

## Article

# Linking the Sensory Taste Properties of Chocolate-Based Biscuits to Consumers' Emotions: A Cross-Cultural Study

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**Abstract:** This research measured consumers' emotions and change in emotion to the specific sensory taste properties and attitudes of chocolate-based biscuits. The sample size involved 216 respondents from South Africa (n = 106) and Switzerland (n = 110). Respondents tasted chocolate-based biscuits and completed an online questionnaire. The increase in consumers' levels of guilt after chocolate-based biscuit consumption and the contribution of a chocolate taste and craving attitude to consumers' subsequent positive emotions and change in positive emotions could help food and consumer scientists to understand the link between emotions and the sensory descriptors of chocolate-based biscuits. Investigating the association between the emotional responses and sensory attributes of sweet baked products could benefit product developers when formulating food products for specific target markets and aid in the understanding of the emotional profile of food products.

**Keywords:** sensory properties; emotional response; ultra-processed food; sweet baked products; attitude



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## 1. Introduction

Ultra-processed food products include food-derived substances (e.g., starch, sugars, oils and fats) that include ingredients such as artificial additives, colourants, flavourants and emulsifiers [1]. Sweet baked products may include a variety of pastries, cakes, biscuits, breads and other sweetened snacks classified as ultra-processed food. Current trends in consumers' eating habits include a higher consumption of energy-dense snacks, leading to less energy consumed at breakfast, lunch and dinner [2]. The snacking trend is contributing to the growth of the global bakery products market, which is driven by consumers' choices of sweet baked products that are easily accessible, resulting in a range of ready-to-eat baked goods.

Globally, confections, cakes and biscuits (sweet baked products) categories hold a large share of snack sales [3]. It is estimated that the market for global bakery products will reach USD 457.4 billion, and it is projected to reach a compound annual growth rate (CAGR) of 3.9% by 2027. Due to the unforeseen economic implications caused by the COVID-19 pandemic, growth in the sweet baked products segment has been revised to 3.8% CAGR for the next 7 years [4]. South Africa showed a strong increase of 8.47% in 2020 [5], and in 2021, the category value share for sweet biscuits was the second highest (23.1%), with chocolate having the highest share at 23.8% [6].

Comparably in Switzerland, biscuits are a popular sweet baked product and regarded as a convenient snack. For Switzerland, it is projected that the market will grow by 3.34% (CAGR 2021–2026) [7]. It is predicted that by the end of 2024, chocolate-based biscuits will dominate the overall market with a share of 39.4% [8].

### 1.1. Emotional Response

Emotional response is defined as an adjustable reaction to an evoked stimulus, which includes bodily or behavioural responses and a change in subjective feeling [9]. The main factors affecting emotional responses towards foods include the type of food product and its sensory attributes, and the consumers' characteristics. Emotional eating may increase the consumption and preference for unhealthy food products with a high sugar and fat content [10]. Therefore, emotional responses are often the deciding component explaining respective variations in the preference for sweet-tasting products [11]. However, a consumer's perception towards a food product is influenced by the emotion evoked by the product (at that moment), and their preference, emotional response and attitudes towards the product. When considering the emotional responses evoked by different food types, it is evident that some foods are considered more emotional than others. For example, fried chicken, pizza and ice cream are labelled as more emotional, whilst carrots and oatmeal are classified as less emotional [12]. Generally, emotion-laden foods are consumed to satisfy cravings and not for nutritional benefit [13]. Reasons for consuming emotion-laden food products could include temptations, an impulsive motivator and the desire to improve ones' general emotional state of well-being [14].

### 1.2. Emotional Response to Sensory Properties

More researchers are investigating the relationship between a food products' sensory attributes and its emotional profile [15]. Emotional aspects are connected to consumers' sensory experiences—this could influence their food preference [16]. Researchers such as Robin have aimed to link specific emotions to sensory properties; respondents had to link the emotions with the basic tastes (bitter, sweet, salty, sour) [17]. The emotion disgust was associated with a bitter taste, happiness with sweet and the emotions of surprise, happiness, fear, sadness, anger and disgust with sour and salty tastes.

Previous research has indicated sensory attributes in driving emotions for an array of foods, such as wine [18], coffee [19], alcoholic cocktails [20] and chocolates [21]. For example, tasting energy-dense food high in fat or sugar elicits positive affective reactions that encourage ingestion, while the tasting of bitter foods elicits negative affective reactions that promote rejection [22]. Researchers stated that the sensory characteristics of chocolate served as a driver for emotional response and confirmed an association between specific sensory characteristics and emotional perceptions [23]. Researchers developed a single-response emotion word to measure to associate emotional responses to peanut butter chocolate chip biscuits and chocolate chip biscuits. While the peanut butter chocolate chip biscuits were more strongly associated with blue/uninspired and unhappy/dissatisfied emotions than the biscuit containing chocolate chips, the emotions of secure/at ease were more strongly associated with the regular chocolate chip biscuits [24].

### 1.3. Emotional Response to Attitudes

Emotional responses depend on consumers' attitudes toward food. Researchers clustered attitude into two distinct clusters, craving and guilty attitude. While those with a craving attitude seek comfort from foods under emotionally stressful conditions, a guilty attitude is linked with dissatisfaction with one's body image and weight [25]. Consumers do not necessarily eat emotion-laden foods for their nutritional benefits, but rather to satisfy cravings or fulfil an emotional need [13]. Researchers found that high-attribute chocolate cravers indicated more positive implicit attitudinal behaviour towards chocolate [26]. Chocolate could arouse one's sensory pleasure and provide emotional comfort [27] as it contributes positively to one's emotional state by providing immediate pleasure [28]. Chocolate consumption has been associated with both positive and negative emotions (guilt is associated with weight gain) [29]. For example, a study on temporal dominance of emotions revealed that for plain chocolate, the sensory attributes crunchy, dry, bitter and cocoa were associated with more negative emotions, such as calm and bored (low arousal) and aggressive (high arousal). For flavoured chocolate, the sensory

attributes fruity, sweet, crunchy and melting were linked to positive emotions such as happy, energetic and loving [30].

#### 1.4. A Cultural Perspective

Food culture refers to a specific country's cultural traditions, agricultural and trade practices, food processing and purchase and consumption habits, which significantly influence consumers' food choices [31]. Therefore, consumers' cultural (anthropology) origins may influence their food choices [32]. South Africa is classified as an emerging country due to its large markets for goods and services, and entrepreneurs that can compete globally if given adequate support [33]. A transition in food consumption behaviour has led to an increased intake of processed foods high in carbohydrates [34]. These changes in a country's food choices negatively affect public health as ultra-processed foods contribute to increased obesity and non-communicable diseases (NCDs) [35]. Switzerland is listed among the top high-income countries with a very high life expectancy and indicates very low prevalence rates of obesity [36]. Notable differences exist between socio-demographic clusters with a possible risk of developing NCDs [37]. Ultra-processed foods could therefore transform dietary patterns, food culture and supplies as for many high-income countries, such as Switzerland, the supply of ultra-processed foods is starting to dominate the market [38], therefore increasing the consumption of these products in low-/middle-income countries [39] such as South Africa [40].

Whilst various studies [29] have investigated emotional responses to chocolate products, measuring the link between the sensory characteristics and the emotions food products evoke remains unsatisfactory in a cross-cultural context. Furthermore, most of these studies aim to describe emotional responses' commercial application and marketing function, providing value and insight to the industry [41], without considering it from a cultural perspective, which would benefit the consumer. Cross-cultural research is necessary to understand consumers' affective responses and emotions in different countries. Research has indicated that different cultures understand the same set of emotions but could express them differently [42].

A comparison between South Africa and Switzerland was made as consumers from emerging countries, such as South Africa, and high-income countries, such as Switzerland, all have different learning experiences with sweet baked products, causing different emotional responses to sensory properties and attitudes. Research into consumers' emotional responses towards emotion-laden foods across cultures is still limited. These emotional and attitudinal responses can aid the food industry in identifying product-specific characteristics to develop and promote the consumption of chocolate-based biscuits, which can be used to understand the link between emotions, sensory descriptors and attitudes. Furthermore, emotional responses can provide insight into consumers' food choices and can be used to market the processing of more health attributes.

Therefore, from a cultural perspective, the aim of this paper was to determine consumers' emotions and changes in emotion to the specific sensory taste properties and attitudes of chocolate-based biscuits.

## 2. Materials and Methods

### 2.1. Respondents

The responses were collected from respondents in South Africa ( $n = 106$ ) and Switzerland ( $n = 110$ ). Respondents received a link for the electronic screening questionnaire that determined whether they were (a) above the age of 18 years; (b) citizens of the particular country; (c) not allergic to bovine milk, gluten, wheat and/or soy; and (d) consumers of chocolate-based biscuits. All qualified respondents received a link containing the final electronic questionnaire. Biscuits were delivered to a South African retail company, and in Switzerland, the biscuits were sent by standard mail. Table 1 provides the demographic characteristics of the South African and Swiss samples.

**Table 1.** Demographical characteristics of the study sample (n = 216).

Characteristics	South Africa	Switzerland
Gender		
Male	24.5%	46.4%
Female	75.5%	53.6%
Age		
Under 35 years	24.1%	25.0%
Above 35 years	81.9%	85.0%
Education level SA		
Grade 12 or below	22.6%	
Above Grade 12	77.4%	
Education level Swiss		
Middle school or below		41.8%
Above middle school		58.2%
Monthly income		
Less than R20,000	37.7%	
More than R20,000	47.2%	
Preference not to disclose information	13.2%	
Monthly income		
Less than CHF 6000		20.9%
More than CHF 6000		57.3%
Preference not to disclose information		23.6%
Marital status		
Single/widowed/divorced	38.7%	19.1%
Married/living with a partner	61.3%	80.9%
Occupational status		
Working	94.3%	30.9%
Not working/on pension	5.7%	69.1%
Geographic region		
City	85.4%	54.5%
Countryside	14.6%	45.5%

## 2.2. Chocolate-Based Biscuits

Biscuits were chosen for this study because of their familiarity and practicality in the food sector and acceptable sensory features such as taste and texture [43]. Chocolate-based biscuits were chosen as baked products containing chocolate are one of the most popular and acceptable products owing to their longer shelf life, versatility and pleasant sensory attributes [44]. Each respondent was provided with one snack pack containing four biscuits for the home-use test from a well-known brand in South Africa and Switzerland, respectively. Both biscuits contained similar sugar (>30 g/100 g), salt (>0.30 g/100 g) and fat (>20 g/100 g) contents (Table A1). It was required of the respondents to taste the biscuits and complete the questionnaire where consumption usually occurs e.g., work, home . . .

## 2.3. Questionnaire

Data gathering was conducted using an online questionnaire [45] operated by QuestionPro (v20.4, Seattle, WA, USA). The screening and final questionnaires were translated from English to German and verified by a native German speaker. The questionnaires were back-translated to English by a qualified language translator. The questionnaire consisted of five sections. Appendix A reveals the scale and items used in the study (Table A2).

In the first and third sections, respondents' emotional responses (positive and negative emotions) was recorded before and after evaluating the sensory taste properties of the biscuits, as one's emotional response to food is often sensitive to expectations based on the sensory attributes of a single taste [46], and the sensory attributes have a strong connection with consumers' emotions. Emotions are viewed based on two aspects: positive versus negative and pleasure versus displeasure. The EsSense25 Profile is a questionnaire that contains a list of single words that describe emotional responses to foods and was validated against the EsSense list (39 attributes) by [47], displaying a balance between positive and

negative words. The EsSense25 Profile was consulted to measure emotional responses (5-point Likert scale with 1 = not at all and 5 = extremely) [47].

In the second section, the rate-all-that-apply (RATA) tool measured the intensity of sensory taste properties using a 5-point unipolar verbal scale with 1 = not at all and 5 = extremely [48]. As a starting point for the sensory taste properties, a list of 12 sensory descriptors for the biscuits were retrieved from the study by Heenan and colleagues [49]. A trained panel reduced the sensory descriptor list from 12 taste descriptors to 6 taste descriptors (chocolate, vanilla, buttery, sweet, caramel, nutty) which best described the two chocolate-based biscuits and the discrepancies between the biscuits in the market due to their sensory variation [50]. In addition, the list of sensory descriptors was reduced to prevent loss of interest and respondent fatigue.

The fourth section applied the Attitudes to Chocolate Questionnaire (ACQ) to determine respondents' attitudes towards the sweet baked biscuits. The ACQ consists of 20 statements [25] and implements a 5-point scale with 1 = strongly disagree and 5 = strongly agree. To gain more insight into the reasons for consuming chocolates, [25] developed the ACQ to evaluate consumers' cravings for chocolate and guilt when consuming chocolate. Due to attitude's evaluative element [51], consumers' attitude of sweet baked products was determined after emotional response after the tasting of the chocolate-based biscuits, and reporting on emotional response before and after consuming the biscuits can create assumptions that may be triggered by the biscuits [23].

In the final section, respondents answered demographic questions, including those regarding age, gender, education level, home language, monthly household income and marital and occupational status (Table 1).

#### 2.4. Statistical Analysis

IBM SPSS Statistics (version 24) was used for all statistical analyses. The internal coherence of the seven indicators and four variables that determined respondents' emotions towards the biscuits were measured with Cronbach's alpha coefficient. For the demographic characteristics, emotions, sensory taste properties, attitudes and descriptive statistics were applied.

For the association between sensory terms, Pearson's correlations were implemented. To determine the indicators of consumers' positive and negative emotions before and after consuming the biscuits, multiple linear regression analyses were implemented. To indicate the significance of consumers' changes in positive and negative emotional states after completing the survey, a *t*-test was run.

Differences were assigned to multiple linear regression analysis (MLRA). Duplicate statistical methods and indices were used to show the factors contributing to the change in emotion. Proof of homoscedasticity, normality and collinearity diagnostics showed the appropriateness for regression analyses. For this study, an enter technique with the use of an experimental setting of the study was applied.

Four regression models, all subjected to MLRA, explained the dependent variable, "positive/negative emotion direct measurement" or "positive/negative emotional change direct measure", with three other predictor variables, i.e., sensory properties, attitude (craving) and attitude (guilty).

### 3. Results

#### 3.1. Mean Values for Emotional Response, Sensory Properties and Attitudes

Respondents' emotional responses before and after biscuit consumption are indicated in Tables 2 and 3, respectively. Before biscuit consumption, for the positive emotions, the South Africans felt happy ( $3.52 \pm 1.09$ ), and the Swiss respondents felt satisfied ( $3.64 \pm 0.84$ ). For the negative emotions, both samples felt worried ( $2.02 \pm 1.34$ ;  $1.98 \pm 1.02$ ) (Table 2).

**Table 2.** Mean and standard deviation ( $m \pm sd$ ) values of consumers' emotions before biscuit consumption.

Items	South Africa	Switzerland
Positive emotions (Cronbach's alpha = 0.834)	3.03 $\pm$ 1.17	3.02 $\pm$ 0.94
Adventurous	2.49 $\pm$ 1.20	2.01 $\pm$ 1.04
Calm	3.49 $\pm$ 1.06	3.49 $\pm$ 0.96
Enthusiastic	2.91 $\pm$ 1.10	2.02 $\pm$ 1.04
Free	2.78 $\pm$ 1.39	3.37 $\pm$ 1.07
Good	3.32 $\pm$ 1.10	3.63 $\pm$ 0.82
Happy	3.52 $\pm$ 1.09	3.36 $\pm$ 0.88
Joyful	3.29 $\pm$ 1.27	3.07 $\pm$ 0.98
Nostalgic	2.05 $\pm$ 1.15	1.86 $\pm$ 0.95
Satisfied	3.12 $\pm$ 1.14	3.64 $\pm$ 0.84
Secure	3.33 $\pm$ 1.20	3.72 $\pm$ 0.78
Negative emotions (Cronbach's alpha = 0.664)	1.71 $\pm$ 1.10	1.50 $\pm$ 0.73
Aggressive	1.56 $\pm$ 1.00	1.23 $\pm$ 0.57
Guilty	1.52 $\pm$ 1.04	1.18 $\pm$ 0.56
Bored	1.74 $\pm$ 1.03	1.59 $\pm$ 0.76
Worried	2.02 $\pm$ 1.34	1.98 $\pm$ 1.02

Note: SA = South Africa; measured on a five-point Likert-type scale; m = mean; sd = standard deviation.

**Table 3.** Mean and standard deviation ( $m \pm sd$ ) values of consumers' emotions after biscuit consumption.

Items	South Africa	Switzerland
Positive emotions (Cronbach's alpha = 0.900)	2.57 $\pm$ 1.20	2.52 $\pm$ 1.04
Adventurous	1.90 $\pm$ 1.29	1.46 $\pm$ 0.81
Calm	3.00 $\pm$ 1.17	3.27 $\pm$ 0.99
Enthusiastic	2.38 $\pm$ 1.32	1.62 $\pm$ 0.88
Free	2.52 $\pm$ 1.27	2.65 $\pm$ 1.22
Good	3.06 $\pm$ 1.19	3.25 $\pm$ 0.98
Happy	2.97 $\pm$ 1.17	2.66 $\pm$ 1.15
Joyful	2.75 $\pm$ 1.23	2.48 $\pm$ 1.11
Nostalgic	1.77 $\pm$ 0.99	1.82 $\pm$ 1.05
Satisfied	2.92 $\pm$ 1.07	3.10 $\pm$ 1.00
Secure	2.42 $\pm$ 1.34	2.92 $\pm$ 1.24
Negative emotions (Cronbach's alpha = 0.562)	1.42 $\pm$ 0.82	1.34 $\pm$ 0.65
Aggressive	1.24 $\pm$ 0.68	1.11 $\pm$ 0.39
Guilty	1.69 $\pm$ 1.12	1.26 $\pm$ 0.66
Bored	1.43 $\pm$ 0.70	1.51 $\pm$ 0.78
Worried	1.30 $\pm$ 0.76	1.47 $\pm$ 0.76

Note: SA = South Africa; measured on a five-point Likert-type scale; m = mean; sd = standard deviation.

The South African and Swiss respondents felt good (3.06  $\pm$  1.19) and calm (3.27  $\pm$  0.99) after consuming the biscuits. Consumers' positive and negative emotions decreased after consuming the biscuits (2.54  $\pm$  1.14; 1.38  $\pm$  0.75), except for the negative emotion guilt, which increased after biscuit consumption (1.35  $\pm$  0.85; 1.47  $\pm$  0.93) (Table 3).

Mean values with applicable standard deviation scores for the sensory properties and respondents' attitudes are indicated in Tables 4 and 5, respectively. A chocolate and sweet taste was the most intense taste experienced by South African (3.80  $\pm$  1.06; 3.65  $\pm$  0.93) and Swiss (3.68  $\pm$  0.82; 3.69  $\pm$  0.82) respondents.



**Table 4.** Mean and standard deviation ( $m \pm sd$ ) values of the sensory properties of biscuits.

Items	South Africa	Switzerland
Sensory taste properties (Cronbach's alpha = 0.707)	2.69 ± 1.07	2.46 ± 0.87
Chocolate	3.80 ± 1.06	3.49 ± 0.82
Vanilla	2.48 ± 1.11	1.80 ± 0.87
Buttery	2.82 ± 1.13	2.37 ± 0.94
Sweet	3.65 ± 0.93	3.68 ± 0.82
Caramel	1.81 ± 1.11	1.77 ± 0.91
Nutty	1.58 ± 1.07	1.63 ± 0.86

Note: SA = South Africa; measured on a five-point Likert-type scale; m = mean; sd = standard deviation.

**Table 5.** Mean and standard deviation ( $m \pm sd$ ) values of consumers' attitudes towards biscuits.

Items	South Africa	Switzerland
Attitude Craving (Cronbach's alpha = 0.872)	2.85 ± 1.17	2.26 ± 1.09
I eat sweet baked products to cheer me up when I am down	2.91 ± 1.32	2.34 ± 1.22
I often eat sweet baked products when I am bored	2.83 ± 1.27	2.37 ± 1.19
I like to indulge in sweet baked products	2.33 ± 1.09	1.72 ± 0.99
My desire for sweet baked products often seems overpowering	3.43 ± 1.07	2.69 ± 1.32
The thought of sweet baked products often distracts me from what I am doing (e.g., watching TV)	2.42 ± 1.22	2.38 ± 1.15
I usually find myself wanting sweet baked products during the afternoon	2.36 ± 1.24	1.50 ± 0.75
I often go into a shop for something else and end up buying sweet baked products	2.82 ± 1.17	2.09 ± 1.08
Sweet baked products often prey on my mind	3.29 ± 1.06	2.05 ± 1.12
Even when I do not really want any more sweet baked products I will often carry on eating it	3.22 ± 1.15	3.35 ± 1.02
Attitude Guilt (Cronbach's alpha = 0.905)	2.50 ± 1.23	2.07 ± 1.01
I feel unattractive after I have eaten sweet baked products	2.36 ± 1.27	1.78 ± 1.03
I often feel sick after eating sweet baked products	2.26 ± 1.21	1.48 ± 0.73
I am often on one kind of diet or another	2.52 ± 1.27	1.62 ± 1.03
I consider sweet baked products to be high in fat and of poor nutritional value	3.32 ± 1.23	3.65 ± 1.15
After eating sweet baked products, I often wish I hadn't	2.75 ± 1.45	2.37 ± 1.15
I feel guilty after eating sweet baked products	2.41 ± 1.31	1.90 ± 1.03
I feel depressed and dissatisfied with life after eating sweet baked products	2.61 ± 1.28	1.96 ± 0.97
I feel unhealthy after I have eaten sweet baked products	2.11 ± 0.97	1.93 ± 1.05
I always look at the calorie value of a sweet baked product before I eat it	2.63 ± 1.23	2.30 ± 1.11
If I resist the temptation to eat sweet baked Products, I feel more in control of my life	2.08 ± 1.13	1.74 ± 0.88

Note: SA = South Africa; measured on a five-point Likert-type scale; sd = standard deviation.

For respondents' craving attitudes to sweet baked products, South Africans indicated that "my desire for sweet baked products often seems overpowering" ( $3.43 \pm 1.07$ ), while the Swiss respondents revealed that "even when I do not really want any sweeter baked products, I will often carry on eating it" ( $3.35 \pm 1.02$ ). For respondents' guilty attitudes, both the countries indicated that "I consider sweet baked products to be high in fat and of poor nutritional value" (South Africa:  $3.32 \pm 1.23$ ; Swiss:  $3.65 \pm 1.15$ ).

### 3.2. Emotional Responses after Biscuit Consumption

For this study, the researchers focused on the respondents' emotional responses after biscuit consumption. Table A3 provides a summary of regression analysis for the variables predicting consumers' emotions before biscuit consumption.

The results of respondents' subsequent positive and negative emotions are provided in Table 6. South Africans regarded the sensory taste variables vanilla, chocolate and caramel as positive predictors influencing their positive emotions towards chocolate-based biscuits. For South African respondents, a craving attitude implied a positive outlook, while a guilty attitude suggested a negative outlook on consumers' subsequent positive emotions.

**Table 6.** Summary of regression analysis for variables predicting consumers' emotions after biscuit consumption.

	<i>B</i>	<i>SE B</i>	$\beta$	<i>p</i>
Positive emotions				
SA ( $R^2 = 0.54$ )				
Constant	−0.10	0.37		0.79
Vanilla taste	0.27	0.07	0.32	0.00 **
Chocolate taste	0.25	0.07	0.29	0.00 **
Caramel taste	0.23	0.07	0.27	0.00 **
Attitude: craving	0.37	0.09	0.31	0.00 **
Attitude: guilt	−0.17	0.08	−0.17	0.03 *
Swiss ( $R^2 = 0.10$ )				
Constant	1.64	0.33		0.00 **
Chocolate taste	0.24	0.09	.27	0.01 *
Negative emotions				
SA ( $R^2 = 0.40$ )				
Constant	0.25	0.26		0.22
Nutty taste	0.34	0.06	0.44	0.00 **
Caramel taste	0.27	0.06	0.42	0.00 **
Buttery taste	−0.17	0.06	−0.27	0.00 **
Sweet taste	0.19	0.06	0.24	0.00 **
Attitude: craving	0.24	0.07	0.27	0.00 **
Attitude: guilt	0.27	0.07	0.25	0.00 **
Gender	0.25	0.13	0.13	0.01 *
Age	−0.39	0.13	−0.23	0.01 *
Education	0.52	0.12	0.32	0.00 **
Swiss ( $R^2 = 0.20$ )				
Constant	0.87	0.23		0.00 **
Vanilla taste	0.14	0.04	0.31	0.00 **
Chocolate taste	−0.17	0.08	−0.20	0.03 *
Nutty taste	0.23	0.09	0.25	0.01 *
Attitude: guilt	0.35	0.10	0.35	0.00 **
Gender	0.18	0.07	0.24	0.01 *
Income	−0.33	0.13	−0.26	0.01 *

Note: SA = South Africa; \*  $p < 0.05$ ; \*\*  $p < 0.001$ . *B* = unstandardized coefficient; *SE B* = standard error;  $\beta$  = standardized coefficient; *p* = significance level.

Unsurprisingly, Swiss consumers indicated that a chocolate taste increased their subsequent positive emotions. Respondents' positive emotions after biscuit consumption were explained by the regression models: 54% (South Africa) and 10% (Swiss). Therefore, it can be confirmed that for both countries, the sensory property, chocolate taste, positively affected consumers' subsequent positive emotions.

For South Africans, mostly females (above the age of 35 years) with an education higher than Grade 12, the sensory taste variables, caramel and sweet, increased their negative emotions towards chocolate-based biscuits. A craving attitude was positively related to negative emotions after consuming the biscuits. Swiss consumers, predominantly females earning an income of more than CHF 6000 per month, regarded a vanilla taste as a positive indicator towards their level of negative emotions.

For both populations, a nutty taste, guilty attitude and the demographic variable gender were positively related to their negative emotions towards chocolate-based biscuits. Interestingly, a buttery and chocolate taste decreased both groups' negative emotions. For both consumer groups, a negative emotion was more positively influenced by a guilty attitude.

Consumers' negative emotions after biscuit consumption were explained by the regression models: 40% (South Africa) and 20% (Swiss). It is evident that for both countries, the sensory property nutty taste positively affect consumers' subsequent negative emotions, and a guilty attitude increased consumers' subsequent negative emotions.



In relation to explicit attributes, food products containing bitter and sweet attributes are seen as more complex. Attributes such as nutty, coffee, cocoa, tart and bitter are associated with the bitter attribute segment, while chocolate and vanilla are associated with the sweet attribute segment [52].

Researchers determined the associations between the sensory characteristics of milk chocolate and consumers' emotional responses and how specific internal consumer behaviour variables (e.g., attitudes) influenced this response. Results reveal that bitterness influenced negative emotion, while sweetness had no effect on either positive or negative emotion [53]. These findings are supported by [54], as pleasant emotion categories received high scores for high sweetness and low bitterness (and vice versa), meaning that both the sweet and bitter attributes influenced emotion segments.

### 3.3. Change in Emotions towards Biscuit Consumption

Table 7 predicts consumers' positive and negative emotional changes. For South Africans, the taste variables chocolate and vanilla increased the change in positive emotion towards chocolate-based biscuits. For both population groups, a craving attitude suggested an increase towards positive emotions. For Swiss respondents who were mostly living in the city, a chocolate taste increased the change in positive emotion for South Africans; however, South Africans' cravings towards chocolate-based biscuits was higher.

**Table 7.** Summary of regression analysis for the variables predicting consumers' emotional changes.

	<i>B</i>	<i>SE B</i>	$\beta$	<i>p</i>
Positive change				
SA ( $R^2 = 0.39$ )				
Constant	−3.68	0.42		0.00 **
Chocolate taste	0.24	0.07	0.27	0.00 **
Vanilla taste	0.20	0.07	0.23	0.01 *
Attitude: craving	0.53	0.10	0.43	0.00 **
Swiss ( $R^2 = 0.24$ )				
Constant	−1.73	0.34		0.00 **
Chocolate taste	0.30	0.09	0.33	0.00 **
Attitude: craving	0.22	0.09	0.23	0.02 *
Residence area	−0.31	0.13	−0.22	0.02 *
Negative change				
SA ( $R^2 = 0.21$ )				
Constant	−0.68	0.43	0.00	0.21
Buttery taste	0.29	0.10	0.27	0.03 *
Nutty taste	−0.07	0.11	−0.03	0.01 *
Vanilla taste	0.33	0.12	0.27	0.01 *
Chocolate taste	−0.36	0.11	−0.28	0.00 **
Attitude: guilt	0.19	0.12	0.09	0.00 **
Attitude: craving	−0.43	0.16	−0.23	0.01 *
Age	−0.59	0.25	−0.20	0.02 *
Income	0.78	0.25	0.28	0.00 **
Swiss ( $R^2 = 0.14$ )				
Constant	0.15	0.21	0.00	0.12
Nutty taste	−0.28	0.10	−0.27	0.01 *
Chocolate taste	−0.18	0.07	−0.24	0.01 *
Caramel taste	−0.21	0.08	−0.25	0.02 *
Attitude: guilt	0.31	0.08	0.38	0.00 **
Income	−0.33	0.10	−0.31	0.00 **
Residence area	−0.25	0.09	−0.28	0.01 *
Occupational status	0.44	0.19	0.23	0.02 *

Note: \*  $p < 0.05$ ; \*\*  $p < 0.001$ ; *B* = unstandardized coefficient; *SE B* = standard error;  $\beta$  = standardized coefficient; *p* = significance level.

The regression models for respondents from South Africa and Switzerland's change in positive emotions explained 39% and 24%, respectively. Based on the results, it can

be established that for both samples, the sensory property, chocolate taste, increased consumers' positive emotional changes and a craving attitude increased consumers' positive emotional changes. South African respondents (older than 35 years) earning an income of more than ZAR 20,000 per month, indicated that a buttery and vanilla taste increased the change in negative emotions towards chocolate-based biscuits. The negative contribution of South Africans' craving attitudes to a change in negative emotions was confirmed, as discussed in the previous section.

As predicted, a chocolate taste decreased the change in negative emotions for both groups. Swiss consumers' (who mainly lived in the city and were not working) attitudes towards guilt increased their change in negative emotions more than those of South Africans. Income and occupational status increased South Africans' and Swiss respondents' changes in negative emotions, respectively. The regression model explained 21% (South Africa) and 14% (Swiss), respectively. It can therefore be confirmed that for both samples, the sensory properties nutty and chocolate taste decreased consumers' negative emotional changes and a guilty attitude increased consumers' negative emotional changes.

#### 4. Discussion

This study reported an overall decrease in consumers' positive and negative emotions after biscuit consumption, except for the negative emotion guilt. Researchers examined consumers' emotional changes after eating chocolate and found that chocolate could evoke responses of guilt in healthy/normal-weight women. These emotional responses are likely to be prompted by negative food-related perceptions dependent on culturally determined attitudes to slimness/body weight [55].

Respondents experienced guilt that resulted in lower positive emotions. Due to chocolate's sensory pleasure, it evoked positive emotions during and after consumption, but the level of guilt increased thereafter due to the respondents' negative thoughts. Kim and co-workers investigated emotions toward sweet-tasting foods according to sweet-liker status and mentioned that a possible reason that emotional responses varied between respondents who like or dislike sweet foods in a non-consistent manner with the sweetness level of sweet-tasting foods is that independent pathways determine development of liking, and varied emotional responses are evoked for that food product [11]. This raised the possibility that, for respondents who liked sweet foods, emotional responses to sweet foods were more influenced by sweetness, while the emotional responses of respondents who disliked sweet foods to sweet foods were more linked with how much the sweet food was liked.

Researchers reported that there are cases where a single sensory attribute was associated with different emotional terms, characterized by different arousal and/or valence properties. In as study where chocolate was used as the subject, sweetness was significantly linked with emotional responses that expressed pleasant activation and both pleasant and unpleasant deactivation, confirming that consumers can be segmented on their emotional responses to the sensory properties of food products [30]. Researchers confirmed in their study that sweet-tasting chocolates increased the positive emotional response and reduced the negative emotional response, but bitter chocolates increased the negative emotional response and reduced positive emotions [56].

Furthermore, respondents' guilty attitudes increased their negative emotions and changes in negative emotions towards chocolate-based biscuits, as they regarded these to be of poor nutritional value and high in fat. Researchers confirmed that the two major ingredients in biscuits are usually sugar and fat [57]. Biscuits are regarded as high-reward food items—they lead consumers to act impulsively, to seek variety in their choice of biscuits and influence them by positive hedonic affect. It could be foreseen that positive characteristics may thus outweigh the negative ones in choice cues in the form of an approach–avoidance imbalance or cognitive suspension process [58].

A chocolate taste increased respondents' positive emotions, but a guilty attitude increased the change in their negative emotions. Differences in emotional responses experi-

enced by women after consuming chocolate in everyday life increased their emotions of joy and guilt. While the sensory enjoyment when consuming chocolates evoked joy, negative thoughts (e.g., effect on body weight) linked with chocolate consumption evoked guilt.

A recent study found that more than 50% of Swiss consumers regarded taste as important when purchasing food products [59]. Research revealed that for South African consumers, the sweetness of baked products was an important driver of choice of whether the sweet food was found to be pleasurable [60]. Milk chocolates are currently the most preferred type as plain milk chocolate is preferred over dark chocolate [61].

In Switzerland, milk chocolate forms an integral part of Swiss culture, and the Swiss are regarded as chocolate connoisseurs [62]. Part of both countries' growing diversification into culinary tourism is the offering of food and beverages, which includes chocolate products, paired with wine and coffee [63,64].

The differences in the regression models of emotions and changes in emotion between the South African and Swiss samples could possibly be described by different influential factors, such as South Africans' higher attitudes towards the craving of chocolate-based biscuits; for instance, one respondent stated "my desire for sweet baked products often seems overpowering". Food cravings are an important predictor of food consumption. Increased food cravings are linked with consuming craved foods, such as chocolate, more habitually [65]. Chocolate can act as a mood booster and may also increase cravings or impose negative emotions, such as guilt [66] when considered as an unhealthy snack. Negative emotional responses such as tiredness, depression and boredom are associated with food cravings [25].

Swiss consumers' craving attitudes can mainly be ascribed to their lack of self-control; for instance, one respondent reported that "even when I do not really want any more chocolate-based biscuits, I will often carry on eating them". Different styles of overeating have been reported; for example, external eating (e.g., responding to a pleasant taste) has been linked with an increase in consumption of high-calorie foods [67]; however, research has indicated that gaining weight for some time was not affected [68]. Furthermore, emotional eating (e.g., responding to negative emotional responses), was positively linked with eating too much calorie-dense food [66] and was linked with weight gain in the long term [69]. In a longitudinal study by [68], high indecisiveness towards palatable foods was linked with more extreme weight variations among females, implying that indecisiveness towards palatable food may result in a habit of overeating [68,69]. These results suggest that initiating interventions to help consumers improve their self-control to restrict their cravings towards chocolate-based biscuits may prevent the overconsumption of high-calorie, energy-dense foods.

#### 4.1. Value of the Study

Two questions emerge from this study. Firstly, how can positive emotions, such as the level of goodness for the South African sample and calmness for the Swiss group, be maintained or increased, and negative emotions, such as the level of guilt and boredom, be reduced when introducing healthier sweet baked product options to consumers? Secondly, how can South Africans' overpowering desire and Swiss consumers' lack of self-control in overeating be addressed to assist them in controlling their craving attitudes towards sweet baked products?

The knowledge gained from comparing South Africa and Swiss consumers' emotions and changes in emotions towards chocolate-based biscuits will help researchers to link the sensory taste properties of chocolate-based biscuits and attitudes to respondents' emotions. This study creates a starting point for future research, presenting variables that positively/negatively contribute to consumers' emotions and changes in emotions towards chocolate-based biscuits so that healthier sweet baked products may be developed. Therefore, emotional responses can be applied as a segmentation, differentiation and product development [70] measure, as the association between food products and consumers' emotions is essential to ensure a positive product experience.

Understanding the emotional responses among consumers from different cultures remains an important issue in sensory and consumer sciences. Investigating the association between the sensory attributes of foods and consumers' emotions could help product developers to formulate food products for specific markets and assist in the understanding of the emotional profile of food products. Furthermore, if consumers' emotions and attitudes towards chocolate-based biscuits are incorporated from a cultural perspective, their feedback and product acceptance could then be predicted; communicating emotional responses to consumers or food product developers could aid in the development of sensory–emotion lexicons for the chocolate-based biscuit category, for example, labelling healthy chocolate-based biscuits with the emotions they evoke. More research on emotion testing before and after the consumption of individual sweet baked products is required to understand the link between sensory properties and emotional responses.

#### 4.2. Limitations and Recommendations

Measuring only one type of biscuit from one brand must be noted and considered when interpreting the data. Due to cultural differences in the interpretations associated with processed foods [71], replicating findings in different cultures would explain the extent to which the findings are applicable to other cultures and sweet baked products.

Furthermore, the same sensory taste descriptors were used for the two biscuits. Researchers reported that European consumers revealed that country of residence with variation in dietary habits was strongly associated with their preferences for the basic tastes of sweet, salty, bitter and umami, suggesting that food culture plays a significant role in food preference and taste perception [72].

Therefore, for a clearer understanding of cross-cultural variability in the sensory properties of chocolate-based biscuits, future research should include different taste, olfactory and visual descriptors for each product. Further studies will need to examine variables such as including a beverage, e.g., coffee or tea, and the social context (e.g., alone, with family), as comfort foods are usually linked with acceptance and security (positive emotional responses) [73]; these food-related emotions may originate from pairing with relatives or cultural contexts [11].

Future researchers may investigate by which processes the sensory attributes, emotions and attitude correspond with foods. Classical or Pavlovian conditioning [74] could be applicable; from the repeated reappearance of a food product with sensory–emotional–attitudinal-associated stimuli, consuming this food product may emerge as a conditioned stimulus influencing emotional and attitude (e.g., craving) states; for example, when energy-dense food products reappear with pictures or descriptions of obese silhouettes in the media, consuming similar food products may evoke anxiety regarding weight management. Therefore, any attempt to change consumers' detrimental choices should also consider their emotional response towards food, for example, exploring emotions evoked by food products and determining whether they prevent with choosing and eating healthier foods.

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**Informed Consent Statement:** All the respondents were required to give informed consent, and participation in this study was completely voluntary. The respondents were reassured of their confidentiality and the privacy of the information that they supplied.

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

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## Appendix A

**Table A1.** Nutritional value of chocolate-based biscuits per 100g.

Description	South Africa	Switzerland
Kilojoules (kJ)	2010	2110
Kilocalories (kcal)	480	504
Carbohydrates (g)	69	67
Carbohydrates of which are sugar (g)	38	32
Protein (g)	5	5
Fat (g)	20	23
Fiber (g)	2.5	2.5
Salt (g)	0.61	0.31

**Table A2.** Scales and items used for cluster analysis, including internal consistency analyses.

Items	Factor Loadings	Cronbach's Alpha
Positive emotions		
Adventurous	0.780	
Calm	0.812	
Enthusiastic	0.716	
Free	0.842	
Good	0.867	
Happy	0.641	
Joyful	0.631	
Nostalgic	0.354	
Satisfied	0.814	
Secure	0.722	
Positive emotions before eating		0.834
Positive emotion after eating		0.900
Negative emotions		
Aggressive	0.760	
Guilty	0.682	
Bored	0.612	
Worried	0.836	
Negative emotion before eating		0.664
Negative emotion after eating		0.562
Sensory taste properties		0.707
Chocolate	0.930	
Vanilla	0.804	
Buttery	0.518	
Sweet	0.379	
Caramel	0.826	
Nutty	0.719	
Attitude: craving		0.872
I eat sweet baked products to cheer me up when I am down	0.575	
I often eat sweet baked products when I am bored	0.429	
I like to indulge in sweet baked products	0.590	
My desire for sweet baked products often seems overpowering	0.673	
The thought of sweet baked products often distracts me from what I am doing (e.g., watching TV)	0.685	
I usually find myself wanting sweet baked products during the afternoon	0.685	
I often go into a shop for something else and end up buying sweet baked products	0.692	
Sweet baked products often prey on my mind	0.397	
Nothing else but sweet baked products will satisfy my cravings	0.699	
Even when I do not really want any more sweet baked Products I will often carry on eating them	0.752	

Table A2. Cont.

Items	Factor Loadings	Cronbach's Alpha
Attitude: guilt		0.905
I feel unattractive after I have eaten sweet baked products	0.817	
I often feel sick after eating sweet baked products	0.724	
I am often on one kind of diet or another	0.617	
I consider sweet baked products to be high in fat and of poor nutritional value	0.590	
After eating sweet baked products, I often wish I hadn't	0.868	
I feel guilty after eating sweet baked products	0.789	
I feel depressed and dissatisfied with life after eating sweet baked products	0.769	
I feel unhealthy after I have eaten sweet baked products	0.867	
I always look at the calorie value of a sweet baked product before I eat it	0.648	
If I resist the temptation to eat sweet baked products, I feel more in control of my life	0.640	

Table A3. Summary of regression analysis for variables predicting consumers' emotions before biscuit consumption.

	<i>B</i>	<i>SE B</i>	$\beta$	<i>p</i>
Positive emotions				
SA ( $R^2 = 0.33$ )				
Constant	4.16	0.34		0.00 **
Caramel taste	0.27	0.06	0.38	0.00 **
Attitude: guilt	-0.37	0.07	-0.45	0.00 **
Gender	-0.57	0.16	-0.31	0.00 **
Occupational status	-0.59	0.28	-0.17	0.04 *
Swiss ( $R^2 = 0.10$ )				
Constant	3.16	0.21		0.00 **
Attitude: guilt	-0.19	0.08	-0.26	0.01 *
People >16 years in household	0.14	0.07	0.21	0.05
Negative emotions				
SA ( $R^2 = 0.21$ )				
Aggressive				
Constant	2.01	0.43		0.00 **
Attitude: guilt	0.29	0.09	0.28	0.00 **
Single	-0.84	0.22	-0.41	0.00 **
Income	-0.54	0.21	-0.26	0.01 *
People >16 years in household	-0.21	0.10	-0.21	0.03 *
Bored ( $R^2 = 0.22$ )				
Constant	1.98	0.33		0.00 **
Attitude: guilt	0.28	0.10	0.26	0.00 **
Age	-0.57	0.19	-0.28	0.00 **
Income	-0.68	0.22	-0.32	0.00 **
Single	-0.50	0.22	-0.24	0.02 *
Guilty ( $R^2 = 0.10$ )				
Constant	0.52	0.37		0.16
Attitude: craving	0.35	0.12	0.27	0.01 *
Worried ( $R^2 = 0.21$ )				
Constant	1.03	0.51		0.05
Nutty taste	0.50	0.12	0.40	0.00 **
Vanilla taste	-0.33	0.12	-0.28	0.01 *
Attitude: craving	.36	0.15	.21	0.02 *
Swiss				
Aggressive ( $R^2 = 0.19$ )				
Constant	0.61	0.15		0.00 **
Vanilla taste	0.21	0.07	0.30	0.00 **
Residence area	0.27	0.11	0.24	0.02 *
Gender	0.23	0.11	0.20	0.04 *



Table A3. Cont.

	<i>B</i>	<i>SE B</i>	$\beta$	<i>p</i>
Bored ( $R^2 = 0.23$ )				
Constant	1.81	0.37		0.00 **
Attitude: guilt	0.40	0.10	0.36	0.00 **
Age	−1.15	0.32	−0.33	0.00 **
Guilty ( $R^2 = 0.20$ )				
Constant	0.47	0.18		0.01 *
Caramel taste	0.22	0.06	0.37	0.00 **
Attitude: craving	0.14	0.07	0.20	0.04 *
Worried ( $R^2 = 0.16$ )				
Constant	1.19	0.21		0.00 **
Caramel taste	0.45	0.11	0.40	0.00 **
Total population				
Aggressive ( $R^2 = 0.13$ )				
Constant	0.45	0.21		0.04 *
Attitude: guilt	0.15	0.07	0.15	0.04 *
Attitude: craving	0.17	0.08	0.17	0.03 *
Residence area	0.34	0.14	0.17	0.01 *
Single	−0.33	0.13	−0.17	0.01 *
Bored ( $R^2 = 0.16$ )				
Constant	1.45	0.21		0.00 **
Attitude: guilt	0.28	0.07	0.26	0.00 **
Age	−0.58	0.14	−0.27	0.00 **
Guilty ( $R^2 = 0.13$ )				
Constant	0.32	0.20		0.12
Nutty taste	0.19	0.06	0.21	0.00 **
Attitude: craving	0.29	0.07	0.27	0.00 **
Worried ( $R^2 = 0.21$ )				
Constant	0.61	0.27		0.02 *
Nutty taste	0.34	0.08	0.27	0.00 **
Attitude: guilt	0.39	0.09	0.28	0.00 **
Gender	0.57	0.17	0.23	0.00 **
Income	−0.37	0.17	−0.15	0.03 *

Note: SA = South Africa; \*  $p < 0.05$ ; \*\*  $p < 0.001$ . *B* = unstandardized coefficient; *SE B* = standard error;  $\beta$  = standardized coefficient; *p* = significance level.

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