had strongest association (r = 0.73) towards WTP. Cochran's Q and McNemar tests showed significant differences in frequencies of emotion-based terms between packaging and informed conditions. These findings can be used in product design to evaluate product attributes by enhancing emotional attachment towards chocolate.

1. Introduction

Product packaging is an important form of marketing communication. When shopping for everyday foods or beverages, consumers base their purchase decision on extrinsic product characteristics and appearance (Fenko et al., 2010). There is a difference in how consumers perceive intrinsic product cues like flavor, aroma, texture and to how they perceive extrinsic product cues like packaging material, information and brand name (e.g. packaging material, information, brand name, price) (Ng et al., 2013). Intrinsic product cues are associated with sensory and perceptual systems, while extrinsic product cues are processed through cognitive and psychological mechanisms (Cardello, 2007).

Aspects of choice occurring outside the conscious awareness have a marked influence on consumers purchasing decisions (Fitzsimons et al., 2002). New products that have been introduced into the market with positive feedback from focus groups still fail after a few months of their launch (Zaltman et al., 2003). Consumer acceptability measurement alone is not sufficient to predict actual consumers food choice as it does not provide deep insights about consumers feelings and motivations (Danner et al., 2017). Emotions are considered better predictors of food choice than using liking scores alone (Dalenberg et al., 2014; Gutjar et al., 2015). Previous research has established that extrinsic product cues such as packaging and branding influence how consumers evaluate food products (Deliza and MacFie, 1996). Furthermore, extrinsic visual cues such as packaging, nutritional information, price and labelling generate consumers expectations (Guinard et al., 2001). Expectations constitute the *"pre-trial-beliefs about the product"* based on the knowledge and memories of the same cue (Okamoto and Dan, 2013). Consumers disconfirmation may occur by failing to meet the product expectations (Deliza and MacFie, 1996). If the consumers expectations are met/confirmed by the sensory perception, consumers would likely repeat the purchase of the product (Deliza and MacFie, 1996). This makes packaging a very important factor for food manufacturers since the function of packaging design is not only to attract consumers attention but also to convey expectations of how that food product will be sensory perceived (Ng et al., 2013).

Information provided in or on packaging can influence consumers expectations, thus affect emotional responses (Ng et al., 2013; Spinelli et al., 2014). Emotions have gained interest in the field of sensory and consumer sciences since the emotional attachment towards products is important for repeated purchases (Paul et al., 2009). The objectives of the study were (i) to identify how packaging affected liking of taste, (ii) to identify how liking affected the emotions evoked by the chocolate product under different packaging, and (iii) to assess if packaging or taste

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affected the willingness to purchase (WTP). It was hypothesized that different packaging concepts/designs affect sensory liking across the packaging (only packaging) and informed (packaging and product) conditions, and the packaging designs affect the taste perception of consumers.

2. Material and methods

The study was conducted in three parts as: (1) blind condition: to study the effects of sensory characteristics of dark chocolate on the sensory perception of consumers without packaging, (2) packaging condition: to study the effect of packaging characteristics on the visual perception of consumers without tasting the chocolate, and (3) informed condition: to study the combined effect of sensory and packaging characteristics on the sensory perception of consumers.

2.1. Participants for the sensory sessions

For this study, consumers (N = 75; Age: 25–55 years old; Gender: 41% males, 59% females) were recruited via e-mail invitations to staff and students from The University of Melbourne, Australia who volunteered to participate in the sensory assessment. Chocolate consumers were used for the study. However, there were no conditions required for the consumers to be recruited for the experiment such as consumption frequency and liking towards milk/dark chocolate, among others Experimental procedures were approved by the Ethics Committee of the Faculty of Veterinary and Agricultural Sciences at The University of Melbourne, Australia (Ethics ID 1545786.2). After completing the study, consumers received incentives in the form of a coffee voucher as appreciation for their participation in the sensory session.

2.2. Stimuli

Dark chocolate (70% cocoa; Coles Supermarkets Australia Pty Ltd, Hawthorn East, VIC, Australia) was provided to consumers for tasting in both blind and informed conditions. Dark chocolate was used since five out of six packaging concepts were dark chocolates based on the packaging element selection (Fig. 1). Based on the TNS NeedScope model™ (NeedScope International, Auckland, New Zealand), six distinct market categories (bold, fun, every day, special, healthy and premium) were identified to provide scope for the six conceptual packaging developments. Six unique style-guides were established using current and leading design trends that provided identity markers for the conceptual representation of the authentic profiles. Elements identified under each category were broadly collected under the criteria of the profiles to be sorted through the iterative design process of explore, ideate, define, prototype, and test (Anderson et al., 2011).

The elements were collated under (1) packaging type, (2) branding, (3) information content, and (4) flavor. Packaging type explored substrates, shapes, windows and material types. The resulting branding elements assessed patterns, textures, color counts, reflective intensities, transparencies, font styles, and product imagery. Information content consisted of logo, name and slogan, product callouts, ingredients, country of origin, nutrition information, manufacturing address, expiry date, and barcode/serial number, based on common Australian packaging designs. Chocolate flavors and fillings available from the market were investigated and grouped into higher levels of milk chocolate (every day), dark chocolate (special, healthy), flavor enhancements (bold), fill inclusions (fun), and multi-layered (premium). The elements tested under the flavor groups were allied with both the six categories and the market groups identified on supermarket shelf in Australia.

As shown in Fig. 1, front and back packaging were developed using SolidWorks software (SolidWorks Corporation, Waltham, Massachusetts, USA) for each concept. The new brand name was created by identifying a word that could be associated to either a sound similar to the chocolate, a rhyming word, a pleasurable emotion, a desirable word or a modified word that evokes cultural status. 'Chuff' was selected as the new brand name for the chocolate product, because the word 'chuffed' is an informal word meaning 'very pleased' in Australia. Removing the 'ed' of the word makes it a little unknown, yet still recognizable. The new chocolate logo was designed to be simple and universal to reach the Australian market. All packaging designs were new and were not available in the marketplace to ensure that the consumers did not have previous experiences with the concepts. The labels were designed by a graphic designer with previous experience in the design of food labels for the industry.

2.3. Data gathering

The sessions were conducted in individual sensory testing booths. They consisted of an integrated camera system controlled by a biosensory application (App) designed for Android tablets PC (Google; Open Handset Alliance, Mountain View, CA, USA) developed by the sensory group from the School of Agriculture and Food, Faculty of Veterinary and Agricultural Sciences, the University of Melbourne (Fuentes

Fig. 1. Front and back packaging concepts designed based on the six segments of TNS NeedScope™ used for the study, where A) represents bold concept, B) Fun concept, C) Everyday concept D) Special concept, E) Healthy concept and F) Premium concept.

et al., 2018). The tablets were used to present the packaging concepts and the questions for the consumers. It was conducted in the sensory laboratory located at The University of Melbourne, Australia (Parkville campus) with controlled temperature (24–26 °C) (Viejo et al., 2018). Participants were asked to sit in individual sensory booths with uniform white lighting conditions. Consumers participated in three different tests under the same session. The tests were the (1) blind, (2) packaging, and (3) informed conditions. The three conditions were tested in the same order for each consumer since they were expected to taste the chocolate first without any extrinsic information, and then observe the packaging designs to evaluate just the packaging, and finally taste the chocolate provided with the packaging to evaluate the combined effect of the chocolate and packaging. The total duration of the session was 20–30 minutes.

2.4. Blind condition

Initially, consumers were given instructions that they would receive a piece of chocolate (1 cm × 1 cm) to taste. The sample was provided in an unlabeled transparent cup (unbranded product) under white lights. Only one sample was provided to the consumers for the blind condition. Participants were asked to rate the taste liking of the chocolate using a 15-point non-structured continuous scale, and was converted to 100-point for ease of comparison between samples and conditions (1 = dislike extremely, 50 = neither like nor dislike 100 = like extremely) (Holland et al., 2017). Consumers were asked to cleanse their palate with water and unsalted crackers after tasting the sample.

2.5. Packaging condition

After completing the blind test, the next test (packaging condition) started after 5 minutes in the same booth. The six designed packaging concepts were presented to consumers one at a time in fixed order (the order of the samples was based on the increasing complexity: from the simple designs to luxurious/premium designs), on tablet PCs for 10 seconds each. Each concept was presented followed by a lexicon of 24 emotion-based terms (four terms representing each segment in the NeedScope™ model; Table 1) giving the option to the consumers to check all emotion-based terms that apply (CATA) during the evaluation of the packaging concepts. The overall liking towards the packaging concepts was also measured using a 15-point non-structured continuous scale, and was converted to 100-point for ease of comparison between samples and conditions (1 = dislike extremely, 50 = neither like nor dislike to 100 = like extremely).

2.6. Informed condition

All consumers (N = 75) who participated in the blind and packaging condition participated in the informed condition. After the packaging condition, within a 5-minute interval, consumers were directed to another sensory booth in the same laboratory for the informed condition. Effect of packaging on taste was tested by presenting the same chocolate in six different packaging designs (Fig. 2) using the six segments of TNS NeedScope™ model. The consumers were handed over the product one at a time, not making them aware that they were receiving the same sample. This was ensured at the end of the experiment by interviewing

Table 1
Emotion-based terms provided to the consumers during the evaluation of the packaging designs sing the Check-all-that-apply (CATA) methodology.

Bold	Fun	Every day	Special	Healthy	Premium
Excitement	Bright	Family	Relaxing	Balance	Achievement
Shocked	Fun	Happy	Calm	Wisdom	Luxury
Adventure	Colorful	Togetherness	Peace	Health	Sophisticated
Energy	Silly	Friendship	Caring	Discipline	Success

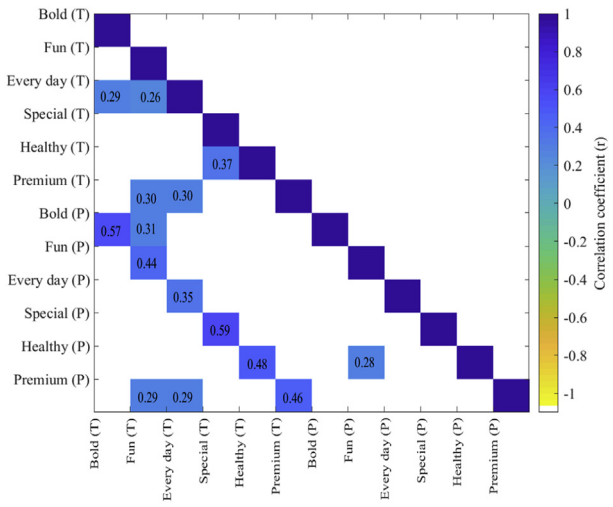

Fig. 2. Correlation matrix showing the relationship between liking towards the taste vs. liking towards the packaging for each concept. Only significant correlations are presented ($p < 0.05$). The color bar represents the correlation coefficients in a scale from -1 to 1, where the blue side denotes the positive correlations, while yellow represents the negative correlations Abbreviations: P = Packaging, T = Taste.

the panelists about their experiences during the sensory session. All participants reported that they were not aware that the chocolate products were the same. The samples provided in packaging condition and informed condition were not randomized, as it would be more complex in trying to let the consumer experience the package only (packaging condition) with the package and taste (informed condition) and letting them compare these conditions.

During the informed condition test, participants were provided with a piece of chocolate together with the wrapped product (using the six concept designs; Fig. 1). Consumers were informed that the piece of chocolate belonged to that specific packaging. They were asked to taste the chocolate and check all the emotion-based terms (CATA), which comes into their mind during tasting of the product. The emotion-based terms were the same as those provided in the packaging condition (Table 1). Crackers and water were used to cleanse the palate between each sample. They were asked to rate the liking towards taste using the same 15-point scale used in blind and packaging conditions, and converted to a 100-point scale (1 = dislike extremely, 50 = neither like nor dislike, 100 = like extremely) and willingness to purchase the product (1 = not at all, 50 = neither likely or not likely, 100 = very likely) on the tablet PCs using the bio-sensory App (Fuentes et al., 2018). All the measurements were taken using a continuous scale to be able to analyse quantitatively (Barber et al., 2012). The WTP obtained was used to attain correlations with liking towards packaging and liking towards taste.

2.7. Statistical analysis

Statistical analyses were performed using Minitab® 18.1 software. The liking towards the packaging and taste of the product were subjected to one-way analysis of variance (ANOVA, $\alpha = 0.05$) and Pearson correlations (r). For all conditions, the liking response (100-point scale) was analyzed using ANOVA accounting for subject variation. Then, inferences on the pairwise comparisons between the packages were considered. To obtain the details of the pairwise comparisons, estimates of the differences, and 95% confidence intervals, adjusted for multiple comparisons using Tukey's method were calculated. A t-test was conducted to identify significant differences between the packaging and informed conditions. Multiple regression analysis was used to obtain predictions of the liking towards packaging and taste scores from the packaging and informed conditions using the emotion-based words as predictors. A forward

selection stepwise procedure was used to obtain a model in each case. Emotion terms that were not used at all for a given condition were not considered as potential predictors. The effect of liking towards taste and liking towards packaging on WTP was tested using multiple regression analysis. Correlation matrices were developed for the data from liking towards packaging with taste, WTP with liking towards package and WTP with liking towards taste using a customized code written in Matlab® R2018a (Mathworks Inc., Matick. MA. USA).

The McNemar test was conducted using XLSTAT (Version, 2018.1., Addinsoft, Paris, France) to test the difference between the packaging and informed conditions for the percentage of frequencies of emotion-based terms selected (CATA responses). Correspondence analysis (CA) and Principal Coordinate Analysis (PCoA) were also conducted using XLSTAT (Version, 2018.1., Addinsoft, USA) for the packaging and informed conditions using the emotion-based terms of each packaging design. The CA was conducted to explore relationships among the selected emotion-based terms with the packaging concepts. On the other hand, PCoA was conducted on the mean liking scores and the total frequency percentages of the emotion-based terms for each concept to examine and visualize the similarities and the differences of the data. Cochran's Q test was conducted to study the differences between the frequencies of the selected emotion-based terms in the packaging and informed conditions.

3. Results

3.1. Blind, packaging and informed liking

The mean values of the taste liking scores for all concept designs including the blind condition sample in the packaging and informed conditions are shown in Table 2. There were significant differences in the mean liking scores towards taste of blind condition to the everyday ($p < 0.0001$), premium ($p < 0.0001$), bold ($p < 0.0001$) and fun ($p < 0.0001$) concepts. The taste liking of special ($p < 0.0001$) and healthy ($p < 0.0001$) concepts in the informed condition was significantly higher than the liking towards packaging. The liking score of the chocolate in the blind condition was the highest when compared to the packaging and informed conditions of all concepts.

3.2. Relationship between the liking towards the package (packaging condition) and the taste (informed condition) of the product

The correlation matrix between the liking towards the packaging and the taste of the product from the packaging and informed conditions are shown in Fig. 2. Based on the results, there is a low to moderate positive correlation ($r = 0.28$ to $r = 0.59$) between the liking of the packaging and the liking towards the taste of the chocolate of each packaging concept, even though the same chocolate was used for all packaging concepts. The strongest correlation was shown in the special packaging concept. Furthermore, there are positive correlations between the liking towards taste of everyday with fun ($r = 0.26$) and bold ($r = 0.29$); premium with fun and everyday ($r = 0.3$); healthy with special ($r = 0.37$). There were non-significant differences observed between different concepts. This is because different concepts conveyed different messages which were not always related to each other.

Table 2
Blind, packaging and informed mean liking scores ± Standard deviation (SD) of products evaluated under blind, packaging and informed conditions by consumers.

Packaging concept	Liking – Packaging condition	Liking – Blind and Informed conditions
Blind condition	N/A	72.3 ± 19.20^{a} (blind)
Bold	$57.6 \pm 23.71^{a,A}$	$55.6 \pm 20.02^{b,A}$ (informed)
Fun	$54.6 \pm 26.09^{a,A}$	$54.5 \pm 22.69^{b,A}$ (informed)
Everyday	$56.5 \pm 21.78^{a,A}$	$56.9 \pm 22.03^{b,A}$ (informed)
Special	$56.5 \pm 24.84^{a,B}$	$71.3 \pm 16.72^{a,A}$ (informed)
Healthy	$60.3 \pm 22.15^{a,B}$	$70.7 \pm 19.37^{a,A}$ (informed)
Premium	$62.7 \pm 20.74^{a,A}$	$55.7 \pm 24.56^{b,A}$ (informed)

[a, b] Means with different superscripts in each column indicate significant differences ($p < 0.05$) by the Tukey's Studentized Range test. [A, B] Means with different superscripts in each row indicate significant differences ($p < 0.05$) by t-test. N/A refers to Non-Applicable since there was no packaging involved in the blind condition, and the liking scores were for the taste.

3.3. Total frequency percentages for the selected emotion-terms (packaging and informed conditions)

The percentage of emotion-based terms selected during the evaluation of the packaging and taste (informed condition) were obtained (Table 3). In the packaging condition, the total frequency percentages for each emotion-based term ranged from 0.0% to 66.7%. In the informed condition, it ranged from 0.0% to 49.1%. All emotion-based terms were selected under all packaging concepts. However, the term discipline was not selected by any consumer irrespective of the packaging concept. The results of the Cochran's Q test are shown in Table 3, which shows that there were significant differences between the packaging concepts based on the emotion-based terms. The selection of emotion-based terms in the packaging condition showed a higher number of significant differences ($p < 0.05$) among the packaging concepts than in the informed condition. The emotion-based terms family ($p = 0.29$), relaxing ($p = 0.52$), silly ($p = 0.06$), wisdom ($p = 0.06$), bright ($p = 0.1$), togetherness ($p = 0.45$), discipline ($p = 0.36$), shocked ($p = 0.11$), caring ($p = 0.27$), calm ($p = 0.22$), friendship ($p = 0.21$), health ($p = 0.1$), happy ($p = 0.22$), balance ($p = 0.3$), energy ($p = 0.2$) and peace ($p = 0.16$), which accounted for 66.7%, did not show significant differences ($p > 0.05$) between the concepts in the informed condition, whereas 29.2% of emotion-based terms: togetherness ($p = 0.15$), caring ($p = 0.13$), fun ($p = 0.1$), friendship ($p = 0.58$), luxury ($p = 0.1$), happy ($p = 0.1$) and achievement ($p = 0.3$) did not show significant differences ($p > 0.05$) between the packaging concepts in the packaging condition.

The McNemar test compares the differences between the packaging and informed conditions for each emotion-based term (correlated-proportions). The emotion-based terms excitement, relaxing, silly, discipline, adventurous, calm, happy, healthy, balance, energy, colorful and peace expressed significant differences ($p < 0.05$) while the terms family, wisdom, bright, togetherness, shocked, caring, success, fun, friendly, luxury, sophisticated and achievement were not significant ($p > 0.05$) in the selection during the packaging and informed conditions.

The selection of the term “excitement” increased significantly for the fun, ($p < 0.001$), and every day ($p = 0.001$) concepts in the informed condition compared to that of the packaging condition (Table 3). The term “adventure” was more associated with the packaging condition in all concepts and its selection significantly decreased (bold: $p = 0.01$, fun: $p = 0.004$, every day: $p = 0.001$, special: $p = 0.002$, healthy: $p = 0.02$, premium: $p = 0.003$) during the informed condition. The term “colorful” obtained the highest percentage in the bold and fun concepts, while its selection significantly decreased (bold: $p = 0.004$, fun: $p < 0.0001$) for the informed condition. Special and premium concepts obtained the highest percentages for “luxury” in the packaging condition. The terms “happy” (bold: $p < 0.0001$, fun: $p < 0.0001$, every day: $p = 0.005$, special: $p = 0.01$, healthy: $p = 0.04$, premium: $p = 0.004$) and “discipline” ($p < 0.001$ for all concepts) obtained significantly higher percentages in the informed condition than in the packaging condition.

3.4. Emotional profiles across the packaging and informed conditions

3.4.1. Correspondence analysis

Figs. 3a and 3b show the correspondence analysis (CA) comparing emotion-based terms obtained under the packaging and informed conditions, respectively. In the CA of the packaging condition (Fig. 3a), the first dimension (F1) explained 68.67% of data variability, while the

Table 3
Emotion-terms: percentages of selection and the Cochran's Q test for each emotion in the packaging and informed conditions.

Emotion-based terms	Packaging condition						Informed condition					
	Bold	Fun	Everyday	Special	Healthy	Premium	Bold	Fun	Everyday	Special	Healthy	Premium
Excitement	29.8%^{b}	**28.1%** ^{b}	**7.0%** ^{a}	**12.3%**^{a,b}	**19.3%**^{a,b}	**26.3%**^{a,b}	24.6%^{a,b}	**40.4%** ^{b}	**10.5%** ^{a}	**5.3%** ^{a}	**24.6%**^{a,b}	**17.5%**^{a,b}
Family	10.5%^{a,b}	7.0%^{a}	28.1%^{b}	10.5%^{a,b}	7.0%^{a}	10.5%^{a,b}	7.0%^{a}	10.5%^{a}	17.5%^{a}	10.5%^{a}	7.0%^{a}	12.3%^{a}
Relaxing	1.8%^{a}	19.3%^{a,b}	26.3%^{b}	**28.1%** ^{b}	**24.6%** ^{b}	7.0%^{a,b}	19.3%^{a}	24.6%^{a}	33.3%^{a}	**22.8%** ^{a}	**26.3%** ^{a}	22.8%^{a}
Silly	**29.8%**^{b,c}	36.8%^{c}	**8.8%** ^{a,b}	3.5%^{a}	**10.5%**^{a,b}	**5.3%** ^{a,b}	**15.8%** ^{a}	12.3%^{a}	**5.3%** ^{a}	3.5%^{a}	**3.5%** ^{a}	**10.5%** ^{a}
Wisdom	0%^{a}	0 %^{a}	10.5%^{a,b}	22.8%^{b}	17.5%^{a,b}	24.6%^{b}	1.8%^{a}	5.3%^{a}	8.8%^{a}	19.3%^{a}	15.8%^{a}	7.0%^{a}
Bright	33.3%^{b,c}	43.9%^{c}	10.5%^{a,b}	3.5%^{a}	10.5%^{a,b}	12.3%^{a,b}	21.1%^{a}	29.8%^{a}	10.5%^{a}	15.8%^{a}	10.5%^{a}	8.8%^{a}
Togetherness	5.3%^{a}	1.8%^{a}	10.5%^{a}	12.3%^{a}	7.0%^{a}	10.5%^{a}	8.8%^{a}	5.3%^{a}	15.8%^{a}	14.0%^{a}	12.3%^{a}	10.5%^{a}
Discipline	**0.0%** ^{a}	**0.0%**^{a}	**0.0%**^{a}	**0.0%** ^{a}	**0.0%** ^{a}	**0.0%** ^{a}	**5.3%** ^{a}	**5.3%** ^{a}	**12.3%** ^{a}	**5.3%** ^{a}	**3.5%** ^{a}	**8.8%** ^{a}
Shocked	24.6%^{b}	8.8%^{a,b}	1.8%^{a}	5.3%^{a,b}	3.5%^{a}	0%^{a}	17.5%^{a}	5.3%^{a}	7.0%^{a}	0.070^{a}	0.070^{a}	0.123^{a}
Caring	0%^{a}	0%^{a}	12.3%^{a}	7.0%^{a}	10.5%^{a}	5.3%^{a}	0%^{a}	1.8%^{a}	8.8%^{a}	8.8%^{a}	12.3%^{a}	7.0%^{a}
Adventure	**36.8%**^{b,c}	**19.3%**^{a,b}	3.5%^{a}	**8.8%** ^{a}	**50.9%** ^{c}	**17.5%**^{a,b}	**17.5%**^{a,b}	**10.5%**^{a,b}	3.5%^{a}	**5.3%** ^{a}	**26.3%** ^{b}	**10.5%**^{a,b}
Success	1.8%^{a}	1.8%^{a}	10.5%^{a,b}	17.5%^{a,b}	8.8%^{a,b}	22.8%^{b}	3.5%^{a}	5.3%^{a}	5.3%^{a}	17.5%^{a,b}	17.5%^{a,b}	26.3%^{b}
Fun	47.4%^{b}	52.6%^{b}	5.3%^{a}	3.5%^{a}	15.8%^{a}	15.8%^{a}	26.3%^{a,b}	35.1%^{b}	8.8%^{a}	8.8%^{a}	14.0%^{a,b}	14.0%^{a,b}
Calm	0%^{a}	12.3%^{a,b}	45.6%^{c}	**42.1%** ^{c}	**28.1%**^{b,c}	**15.8%**^{a,b}	21.1%^{a}	24.6%^{a}	45.6%^{a}	**38.6%** ^{a}	**29.8%** ^{a}	**36.8%** ^{a}
Friendship	10.5%^{a}	8.8%^{a}	7.0%^{a}	5.3%^{a}	3.5%^{a}	7.0%^{a}	5.3%^{a}	15.8%^{a}	12.3%^{a}	12.3%^{a}	7.0%^{a}	8.8%^{a}
Luxury	3.5%^{a}	3.5%^{a}	8.8%^{a}	61.4%^{b}	17.5%^{a}	66.7%^{b}	12.3%^{a}	10.5%^{a}	12.3%^{a}	42.1%^{b}	24.6%^{a,b}	42.1%^{b}
Health	8.8%^{a}	10.5%^{a}	12.3%^{a,b}	21.1%^{a,b}	**29.8%** ^{b}	24.6%^{a,b}	21.1%^{a}	19.3%^{a}	21.1%^{a}	26.3%^{a}	**33.3%** ^{a}	31.6%^{a}
Happy	28.1%^{a}	**31.6%** ^{a}	**12.3%** ^{a}	**12.3%** ^{a}	**8.8%** ^{a}	**15.8%** ^{a}	28.1%^{a}	**33.3%** ^{a}	**21.1%** ^{a}	**29.8%** ^{a}	**38.6%** ^{a}	**26.3%** ^{a}
Balance	3.5%^{a}	3.5%^{a,b}	**33.3%** ^{c}	**40.4%** ^{c}	19.3%^{a,b,c}	22.8%^{b,c}	22.8%^{a}	19.3%^{a}	**33.3%** ^{a}	**28.1%** ^{a}	35.1%^{a}	28.1%^{a}
Energy	**31.6%**^{b,c}	42.1%^{c}	8.8%^{a,b}	5.3%^{a}	31.6%^{b,c}	24.6%^{a,b,c}	**28.1%** ^{a}	33.3%^{a}	17.5%^{a}	22.8%^{a}	31.6%^{a}	24.6%^{a}
Sophisticated	19.3%^{a,b}	1.8%^{a}	21.1%^{a,b}	42.1%^{b}	29.8%^{b}	43.9%^{b}	19.3%^{a}	8.8%^{a}	12.3%^{a}	49.1%^{b}	31.6%^{a,b}	28.1%^{a}
Colorful	**61.4%** ^{b}	**52.6%** ^{b}	5.3%^{a}	**5.3%** ^{a}	**12.3%** ^{a}	5.3%^{a}	**21.1%**^{a,b}	**21.1%** ^{b}	5.3%^{a,b}	**1.8%** ^{a}	**10.5%**^{a,b}	5.3%^{a,b}
Achievement	1.8%^{a}	3.5%^{a}	17.5%^{a}	10.5%^{a}	10.5%^{a}	21.1%^{a}	0%^{a}	3.5%^{a,b}	5.3%^{a,b}	21.1%^{b}	8.8%^{a,b}	15.8%^{a,b}
Peace	1.8%^{a}	8.8%^{a,b}	24.6%^{b,c}	**49.1%** ^{c}	17.5%^{a,b}	7.0%^{a,b}	15.8%^{a}	12.3%^{a}	29.8%^{a}	**33.3%** ^{a}	26.3%^{a}	21.1%^{a}

The values represent the percentages across consumers for each combination of concepts and emotion-based terms in packaging and informed conditions. ^{a,b,c} Values that do not share a letter are significantly different ($p < 0.05$). Bold values show concepts that were significantly different ($p < 0.05$) between the packaging and informed conditions using the McNemar test.

second dimension (F2) accounted for 14.89%, hence it explained 83.55% of the total data variability. In the CA of the informed condition (Fig. 3b), F1 explained 59.32% of data variability, while F2 accounted for 18.16%, hence it explained 77.48% of the total data variability. The emotion-based terms were loaded heavily on F1 in the packaging condition, while it was more scattered across F1 and F2 in the informed condition. However, there were slight differences in the emotion-based terms loaded on either ends of F1 and F2 for the packaging and informed conditions. For example, the first dimension for packaging condition was associated with achievement, togetherness, shocked and fun whereas for informed condition it was associated with bright, wisdom and health. In the packaging condition, premium was associated with luxury and wisdom, whereas fun and bold concepts were associated with happy, fun, bright, colorful, energy, silly and shocked. The everyday concept was associated with relaxing, while the healthy concept was associated with health. The special concept was associated with achievement, balance and togetherness. In the informed condition, special concept was associated with wisdom, whereas premium and healthy were with health and luxury. Fun and bold concepts were associated with bright and fun, while everyday was related to discipline in the informed condition.

3.4.2. Principal coordinate analysis

Principal coordinate analysis (PCoA) was conducted using the emotion-based terms and the liking scores. Figs. 4a and 4b show the results of the packaging and informed conditions, respectively. Liking of packaging condition was positively related with emotion-based terms such as achievement, balance, wisdom, success and relaxing, while negatively related with shocked, silly, adventure, family and colorful. Liking of informed condition was positively related with family, fun, excitement friendship and bright while negatively related with luxury, success, wisdom, achievement, sophisticated, discipline and caring.

3.5. Regression analysis (general linear model) predicting liking using the selection of emotions

Emotion-based terms associated with the prediction of liking varied within the packaging concepts (data not shown). The selection of the word 'silly' significantly ($p < 0.001$) reduced the liking towards the packaging (packaging condition) and the liking towards the taste of product (informed condition). The emotion-based term 'calm' significantly ($p = 0.02$) reduced the liking during the packaging condition, while it increased the liking during the informed condition. Emotion terms 'shocked' and 'discipline' significantly reduced ($p < 0.001$) the liking during the packaging condition and informed condition, respectively. Based on regression analysis, the term 'sophisticated' predicted the liking score to be increased in the special concept, while it reduced the liking score in the healthy concept. Terms such as happy, health, fun, bright, relaxing, peace, achievement, togetherness, balance, excitement and friendship significantly increased ($p < 0.05$) the liking irrespective of the condition (packaging/informed).

3.6. Effect of liking towards taste and packaging on the willingness to purchase (WTP)

The correlation matrices for liking towards packaging (packaging condition) and liking towards taste (informed condition) with WTP are shown in Figs. 5 and 6, respectively. The liking towards packaging and taste were significantly associated with WTP for all six packaging concepts.

Furthermore, in additon to the correlations of WTP with liking towards respective packaging concepts, there were additional correlations observed. As shown in Fig. 5, WTP of bold was positively correlated with WTP of premium, healthy and fun concepts as well as the liking towards special and healthy packaging concepts. WTP of fun was positively correlated with WTP of everyday, special and premium while everyday was correlated with premium and special. The WTP of special was positively correlated with WTP of healthy and special as well as the liking towards packaging of premium. The liking of the taste (informed condition) had the strongest correlations ($r = 0.65$ to $r = 0.87$) with WTP when compared to liking of the packaging ($r = 0.34$ to $r = 0.56$).

Based on Fig. 6, WTP of bold was positively correlated with WTP of healthy, premium, fun and liking towards taste of fun, every day and premium. WTP of fun was positively correlated with WTP of everyday, special, premium and liking towards taste of everyday and premium.

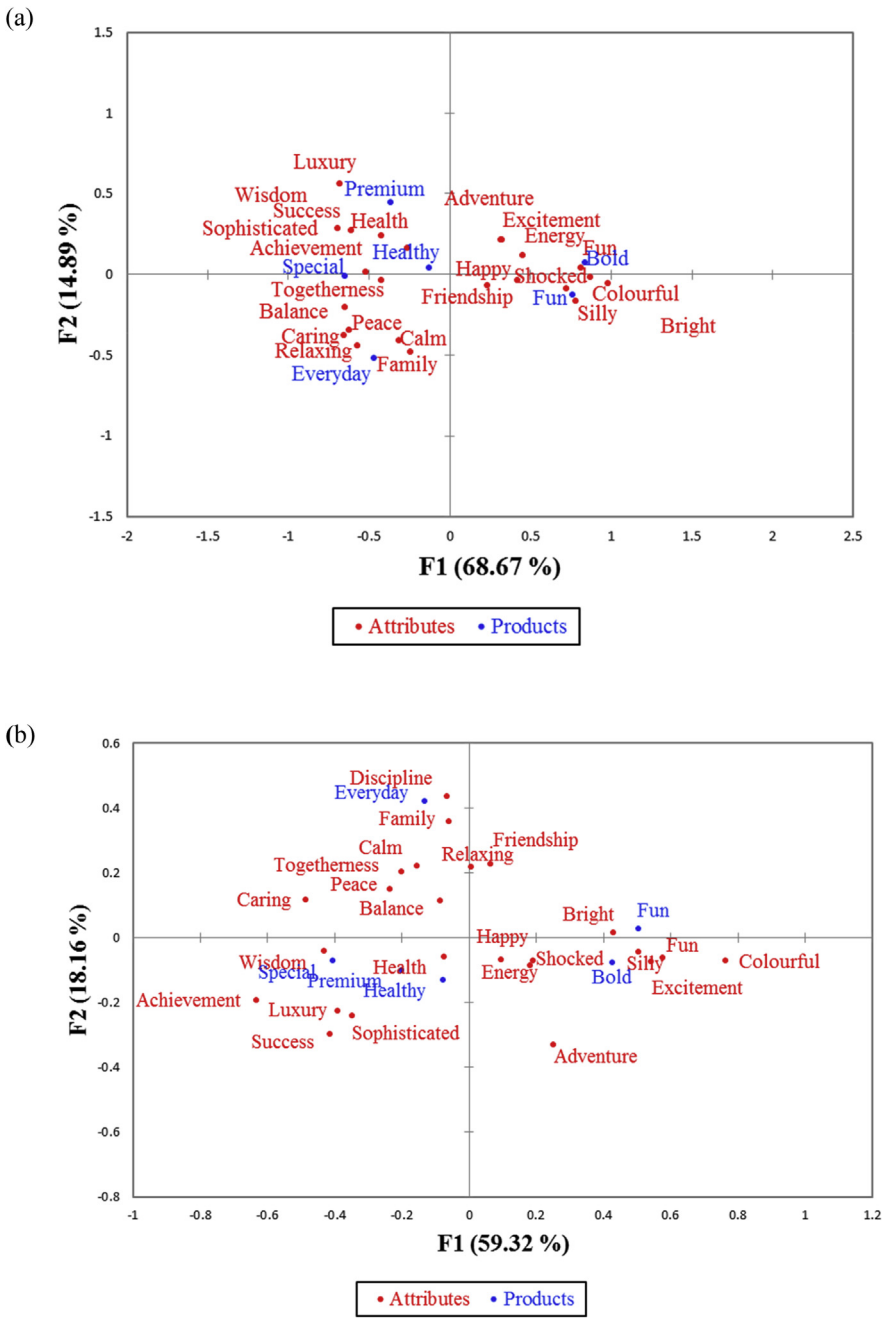

Fig. 3. Correspondence analysis obtained from the (a) packaging and (b) informed conditions. The packaging concepts are shown in blue while the emotion-based terms are in red.

WTP of everyday was correlated with WTP of special, premium and likng towards the taste of fun and premium. WTP of special was correlated with WTP of healthy, premium and taste liking of bold. WTP of healthy and premium were positively correlated with taste liking of special and everyday respectively. Positive correlations between liking towards taste was observed between everyday with bold and fun; premium with fun and evreyday with special. Taste of everyday was negatively correlated with taste of special and healthy.

As shown in Equation 1 (Eq.(1)), the WTP could be explained by liking towards taste, liking towards packaging and the packaging concepts themselves using a multiple regression analysis (general linear model). Table 4 explains the factors which affected the WTP in developing a general linear model. The correlation coefficient of liking towards taste and packaging were positive and explain that higher liking (taste and packaging) was associated with higher willingness to purchase. However, in the case of the concepts, for example, the coefficients of premium and bold were negative, which means that these concepts had a negative effect on the WTP.

$$\begin{aligned} WTP = {} & 0.017 + 0.732\,(X_{liking,taste}) + 0.027(X_{liking,packaging}) - 0.988(X_{bold}) \\ & + 0.199(X_{fun}) + 0.356(X_{everyday}) + 0.702\,(X_{special}) + 0.523(X_{healthy}) \\ & - 0.791(X_{premium}) \end{aligned} \quad (1)$$

4. Discussion

The effect of chocolate packaging designs on sensory attributes was tested in this study based on liking scores, emotion-based terms and willingness to purchase. It was measured by combining a blind liking test with an informed tasting of the same chocolate packed in different

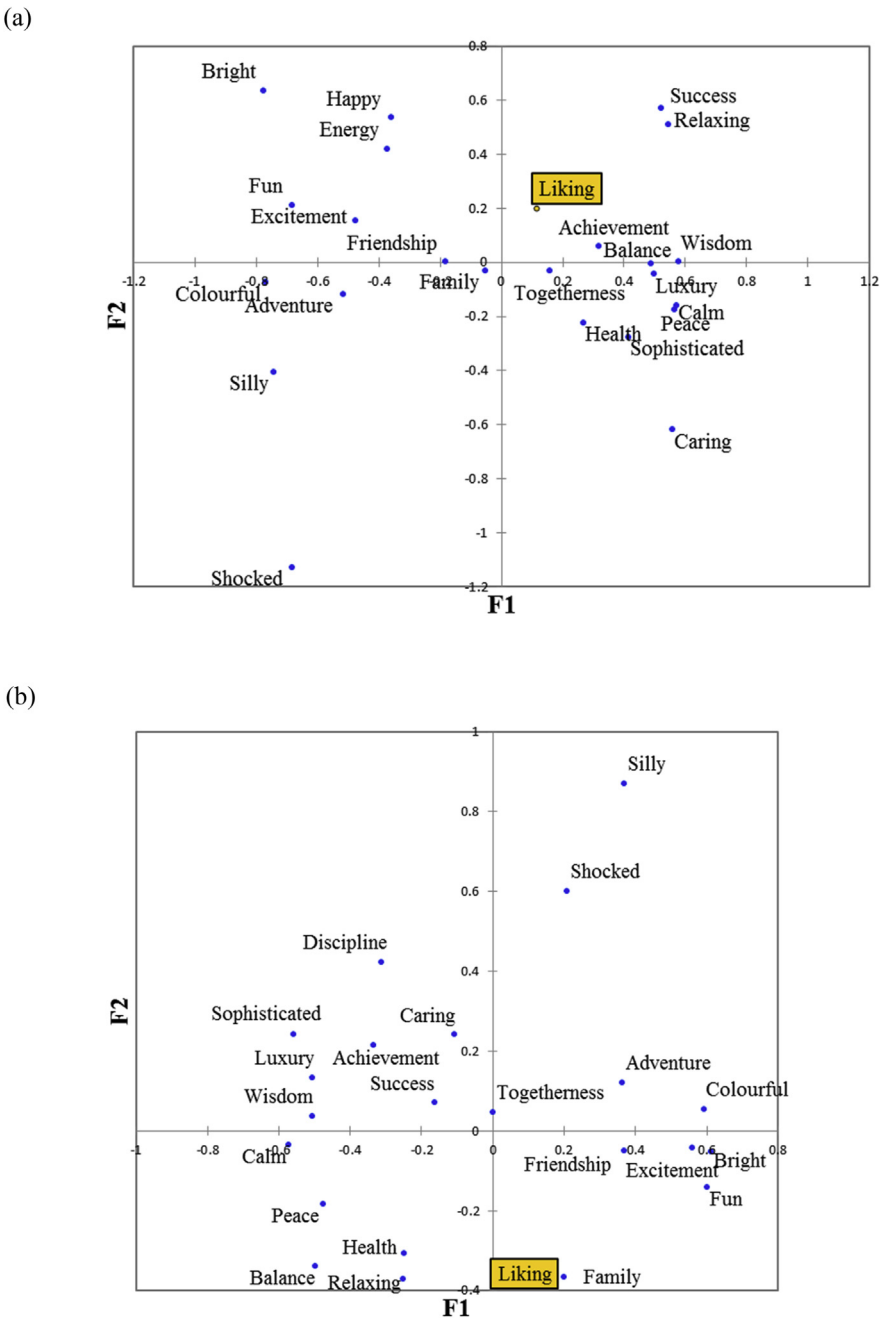

Fig. 4. Principal coordinate analysis obtained from the (a) packaging and (b) informed conditions. The mean liking score for the concepts is shown in the yellow box. Distribution of other emotional terms with respect to liking is shown in the plot.

packaging concepts. This study shows that there was a positive correlation between liking towards taste and packaging. However, tasting generated higher liking scores than the visual liking towards the packaging (Table 2). This can be due to the lack of familiarity and trust towards the novel packaging concepts. This is in contrast to a previous study, which explains that the liking towards the packaging was higher than the taste when using commercially available blackcurrant squashes (Ng et al., 2013). The variation of liking scores in the blind condition to the informed condition confirms the effect of packaging on the taste. In the present study, bold ($p < 0.0001$), fun ($p < 0.0001$), every day ($p < 0.0001$) and premium ($p < 0.0001$) concepts showed a significant decrease in liking scores for the informed condition than for the blind condition. As explained by Combris et al. (2009), extrinsic characteristics like packaging can both increase and decrease consumer acceptance of a product that is well liked in blind conditions. The significant decrease in liking in the informed condition of the bold, fun, every day and premium concepts can be due to the disconfirmation of the expectations of the product when compared to the packaging. The product provided inside all packaging concepts was a plain dark chocolate, whereas the packaging communicated that they were chili flavored (bold), contained chewy candy (fun), milk chocolate (every day) and contained premium berries, nuts and peels (premium), which the consumers could not experience. This further confirms that the food packaging has played a major role in sensory experience of participants.

It has been found that food evoked emotions are better predictors of food choice than using liking scores alone (Dalenberg et al., 2014). Thus, the liking scores were combined with the selection of emotion-based terms in the present study. The significant variation in selection of emotion-based terms in the packaging condition (70.8%) than that of the informed condition (33.3%) explains the emotional engagement of

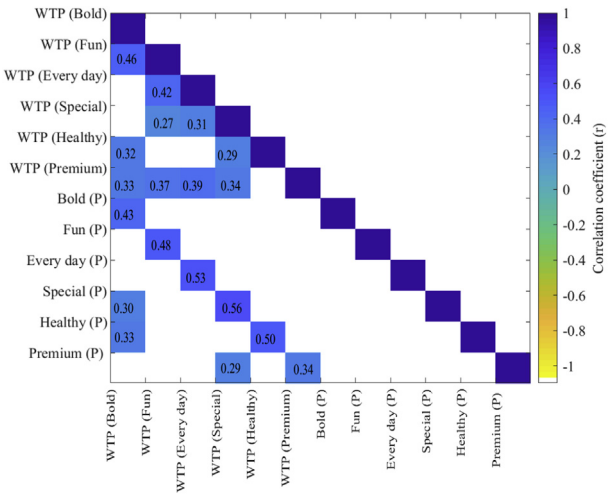

Fig. 5. Correlation matrix showing the relationship between willingness to purchase vs. liking towards packaging for each concept in the packaging condition. Only significant correlations are presented ($p < 0.05$). The color bar represents the correlation coefficients in a scale from -1 to 1, where the blue side denotes the positive correlations, while yellow represents the negative correlations Abbreviations: WTP = Willingness to purchase, P = Liking of packaging.

consumers during the evaluation of the food packaging. The difference in emotions generated for the packaging and informed conditions replicated the findings by Gutjar et al. (2015), where intrinsic and extrinsic product properties elicited, in part, different emotions. The non-selection of the word 'discipline' by any of the participants for any packaging concept under the packaging condition can be taken into consideration for future research. The significant differences in the selected proportions of some emotion-based terms (excitement, relaxing, silly, discipline, adventurous, calm, happy, healthy, balance, energy, colorful and peace) between the packaging and informed conditions using McNemar test (Table 3) shows that the packaging concepts arouse different emotions in the mind of the consumers during the evaluation of the packaging materials and tasting of the samples. This further confirms that the packaging concept affects how people perceive the taste of the product based

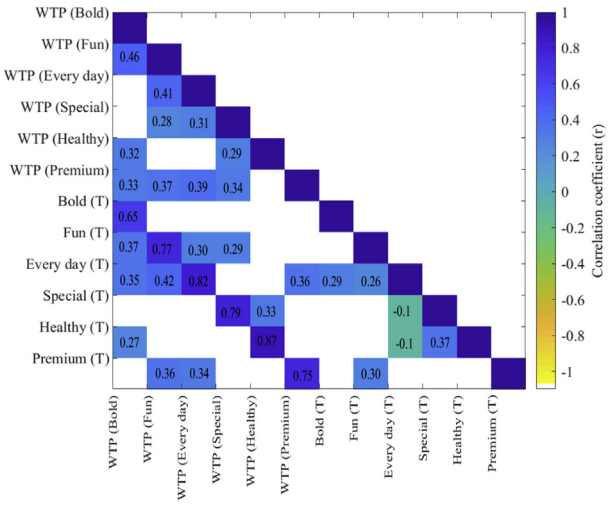

Fig. 6. Correlation matrix showing the relationship between willingness to purchase vs. liking towards taste for each concept in informed condition. Only significant correlations are presented ($p < 0.05$). The color bar represents the correlation coefficients in a scale from -1 to 1, where the blue side denotes the positive correlations, while yellow represents the negative correlations Abbreviations: WTP = Willingness to purchase, T = Liking of taste.

Table 4
Coefficients in regression equation for the general linear model (willingness to purchase vs. liking towards taste, liking towards package and package concept).

Variable	Coefficient (Coef.)	SE Coef.	T-value	P-value
Liking towards Taste	0.732	0.052	14.2	<0.001
Liking towards package	0.027	0.007	3.86	<0.001
Bold	-0.988	0.275	-3.59	<0.001
Fun	0.199	0.275	0.72	0.470
Everyday	0.356	0.273	1.30	0.194
Special	0.702	0.282	2.49	0.013
Healthy	0.523	0.280	1.87	0.063
Premium	-0.791	0.285	-2.78	0.006

The coefficient for liking towards taste is higher than the coefficients of liking towards packaging and the packaging concepts.
Coef. = Coefficient, SE – Standard Error, T-value = Test statistic, P-value = Significant level ($\alpha = 0.05$).

on emotions.

The CA (Fig. 3) showed different patterns of selection of emotions in the packaging and informed conditions. The selection was more scattered throughout the matrix in the informed condition. This may be because taste and visual stimuli were responsible for a higher dispersion. Based on the PCoA (Fig. 4), the positive association of liking with the terms such as wisdom, achievement and success in packaging condition and negative association of those words in the informed condition can be due to the lack of meeting the expectations created by the packaging in the packaging condition.

The negative effect on WTP of bold and premium concepts may be because the expectations created by the packaging for the bold (chili) and premium (berries and nuts) concepts in the informed condition were not met. The lower positive effect on WTP of the fun concept may be since it communicated a chewy caramel chocolate, which was not experienced in the tasting at the informed condition. Every day, special and healthy concepts did not communicate any addition of nuts, berries, or caramel to the chocolate, and the consumers expected a plain chocolate, which was the chocolate given in the informed condition. Hence they expressed positive correlations.

The findings of this study can be used in product design and development to control product intrinsic and extrinsic attributes by enhancing the emotional attachment towards the food products. This study eliminates the limitation of the study conducted by Gutjar et al. (2015), where they assessed liking only in the blind condition and it was recommended to evaluate liking at packaging and informed conditions, whereas this study assessed liking at all three stages (blind, packaging, and informed).

These results agree with recent studies showing that a wide range of extrinsic product attributes such as packaging/branding (Chaya et al., 2015; Ng et al., 2013; Schifferstein et al., 2013; Spinelli et al., 2015), can significantly influence product-evoked emotions. Moreover, the background color impacts on food perception and behavior (Spence, 2018).

Findings of Spinelli et al. (2014) indicated that emotion measures can deliver valuable information of how well consumers' expectations are met. In the current study, some emotion-based words (happy, health, fun, bright, relaxing, peace, achievement, togetherness, balance, excitement and friendship) significantly affected the liking scores of both packaging and informed conditions.

This study did not take into consideration, specific conditions during recruiting consumers. Further studies may be conducted by recruiting consumers with specific conditions (liking towards milk/dark chocolate, and consumption frequency, among others) to obtain deep insights about consumer responses based on different consumer groups. Also, a source of bias could exist in the informed condition when consumers tasted a plain chocolate and the package was labelled for example as chilli (where maybe consumers tried to search for the extra aromatic notes), or in the premium (where consumers could try to look for the extra nuts). This bias was not evaluated in this study. However, it could be able to obtain valuable information by taking this bias into consideration in future

studies.

5. Conclusion

The liking towards products are affected by the expectations generated by the packaging. The taste of food products strongly affects the willingness to purchase. There are variations in emotion-based terms associated with food packaging and the product, where higher emotional attachment is associated with the packaging than the taste of product. The findings of this study can be used in product design and development to control product intrinsic and extrinsic attributes by enhancing the emotional attachment towards the food products. It is proposed that a cross-disciplinary approach with a combination of sensory and consumer science as well as psychology and physiology is important to understand the implicit response of consumers to meet the expectations of products in the market.

Declarations

Author contribution statement

Nadeesha M. Gunaratne: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Sigfredo Fuentes, Caroline Francis, Hollis Ashman: Conceived and designed the experiments; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Thejani M. Gunaratne: Performed the experiments; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Damir Dennis Torrico, Claudia Gonzalez Viejo: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Frank R. Dunshea: Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Competing interest statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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