

# How Does Consumers' Taster Status Influence Their Emotions on Sugar-Free Chocolate? †

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**Abstract:** The aim of the study was to develop emotional lexicons to describe sugar-free chocolate according to consumers' taster status. Respondents (N = 153) received a milk and dark sugar-free chocolate for tasting. An electronic questionnaire was employed to collect quantifiable data. Results showed that respondents could be classified into three groups: non-tasters (38.6%), medium tasters (39.9%) and supertasters (21.5%). Most respondents liked dark chocolate more than milk chocolate. However, the non-tasters (>50%) selected positive emotions for milk chocolate, while the medium tasters, chose more positive emotions for dark chocolate. Most of the supertasters selected negative emotions for dark chocolate. Each taster status requires the development of a distinctive lexicon to be emotionally satisfied by sugar-free products. Taste sensitivity can have a significant impact on consumers' food choices.

**Keywords:** taster status; emotion; lexicon; sensory; Check-all-that-apply

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## 1. Introduction

Statistics show that 61% of the population living in South Africa is either overweight or obese [1]. Excess sugar consumption leads to several health problems that include non-communicable diseases (NCDs) such as cardiovascular diseases (like heart attacks and stroke), cancers, chronic respiratory diseases (such as chronic obstructive pulmonary disease and asthma), and diabetes [2–4].

The easy answer would be for an overweight population to consume less sugar, right? The fact is that taste is an important factor when we choose food products, therefore consumers will rather choose “unhealthy” foods with higher sugar content [5]. Consumers have a general perception that foods with reduced sugar content, are seen as healthier products that may taste unpleasant [5] and that these foods are only consumed when one has certain health issues such as diabetes and weight problems [6].

Several studies confirm the link between the sensory properties of food and consumers' emotional responses, influencing their food choices [7–10]. Consumers are classified into three taster status categories according to their bitter sensitivity, namely non-tasters, medium tasters, and supertasters [11–13], which is determined by a gene, TAS2R38 [14]. Taster status is tested through the use of 6-n-propylthiouracil (PROP) [15]. Non-tasters find PROP a little bitter or tasteless and does not mind the taste thereof. Medium tasters experience PROP quite bitter. Supertasters find PROP exceptionally bitter as they do not like the taste thereof [11,12,15] and tend to show a negative emotional response towards food and beverages (e.g., beer, broccoli, caffeine, dark chocolate, kohlrabi, tonic water) with a bitter-tasting compound (e.g flavonoids, phenols, glucosinolates) [16,17].

Furthermore, consumers' taster status tends to influence their consumption and purchasing behaviour of food products. For example, chocolate consumption might be related to cravings or feelings of guilt that affects consumers' emotions [18]. Sweeteners are used in food products since they are essentially calorie-free, but some of these sweeteners can impact food products and beverages causing undesirable flavours and after tastes such as bitterness [17–19]. Therefore, as consumers differ according to their taster status, they perceive a specific product differently, and for this reason, it is worth investigating this association between the consumers' emotion on food products. Limited research is done on consumers' emotions and emotional response towards sugared food products such as chocolates [8]. In addition, very few studies have looked at how consumers' different taster status influence their emotions when consuming chocolate products. Therefore, the aim of this study is to develop emotional lexicons for sugar-free chocolates based on consumers' taster status (non-, medium- and supertasters) using the Check-All-That-Apply (CATA) methodology.

## 2. Methodology

A quantitative non-experimental, descriptive, and cross-sectional study was conducted using a self-administered electronic questionnaire to collect quantifiable data. A non-probability convenience sampling method was used with inclusion and exclusion criteria. Respondents were recruited via social media platforms where electronic posters were posted. Those interested in the study followed the link on the advertisement to be screened.

Successfully screened respondents collected their sample bags at a central location in the city of Potchefstroom, South Africa. The sample bag included: two unbranded chocolate bars clearly marked as Sample 1 (milk chocolate) and Sample 2 (dark chocolate); three PROP test paper strips in a zip-lock bag; one bottle of still water (250 mL) and one instruction pamphlet.

The chocolate samples consisted out of one milk and dark sugar-free bar (40 g each), purchased at a local food retail company. Both chocolate samples contain no added sugar and include certain fibres (dextrin, inulin, oligofructose) and sweeteners such as erythritol and steviol glycoside. The milk and dark chocolate contains cocoa solids of 36% and 80%, respectively. The milk chocolate is higher in energy, protein, carbohydrates, total sugar and sodium, while the dark chocolate is higher in dietary fibre.

After collection of the sample bags, consumers received the link of the main electronic questionnaire (QuestionPro©) per email. The questionnaire started with the PROP taster status test where respondents placed a paper strip on the tip of their tongue for 30 s after which they rated their perception of the stimulus on a Labelled Magnitude Scale (LMS), which ranged from 1 being "barely detectable" to 100 being "strongest imaginable". The cut-off criteria for the tasting groups' classification were as follows: non-tasters between 0 and 15.5; medium tasters between 15.5 and 51; and supertasters above 51 [20–22].

In the following section, consumers' general chocolate consumption was determined followed by their sensory acceptance and purchase intention of sugar-free chocolates. 5-point Likert scales were implemented. Thereafter, consumers' emotional response was determined by using the emotional terms from the EmoSensory wheel [23] and the Check-All-That-Apply (CATA) method to indicate what they were feeling when they tasted the chocolate samples. CATA is utilized in sensory research because it can generate detailed, discriminative data [24]. An open-ended question was included for consumers to indicate if they would like to add any additional emotional terms during the tasting of the chocolates. Lastly, the researchers collected demographic information such as gender, age and the origin of consumers' geographic location.

Data collection occurred in January 2021 during which South Africa entered lockdown level 3 due to the Covid-19 pandemic. The respondents were requested to complete the questionnaire within 72 h after collection of the sample bag at a place where they usually would consume chocolate so as to mimic a "natural" setting.

For data analysis, descriptive analysis was performed for all variables, including means, frequencies and percentages. To assess if there is a significant association between consumers' taster status, demographics and consumers' emotions, cross-tabulations with phi coefficient and Cramer's V were performed. A significance level of  $p < 0,05$  was implemented.

### 3. Results and Discussion

#### 3.1. Demographics

The study sample consisted out of 153 South African adult consumers (Table A1). The smaller sample size can be ascribed to consumers' hesitancy to leave their homes during the Covid pandemic and to take part in research studies as they took extra safety precautions to protect themselves. Most of the respondents were female and relatively young between the ages of 18 and 29 years.

#### 3.2. PROP Taster Status Test

There was an almost equal distribution of respondents between non tasters (38.6%) and medium tasters (39.9%). The remainder of the respondents are classified as super tasters (21.5%). The distribution of the taster groups is similar to the distribution in a similar study who reported super tasters as 25.95%, and medium- and non tasters as 32.06% and 41.98%, respectively, in their study [25].

#### 3.3. General Chocolate Consumption

Table 1 provides an overview of the consumers' chocolate consumption and purchasing behaviour. Most of the respondents (32.9%;  $n = 52$ ) consume chocolates at least once a week, followed by those consuming chocolate more than twice a week (25.9%;  $n = 41$ ). These findings confirm the respondents' regular chocolate consumption. Majority of the respondents (58.2%;  $n = 92$ ) indicated that the main reason for their eating chocolate was for emotional satisfaction (indulgence). It may be due to cravings [18], elevated mood and energy levels or because it is seen as pleasurable, relaxant, aphrodisiac and as an antidepressant [26]. It is similar to what has been found by other researchers [8], who also found that in their sample group, the majority of the respondents consumed chocolate at least once a week, ate chocolate for satisfaction (indulgence) and indicated that flavour was the main reason for their purchasing chocolate. The main considerations when purchasing chocolate for own consumption are flavour (75.3%;  $n = 119$ ), followed by brand (16.5%;  $n = 26$ ) and price (8.2%;  $n = 13$ ). These findings are supported by researchers who revealed that buyers of chocolate were encouraged to purchase a bar of chocolate if they saw a new flavour in store [27].

**Table 1.** Consumers' general chocolate consumption and purchasing behaviour.

Item on Scale	Percent (%)
Frequency of chocolate consumption	
Daily	7.0
More than twice a week	25.9
Twice a week	17.7
Once a week	32.9
Once a month or less	16.5
Reason for chocolate consumption	
For emotional satisfaction (indulgence)	58.2
To overcome hunger	0
Regard it as healthy	0.6
As a habit	24.1
Other reason	17.1

Considering factors when purchasing chocolate	
Brand	16.5
Flavour	75.3
Price	8.2
Packaging	0
Other reason	0

### 3.4. Sugar-Free Chocolates: Sensory Acceptance and Purchase Intention

Table 2 gives an overview of the respondents' taste, aftertaste and purchase intent regarding both chocolate samples. Overall, the respondents enjoyed the taste and aftertaste of the dark chocolate more than the milk chocolate. The taste of the dark chocolate was liked very much. Dark chocolate is usually not as sweet due to the high quantity of cocoa present [28]. The purchase intention for dark chocolate was slightly higher. More than 30% (n = 50) and 42.7% (n = 67) of the respondents indicated that they definitely would buy the milk and the dark chocolate, respectively. When purchasing or consuming chocolate, taste is very important, although the perception of taste varies greatly from person to person [28]. Taste is still the most influential factor influencing chocolate consumer behaviour [30,31].

**Table 2.** Taste, aftertaste and purchase intent for sugar-free chocolates.

	Mean	Standard Deviation
Milk chocolate		
Taste <sup>1</sup>	3.95	0.80
Aftertaste <sup>1</sup>	3.78	0.92
Purchase intent <sup>2</sup>	3.85	1.11
Dark chocolate		
Taste <sup>1</sup>	4.09	0.97
Aftertaste <sup>1</sup>	3.90	1.102
Purchase intent <sup>2</sup>	3.97	1.171

Note: <sup>1</sup> 1 = dislike extremely, 2 = dislike very much, 3 = neither like nor dislike, 4 = like very much, 5 = like extremely. <sup>2</sup> 1 = definitely would not buy, 2 = probably would not buy, 3 = might or might not buy, 4 = probably would buy, 5 = definitely would buy.

### 3.5. Emotional Response

Table 3 captures the identified emotions for the two chocolate samples. Overall, the majority of the respondents chose positive emotions for both chocolate samples, with the highest selection being satisfied, pleasant, good, happy and content. The highest selected emotion for both the milk (n = 91; 57.6%) and dark chocolate (n = 85; 53.8%) was satisfied. Therefore, sugar-free chocolates can satisfy consumers without sacrificing enjoyment due to being a guilt-free option. The open-ended question revealed that the respondents felt fancy, powerful, wealthy, accomplished and extravagant, which were categorised under luxury, when they consumed the dark chocolate. Researchers have indicated that respondents felt luxurious and sophisticated while consuming dark chocolate and that the emotional terms "powerful" and "energetic" could be associated with the cocoa flavour, while the bitter taste is associated with being confident [32].

**Table 3.** Consumers' emotions with regard to sugar-free chocolates.

Emotion	Milk (%)	Dark (%)
Positive		
Contented	36.1	35.4
Desire	12.7	24.7
Enthusiastic	6.3	13.9

Glad	17.1	22.8
Good	51.9	53.2
Happy	43.7	39.9
Pleasant	56.3	49.4
Satisfied	57.6	53.8
Negative		
Disappointed	12	10.1
Discontented	2.5	5.1
Disgust	3.2	5.1
Dissatisfied	8.9	10.1
Guilty	9.5	3.2
Nervous	0	2.5
Sad	2.5	1.9
Unpleasant surprise	3.8	8.9
Unclassified		
Calm	51.9	43.7

3.6. Emotional Lexicons

Successful lexicons could be created for each taster status, and although they were very similar, there were a few differences. Table 4 provides a summary of the highest and lowest selection of emotional terms per taster status. For the milk chocolate, the non-tasters showed a higher selection for the pleasant emotion compared to the supertasters. This can be due to the non-tasters not being able to taste the bitterness of the sugar-free chocolate, which is caused by the cocoa, and the bitter aftertaste due to sweeteners, while the supertasters could taste the bitterness and found it unpleasant. The supertasters also felt more disappointed, discontented and disgust compared to the rest of the respondents. Despite supertasters being in the minority, emotionally, they felt the most negative. Ideally, sugar-free products should be made to evoke the highest selection of positive emotions from consumers, and the food industry should determine which positive emotions are the least selected so improvements can be made. The supertasters indicated the lowest selection for the emotions happy, pleasant and satisfied for the dark sugar-free chocolate. This may be ascribed to their high sensitivity towards bitter-tasting ingredients, such as the high cocoa content of dark chocolate. Owing to salt, which can mask bitter tastes, supertasters tend to consume more sodium [33,34]. Therefore, a possible solution for product developers is to add different types of salt, such as Himalayan salt, to dark chocolate to mask the bitterness of the cocoa. In addition, these products can be marketed as “low in bitterness” or “saltier” to motivate supertasters to purchase these sugar-free alternatives. The medium tasters indicated the lowest selection of the pleasant emotion for the dark chocolate, since the larger proportion of medium tasters may also be sensitive towards bitter tastes. Therefore, they may also prefer chocolate alternatives with a higher salt content. Among the non-tasters, the lowest selection of positive emotions for the sugar-free milk chocolate was for desire, enthusiastic and glad. Therefore, the food industry can improve sugar-free milk chocolate by incorporating strong flavours, such as spicy elements or chillies.

Table 4. Summary of taster status selection of emotional terms.

	Non Tasters	Medium Tasters	Super Tasters
Milk chocolate: Highest selected emotion	Pleasant (+) Sad (-)	Guilty (-)	Happy (+) Satisfied (+) Calm
Dark chocolate: Highest selected emotion		Glad (+) Good (+)	Desire (+) Enthusiastic (+)

		Dissatisfied (-) Unpleasant (-) surprise	Disappointed (-) Discontented (-) Disgust (-) Nervous (-)
Dark chocolate: Lowest selected emotion	Desire (+) Enthusiastic (+) Glad (+) Unpleasant surprise (-)	Discontented (-) Disgust (-) Sad (-)	Discontented (-)
Dark chocolate: Lowest selected emotion	Guilty (-) Nervous (-) Sad (-)	Pleasant (+) Dissatisfied (-)	Happy (+) Pleasant (+) Satisfied (+)

Note: + = positive emotion; - = negative emotion; X = no selection.

### 3.7. Associations between Consumers' Taster Status and Emotional Lexicons and Demographic Characteristics

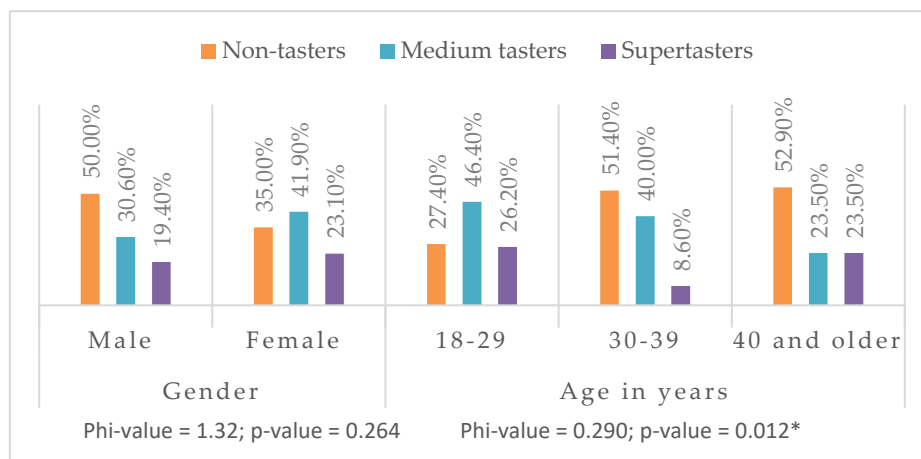
For the milk chocolate, there was a practical significance of the association between non-tasters and the guilty emotion. Furthermore, there was also a practical significance of the association between all taster status groups and the content emotion. For the dark chocolate, results revealed a practical significance for the association between supertasters and the emotions, discontented and disgust (Table 5).

Half of the male respondents were classified as non-tasters (50%), while the majority of the female respondents were classified as medium tasters (41.9%) (Figure 1). Researchers have reported in his study that they could not distinguish between male and female consumers in perceiving taste, although the findings showed that women (34%) were slightly more likely to be super tasters compared to men (22%) [35]. However, other studies have found that women are significantly more sensitive towards salty, bitter, sweet, and sour taste stimuli compared to men [36–38]. Despite the findings presented above, the results of this study is in line with the above-mentioned results indicating that women are more likely to be super tasters, as supported by other studies [39].

**Table 5.** Associations between consumers' taster status and emotions.

Chocolate sample	Taster status	Emotion	Phi-Value	p-Value
Milk chocolate	Non tasters	Content (+)	0.2216	0.070
		Guilty (-)	-0.212	0.008 *
	All tasters	Content (+)	0.220	0.020 *
Dark chocolate	Super tasters	Dicontented (-)	0.230	0.004 *
		Disgust (-)	0.160	0.044 *

Note: + = positive emotion; - = negative emotion; \* =  $p < 0.05$ .



**Figure 1.** Consumers' taster status according to gender and age.

There was a practically visible association between age and taster status, with the majority of the 18- to 29-year-old respondents being classified as medium tasters (46.4%), with the remainder of them classified as non-tasters (27.4%) and supertasters (26.2%). The other age groups were mainly classified as non-tasters. The reason why the older age groups were mostly classified as non-tasters may be due to their taste function declining with age [40]. Researchers found that as age increased, consumers seemed to like and consume strong tastes, such as strong-tasting vegetables, as bitterness was not a barrier to liking these food products [41]. Their findings indicate that most male respondents in the older age categories seem to be non tasters, and female respondents between the ages of 18 and 29 years are mostly classified as medium tasters.

### 3.8. Value of the Study

The relationship between demographic characteristics and consumers' taster status reveals valuable information that can be used by marketers to target a set of consumers. For example, when developing sugar-free foods with bitter notes, they could rather target male consumers in advertisements, as female consumers are more likely to be supertasters. The same principle can be used with the age groups; since ageing has a declining effect on the taste function [39], older consumers can be targeted for stronger flavoured sugar-free products.

The findings can provide insight on the influence of taste sensitivity and give some guidance to the confectionery industry and individuals who work with various methods of marketing communication strategies on making use of tasting notes to advertise their products. The results can be beneficial to the industry role players, as they can use these developed emotional lexicons in their product development to ensure that the product meets the need of consumers in different segments, which can potentially increase the success rate of their product. For example, the industry can run a marketing campaign that focuses on Generation Z, influencing their perception of sugar-free dark chocolate by advertising it as an affordable luxury item. When the focus is rather on a specific taster status, it will ensure that consumers have access to foods that have been altered to their taste sensitivity.

## 4. Conclusions

Sugar-free chocolate with sweeteners can be consumed and enjoyed as a healthier alternative and evoked different emotional terms for consumers with different taster statuses. Different emotional lexicons are required for each taster status, as the main reason for consuming chocolate is emotional satisfaction, and the main factor which influences purchases is flavour. These emotional lexicons will contribute to future research on the sensory acceptability of and behaviour with regard to chocolate and sugar-free products for the South African market.

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**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** The data presented in this study are available on request from the corresponding author.

**Conflicts of Interest:** The authors declare no conflict of interest.

## Appendix A

**Table A1.** Demographic profile of respondents (N = 153).

Demographic Characteristics	Frequency (n)	Percent (%)
Gender		
Male	36	23.38
Female	117	75.97
Other	1	0.65
Age in years		
18–29	84	54.90
30–39	35	22.88
40–49	13	8.50
50–59	12	7.84
>60	9	5.88
Hometown location		
Eastern Cape	1	0.65
Free State	5	3.27
Gauteng	10	6.54
KwaZulu-Natal	1	0.65
Limpopo	5	3.27
Mpumalanga	3	1.96
Northern Cape	2	1.31
North-West	126	82.35
Western Cape	0	0

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