**Paper published online on** https://onlinelibrary.wiley.com/doi/10.1002/cb.1874

Rita P, Guerreiro J, Omarji M. Autonomic emotional responses to food: Private label brands versus National Brands. J Consumer Behav. 2020; 1–9. https://doi.org/10.1002/cb.1874

**Autonomic Emotional Responses to Food: Private Label Brands vs. National Brands**

Private label brands (PLB) have been increasing both perceived quality and consumer acceptance in the last decades, which has compelled national brands (NB) to invest in maintaining consumer confidence and preference. Recent economic crisis led consumers to become more price sensitive and more worried about cutting on daily needs, such as food consumption. However, taste is still one the most important factor of decision for consumers regarding food products. Despite such importance of taste in decision making, most research on consumer senses still relies on traditional methods of surveying consumers, which are unable to measure the consumers' autonomic emotional reactions. The current paper uses a psychophysiological method to measure emotional arousal - electrodermal activity (EDA) and a self-assessment manikin to measure pleasure. Emotions are then tested to assess their influence on perceived quality and willingness to buy (WTB). Findings show that NB are still perceived by consumers as superior, but consumers' WTB is not higher for NB. These results show that consumers' decisions are not always in favor of the product which is perceived to have a better quality which suggests that the "quality gap" is fading and the "branding gap" is gaining momentum.

**Keywords:** Private Label Brands; National Brands; Consumer Neuroscience; Consumer Goods.

**Autonomic Emotional Responses to Food: Private Label Brands vs. National Brands**

## Introduction

Since the late 1970s, private label brands (PLB) have flourished in the retail landscape of developed economies, particularly in Europe (Weib, 2015). Although PLB were initially associated with poor quality due to their heavily discounted goods and basic packages (PWC Report, 2011), during the 1980s PLB quality improved and their resemblance to national brands (NB) increased (International Markets Bureau, 2010). PLB also became a way for retailers to increase their profits in a low margin sector such as the retailing industry, more specifically the fast moving consumer goods, in which PLB, as opposed to NB, have shown a 44% increase in gross profit margins (Davies and Brito, 2002). Moreover, the recent economic crisis of 2000 and 2008 have forced consumers to become more price sensitive and more worried about cutting on daily necessities, such as food consumption, shifting their focus towards products with acceptable levels of quality at a reasonable price (Weib, 2015; Sethuraman & Mittelstaedt, 1992). Previous studies found that consumers do not return to NB after being satisfied with PLB, due to an acquired familiarity with the product, and trust on the products' quality (Goldsmith et al., 2010; Lamey et al. 2007). Therefore, the importance of understanding what affects consumer choice for food products is of increasing importance, namely the study of what drives consumers to choose between a NB or a PLB.

Although recent research on food consumption has explored how extrinsic (e.g. packaging) and intrinsic (e.g. taste) product cues may affect consumers perception (Salnikova & Grunert, 2020; Wang et al., 2019), most studies are based on self-reported methods, such as surveys, to measure consumer perceptions. Although such methods constitute an important quantitative tool to access some attributes, they seldom portrait the true emotions felt when consumers evaluate the

product, thus leaving room for bias and subjectivity (Camerer & Yoon, 2015). Such effect may be even more relevant in assessing intrinsic cues such as taste and smell, which are known to affect consumers autonomic nervous system responses (Lagast et al., 2020). Previous studies have analyzed how human taste genetics and anatomy affect consumers' hedonic responses to sweetness (Yeomans et al., 2007). Drescher et al., (2008), Moore (2012). Labbe et al. (2015) also explored the hedonic/utilitarian impacts on consumers' perceptions of taste, emotions, pleasantness and choice of food products. However, existing literature on sensory perceptions and emotions, measured by taste fall short to fully understand and measure the sensory cues and emotions that are felt by consumers when tasting food (Lowengart, 2012; Rossi et al., 2015). Therefore, the current study fills such research gap by exploring the differences in consumers' emotions, perceived quality and willingness to buy, based on whether the product is a PLB or NB and using psychophysiological measures of emotion. In order to understand such discrepancies, common practice within literature is to rely on blind and non-blind tests. This method allows for an understanding of the dynamics of choice between these two types of products and to evaluate the impacts of singular attributes on choice (e.g. price; branding; hedonic versus utilitarian products, among others).

The current paper starts with a background on food consumption theory and presents a conceptual framework and research hypotheses to explore the effects of taste on willingness to buy and the moderating effect of PLB and NB in different blind/non-blind scenarios. Then, the psychophysiological methods used for data collection are explained, followed by an analysis of the results. Finally, results are discussed, and conclusions explore (1) the limitations of the study, (2) the theoretical contributions, (3) the practical implications and (4) how the current research may be further extended.

## Theoretical Background

Food consumption has been studied in the past according to a variety of conceptual theories that explain the mechanisms of consumer responses. The primary mechanism revolves around expectations created prior to food consumption (Piqueras-Fiszman & Spence, 2015). Studies show that when there is a confirmation of expectations, consumers don't find that to be particularly interesting, and there is a 'boring' effect that lowers hedonic responses (Piqueras-Fiszman & Spence, 2014). Therefore, dissonance is often a good strategy in food consumption due to the positive effect that it may have on consumer responses. However, not all incongruences are beneficial. When there are higher inconsistencies such as an expectation that greatly exceeds the experience, such dissonance creates a hedonic displeasure and consumer tend to negatively react to such product, according to the *contrast* theory (Cardello & Sawyer, 1992). When consumers have a low expectation but a good experience, they are generally satisfied in the end. Yet, consumers may also go through an *assimilation* process. During *assimilation*, consumers adapt their perception to their prior expectations. For example, if consumer expectation about a given food is low, the liking rate will also be low due to such baseline expectation (Tuorilla, Cardello & Fisher, 1994). However, such effect is more prevalent when the difference in terms of expectation-perception in not very large.

According to past studies, an *assimilation-contrast* may also happen in the same evaluation. Consumers may start by reflecting *assimilation* until a certain threshold of inconsistency is surpassed and a *contrast* effect than takes place. A third model, *generalized negativity*, explains other type of attitudes, namely those where consumers always express dissatisfaction towards inconsistencies independently of how good or worse they are from their first expectations.

Regardless of the consumer attitude toward food, the familiarity that the consumer has with the food and intrinsic and extrinsic cues such as quality perception are very important variables during the decision-making process. Extrinsic cues, which are related to what surrounds the

product but not to the physical product itself, influences consumers' perceptions of product performance and quality and can be assessed through price, brand name, brand image, company image, advertising budget, packaging, country of origin seals, among others (Veale & Quester, 2009; Field et. al, 2009; Zeithaml, 1988). Intrinsic cues include the attribute of taste, texture, aroma, shape and appearance features such as color and form (Meisalman, 2001; Espejel et al., 2007; Field et al., 2009; Olson & Jacoby, 1972; Bernués et al., 2003). Such extrinsic and intrinsic cues are known to affect autonomic emotions (Prescott, 2017) and emotions have important consequences in consumer responses (Mehrabian and Russell (1974). According to the S-O-R theory of Mehrabian and Russell (1974). (S)timuli such as PLB and NB product experiences (e.g. through taste) affect (O) organism responses (e.g. autonomic emotions), which finally affect consumers (R)esponses, (e.g. WTB). Autonomic emotions arise from the autonomic nervous system and are thus impossible to bias or to control (Bouscein, 1992). While self-reported measures require consumers to rationalize their intentions, emotions measured by psychophysiological responses such as electrodermal activity (EDA) are directly linked to the brain (Sequeira and Roy, 1993; Boucsein, 1992). EDA detects electrical changes of the skin properties depending on the level of moisture, thus allowing for the measurement of emotion (Kumar, 2015). Zurawicki (2010) argued that skin conductivity is a sensitive gauge of emotional arousal and Damasio (1994) stated that EDA is able to observe differences in sweat that is an indication of arousal, whether this has a positive or negative valence (see also: Kenning & Linzmajer, 2010). Moreover, valence is easily explained and exemplified by sadness involving negative valence, while happiness typically involves positive valence (Zawadzki et al., 2016). In addition, Russel (1980) and Watson & Tellegen (1985) reported the importance and relevance of studying these two constructs in combination, by defending that emotions are composed of a distinct pattern of both valence and arousal, and therefore should be both examined together. Given

that EDA is unable to measure valence, self-assessment Manikin (SAM) is often used to complement autonomic measurements of emotions. SAM is a picture-oriented method which directly measures pleasure, arousal, and dominance associated in response to an object or event (Lang, 1980; Lang et al., 1985) and it is known to correlate and confirm EDA measures. For this reason, the self-assessment manikin method was used to evaluate valence and complement the autonomic measurement of arousal given by EDA. In Guerreiro et al., (2015) the construct of dominance was singled out due to low correlation levels, citing Donovan and Rossiter (1982), Mehrabian (1995), Russell and Pratt (1980) and Vieira (2013). Thus, this study used a two-dimensional approach, with focus on arousal and valence.

In a blind condition, consumers are not aware of extrinsic cues, but only of the intrinsic cues of the product such as taste, texture, aroma, etc. Therefore, in such cases, and due to the increasing quality of PLBs, we posit that consumers will not acknowledge the difference in terms of both self-reported measures and autonomic measures. Without extrinsic cues, consumers are unaware of brands positioning or price for each product. Therefore, their expectations are solely based on past experiences with products from such category. If products are similar in terms of their intrinsic cues *assimilation* may occur and thus, a confirmation of expectations is likely to have no particular changes in emotional arousal (Piqueras-Fiszman & Spence, 2015).

Therefore, we hypothesize that:

**H1a**: Autonomic emotional arousal is the same for NB and PLB in a blind condition.

**H1b:** Self-reported emotional arousal is the same for NB and PLN in a blind condition.

**H1c:** Self-reported pleasure is the same for NB and PLB in a blind condition.

However, previous studies suggest that the opposite occurs when evaluating in a non-blind condition, with consumers' sensory perceptions, preference and purchase intentions being higher

for NB vs. PLB, due to the effect of branding. For example, Field et al., (2009) changed cookies from its initial packaging between a PLB and NB and showed that branding had a positive effect and NB boasted more positive ratings of taste and preference, even though consumers would be tasting a PLB cookie in a NB packaging. While tasting PLBs consumers have low expectations and therefore the difference between expectations and experience is not so high. This may lead to a "boredom" effect as previously stated in the literature (Piqueras-Fiszman & Spence, 2014) or even to *assimilation*, thus reflecting a low emotional arousal and pleasure response (Piqueras-Fiszman & Spence, 2014; Tuorilla, Cardello & Fisher, 1994). On the other hand, expectations for NBs are high and the difference between such expectations and the perceived experience may sometimes be more evident thus leaving more often to *contrast* or *generalized negativity* and thus a higher emotional arousal and pleasure than in PLBs (Cardello & Sawyer, 1992). Therefore:

**H2a:** Autonomic emotional arousal is higher for NB than for PLB in a non-blind condition.

**H2b:** Self-reported arousal is higher for NB than for PLB in a non-blind condition.

**H2c:** Self-reported pleasure is higher for NB than for PLB in a non-blind condition.

While being exposed to intrinsic and extrinsic cues, consumers evaluate the product and make assumptions regarding its perceived quality. Two types of quality are defined by Brunso et al., (2005): objective quality and perceived quality. On the one hand, objective quality relates to the technical superiority or excellence of a product/service, which is, by its own nature, measurable and verifiable. On the other hand, subjective or perceived quality refers to the consumers' value judgements or perceptions of quality based on a pre-determined notion of standards. Richardson et al., (1994), refers to the importance of studying perceived quality by arguing that quality perception has been found to be more important than objective quality in influencing consumer

purchase intention of PLB. The importance of perceived quality for this research is immense since this construct, according to Espejel et al., (2007) and Zeithaml, (1988), can be compared based on its excellence and superiority with similar products, such as a scenario of PLB vis a vis NB, with one being ranked higher or lower, particularly on a non-blind conditions where consumers are aware of the brand, which is known to be an important marker for quality perceptions. Perceived quality and WTB on blind conditions are expected to be similar between PLB and NB due to the little deviation in terms of intrinsic cues. However, when in a non-blind condition, we expect that the increase in arousal and pleasure in favor of NB (as stated in the previous hypothesis) may be translated into perceived quality.

Therefore:

**H1d:** Consumers' perceived quality is the same between NB and PLB in a blind condition.

**H2d:** Consumers' perceived quality is higher for NB than for PLB in a non-blind condition.

Although studies often place emotions as a consequence of perceived quality (following Mehrabian and Russel, 1974 S-O-R model) (Jang, 2009), studies also show that satisfaction with food consumption experience and quality perception may be affected by many contextual factors, such as mood, other than the food itself (Cardello et al., 2000; Hansen, 2002). Therefore, in the case of a tasting experience that elicits a strong psychophysiological response, particularly in a blind scenario, we expect that such emotional responses (arousal and pleasure) may contribute as a way for consumers to infer perceived quality. Hence,

**H3a:** Emotions (arousal and pleasure) positively influence perceived quality.

Finally, we also suggest that perceived quality exerts a positive influence on consumers' WTB, given that it is a way for consumers to evaluate how good the product fits their initial expectations (Donovan and Rossiter, 1982; Greewall, 1998; Jang, 2009).

**H3b:** Perceived quality positively influences WTB.

Figure 1 shows the proposed conceptual model based on the theoretical framework.

**-- PLACE FIGURE 1 AROUND HERE --**

## Materials and Methods

Several methods of measuring such autonomic responses are available and used in the literature, such as: fMRI (Akdeniz, 2017); electroencephalography/EEG (Gao, Wang and Zhang, 2016); magnetoencephalography/MEG (Haumann et al., 2016); positron emission tomography (PET); eye-tracking and pupil dilatation (Zhang et al., 2017); electrodermal activity (Guerreiro et al., 2015)); electrocardiography; electromyography (Walla, 2011); analysis of blush, blinking, breathing or heartbeat (Fisher et al., 2010; Camerer et al., 2004). For this research arousal was measured through electrodermal response (EDA) and its valence was measured by using the Self-Assessment Manikin (SAM) (Bradley and Lang, 1994). This method was of particular importance since although skin conductance is a reliable method of evaluation, it fails to separate whether the stimuli evoked positive or negative reactions (pleasure).

Perceived quality was measured using Grewal et al. (1998) scale, ranking perceived quality through a seven-point Likert scale ranging from (1) = *Strongly disagree* to (7) = *Strongly Agree*. Three core items compose perceived quality: 1) The "product" appears to be of good quality; 2)

The “product” appears to be fresh; 3) The “product” appears to be reliable. Moreover, perceived quality is likely to have an impact on willingness to buy. Grewal et al. (1998) further proposed a model of a three-item scale ranging from (1) = *Very Low* to (7) = *Very High:* 1) If I was going to buy a “product”, the probability of buying this “product” would be; 2) The probability that I would consider buying this “product” would be; 3) The likelihood that I would purchase this “product” would be.

**Experimental Design and Participants**

A total of 20 individuals were gathered through social media to voluntarily participate in a laboratory experiment. Of those, 19 participants were considered for valid analysis as one subject´s data collection was frequently disconnected, producing incomplete readings. From the valid sample of 13 females and 6 males, the participants were all aged 18-34. Each participant was asked to come to a laboratory condition to control for extraneous variables which also limited the number of potential participants. However, the number of participants follows other studies using psychophysiological measures in laboratory conditions (Mobascher et al., 2009; Posada-Quintero et al., 2016).

**Design and Procedure**

Consumers tasted different PLB chocolate types from the most popular local retailers. Three different bundles of PLB and NB chocolates where created and randomly assigned to participants, each one comprising similar PLB and NB chocolates to minimize the risk of bias results due to taste preferences.

Table 1 shows the PLB and NB used for the study:

**-- PLACE TABLE 1 AROUND HERE --**

Light display was maintained unvarying and room temperature was controlled and set to approximately 23 degrees in agreement with Bouscein (1992) to avoid its possible interference on skin conductance level (SCL). Upon arrival, participants were asked to sit in a chair and fill a consent form. Participants were then seated approximately 60 cm of the table and presented with the instructions, which included information of the progression of the experiment such as all the technological equipment used and the administration of a questionnaire following the tasting experiment. For the appropriate measure of SCL, an isotonic NaCl gel solution was placed on the electrodes, guaranteeing feasible measurement (Bouscein, 1992). Then, two electrode were placed in the middle phalanges of the index finger and middle finger of the non-dominant hand. EDA equipment was set to a 5,000 μʊ rate of gain, and a low pass filter of 1,000 Hz in order to remove possible artifacts that might arise from unwanted interferences of natural body movements (Schmidt and Walach, 2000). Participants were advised to minimize the non-dominant hand motion in order to avoid intrusive effects of noise in readings, and to place their hands on the table, facilitating finding the plate with chocolate. Figure 2 shows the timeline of the experiment.

**-- PLACE FIGURE 2 AROUND HERE --**

The maximum peak was reached after a clap was heard in the room to allow for Lykken & Venables (1971) correction of the baseline measurement to be used. Such maximum peak was followed by one minute of silence and three more minutes of relaxing music to record the participants' baseline. After the baseline was recorded, each scenario was presented to the participants. In the end of each tasting scenario participants were given some time to fill a questionnaire on a digital tablet to measure the non-psychophysiological measures (SAM, PT, WTB). With the completion of the questionnaire, the participants underwent two minutes of baseline with calming music, lowering and stabilizing their emotion levels, of which the end again marked the commencement of the two minute of tasting, followed by the same questionnaire.

These first two blocks of experiment were done on a blind setting, which was always placed before initiating the baseline. For the first block, participants were presented with a PLB chocolate and the second block with a NB chocolate. For the remaining two blocks, the exact same procedure was conducted, although no blind was used and the participants were asked to only open their eyes in the moment of tasting, not provoking this way emotions with the sight of the product before tasting. On the PLB and NB blocks, the brand logo was cut from the packaging and placed on the plate along with the chocolate, giving consumers the cue of the brand (retailer and/or manufacturer) with no interference of packaging or any other unwanted cues.

The questionnaire in the end of each scenario was the same for all four blocks of the experiment, allowing for an evaluation and comparison of the different experimental settings. The first part of the survey was designed to measure arousal and valence, using SAM – Arousal, which was rated through a nine-point pictorial scale ranging from (9) = *stimulated, excited, tense* to (1) = *relaxed, calm, indifferent,* as well as valence, which was rated with a scale ranging from (9) = *pleased, positive, satisfied* to (1) = *displeased, negative, unsatisfied*. Participants then evaluated perceived quality followed by willingness-to-buy. On the last block participants were presented with an additional questionnaire accounting for their socio-demographics (age, gender and education level) and also other cautionary questions guaranteeing the feasibility of the experiment. This cautionary questions were replicated from Rossi et al., (2015) and were used to measure hunger using a scale that asked "Are you hungry right now?" ranging from (1) = *not hungry at all* to (7) = *very hungry*, likeability of chocolate (how much do you like chocolate?) with a seven-type scale, ranging from (1) = *not at all to* (7) = *a lot*, previous experience with chocolate (how often do you eat chocolate) ranging from (1) = *never* to (7) = *frequently*, mood (as it is a known influencer of attitude) with a question asking if consumers "feel happy right now.", ranging from (1) = *strongly disagree* to (7) *strongly agree*, and an open question about their preferred brand.

After concluding and escorting the participants out, the electrodes were cleaned with a cotton swab and the gel solution was used again.

## Results

This research studied arousal, both from EDA and from a survey (i.e. SAM) and also valence through SAM. EDA data was treated for analysis using the AcqKnowledge software. First, a low-pass filter of 5 Hz was used to remove undesirable artefacts that may have occurred due to unwanted natural body movements which can interfere with skin conductance response (Schmidt and Walach, 2000). Second, the EDA results regarding each of the tasting scenarios were selected. For each participant four blocks of EDA measurements were available. In order to correct individual differences in range, Lykken et al. (1966) correction was used and the average skin conductance level SCL for each experimental group for every participant was calculated (Arousal EDA). These final values were then grouped, forming a series with every participants' final averaged SCL, for each of the four experimental blocks. Such values were then used to test the hypotheses along with the arousal (Arousal SAM) and valence (Valence SAM) ratings measured using SAM, the perceived quality (PQ) scale and the WTB scale.

A nonparametric independent samples Kruskal-Wallis was conducted with the aim of testing for differences of arousalEDA, arousalSAM and valenceSAM, within the four experimental groups: F1=BlindPLB; F2=BlindNB; F3=NonBlindPLB; F4=NonBlindNB. Results showed there was no statistical difference among the blind groups (i.e. F1 and F2) for all measures of emotion, confirming H1a. Hence, H1a was not rejected, thus concluding that arousalEDA was similar for NB and PLB in a blind setting ($\chi(3) = 7.368, p > .05$ with a mean rank F1 $=$ $41.42$ and F2 $=$ $34.05$. The same applied for arousalSAM (H1b) ($\chi(3) = 0.841, p >$ $.05$ with a mean rank F1 $=$ $38.05$ and F2 $=$ $35.18$) and valenceSAM (H1c) ($\chi(3) =$

$3.226, p > .05$ with a mean rank F1 $=$ 39.76 and F2 $=$ 40.84, thus confirming H1b and H1c, respectively. On the non-blind setting, results showed significant differences in terms of psychophysiological arousal between NB and PLB, which confirmed H2a ($\chi(3) = -23.58, p <$ .05 with a mean rank F3 $=$ 27.68 and F4 $=$ 50.84. However, no significant differences were found in terms of arousalSAM (H2b) ($\chi(3) = 0.841, p > .05$ with a mean rank F1 $=$ 39.21 and F2 $=$ 41.55) and valenceSAM (H2c), ($\chi(3) = 3.226, p >$ .05 with a mean rank F1 $=$ 30.97 and F2 $=$ 42.42).

Regarding perceived quality, similarity among PLB and NB in a blind scenario was found, which confirmed H1d ($\chi(3) = -6.763p > .05$ with a mean rank F1 $=$ 33.21 and F2 $=$ 39.97). In the non-blind scenario, and as expected, perceived quality in NB scenario was also significantly higher than in the PLB scenario, thus confirming H2d ($\chi(3) = -24.447, p <$ .05 with a mean rank F3 $=$ 28.18 and F4 $=$ 52.63). Moreover, WTB was confirmed to be similar between NB vs. PLB scenarios in a blind condition ($\chi(3) = 2.658, p >$ .05 with a mean rank F1 $=$ 33.71 and F2 $=$ 40.58) However WTB was not found to be higher for NB as opposed to PLB in a non-blind setting ($\chi(3) = 2.658, p >$ .05 with a mean rank F3 $=$ 35.58 and F4 $=$ 44.13).

To test whether emotions influence perceived quality, and subsequently perceived quality impacts on WTB, two simple linear regressions were computed. First, H3a was tested with perceived quality as the dependent variable and arousalEDA, arousalSAM and valenceSAM as independent variables. It was concluded that emotions played a significant role in explaining perceived quality, thus confirming the hypothesis that the level of emotion positively influences perceived quality, with arousalEDA contributing the most ($\beta = 5.147, p < .05$), followed by valenceSAM ($\beta = .390, p < .01$) and last by arousalSAM ($\beta = .174, p < .05$). A significant

regression was found (F(3, 72) = 12.295 (p < .01)) with an adjusted $R^2$ of .311 and a Durbin-Watson of 1.767. A second linear regression was conducted to test for H3b leading to the conclusion, as also expected, that the level of perceived quality positively influenced WTB on a proportion of $\beta = 1.011, p < .05$. A significant regression was found (F(3,74) = 93.717 (p<.01)) with an adjusted $R^2$ of .553 and a Durbin-Watson of 1,218. Table 2 shows the results of the tested hypotheses.

**-- PLACE TABLE 2 AROUND HERE --**

## Discussion

First and foremost, it is highly important to understand and highlight the differences of two dimensions of measurement studied in this research: objective and sensorial. Both methods of measurement have weaknesses and strengths and should therefore be used in combination, producing more reliable conclusions (Camerer et al., 2004). For this reason, emotions were recorded through EDA, a sensorial method of measurement, and through the SAM surveys which are objective measurements. Results revealed a curious discrepancy between the true emotions felt by participants, called arousalEDA, and their objective measure of arousalSAM. While on arousalEDA there was a clear alignment with literature, presenting similar emotions for PLB vs. NB in a blind setting (H1a) and higher emotions for the NB's as opposed to PLB in a non-blind scenario (H2a), the results for arousalSAM, which were expected to follow the same results, although aligned with literature in a blind setting (H2a) scenario, were not so in a non-blind setting, thus not holding the pre-assumptions of literature that NB would produce higher levels of arousal. This discrepancy between the results of arousalEDA and arousalSAM in a non-blind setting was also not evident in the results of valenceSAM, which also did not demonstrate higher values for NB in a non-blind scenario. This is where the importance of sensory analysis becomes

indispensable, since most felt emotions remain undetected by humans (Zurawicki, 2010), hiding their true impacts and often producing unreliable or biased responses of an objective measurement such as self-reported surveys (Camerer, 2004; Miljkovic & Alcakovic, 2010; Morin, 2011). Camerer (2004; 2005), states that sensorial analysis, such as the one conducted for arousalEDA, are direct measures that generate more reliable results and therefore better than self-assessment methods. Kenning & Linzmajer (2010) state that consumer neuroscience is able to deliver more objective and complete understanding of consumer's desires. The consensus in the literature leans towards using the measure of arousalEDA, conceding it has more strength and shows superiority comparatively to its objective measure, arousalSAM, and to valenceSAM. For this reason it is understood that consumers' emotions are similar in a blind setting and are higher for NB's in a non-blind setting. These findings support the notion that quality-wise, PLB quality is in fact increasing and reaching closer to NB's. However, consumers still rate NB superior, and while taste is singularly the most important element of food products (Lowengart, 2012), it is composed of various elements and cues, such as packaging, reputation, price and brand name that still play an important role for consumers (Rossi et al., 2015).

The current findings point to two strategies that managers may adopt in the case of PLB: 1) reinforcement of product quality and brand equity; 2) dissociation of the retailer name. First and foremost, retailers need to highlight its high quality standards while increasing spending on brand reputation so that perceptions of PLB quality become more favorable, yielding a higher brand equity. Other approach is for retailers to dissociate themselves from their brand name, therefore distancing from their corporate brand image. However, as concluded by Rossi et al. (2015), consumers can still have negative biases even when not presented with the retailer's brand name, and therefore the best solution would be strengthening PLB brand image and brand equity, possibly yielding consistent long-term gains. For NB, consumers' confidence in its products´

quality and its strong branding is a strong force to which manufacturers should further leverage on, exploit and figure ways of making it more salient.

Overall, retailers need to create more positive hedonic associations, thus making consumers quality more consciously salient as showed by H3a. Such results show that higher levels of emotion lead to higher levels of perceived quality. This finding, in line with literature, reinforces the importance of emotions for consumers, retailers, and for manufacturers which should keep reinforcing their brand equity. Moreover, findings suggest that perceived quality positively influences WTB, thus showing a clear correlation between quality and consumers' purchase intentions (H3b). However, this influence may not always be strong or enough to lead consumers to an actual purchase. This is shown in the current study by the fact that in a non-blind scenario, although perceived quality was higher for NB as opposed to PLB, participants did not particularly score their WTB higher for NB. This suggests that the emphasis on quality should not be disregarded; in fact, a great amount of care should be taken to ensure that consumers are more than satisfied with the products´ taste.

## Conclusions

### *Theoretical Implications*

The dynamics of PLB vs. NB are of increased importance for consumers, retailers and manufacturers. Various motivational cues, either intrinsic or extrinsic influence consumers' decision-making for food products (Veale and Quester, 2009; Espejel et al. 2007; Lowengart 2012). Although price and packaging are exhaustively studied, taste has not been as widely investigated (Lowengart, 2012; Rossi et al., 2015). Also, previous literature has mainly studied the importance of taste on emotions and consequently on behavior using surveys, which may not

reflect real consumer emotions. Therefore, the current study presents theoretical contributions by exploring the differences in consumers' emotions, perceived quality and willingness to buy based on whether the product is a PLB or NB and in a blind/non-blind test using psychophysiological measures of emotion.

### *Marketing Implications*

The conclusions achieved in this research, aligned with general literature, show that NB are still perceived by consumers as superior (H2a/H2b), although PLB are tightening the gap showing similarity within blind tests (H1a/H1b/H1c/H1d). Such results are important findings to managers that shed some light on consumers´ actual emotions which would not be possible through objective measurements. Even though, objective measures (i.e. surveys) demonstrate incoherent results with EDA measurements (H2a opposed to H2b), physiological findings prevail as these are more reliable. Findings also suggest that consumers WTB will not necessarily be higher for NB, even if they are perceived of a better quality (H2d). Rossi et al (2015) reaches the conclusion that the "quality gap" is fading and that it is now time to confront the "branding gap". The current results confirm such statement. When consumers opt to purchase PLB even when acknowledging that NB quality can be superior, solely based on the element of taste, this demonstrates that in fact the first step of increased quality parity is achieved.

### *Research limitations and directions for future research*

Despite care was taken in order to ensure that no unwanted cues would influence consumers' emotions and decisions, such as presenting during experiment no cues of price and no elements of branding, the current study has some limitations. The first limitation is the small number of participants that were tested in a laboratory condition. Such limited number of participants may endanger external validity. However, although surveys may be a better method

to collect a large number of participants, the current study was able to control all the extraneous variables, thus increasing internal validity, Moreover, the number of participants follows other studies using psychophysiological measures in laboratory conditions (Mobascher et al., 2009; Posada-Quintero et al., 2016). Another limitations was a small cue with the products brand name that was made available on non-blind scenarios as otherwise it would not be possible to distinguish the PLB from the NB. This cue is a limitation as it may allow brand reputation to influence participants' decisions and/or emotions. In future research an interesting complement to this study would be to use a physiological measure for valence such as heartbeat to complement the SAM measure. Moreover, it would be interesting to study other elements such as: reputation of retailer; price; branding (e.g. brand equity, brand awareness, budget); nutritional value; social or environmental impacts (e.g. fair trade, eco labels, corporate social responsibility); country of origin labels; among others. This could be done by either replacing the taste component for one of the mentioned above, or more interestingly, by combining several of these elements, accounting for the impacts of both taste and social presence, for example. Other interesting possibility would be to replicate this experiment in other product categories, such as beauty, homecare or clothing segments.

## REFERENCES

Akdeniz, G. (2017) Complexity Analysis of Resting-State fMRI in Adult Patients with Attention Deficit Hyperactivity Disorder: Brain Entropy. *Computational Intelligence and Neuroscience, 2017*.

Allison, R., Uhl, K. (1964) Influence of beer brand identification on taste perception. Journal of Marketing. 1(3): 36-39.

Bernués, A., Olaizolab, A., Corcoran, K. (2003) Extrinsic attributes of red meat as indicators of quality in Europe: an application for market segmentation. Food Quality and Preference 14: 265-276

Boucsein, W. (2012) Electrodermal activity. Springer Science & Business Media.

Bradley, M. M., Lang, P. J. (1994) Measuring emotion: The self-assessment manikin and the semantic differential. Journal of Behavior Therapy and Experimental Psychiatry. 25(1): 49-59

Brunso, K., Bredahl, L., Grunert, K. G., Scholderer, J. (2005) Consumer perception of the quality of beef resulting from various fattening regimes. Livestock Production Science, 94(2): 83-93.

Camerer, C. F., Loewenstein, G., Prelec, D. (2004) Neuroeconomics: why economics needs brains. Scandinavian Journal of Economics. 106(3): 555–579

Camerer, C., Loewenstein, G., Prelec, D. (2005) Neuroeconomics: How Neuroscience Can Inform Economics. Journal of Economic Literature. 43: 9–64

Camerer, C., & Yoon, C. (2015) Introduction to the journal of marketing research special issue on neuroscience and marketing. *Journal of Marketing Research*, *52*(4), 423-426.

Cardello, A. V., Schutz, H., Snow, C., & Lesher, L. (2000). Predictors of food acceptance, consumption and satisfaction in specific eating situations. *Food Quality and Preference*, 11(3), 201-216.

Damasio, A. R. (1994) "Descartes' error: Emotion reason, and the human brain". Putnam. New York, NY.

Davies, G., Brito, E. (2002) Price and quality competition between brands and own brands – A value systems perspective. European Journal of Marketing, 38(1): 30-55.

Donovan, R. J. and Rossiter, J. R. (1982) "Store atmosphere: an environmental psychology approach", Journal of Retailing, 58(1), 34–57.

Drescher, L., Thiele, S., & Weiss, C. R. 2008. The taste for variety: A hedonic analysis. *Economics Letters*, *101*(1), 66-68.

Espejel, J., Fandos, C., Flavián, C., (2007) The role of intrinsic and extrinsic quality attributes consumer behaviour for traditional food products. Managing Service Quality: An International Journal, 17(6): 681–701

Field, J. R., Bergiel, B. K., Giesen, J. M., Fields, C. L. (2009) Effects of branding on taste perceptions. Competition Forum, 7(2).

Fisher, C. E., Chin, L. J., Klitzman, R. (2010) Defining Neuromarketing: Practices and Professional Challenges. Harvard Review of Psychiatry. 18(4): 230-7

Gao, J., Wang, W., & Zhang, J. (2016) Explore interregional EEG correlations changed by sport training using feature selection. *Computational intelligence and neuroscience*, *2016*, 30.

Goldsmith, R. E., Flynn, L. R., Goldsmith, E., Stacey, E. C. (2010) Consumer attitudes and loyalty towards private brands. International Journal of Consumer Studies, 34: 339–348.

Guerreiro, J., Rita, P., & Trigueiros, D. (2015) Attention, emotions and cause-related marketing effectiveness. *European Journal of Marketing*, *49*(11/12), 1728-1750.

Hansen, T. (2002). The effect of physical surroundings in usage situations on consumer perception of food quality and on consumer emotions. *Journal of International Consumer Marketing*, 15(1), 31-51.

Haumann, N. T., Parkkonen, L., Kliuchko, M., Vuust, P., & Brattico, E. (2016) Comparing the performance of popular MEG/EEG artifact correction methods in an evoked-response study. *Computational intelligence and neuroscience, 2016*, 3.

Holm, L., & Kildevang, H. (1996) Consumers' views on food quality. A qualitative interview study. Appetite, 27(1), 1-14.

Hubert, M., Kenning, P. (2008) A current overview of consumer neuroscience. Journal of Consumer Behaviour. 7: 272-292

Hurling, R., & Shepherd, R. (2003) Eating with your eyes: effect of appearance on expectations of liking. Appetite, 41(2), 167-174.

International Markets Bureau (2010) Global private label trends, Market Analysis Report. Accessed: 15/05/16. https://www.gov.mb.ca/agriculture/market-prices-andsstatistics/foodandvalueaddedagriculturestatistics/pubs/global_private_label_trends_en.pdf.

Jang, S. S., & Namkung, Y. (2009). Perceived quality, emotions, and behavioral intentions: Application of an extended Mehrabian–Russell model to restaurants. *Journal of Business Research*, 62(4), 451-460.

Kenning, P., Linzmajer, M. (2010) Consumer neuroscience: an overview of an emerging discipline with implications for consumer policy. Journal of Consumer Protection and Food Safety. 6(1): 111-125

Koivisto Hursti, U. K., & Sjödén, P. O. (1997) Changing food habits in children and adolescents Experiences from intervention studies. Näringsforskning, 41(1), 102-110.

Kumar, S. (2015) Neuromarketing: The New Science of Advertising. Universal Journal of Management. 3(12): 524-531

Labbe, D., Ferrage, A., Rytz, A., Pace, J., & Martin, N. (2015) Pleasantness, emotions and perceptions induced by coffee beverage experience depend on the consumption motivation (hedonic or utilitarian). Food quality and preference, 44, 56-61.

Lamey, L., Deleersnyder, B., Dekimpe, M. G., & Steenkamp, J. B. (2007) How business cycles contribute to private-label success: evidence from the United States and Europe. Journal of Marketing, 71(1): 1-15.

Lowengart, O. (2012) The effect of branding on consumer choice through blind and non-blind taste tests. Innovative Branding.

Lykken, D. T., Venables, P. H. (1971) Direct measurement of skin conductance: a proposal for standardization. Psychophysiology. 8(5)

Mehrabian, A. (1995) Relationships among three general approaches to personality description, *The Journal of Psychology*, 129(5), 565–581.

Meiselman, H. L. (2001) Criteria of food quality in different contexts. Food Service Technology, 1: 67–84

Miljković, M., Alcakovic, S. (2010) Neuromarketing: Marketing Research Future? Singidunum Revija, 7(2): 273 – 283

Mobascher, A., Brinkmeyer, J., Warbrick, T., Musso, F., Wittsack, H. J., Saleh, A., ... & Winterer, G. (2009) Laser-evoked potential P2 single-trial amplitudes covary with the fMRI BOLD response in the medial pain system and interconnected subcortical structures. Neuroimage, 45(3), 917-926.

Moore, D. J., & Lee, S. P. (2012) How advertising influences consumption impulses. Journal of Advertising, 41(3), 107-120.

Morin, C. (2011) Neuromarketing: The New Science of Consumer Behavior. Society. 48(2): 131-135

Nielsen Global Private Label Report; November (2014) http://www.nielsen.com/content/dam/nielsenglobal/eu/nielseninsights/pdfs/Nielsen%20Global%20Private%20Label%20Report%20November%202014.pdf. Accessed: 27/05/16

Olson, J. C., Jacoby, J. (1976) Consumer response to price: An attitudinal, information processing perspective in moving ahead with attitude research. Pennsylvania: College of Business Administration of Pennsylvania State University.

Ophuis, P. A. O., & Van Trijp, H. C. (1995) Perceived quality: A market driven and consumer oriented approach. *Food quality and Preference*, *6*(3), 177-183.

Posada-Quintero, H. F., Florian, J. P., Orjuela-Cañón, A. D., Aljama-Corrales, T., Charleston-Villalobos, S., & Chon, K. H. (2016) Power spectral density analysis of electrodermal activity for sympathetic function assessment. Annals of biomedical engineering, 44(10), 3124-3135.

PWC Report, (2011) The private labels revolution, Retail Consumer. https://www.pwc.ru/ru/retail-consumer/assets/private-labels-eng-may2011.pdf. Accessed: 23/05/16.

Richardson, P. S., Dick, A. S., Jain, A. K. (1994) Extrinsic and intrinsic cue effects on perceptions of store brand quality. Journal of Marketing, 58: 28-36

Rossi, P., Borges, A., Bakpayev, M. (2015) Private labels versus national brands: The effects of branding on sensory perceptions and purchase intentions. Journal of Retailing and Consumer Services. 27: 74–79

Russell, J. A. and Pratt, G. (1980) A description of the affective quality attributed to environments, *Journal of personality and social psychology*, 38(2), 311–322.

Schmidt, S., Walach, H. (2000). Electrodermal activity (EDA) State-of-the-art measurement and techniques for parapsychological purposes. Journal of Parapsychology. 64(2): 139-164.

Sethuraman, R., Mittelstaedt, J. (1992) Coupons and private labels: A cross-category analysis of grocery products. Phsycology and Marketing. 9(6): 487-500.

Veale, R., Quester, P. (2009) Tasting quality: the roles of intrinsic and extrinsic cues. Asia Pacific Journal of Marketing and Logistics. 21(1): 195-207

Vieira, V. A. (2013) Stimuli-organism-response framework: A meta-analytic review in the store environment", *Journal of Business Research*, 66(9), 1420–1426.

Walla, P., Brenner, G., & Koller, M. (2011) Objective measures of emotion related to brand attitude: A new way to quantify emotion-related aspects relevant to marketing. *PloS one*, *6*(11), e26782.

Walsh, G., Mitchell, V. W. (2010) Consumers' intention to buy private label brands revisited. Journal of General Management. 35(3): 3-24.

Watson, D., & Tellegen, A. (1985) Toward a consensual structure of mood. *Psychological bulletin*, *98*(2), 219.

Weib, S. (2015) Determinants of private label attitude: Predicting consumers' brand preferences using psychographics. Wiesbaden, Hessen: Springer-Verlag

Yeomans, M. R., Tepper, B. J., Rietzschel, J., & Prescott, J. (2007) Human hedonic responses to sweetness: role of taste genetics and anatomy. *Physiology & behavior*, *91*(2-3), 264-273.

Zawadzki, M. J., Mendiola, J., Walle, E. A., Gerin, W. (2016) Between-person and within-person approaches to the prediction of ambulatory blood pressure: the role of affective valence and intensity. Journal of Behavior Medicine. 39: 757–766

Zeithaml, V. A. (1988) Consumer perception of price, quality and value: a means-end model and synthesis of evidence. Journal of Marketing. 52(3): 2-22

Zhang, X., Liu, X., Yuan, S. M., & Lin, S. F. (2017) Eye Tracking Based Control System for Natural Human-Computer Interaction. *Computational Intelligence and Neuroscience*, *2017*.

Zurawicki, L. (2010) Neuromarketing: Exploring the brain of the consumer. Berlin Heidelberg: Springer-Verlag

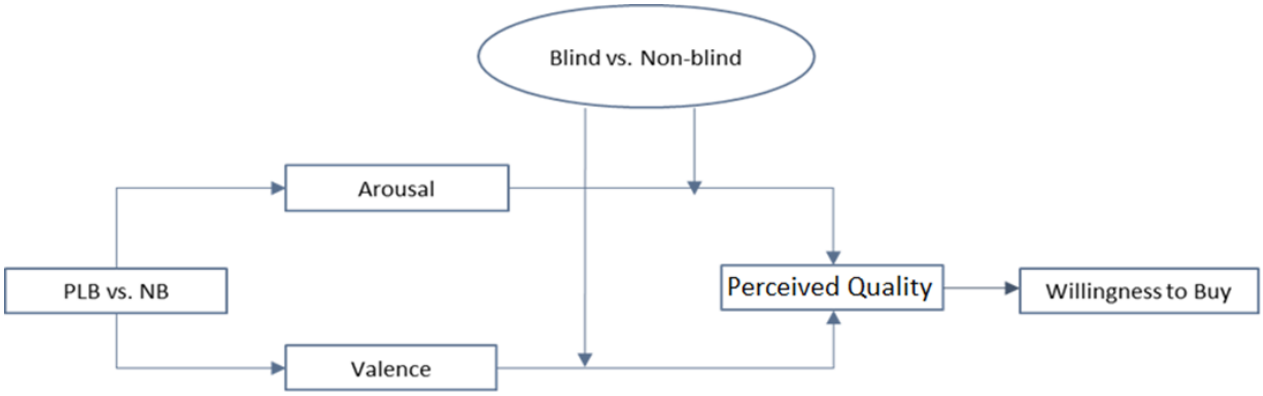


Figure 1. Conceptual Model

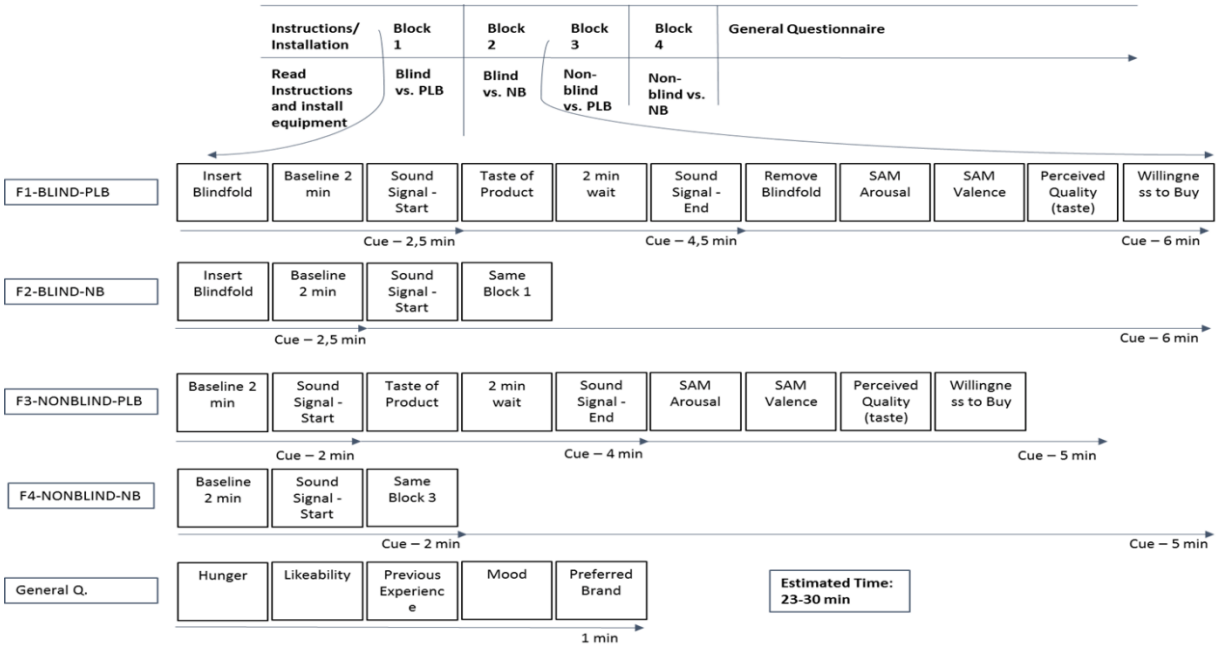


Figure 1 - Timeline of Experimental Events

| PLB | NB |
|---|---|
| Continente Milk Chocolate (No sugar added) | Guylian Milk Chocolate (No sugar added) |
| Pingo Doce Chocolate with Caramel (similar to Twix) | Twix |
| Lidl J.D. Gross Ecuador Dark Chocolate Berry | Lindt Excellence Strawberry |

Table 1. PLBs and NBs used in the experiment

| Hypothesis | Results | Hypotheses | Results |
|---|---|---|---|
| **H1a** | Confirmed | **H2a** | Confirmed |
| **H1b** | Confirmed | **H2b** | Not Confirmed |
| **H1c** | Confirmed | **H2c** | Not Confirmed |
| **H1d** | Confirmed | **H2d** | Confirmed |
| **H3a** | Confirmed | **H3b** | Confirmed |

Table 1 – Hypotheses Testing