Food Quality and Preference 122 (2025) 105299

Contents lists available at ScienceDirect

Food Quality and Preference

journal homepage: www.elsevier.com/locate/foodqual

Cross-cultural differences and acculturation in affective response and sensory perception: a case study across Chinese immigrants and local consumers in New Zealand

Amanda Dupas de Matos [a,b,*], Ao Chen [a,b], Robyn Maggs [a,b], A. Jonathan R. Godfrey [c], Maheeka Weerawarna N.R.P. [a], Joanne Hort [a,b]

[a] Food Experience and Sensory Testing (Feast) Laboratory, Massey University, Palmerston North, New Zealand
[b] Riddet Institute, Massey University, Palmerston North, New Zealand
[c] School of Mathematical and Computational Sciences, Massey University, Palmerston North, New Zealand

ARTICLE INFO

Keywords:
Emotions
Liking
Sensory
Cross-cultural
Chinese immigrants
Yoghurt

ABSTRACT

Understanding cross-cultural variation in perception is essential for identifying culture-specific factors impacting product acceptability. While immigrants may initially maintain their preferences, acculturation levels vary. To understand to what extent immigrants can be used as a proxy to model overseas markets, this study investigated short (CHS) and long-term (CHL) Chinese immigrant responses to plain yoghurts compared to New Zealand (NZ) Europeans (E). Three groups (CHS, CHL and NZE, n = 222) evaluated liking of, emotional response to, and sensory perception of 10 plain yoghurts. Groups liked yoghurts similarly. Notably, NZE rated emotions lower than both immigrant groups, with a few exceptions. Both Chinese groups rated most emotions similarly, but CHL rated some closer to NZE. Positive emotions correlated with higher liking scores. However, cross-cultural differences existed for 'guilty' which was associated with yoghurts liked by NZE; and for 'wild' and 'mild' associated with yoghurts disliked by both immigrant groups. Citation proportions for some sensory attributes differed among all groups, dependent on the sample. But level of acculturation between immigrant groups was limited. Sweetness, vanilla, stone fruit and cream flavours, smoothness, and creaminess drove liking across all groups, whereas only the Chinese valued umami, undoubtedly due to positive associations with it. Some effects of acculturation for long-term immigrants were evident, but responses were often closer to their short-term counterparts. Therefore, immigrants in general provide a useful proxy for measuring consumer responses in early stages of product development for this overseas market, but with consideration of their residence time in the host culture.

1. Introduction

Food choice is determined by complex interactions between food, situation and personal interactions (Köster, 2009; Lee & Lopetcharat, 2017), in which culture plays a pivotal role. Culture encompasses shared meanings and values, within and among groups (Lee & Lopetcharat, 2017) operating conjointly with language (Imai, Kanero & Masuda, 2016). Moreover, culture is one of the main factors influencing purchase decisions, sensory preferences and willingness in accepting new products (Prescott, Young, O'Neill, Yau, & Stevens, 2002; Sulmont-Rossé et al., 2019). Indeed, studies have investigated cross-cultural differences in food preferences and habits among consumers residing in many countries (e.g., Thompson et al., 2007; Kim, Petard, & Hong, 2018; Hay et al., 2021). Understanding the factors driving food acceptance and choice in different cultural groups is critical for designing successful products for diverse and competitive market landscapes (Hay et al., 2021). This is particularly important for the introduction of emerging food categories into new markets such as dairy products in China.

As opposed to New Zealand (NZ) (Birkbeck, 1981), dairy products are not traditionally part of the Chinese diet (Fuller, Beghin, & Rozelle, 2007) but have emerged as a fast-growing food category in China (Chen et al. 2024), In recent years, yoghurt has gained popularity in the Chinese market (Wang, 2022), but is typically ambient (Feng, 2021) and equipped with straws for convenient consumption or with resealable lids

* Corresponding author at: Food Experience and Sensory Testing (Feast) Laboratory, Massey University, Palmerston North, New Zealand.
E-mail address: a.dupasdematos@massey.ac.nz (A. Dupas de Matos).

https://doi.org/10.1016/j.foodqual.2024.105299
Received 27 May 2024; Received in revised form 9 August 2024; Accepted 12 August 2024
Available online 13 August 2024

for multiple servings (Ou & Zhang, 2018). In NZ, yoghurts are mainly chilled and spoonable, and only occasionally drinkable (e.g., Kefir). Inherent differences in Chinese and NZ dietary habits and exposure to different types of yoghurt products in-market make yoghurt an excellent stimulus for studying cross-cultural differences and potential acculturation patterns using Chinese immigrants residing in NZ.

Acculturation refers to the process through which a group adopts the cultural patterns of a host culture (Satia-About, 2003). Acculturation of immigrants in a foreign country can influence their food preferences over time. In exploratory research (Dupas de Matos et al., 2021), Chinese immigrant sensory responses varied with residency duration (more than three years) in NZ, suggesting that as individuals immersed themselves in a new cultural environment, their perceptions evolved over time, reflecting a complex relationship between cultural adaptation and the influence of the host culture. Nevertheless, quantitative confirmatory research is needed, and a gap remains in understanding how emotions influence product perception across cultures, and whether long-term immigrants can also be a useful proxy to effectively represent overseas markets, particularly in situations where travel is unfeasible or research budgets are small. While few studies have explored the relationship between liking, emotions and sensory (e.g., Cardello et al., 2024; Jaeger et al., 2023), there is a need to take a multifactorial approach within the cross-cultural space. Therefore, building on previous qualitative research (Dupas de Matos et al., 2021), the main objectives of the present study were, utilising plain drinking yoghurt as a stimulus, to (i) determine if differences exist in liking, emotional response and sensory perception between NZ Europeans (NZE) and short-term and long-term Chinese immigrants; (ii) investigate overall relationships between liking, emotions, and sensory perception between the different cultural groups; and (iii) determine if Chinese immigrants acculturate in these responses.

2. Material and methods

2.1. Participants

Participants (n = 222) were recruited via the Feast consumer database, posters locally in Palmerston North and by Kantar Group Limited, (Auckland, NZ). Eligible participants met the following criteria: regularly consume plain/natural yoghurt (at least once a month), willing to attend two one-hour sessions one week apart, aged between 18 and 65 years old, be either Chinese or NZE, not allergic or intolerant to any product ingredients, not pregnant or lactating, and able to communicate competently in English (clarification/translation by a bilingual Chinese researcher was available). Age, gender and yoghurt consumption frequency were collected during recruitment. Participants were evenly divided into three groups: short-term Chinese immigrants (CHS), long-term Chinese immigrants (CHL) and NZE.

2.1.1. Chinese immigrants in NZ

CHS were of Chinese descent, born in China and had lived in NZ for less or equal to four years. CHL were of Chinese descent, born in China and had lived in NZ for more than four years. This timing was based on prior research indicating that sensory preferences of Chinese immigrants begin to undergo acculturation after residing in NZ for more than three years (Li, 2013; Dupas de Matos et al., 2021).

2.1.2. NZ Europeans

NZE participants were of European descent and had resided in NZ either exclusively or for at least 10 years (as previously adopted by Hay et al. (2021) and Dupas de Matos et al. (2021)).

2.2. Ethics statement

This study was assessed and considered low risk following the Massey University Human Ethics Committee process (Human Ethics Notification: 4000026227). Prior to study attendance, participants received an information sheet outlining study details and then provided informed written consent. Participants were assigned a unique code to ensure anonymity. Upon study completion, participants were offered a snack treat and a supermarket voucher as compensation for their time.

2.3. Samples

2.3.1. Samples used in the study

Yoghurts are typically equipped with straws for convenient consumption or with resealable lids for multiple servings in China (Ou & Zhang, 2018). To represent typical yoghurt consumption in China, all the participants were asked to use straws to assess samples.

Four experimental samples using commercially available cultures were manufactured in a food-grade certified pilot plant at Massey University to vary in sweetness, acidity and thickness. Additionally, six plain yoghurts commercially available in NZ (four from NZ and two from China) were carefully chosen to span the sensory range of plain yoghurts with respect to taste/flavour and texture/mouthfeel characteristics. NZ commercial yoghurts were chilled and, although classified as spoonable, with one exception, were representative of the thickness/consistency of drinking yoghurts in China. The drinking yoghurts from China were ambient/pasteurised, and popular products in the Chinese market (Liu, 2018). Sample selection was conducted by an in-house panel (n = 6) from the Feast team comprising staff members with relevant sensory expertise. The final 10 yoghurt samples are listed in Table 1 (refer to **Table S1** in Supplementary Material for additional sample details).

2.3.2. Sample preparation and serving

Commercial yoghurts from the same batch were purchased directly from supermarkets. The experimental samples were transferred to the Feast refrigerator within 1–2 days of production in the pilot plant. All products were stored between 2 and 3 °C upon arrival on site, including the ambient yoghurts. Commercial yoghurts sample preparation took place the day before testing (~18–24 h) and the same day of evaluation for the experimental samples (~2–7 h). In both cases, samples were poured, covered, and stored in a refrigerator (~3 °C) until the beginning of each session.

2.4. Consumer study

2.4.1. Response variables

Consumers (n = 222) attended two sessions with three responses obtained for each sample. Overall liking was rated on a fully labelled 9-point hedonic scale from “dislike extremely” (1) to “like extremely” (9) (Peryam & Pilgrim, 1957). Next, participants rated intensity of emotions elicited by each sample using a 5-point scale “not at all” (0) to

Table 1
Study yoghurt samples.

Sample name	Style	Type	Origin
CHN-Box	Greek, Drinking	Ambient	China
CHN-Bottle	Greek, Drinking	Ambient	China
NZ-Kefir	Kefir, Drinking	Chilled	New Zealand
NZ-Puhoi	Authentic Greek, Spoonable	Chilled	New Zealand
NZ-Gopala	Full-cream, Spoonable	Chilled	New Zealand
NZ-Zany	Greek, Spoonable	Chilled	New Zealand
Pilot-CH1	Drinking	Chilled	Experimental*
Pilot-CH1+	Drinking	Chilled	Experimental
Pilot-YFL	Drinking	Chilled	Experimental*
Pilot-YFL+	Drinking	Chilled	Experimental

*CH-1 and YF-L811 cultures were freeze-dried direct vat set mixed strains consisting of *Streptococcus thermophilus* and *Lactobaciluus delbrueckii* subsp. *Bulgaricus* (Christen Hansen Holding, Denmark).
+: indicates addition of 8 % w/w sugar (Woolworths Brand pure cane white sugar) and 0.25 % w/w pectin (Grindsted® Pectin SY 200) in the experimental samples.

"extremely" (4) using the EsSense 25 profile lexicon (Nestrud et al. 2016) with the addition of Curious, a word often present in other emotional lexicons (e.g., Spinelli et al. 2014). Data for Tame was removed from the data analysis because it was translated incorrectly to "温顺", which means "docile" by back translation, instead of "乏味", which means "lack of interest". Emotion terms were always presented in English and Mandarin, the final emotion list is shown in Table 2 (for a complete list with definitions/examples refer to Supplementary Material, **Table S2**).

Finally, sensory product characterisation was performed via a CATA (check-all-that-apply) question including a total of 20 sensory attributes: 5 tastes, 6 flavours and 8 textures/mouthfeels. The sensory lexicon was defined by a trained panel (n = 12), and adjusted by the research team, when necessary, into consumer-friendly terms. Sensory terms were also presented in English/Mandarin (Table 3) (for a complete list with definitions/examples refer to Supplementary Material, **Table S3**). To minimise order bias, both emotion and sensory term order was randomised across consumers, but each consumer retained the same order throughout the evaluation session (Meyners & Castura, 2016). To avoid possible interpretation bias of terms (Ares, 2018), participants were provided with a clear and unambiguous written list of emotions and sensory attributes with definitions/examples in both English and Chinese (**Table S2** and **Table S3**).

The English terms were translated into Mandarin by a bilingual Chinese researcher proficient in both English and Mandarin and subsequently back-translated by a second bilingual Chinese researcher. Further, their meanings were reviewed and discussed with another researcher proficient in English. Any discrepancies were considered and then agreed in discussion with the principal investigator.

2.4.2. Data collection procedure

Data were collected at either the Feast Laboratory in Palmerston North or Kantar facilities in Auckland. Both were conducted as central location tests in groups of 15–17 participants. Prior to sample evaluation, participants were briefed on study procedures in English by a multilingual researcher proficient in English, followed by Mandarin. Following Sekaran (1983), translation to Mandarin was provided by a bilingual Chinese researcher, proficient in both English and Mandarin, and familiar with the different cultures. Clarification in both English or Mandarin was provided by both researchers when requested before and during the sample evaluation.

Five samples were allocated to each session ensuring a range of sensory characteristics were represented in each session. Within a session, samples were presented according to an experimental design based on a Williams Latin Square. Presentation was monadic with a forced 1 min-break between samples. While acknowledging the first-position effect reported in previous literature (Dorado et al., 2016), a warm-up sample was not used due to the maximum number of samples participants could consume per session. To minimise carryover effects, participants were instructed to cleanse their palate before each sample in a consistent manner (bite of cracker (Gourmet Food Biscuits, Victoria, Australia) followed by filtered water). Data were collected with tablets/laptops using Compusense® Cloud (Compusense Inc., Guelph, Ontario, Canada).

Samples (20 mL) were served chilled (~4 °C) in 30 mL clear and odour-free plastic cups covered with a lid, labelled with 3-digit random codes, and evaluated under white lighting. Room temperature was 21 ± 1 °C. Participants received one cup and straw (7 mm x 100 mm clear bioplastic compostable, Ecoware, Auckland, New Zealand) for affective responses (liking and emotions) and one cup and straw for sensory profiling (CATA). To ensure a consistent consumption protocol, participants were instructed to remove the lid, stir the yoghurt using the straw and use the straw to drink the yoghurt, as opposed to sipping directly from the cup or spooning it with the straw.

2.5. Data analysis

Data were analysed in XLSTAT version 2023.1.6 (Lumivero, New York, United States) and R software version 4.2.3 (R Core Team, 2020) in RStudio 2023.06.0 using the following packages: multcomp (Hothorn et al., 2008) and emmeans (Lenth, 2023). The α-risk was set at 0.05.

Two-way Analysis of Variance (ANOVA) (sample, cultural group) with interaction was performed on liking and emotion data to ascertain any significant differences or interactions between cultural groups and samples.

A Generalised Linear Model (GLM) (Meyners & Hasted, 2022) with a binomial distribution is recommended for binary data analysis (Agresti, 2018; Bi & Kuesten, 2022; Weerawarna et al., 2021). A GLM was used to investigate product and cultural group effects on sensory CATA responses. GLM default functions function = glm, family="binomial", link

Table 2
Emotion lexicon presented in English/Mandarin.

Emotion/心理活动
Active/活跃
Adventurous/大胆创新
Aggressive/激进
Bored/无聊
Calm/平静
Curious/好奇
Disgusted/恶心
Enthusiastic/热情
Free/自由
Good/良好
Good natured/善意
Guilty/罪恶感
Happy/高兴
Interested/感兴趣
Joyful/快乐
Loving/爱意
Mild/平庸
Nostalgic/怀旧
Pleasant/愉快
Satisfied/满意
Secure/有安全感
Understanding/可理解
Warm/暖心
Wild/野性
Worried/担心

Table 3
Check-All-That-Apply sensory attributes presented in English/Mandarin.

Attribute/属性
Taste
Sweet/甜
Sour/酸
Bitter/苦
Salty/咸
Umami/鲜
Flavour
Stone fruit /核果味
Lemon/柠檬味
Vanilla/香草味
Cream/奶油味
Fermented dairy/发酵乳制品味
Earthy/泥土味
Cheesy/起司味
Texture/Mouthfeel
Thick/黏稠感
Thin/稀薄感
Creamy/奶油感
Smooth/顺滑感
Chalky/白土粉感
Fizzy/起泡感
Mouthcoating/口腔黏附感
Astringent/涩味

= Logit (Agresti, 2018) were used to model the citation proportions of the two factors (product and cultural group) with two-way interactions for each attribute. Analysis of Deviance and associated chi-square tests were used to determine the statistical significance of product, group and interactions (Agresti, 2018). Post hoc tests were conducted subsequently, using Tukey HSD's test via emmeans package for pairwise comparisons. Where the interaction was not significant ($p > 0.05$), it was removed from the model for post-hoc tests.

Furthermore, Multiple Factor Analysis (MFA) was applied to visualise the relationship between liking, emotions and sensory attributes across Chinese and NZ Europeans. MFA included liking (1 variable per population group), emotions (26 variables per group), and sensory attributes (20 variables per group).

3. Results

3.1. Participants

Age and gender quotas were not implemented. Participants were predominantly female (74 %), a trend across all groups, and aged between 19 and 65 years. Notably CHS contained more younger participants and the NZE more older participants. A total of 222 consumers

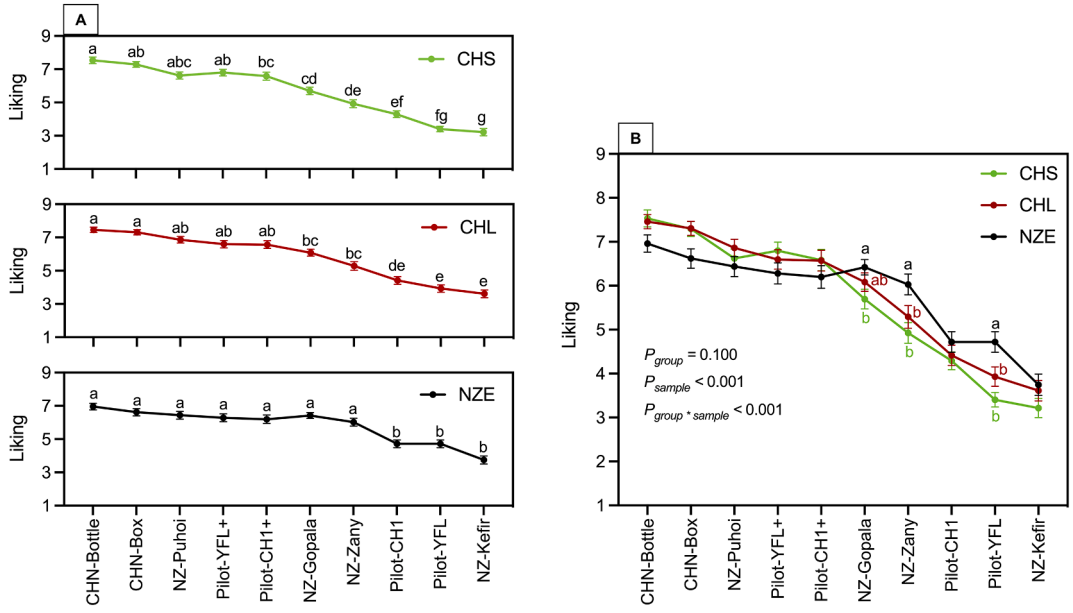

Fig. 1. A) Mean overall liking by cultural group and yoghurt samples. Samples with different letters are significantly different (Tukey's HSD, 5 % level) within a group. **B)** All groups plotted together with p-values associated with ANOVA factors and their interaction. Groups with different letters are significantly different (Tukey's HSD, 5 % level) within a sample. CHS: green line, CHL: red line, NZE: black line. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

participated in the study: CHS: n = 79, CHL: n = 72, and NZE: n = 71. Participant demographics and yoghurt consumption frequency are detailed in Supplementary Material (**Table S4**).

3.2. Overall liking

Mean overall liking ratings for each cultural group across yoghurt samples are illustrated in Fig. 1**A** (see also **Table S5**). ANOVA results indicated no significant main effect of cultural group (p = 0.10, Fig. 1**B**), but a significant interaction between sample and cultural group, whereby NZE generally scored some lesser liked samples (NZ-Zany and Pilot-YFL) significantly higher, resulting in lower liking discrimination by NZE than CHS and CHL (Fig. 1**A**). Notably, both CHS and CHL groups displayed a similar sample liking ranking pattern.

3.3. Emotional responses

On average, all emotions were rated lower than 2 ('moderately'). Nevertheless, ANOVA indicated some group, sample, and interaction effects on emotional response (Table 4). Notably, NZE rated emotional responses significantly lower than both Chinese groups overall, except disgusted and mild (Fig. 2). Significant interactions between group and sample were found for active, adventurous, aggressive, bored, enthusiastic, good, guilty, happy, interested, joyful, loving, mild, pleasant, satisfied, secure, warm, wild, and worried (Table 4, Fig. 3). These interactions were driven by two phenomena. The first was the overall lower emotional engagement of NZE, resulting in lower variation in emotional response to the yoghurts compared to both Chinese groups, for example active, aggressive, bored and wild (Fig. 3). Secondly, certain samples evoked significantly different emotional responses between the cultural groups, but others did not. For example, Chinese groups felt more active, good, happy, interested, joyful, loving, pleasant, satisfied, secure and warm when drinking CHN-Box, CHN-Bottle, Pilot-CH1+ and Pilot-YFL+ than they did for other samples (Fig. 3). Conversely, NZE felt less aggressive, bored, guilty, mild, wild and worried for certain samples, such as NZ-Kefir and Pilot-YFL (Fig. 3). CHS and CHL did not significantly differ on most emotional responses with a few exceptions including guilty, wild, free, loving, enthusiastic, worried, and aggressive, where intensities were significantly greater in CHS than in CHL (Fig. 2). Supplementary Material **Table S6** provides full details on mean values for each group and sample for each emotion.

Table 4
P-values associated with effect of group, sample, and their interaction from ANOVA by emotion.

Emotion terms	Group p-value	Sample p-value	Group*Sample p-value
Active	<0.001	<0.001	0.003
Adventurous	<0.001	<0.001	0.010
Aggressive	<0.001	<0.001	<0.001
Bored	<0.001	<0.001	0.009
Calm	<0.001	<0.001	0.834
Curious	<0.001	<0.001	0.561
Disgusted	0.250	<0.001	0.287
Enthusiastic	<0.001	<0.001	0.022
Free	<0.001	<0.001	0.520
Good	<0.001	<0.001	0.001
Good natured	<0.001	<0.001	0.433
Guilty	<0.001	<0.001	0.004
Happy	<0.001	<0.001	<0.001
Interested	<0.001	<0.001	<0.001
Joyful	<0.001	<0.001	<0.001
Loving	<0.001	<0.001	<0.001
Mild	0.003	<0.001	<0.001
Nostalgic	<0.001	<0.001	0.078
Pleasant	<0.001	<0.001	<0.001
Satisfied	<0.001	<0.001	<0.001
Secure	<0.001	<0.001	0.020
Understanding	<0.001	<0.001	0.082
Warm	<0.001	<0.001	<0.001
Wild	<0.001	<0.001	<0.001
Worried	<0.001	<0.001	0.048

3.4. Sensory characterisation

Analysis of Deviance indicated sample, several group, and some interaction effects on perceived sensory attributes as shown in Table 5. Each cultural groups characterised each yoghurt similarly for sweet, vanilla flavour, cream flavour, earthy flavour and mouthcoating (Fig. 4), with no group*sample interaction evident. Nevertheless, there were significant differences in overall attribute citation proportions among groups, with no significant group*sample interaction. Specifically, NZE were more likely to select bitter, stone fruit flavour, lemon flavour and fizzy, while both CHS and CHL were more likely to select salty and cheesy flavour (Fig. 4). In most cases, the citation proportions on sensory characteristics across yoghurt samples did not differ between CHS and CHL (Fig. 4 and Fig. 5). Exceptions were fermented dairy flavour and creaminess, in which CHS selected them more (CHN-Bottle) and less (NZ-Puhoi), than CHL, respectively (see 'fermented dairy flavour' and 'creaminess' interaction plots in Fig. 5). However, there were substantial differences in sensory perception between NZE and Chinese groups depending on the sample (p sample*group < 0.05, Table 5), including sour, umami, fermented dairy flavour, thick, thin, creaminess, smooth, chalky, and astringent. For example, NZE were less likely to select sour taste in CHN-Box, CHN-Bottle, NZ-Gopala and NZ-Zany than at least one Chinese group, as depicted in the 'sour' interaction plot in Fig. 5. On the other hand, when it came to creamy texture, NZE selected it more frequently in NZ-Puhoi, NZ-Gopala, NZ-Zany and Pilot-YFL+ than at least one Chinese group (see 'creaminess' interaction plot in Fig. 5). Similarly, NZE were more likely to select smooth for CHN-Box, NZ-Puhoi, NZ-Gopala, and NZ-Zany compared to both Chinese groups. Supplementary Material (**Table S6**) provides details on sensory attributes citation proportions for each group and sample.

3.5. Multiple factor analysis (MFA)

MFA provided insights regarding the relationship between liking, emotions, and sensory attributes, highlighting similarities but also key differences between the cultural groups. Factor 1 (72.07 %) and Factor 2 (16.34 %) explained 88.41 % of the total variance in the dataset (Fig. 6). Overall, and not surprisingly, yoghurt samples with higher liking scores were associated with positive emotions, such as enthusiastic, pleasant, happy, joyful, good, interested, warm, satisfied, loving, free, understanding, good natured, secure, active, and to some extent curious, and nostalgic, along with appealing sensory attributes, such as sweetness, stone fruit flavour, vanilla flavour, cream flavour, and to a large extent, smoothness, and creaminess. Specifically, CHN-Box and CHN-Bottle shared proximity on the negative pole of Factor 1 which was associated with liking and generally pleasant emotions, whilst Pilot-CH1+ and Pilot-YFL+ shared proximity on the positive pole of Factor 2 (Fig. 6**D**) which was also associated with positive, and more arousing, emotions. Most of the NZ yoghurts (NZ-Puhoi, NZ-Gopala and NZ-Zany) exhibited proximity towards the negative end of Factor 2, associated with low arousal emotions. Finally, less liked samples (NZ-Kefir, Pilot-CH1, Pilot-YFL), which shared proximity on the positive pole of Factor 1, were associated with negative emotions, such as aggressive, disgusted, worried, and bored, as well as with some undesired sensory attributes (salty, sour, bitter, earthy flavour, fermented dairy flavour and chalky). Exceptionally, CHS and CHL associated emotions guilty, wild, and mild, with lower liked samples, whereas NZE exceptionally associated them with the sensory attribute umami. Interestingly, for NZE (Fig. 6**C**), the emotions adventurous and active were positioned towards 'pleasant activation' dimension, closely associated with lemon flavour and the samples Pilot-CH1+ and Pilot-YFL+. For CHL (Fig. 6**B**), adventurous was positioned towards 'pleasant activation', albeit more centrally,

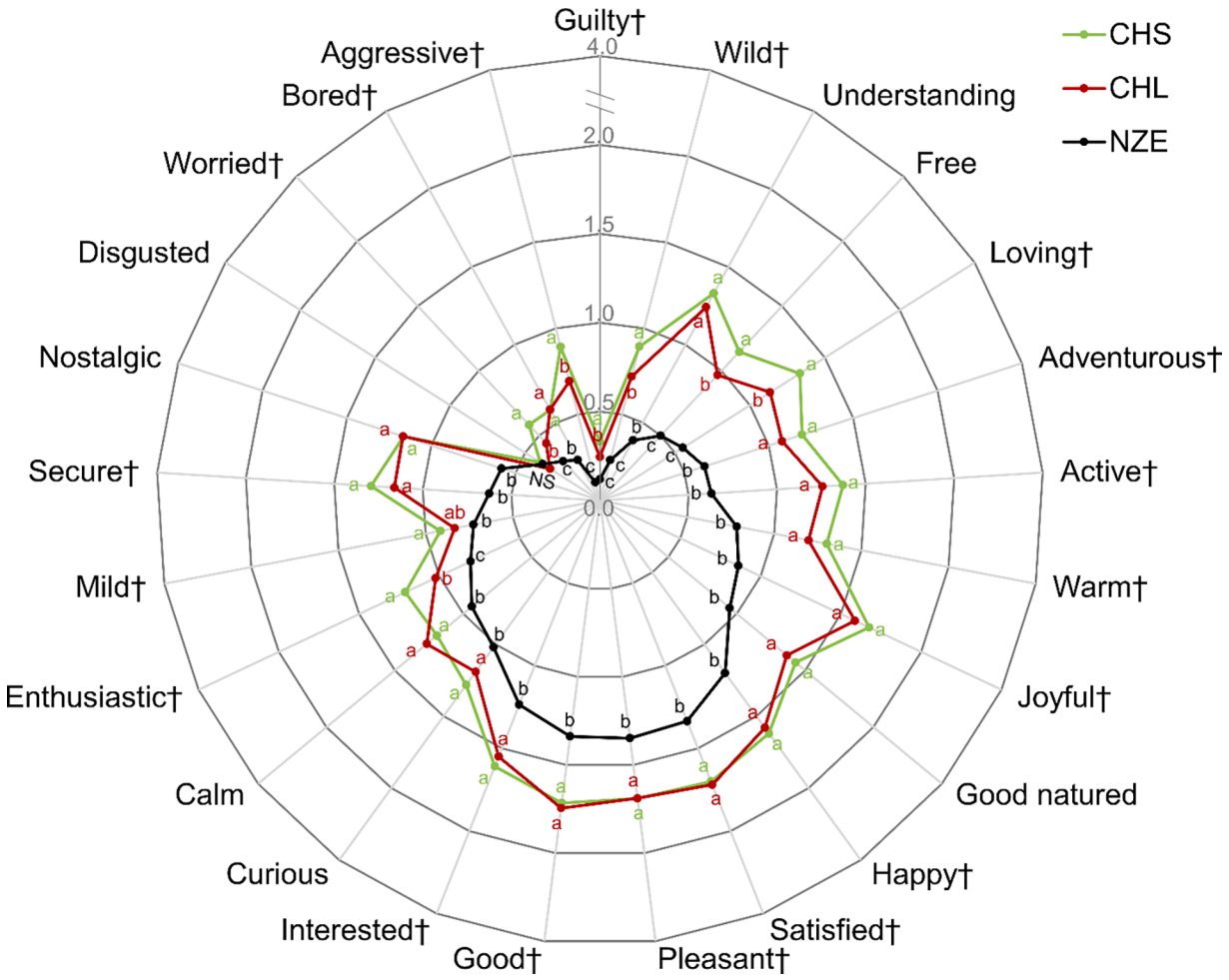

Fig. 2. Mean overall emotional response for each cultural group (CHS: green line, CHL: red line, NZE: black line). †: indicates significant interaction identified in Analysis of Variance. Different lower case letters within an emotion indicate significantly different group responses at the 5 % level (Tukey's test). NS: not significant. The rating scale ranged from "not at all" (0) to "extremely" (4). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

while the emotion active was closer to sweet and stone fruit flavour. In contrast, for CHS (Fig. 6**A**), adventurous fell under the 'unpleasant low arousal' dimension, closer to disliked samples NZ-Kefir and Pilots (CH1+ and YFL+).

4. Discussion

This study identified both similarities and differences across Chinese immigrant and New Zealand European overall liking, emotional response and sensory characterisation of plain yoghurts. Additionally, signs of acculturation among long-term Chinese immigrants were observed.

4.1. Cross-cultural similarities

Unexpectedly, all groups liked the Chinese yoghurts (CHN-Box and CHN-Bottle), despite the unlikelihood of NZE participants having consumed them before. Tentatively, the preference for sweet yoghurts across all cultures (Drewnowski et al. 2012; Torrico et al. 2019) led to the higher liking scores for the two Chinese yoghurts, which had higher sugar contents than most of the other samples (**Table S1**). Additionally, all groups disliked NZ-Kefir, Pilot-YFL and Pilot-CH1, the sourest yoghurts. Given that sourness can be commonly viewed as a negative taste quality (Desor et al., 1975,), it was not surprising that participants from both groups disliked these yoghurts. In fact, balanced sourness and sweetness is recognised as a factor influencing liking, e.g., fruit and beverage (Jayasena & Cameron, 2008; Spinelli et al., 2024) and dairy yoghurts (Hay et al., 2021). Despite cultural differences, participants agreed on the most and least liked yoghurts, indicating a common sensory predisposition transcending cultural boundaries. Similarly, a previous study also found no significant differences between Chinese and Danish consumers on taste, texture and overall liking of yoghurt (Liu et al., 2021).

Irrespective of cultural group, intensity of emotional response was low suggesting a generally low emotional engagement with the plain drinking yoghurts category across all groups. Studies have investigated emotional responses evoked by a wide variety of foods and beverages (e.g., King & Meiselman, 2010; Spinelli et al. 2014; van Zyl & Chaya, 2021). Some have reported a similar relatively low emotional response (e.g., mashed potatoes and gravy, in King & Meiselman (2010)'s work), while other products such as alcoholic/non-alcoholic beverages have evoked positive emotions to a greater extent (Calvo-Porral, Rivaroli & Orosa-González, 2021). Yao (2016) explored emotional response to various dairy products, such as milk, cheese, yoghurt and sour milk (maas), with average intensity ratings lower than moderate for positive emotions, which is in line with our findings. For disgusted, there was no significant difference among groups, showing common negative valence towards disliked samples.

In terms of sensory characterisation, CATA showed that all groups perceived sweet, vanilla flavour, cream flavour, earthy flavour and

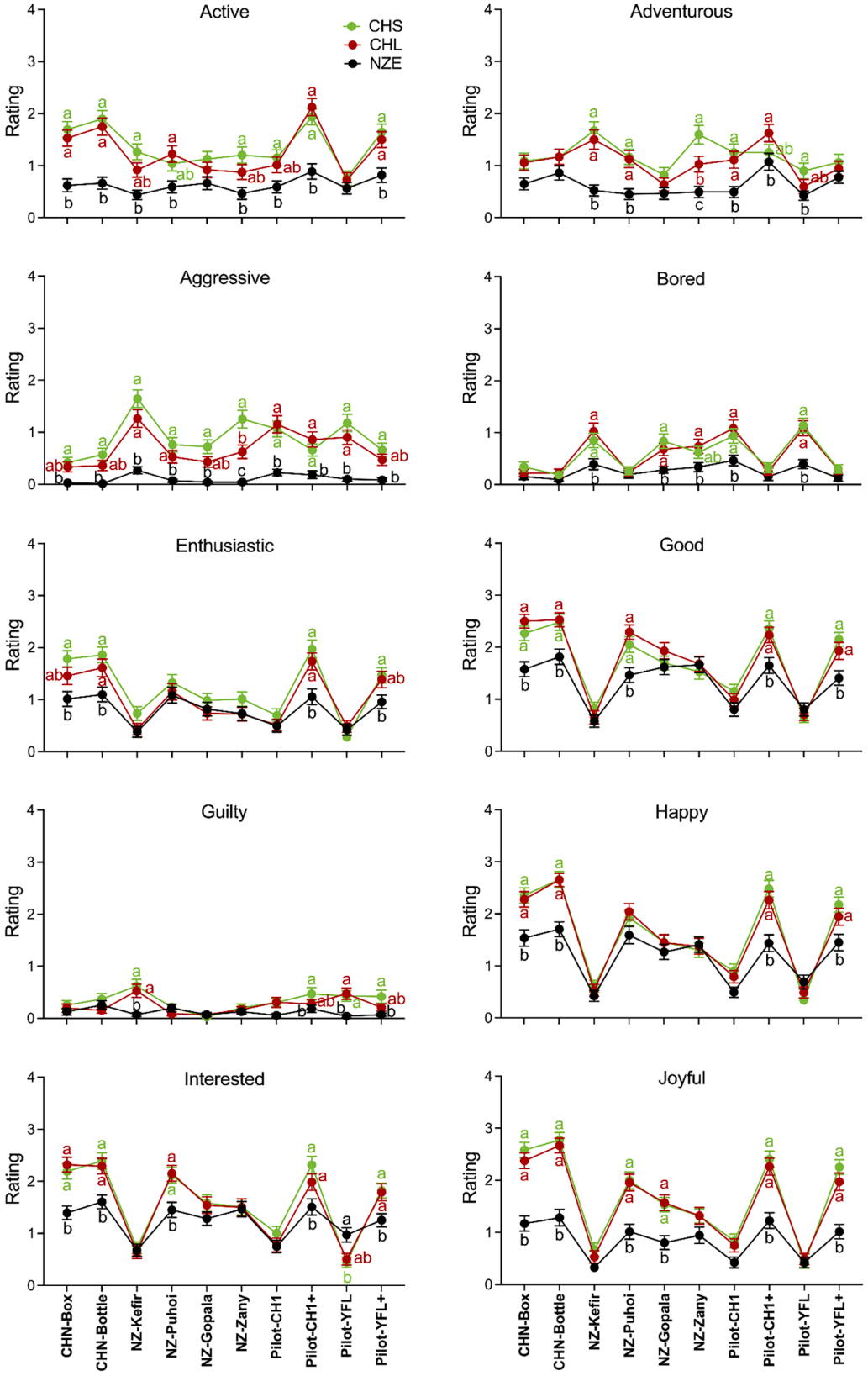

Fig. 3. Interaction plots for emotions with significant interactions ($p < 0.05$) for each cultural group (CHS: green line, CHL: red line, NZE: black line). Different lower case letters within an emotion indicate significantly different group responses at the 5 % level (Tukey's HSD test). The rating scale ranged from "not at all" (0) to "extremely" (4). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

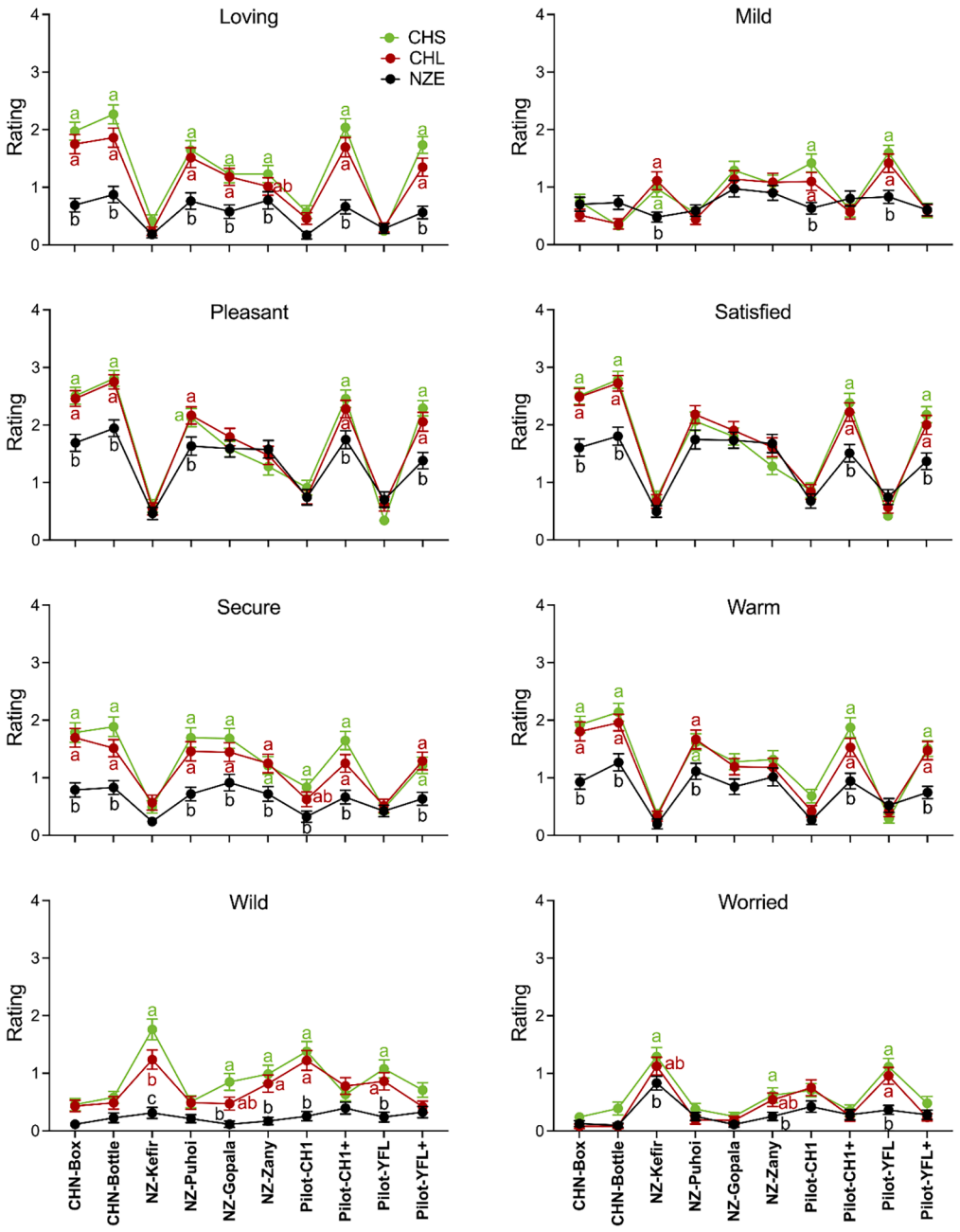

Fig. 3. (*continued*).

mouthcoating similarly for each individual sample. This agrees with previous research where, Dupas de Matos et al. (2021) found that sweetness, sourness, and vanilla flavour descriptors were commonly used to characterise drinkable yoghurts among Chinese and New Zealand Europeans. Taste and texture sensitivity evaluated in Dutch and Chinese immigrants residing in the Netherlands, also showed no significant distinctions in sweetness and thickness perception between Dutch and Chinese adults living in the Netherlands for less than one year (Ketel et al., 2022). Additionally, Prescott & Bell (1995) reported no differences in responses to sweet and salty solutions between North American and Chinese individuals living in the USA. Nevertheless, differences in perception were also observed in the present study.

4.2. Cross cultural differences

While liking rankings were similar among cultural groups overall, NZE showed notably less discrimination among samples compared to both Chinese groups, with higher liking scores for low-ranking NZ samples and lower liking scores for top-ranking Chinese samples, which could be linked to the Chinese participants having more familiarity with natural drinking yoghurts. It is well-known that familiarity plays a crucial role in consumer experience, as it builds knowledge of products that can significantly influence opinions about product characteristics (Mielmann, Roux and Taljaard, 2022). Evidently, familiarity with a food has been positively linked to preference (Cooke, 2007). Previous studies have shown increased product familiarity correlated with increased liking scores (Hwang & Hong, 2013). This effect has also been observed in other product categories, as reported by Choi and Seo (2023) and Nguyen & Wismer (2020). Likewise, Torrico et al. (2019) conducted a comprehensive review encompassing different foods and found that both Asian and Western backgrounds exhibited greater familiarity with and expressed higher liking scores for foods originating within their

Table 5
Deviance and associated Analysis of Deviance p-values regarding group, sample and their interaction effects by perceived sensory attribute.

Attributes	Group		Sample		Group*Sample	
	Deviance	p-value	Deviance	p-value	Deviance	p-value
Taste						
Sweet	0.36	0.837	1835.65	<0.001	22.89	0.195
Sour	19.10	<0.001	813.45	<0.001	34.91	0.010
Bitter	27.12	<0.001	434.40	<0.001	11.86	0.854
Salty	23.74	<0.001	149.85	<0.001	15.89	0.600
Umami	81.36	<0.001	27.49	<0.001	65.34	<0.001
Flavour						
Stone fruit	25.44	<0.001	326.66	<0.001	27.81	0.065
Lemon	11.52	0.003	245.21	<0.001	16.68	0.545
Vanilla	4.52	0.104	552.81	<0.001	27.87	0.064
Cream	0.30	0.859	453.59	<0.001	28.49	0.055
Fermented dairy	47.55	<0.001	132.90	<0.001	67.67	<0.001
Earthy	1.18	0.554	111.00	<0.001	25.32	0.116
Cheesy	14.26	0.001	174.34	<0.001	24.53	0.138
Texture/Mouthfeel						
Thick	0.60	0.742	1490.81	<0.001	41.29	0.001
Thin	1.40	0.496	1354.87	<0.001	36.17	0.007
Creaminess	27.24	<0.001	773.09	<0.001	30.57	0.032
Smooth	25.50	<0.001	328.87	<0.001	85.81	<0.001
Chalky	10.00	0.007	222.11	<0.001	34.08	0.012
Fizzy	7.46	0.024	162.36	<0.001	20.17	0.323
Mouthcoating	3.28	0.194	271.79	<0.001	16.33	0.570
Astringent	3.95	0.139	423.50	<0.001	29.68	0.041

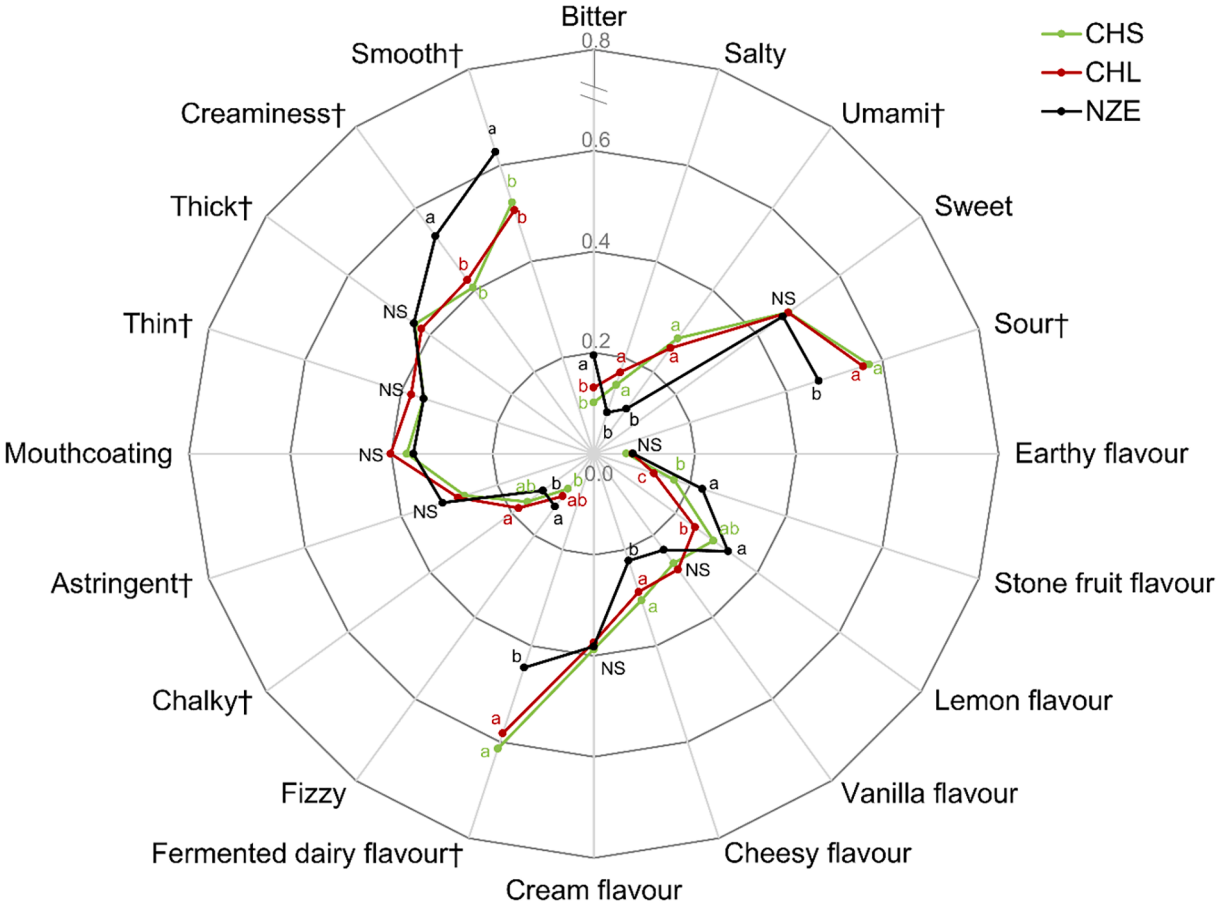

Fig. 4. Sensory attributes citation proportions across cultural groups (CHS: green line, CHL: red line, NZE: black line). †: indicates significant interaction identified in Analysis of Deviance. Within a term, different lower case letters are significantly different across groups at the 5 % level according to Tukey's HSD test. NS: not significant. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

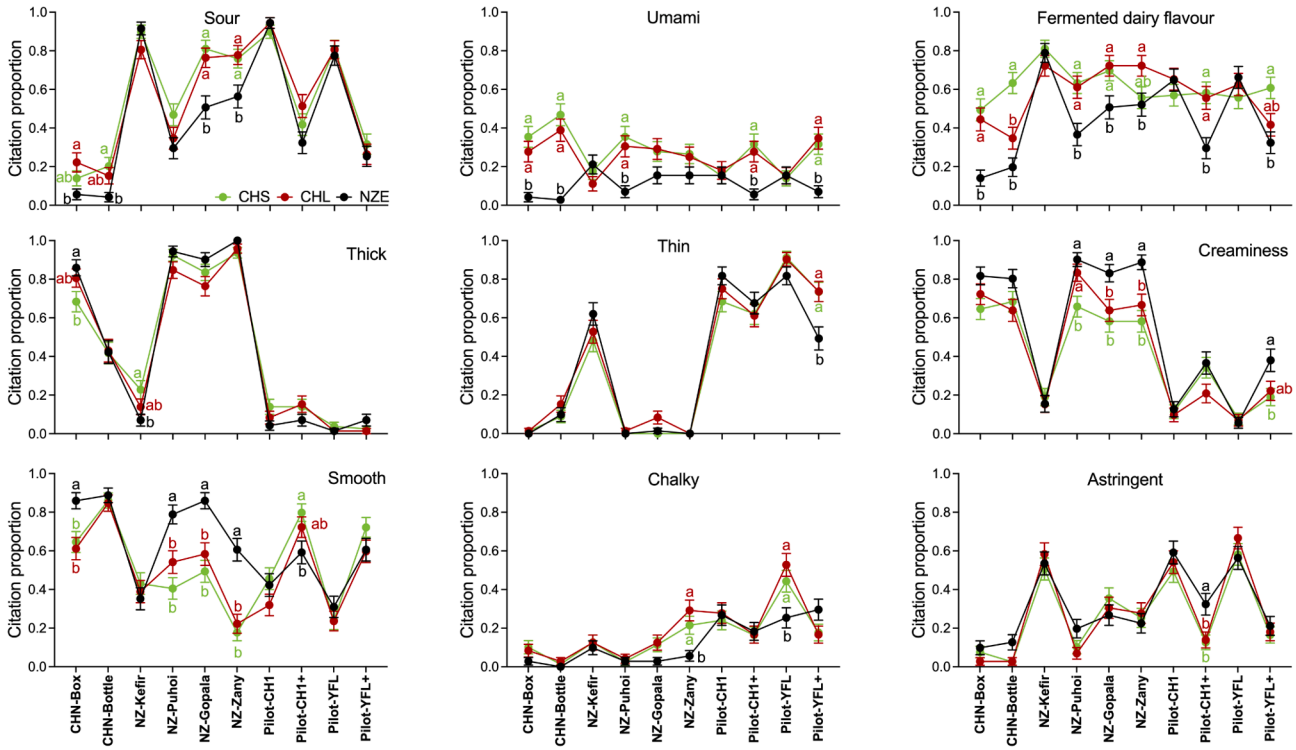

Fig. 5. Interaction plots for sensory attributes with significant interactions ($p < 0.05$) for each cultural group (CHS: green line, CHL: red line, NZE: black line). Within a term, different lower case letters are statistically different across groups at the 5 % level. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

respective cultural contexts. Lee et al. (2010) found that Korean consumers had a larger hedonic score range for green tea samples than American consumers. According to these authors, this difference was attributed to a greater product familiarity of Koreans, suggesting that cultural differences in hedonic responses may differ according to the product being considered. Consequently, consumers often assess products from their own country/culture more favourably than those from other countries/cultures, a tendency that could be attributed to familiarity and cultural identity. Additionally, direct comparison of hedonic scores across different cultures should be taken with care as they can be influenced by differences in response style (Ares, 2018).

Notable differences emerged when comparing emotional response in both cultural groups. Overall, NZ Europeans rated emotions at lower intensities compared to Chinese groups, suggesting a general tendency of Westerners to exhibit lower emotional responses to plain yoghurts compared to Asians. In fact, previous literature has shown that Asian consumers selected more emotion terms than Westerners (Gunaratne et al., 2019). Torrico et al. (2019), also found that Western consumers demonstrated significantly higher intensities of 'neutral' facial expressions to different food stimuli, compared with Asian consumers, indicating lower emotional engagement of Western consumers. However, the mechanisms behind this remain unknown. Another reason may be the scale use. Previous research has shown variations in scale usage between Western and non-Western cultures (e.g., Yeh et al., 1998; Yao et al., 2003; Feng et al., 2015). For example, Yeh et al. (1998) showed that Asians tend to display central tendency and potentially avoid dislike categories on a scale, while Western cultures lean towards using more extreme scale categories and avoiding central ones. Yeh et al. (1998) also indicated that Chinese, as well as Korean and Thai respondents, used a smaller scale range than Americans, irrespective of residency in the United States or length of stay.

In terms of yoghurt sensory characterisation, several cross-cultural differences were identified. NZE selected bitter and stone fruit flavour more than both immigrant groups, and more often for lemon than CHL and fizzy than CHS to characterise the yoghurts. However, both CHS and CHL selected salty and cheesy flavour more often than NZE. As consumers tend to describe foods based on their past experiences (Kumar & Chambers, 2019), the higher citation frequency of salty and cheesy flavour by Chinese consumers may tentatively suggest a lack of familiarity with cheese flavour. In China, cheese products comprise a very small proportion of the dairy market (Mintel, 2018) and its consumption is much lower compared to New Zealand (Birkbeck 1981), as cheese is not traditionally part of the Chinese diet. This could have made Chinese consumers associate cheesy flavour with other sensory characteristics. Although term citation frequency serves as a proxy for perceived intensity, it is not a direct measurement (Jaeger et al., 2023) and hence the results here only give an indication.

Additionally, the present study found that, for some sensory attributes (e.g., sour, umami, fermented dairy flavour, thick, thin, creaminess, smooth, chalky, and astringent), cross-cultural differences were sample dependent. For example, the most liked yoghurts (CHN-Box, CHN-Bottle, NZ-Puhoi, Pilot-YFL+ and Pilot-CH1+) were more often characterised as umami by both Chinese groups, reflecting a subjective cultural interpretation of umami. Sensory terminology used by consumers is linked to cultural experiences (Kim, Petard & Hong, 2018), and words can take on new and multiple meanings when translated from one language into another (Jamir, Stelick & Dando, 2020). In this case, the word 'umami' in Chinese (鲜, xiān) has two other meanings, delicious and fresh, both with a positive connotation (Liu & Chen, 2001). On the other hand, for NZE, umami was associated with savoury, which had lower citation frequencies in the aforementioned sweet yoghurt samples. Previous literature has also reported cross-cultural differences in the use of umami. For instance, Tu et al. (2010) have shown that French consumers did not use umami to describe yoghurts whereas Vietnamese did use this term. Also, Americans but not Japanese had difficulties in consensually describing the sensation elicited by monosodium glutamate (O'Mahony & Ishii, 1986). Another example involved perceived differences in sourness and creaminess across groups when tasting some

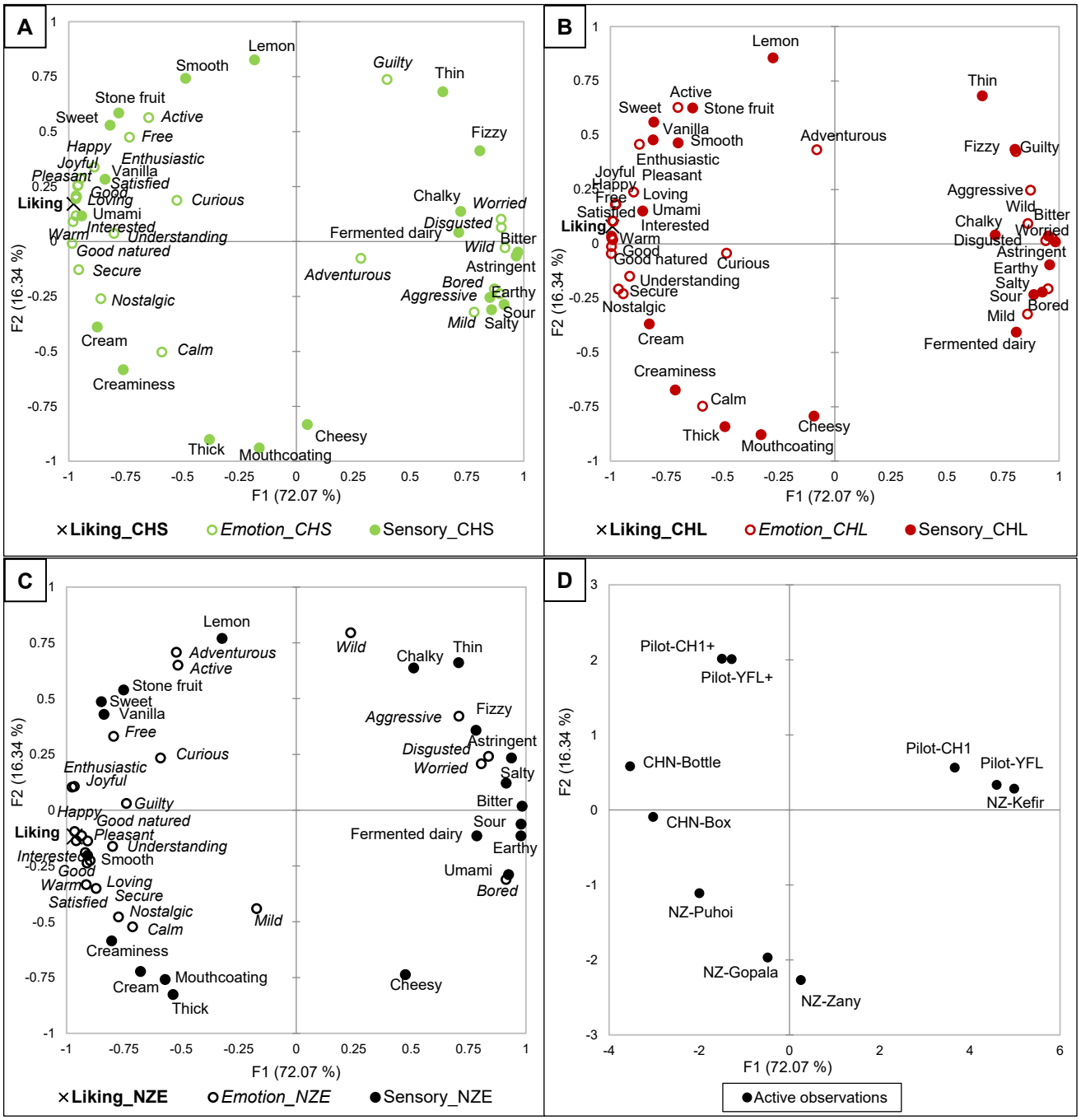

Fig. 6. A-C) Multiple Factor Analysis F1/F2 plots, accounting for 88.41 % total variance across the first 2 factors. Liking (crosses), emotions (unfilled circles), and sensory attributes (filled circles) loadings. CHS: green colour, CHL: red colour, NZE: black colour. **D)** Yoghurt samples observations. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

NZ yoghurts (NZ-Gopala and NZ-Zany). Both Chinese groups characterised these two samples more frequently as sour in taste and less frequently for creamy texture, compared to NZE consumers. This could be due to Chinese consumer sensitivity to sourness and lack of familiarity with creaminess. In a previous study, Beijing and NZ European consumers sought a balanced sweetness and sourness in yoghurts, however the concept of balance differed between cultures, with Chinese consumers having a cultural expectation for higher sweetness and much lower sourness compared to NZ Europeans (Hay et al., 2021). Creaminess has been closely related to other positive terms such as thickness, smoothness, and richness (Hay et al., 2021, Dickinson, 2018) reflecting the combination of flavour and texture in the perception of creaminess (Kirkmeyer & Tepper, 2003). However, in the Chinese language, the direct translation of creaminess (奶油状, cream-like) is not a commonly used term in their vocabulary (Cowie et al., 1986; Liu & Chen, 2001), potentially leading to a lower citation rate within Chinese groups. Antmann et al. (2011) also revealed such cross-cultural differences in the understanding of the word 'creaminess' across Spanish speaking cultures.

4.3. Relationship between liking, emotions, and sensory attributes across cultural groups

Results, not surprisingly, underscored that the yoghurts receiving

higher liking scores also evoked positive emotions and had desirable sensory attributes, while those with lower liking scores were associated with negative emotions and less appealing sensory characteristics. The similarity across cultural groups highlighted the existence of common patterns in some taste, flavour, and texture characteristics that evoked positive feelings in yoghurt. Several consumer studies have investigated the links between sensory properties and emotions in foods and beverages (Spinelli & Jaeger, 2019). In general, positive emotions are positively correlated with liking, and negative emotions are negatively correlated with liking (Cardello et al., 2012; Ng, Chaya & Hort, 2013).

Interestingly, our findings revealed that both Chinese groups experienced feelings of guilt when consuming yoghurts that they disliked, whereas guilt was associated with the most-liked yoghurts by NZE. This was particularly intriguing because the experience of guilt is commonly associated with negative affect (e.g., Cardello et al., 2012; Ballco et al. 2022), however it appears that many products can evoke guilt while still being associated with heightened enjoyment (Goldsmith, Cho & Dhar, 2012), influencing pleasure from consumption. For instance, in Gunaratne et al (2019)'s work, guilty was associated to other positive emotions such as enjoyment and comforting by Western consumers, when evaluating chocolate. Additionally, according to the dictionary, 'guilty' as an emotion means "a feeling of shame and sadness when you know or believe you have done something wrong" (Luo & Liu, 2006). Hence, the cross-cultural difference in guilty responses could lie in their contrasting perceptions of the fundamental essence of guilt, namely "wrongdoing" (Bedford & Hwang, 2003). Tentatively, for NZE, the two Chinese yoghurts could have prompted associations with unhealthiness due to high perceived sweetness, which they enjoyed, but perceived perhaps as 'wrong' or 'not ideal'. In contrast, for CHS and CHL, consuming yoghurts they disliked was associated with a negative sensory experience, which they may have felt as 'wrong' or 'undesirable'. When using nuanced emotional and cultural concepts, translation across languages and cultures can create difficulties (Ogarkova, 2016). Thus, it is important to underscore the challenge of maintaining the 'original' meaning of terms during the translation process.

Additionally, Chinese groups associated disliked yoghurts with both wild and mild emotions, while NZE did not link liking with either. The meanings of 'mild' and 'wild' as emotions in English are 'not severe or strict' and 'feeling or expressing uncontrolled emotions', respectively (Luo & Liu, 2006). They can be either positive or negative, for example, 'wild laughter' versus 'wild anger'. This likely explains why these two emotions were not associated with liked or disliked yoghurts for English-speaking consumers. However, for Chinese-speakers, finding equivalent translations for mild and wild in the Chinese language posed a challenge. The emotional connotations carried a translation which could have influenced Chinese consumer associations of mild and wild with certain yoghurt samples. In fact, they seemed to dislike the feelings of 平庸 (mediocre) and 野性 (unruliness), which were the translation of mild and wild (Liu & Chen, 2001), respectively, used in the present study. Difficulties associated with transmitting concepts among countries have been described previously wherein certain words pose challenges due to their nuanced cultural connotations (Son et al., 2014).

Cross-cultural differences in umami perception presented themselves through the MFA (Fig. 6). The word 'umami' originates from Japanese as a loanword, however, umami was assigned to an existing Chinese character (鲜, xiān), which contains the meaning of 'delicious' and 'fresh' (Cowie et al., 1986; Liu & Chen, 2001). Although participants were provided with the term 'umami/鲜' followed by 'savoury taste/咸鲜味' as explanation, Chinese immigrants still appeared to associate '鲜' with a positive sensory and emotional experience overall. For NZE, umami was interpreted as savoury, as proposed in the attribute list, which was associated with negative feelings towards the disliked yoghurts.

Another interesting finding was that perceived smoothness of the yoghurt samples played a role in driving liking of NZE to a higher extent compared to both Chinese groups. While smoothness is commonly recognised as a perceived quality attribute linked to a positive sensory experience (e.g., Zhang et al. 2011; Bi, Qiu & Huang, 2020; Dupas de Matos et al. 2021), the relative importance differed among cultures. Nonetheless, the underlying cause of this diversity remains uncertain.

4.4. Acculturation

Although CHS and CHL were similar in most of the responses, they did not always agree on overall liking of some yoghurt samples, certain emotions and several sensory attributes. Importantly, when CHL differed from CHS, their opinions consistently moved towards NZE, suggesting an acculturation in liking, emotional responses and sensory perceptions.

Emotional patterns change in response to engagement in a (new) cultural context (Leersnyder, Mesquita & Kim, 2011). Leersnyder et al. (2013) explained that across various immigrant groups and host cultures, individuals tend to align their emotional experiences with the mainstream patterns prevalent in the host culture, a process notably influenced by exposure to the mainstream culture. The findings of the present study parallel the observation made by Leersnyder et al. (2013) regarding the correlation between emotional alignment and duration of residency in the host country. These authors found that the emotional concordance tended to be higher among later immigrants compared to newly arrived immigrants (Leersnyder et al., 2013). Just as Korean immigrants' emotional alignment with mainstream United States emotional patterns increased with the residency duration, it is likely that emotional acculturation of CHS immigrants strengthens over time as they become more integrated into New Zealand culture.

Interestingly, acculturation for some emotions appears to be sample-dependent, as demonstrated by the interaction plots in Fig. 3. For instance, the significant increase in the feeling of 'wildness' among CHS compared to CHL for NZ-Kefir, one of the most acidic yoghurts, indicates a potential shift in perception over time. It is possible that the longer Chinese immigrants lived in NZ, the less 'wild' they felt towards local yoghurts due to an increasing tolerance for sourness compared to what they were used to in China. Furthermore, this suggestion that Chinese immigrants develop a greater tolerance for sourness with increased duration of stay in New Zealand aligns with the acculturation process, as previously shown in Dupas de Matos et al. (2021)'s exploratory work. This suggests that as individuals immerse themselves in a new cultural environment, their perceptions of emotions may evolve over time, reflecting a complex interplay between cultural adaptation and host culture. While the impact of acculturation on sensory perception was limited, evidenced by comparable disparities in sensory citation proportion among groups (CHS and NZE, CHL and NZE), there were instances of potential acculturation, such as differences in thickness perception illustrated by CHN-Box and NZ-Kefir. However, our previous research (Dupas de Matos et al., 2021) has revealed that both recent and established Chinese immigrants maintained a preference for thicker drinkable yoghurt. Therefore, the impact of acculturation on sensory perception appeared to be minimal in the present study.

4.5. Limitations

Limited by the number of Chinese participants, there was no gap between two Chinese immigrant groups in terms of the residence time. Greater acculturation effects could be expected with a larger sample set and gap between immigrant groups. Additionally, in this study, some emotion terms, such as wild and mild, could not be translated precisely, because these words do not have direct translations in Chinese. Being restricted by the character length, part of their meanings was lost during translation process, potentially causing bias in subjective interpretations between cultures.

5. Conclusions

This study investigated liking, emotional responses, and sensory perception among Chinese immigrants and New Zealand Europeans as they consumed plain drinking yoghurts. While liking scores were similar across both cultural groups, distinctions emerged in emotional responses and sensory perceptions between Chinese immigrants and NZ Europeans. Additionally, different cultural groups associated some emotions (e.g., guilty, mild and wild) and sensory terms (e.g., umami) with the liking scores in different directions, which is crucial to be understood before entering in the target market.

Some effects of acculturation for long-term immigrants were evident, but responses were often closer to their recent counterparts, indicating a shared cultural preference or familiarity with certain yoghurts. This study also underlines the importance of understanding how acculturation influences immigrant acceptability, emotional and sensory responses. Our findings suggest that immigrants in general provide a useful proxy for measuring consumer responses to yoghurt in early stages of product development for this overseas market, but with consideration of their residence time in the host culture.

It is crucial to emphasise the challenge of preserving the meaning of terms (emotions and sensory) in the translation process. Cross-cultural differences found in this study often stemmed from language interpretation, reflecting diverse cultural expectations between Chinese and English-speaking countries, which has not been addressed in past studies and should be considered in future research endeavours. This aspect adds an innovative dimension to this research, shedding new light on how emotions influence product perception across cultures. These insights make a valuable and progressive contribution to the literature on cross-cultural research.

Funding

This work was funded by a Ministry of Business, Innovation and Employment (MBIE) 2017 Endeavour Round Program entitled “Accelerated Evolution: a step change in food fermentation” (grant number 51593-ENDRP-AGR).

CRediT authorship contribution statement

Amanda Dupas de Matos: Writing – review & editing, Writing – original draft, Visualization, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Ao Chen:** Writing – original draft, Visualization, Investigation, Formal analysis. **Robyn Maggs:** Investigation, Data curation. **A. Jonathan R. Godfrey:** Methodology. **Maheeka Weerawarna N.R.P.:** Methodology. **Joanne Hort:** Writing – original draft, Supervision, Resources, Methodology, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

Acknowledgements

The authors would like to thank the Ministry of Business, Innovation and Employment (MBIE) for the funding, the AgResearch team for manufacturing the experimental samples, the dedicated trained panelists for their commitment to sensory lexicon generation and product characterisation, and all the participants who generously contributed their time to the consumer study. Additionally, the authors would like to express their appreciation to the Kantar team for assisting with participant recruitment in Auckland.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.foodqual.2024.105299.

References

Agresti, A. (2018). Generalised linear models. *An introduction to categorical data analysis* (Third edition). John Wiley & Sons Inc.

Antmann, G., Ares, G., Varela, P., Salvador, A., Coste, B., & Fiszman, S. M. (2011). Consumers’ creaminess concept perception: A cross-cultural study in three Spanish-speaking countries. *Journal of Texture Studies, 42*(1), 50–60. https://doi.org/10.1111/j.1745-4603.2010.00267.x

Ares, G. (2018). Methodological issues in cross-cultural sensory and consumer research. *Food Quality and Preference, 64*, 253–263. https://doi.org/10.1016/j.foodqual.2016.10.007

Ballco, P., Piqueras-Fiszman, B., & van Trijp, H. C. M. (2022). The influence of consumption context on indulgent versus healthy yoghurts: Exploring the relationship between the associated emotions and the actual choices. *Sustainability, 14*(13). https://doi.org/10.3390/su14138224

Bedford, O., & Hwang, K. (2003). Guilt and shame in Chinese culture: A cross-cultural framework from the perspective of morality and identity. *Journal for the Theory of Social Behaviour, 33*(2), 127–144. https://doi.org/10.1111/1468-5914.00210

Bi, J., & Kuesten, C. (2022). Commentary on Meyners and Hasted (2021): On the applicability of ANOVA models for CATA data, Food Quality and Preference, 92. *Food Quality and Preference, 95*, Article 104340. https://doi.org/10.1016/j.foodqual.2021.104340

Bi, K., Qiu, T., & Huang, Y. (2020). A deep learning method for yogurt preferences prediction using sensory attributes. *Processes, 8*(5), 518. https://doi.org/10.3390/pr8050518

Birkbeck, J. A. (1981). The role of dairy products in the New Zealand diet. *The New Zealand Medical Journal, 94*(696), 386–387.

Calvo-Porral, C., Rivaroli, S., & Orosa-González, J. (2021). The asymmetric emotional associations to beverages: An approach through the theory of positive asymmetry. *Foods, 10*(4), 794. https://doi.org/10.3390/foods10040794

Cardello, A. V., Meiselman, H. L., Schutz, H. G., Craig, C., Given, Z., Lesher, L. L., & Eicher, S. (2012). Measuring emotional responses to foods and food names using questionnaires. *Food Quality and Preference, 24*(2), 243–250. https://doi.org/10.1016/j.foodqual.2011.12.002

Cardello, A. V., Llobell, F., Jin, D., Ryan, G. S., & Jaeger, S. R. (2024). Sensory drivers of liking, emotions, conceptual and sustainability concepts in plant-based and dairy yoghurts. *Food Quality and Preference, 113*, Article 105077. https://doi.org/10.1016/j.foodqual.2023.105077

Chen, A., Moradi, S., Huang, J., Xu, S., Sismey, M., & Hort, J. (2024). Chinese older adults’ milk consumption habits: A study across five cities. *Journal of Dairy Science, 107*(6), 3515–3530. https://doi.org/10.3168/jds.2023-24013

Choi, W.-S., & Seo, H.-S. (2023). Effects of age group, gender, and consumption frequency on texture perception and liking of cooked rice or bread. *Foods, 12*(9), 1793. https://doi.org/10.3390/foods12091793

Cooke, L. (2007). The importance of exposure for healthy eating in childhood: A review. *Journal of Human Nutrition and Dietetics, 20*(4), 294–301. https://doi.org/10.1111/j.1365-277X.2007.00804.x

Cowie, A. P., Evison, A., Zhu, Y., Wang, L., Ren, Y., Wu, J., Mei, P., & Ren, X. (1986). *Concise English-Chinese Chines-English dictionary* ((1st edition)). Oxford University Press and The Commercial Press.

Desor, J. A., Maller, O., & Andrews, K. (1975). Ingestive responses of human newborns to salty, sour, and bitter stimuli. *Journal of Comparative and Physiological Psychology, 89*(8), 966–970. https://doi.org/10.1037/h0077171

Dickinson, E. (2018). On the road to understanding and control of creaminess perception in food colloids. *Food Hydrocolloids, 77*, 372–385. https://doi.org/10.1016/j.foodhyd.2017.10.014

Dorado, R., Pérez-Hugalde, C., Picard, A., & Chaya, C. (2016). Influence of first position effect on emotional response. *Food Quality and Preference, 49*, 189–196. https://doi.org/10.1016/j.foodqual.2015.12.009

Drewnowski, A., Mennella, J. A., Johnson, S. L., & Bellisle, F. (2012). Sweetness and Food Preference. *The Journal of Nutrition, 142*(6), 1142S–S1148. https://doi.org/10.3945/jn.111.149575

Dupas de Matos, A., Hay, C., Low, J., Feng, J., Lu, D., Day, L., & Hort, J. (2021). Comparing liking and attitudes of Chinese immigrants in New Zealand towards drinkable yoghurt: An exploratory study. *Food Quality and Preference, 94*, Article 104299. https://doi.org/10.1016/j.foodqual.2021.104299

Feng, C. (2021). Focusing on the Chinese yogurt market: How much potential for further blossoming remains? *Dairy and Human, 3*, 12–21.

Feng, Y.-H., Gutiérrez-Salomón, A. L., Angulo, O., O’Mahony, M., & Wichchukit, S. (2015). Data from ‘words only’ and ‘numbers only’ 9-point hedonic scales are not interchangeable for serial monadic as well as rank-rating protocols: Aspects of memory and culture. *Food Quality and Preference, 41*, 12–19. https://doi.org/10.1016/j.foodqual.2014.11.004

Fuller, F., Beghin, J., & Rozelle, S. (2007). Consumption of dairy products in urban China: Results from Beijing, Shangai and Guangzhou. *Australian Journal of Agricultural and Resource Economics, 51*(4), 459–474. https://doi.org/10.1111/j.1467-8489.2007.00379.x

Goldsmith, K., Cho, E. K., & Dhar, R. (2012). When guilt begets pleasure: The positive effect of a negative emotion. *Journal of Marketing Research, 49*(6), 872–881. https://doi.org/10.1509/jmr.09.0421

Gunaratne, T. M., Gonzalez Viejo, C., Fuentes, S., Torrico, D. D., Gunaratne, N. M., Ashman, H., & Dunshea, F. R. (2019). Development of emotion lexicons to describe chocolate using the Check-All-That-Apply (CATA) methodology across Asian and Western groups. *Food Research International, 115*, 526–534. https://doi.org/10.1016/j.foodres.2018.10.001

Hay, C., Dupas de Matos, A., Low, J., Feng, J., Lu, D., Day, L., & Hort, J. (2021). Comparing cross-cultural differences in perception of drinkable yoghurt by Chinese and New Zealand European consumers. *International Dairy Journal, 113*, Article 104901. https://doi.org/10.1016/j.idairyj.2020.104901

Hothorn, T., Bretz, F., & Westfall, P. (2008). Simultaneous Inference in General Parametric Models. *Biometrical Journal, 50*(3), 346–363. https://doi.org/10.1002/bimj.200810425

Hwang, S.-H., & Hong, J.-H. (2013). Sensory drivers of goso flavor in soymilk: Understanding a complex traditional Korean sensory attribute. *Food Quality and Preference, 29*(2), 113–125. https://doi.org/10.1016/j.foodqual.2013.03.003

Imai, M., Kanero, J., & Masuda, T. (2016). The relation between language, culture, and thought. *Current Opinion in Psychology, 8*, 70–77. https://doi.org/10.1016/j.copsyc.2015.10.011

Jaeger, S. R., Giacalone, D., Jin, D., Ryan, G. S., & Cardello, A. V. (2023). Information about health and environmental benefits has minimal impact on consumer responses to commercial plant-based yoghurts. *Food Quality and Preference, 106*, Article 104820. https://doi.org/10.1016/j.foodqual.2023.104820

Jayasena, V., & Cameron, I. (2008). Brix/acid ratio as a predictor of consumer acceptability of Crimson Seedless table grapes. *Journal of Food Quality, 31*(6), 736–750. https://doi.org/10.1111/j.1745-4557.2008.00231.x

Jamir, S. M. R., Stelick, A., & Dando, R. (2020). Cross-cultural examination of a product of differing familiarity (Hard Cider) by American and Chinese panelists using rapid profiling techniques. *Food Quality and Preference, 79*, Article 103783. https://doi.org/10.1016/j.foodqual.2019.103783

Liu, J., Bech, A. C., Stolzenbach Waehrens, S., & Bredie, W. L. P. (2021). Perception and liking of yogurts with different degrees of granularity in relation to ethnicity, preferred oral processing and lingual tactile acuity. *Food Quality and Preference, 90*, Article 104158. https://doi.org/10.1016/j.foodqual.2020.104158

Liu, L. (2018). Chinese yoghurt industry: Past, present, and future. *Dairy and Human, 4*, 4–14.

Li, M. (2013). Acculturation, filial responsibilities and living arrangements: An empirical study of the acculturative experiences of elderly Chinese immigrants in New Zealand. *Journal of Intercultural Communication Studies, 12*(1), 301–322.

Liu, X., & Chen, Z. (2001). *A modern Chinese-English dictionary* ((1st ed.).). Foreign Language Teaching and Researching Press.

Luo, L., & Liu, A. (2006). *Longman advanced American dictionary* ((1st ed.).). Longman and Foreign Language Teaching and Researching Press.

Ketel, E. C., de Wijk, R. A., de Graaf, C., & Stieger, M. (2022). Effect of cross-cultural differences on thickness, firmness and sweetness sensitivity. *Food Research International, 152*, Article 109890. https://doi.org/10.1016/j.foodres.2020.109890

Kim, S.-H., Petard, N., & Hong, J.-H. (2018). What is lost in translation: A cross-cultural study to compare the concept of nuttiness and its perception in soymilk among Korean, Chinese, and Western groups. *Food Research International, 105*, 970–981. https://doi.org/10.1016/j.foodres.2017.12.002

King, S. C., & Meiselman, H. L. (2010). Development of a method to measure consumer emotions associated with foods. *Food Quality and Preference, 21*(2), 168–177. https://doi.org/10.1016/j.foodqual.2009.02.005

Kirkmeyer, S. V., & Tepper, B. J. (2003). Understanding creaminess perception of dairy products using free-choice profiling and genetic responsivity to 6-n propylthiouracil. *Chemical Senses, 28*(6), 527–536. https://doi.org/10.1093/chemse/28.6.527

Köster, E. P. (2009). Diversity in the determinants of food choice: A psychological perspective. *Food Quality and Preference, 20*(2), 70–82. https://doi.org/10.1016/j.foodqual.2007.11.002

Kumar, R., & Chambers, E. (2019). Understanding the terminology for snack foods and their texture by consumers in four languages: A qualitative study. *Foods, 8*(10), 484. https://doi.org/10.3390/foods8100484

Lee, H.-S., & Lopetcharat, K. (2017). Effect of culture on sensory and consumer research: Asian perspectives. *Current Opinion in Food Science, 15*, 22–29. https://doi.org/10.1016/j.cofs.2017.04.003

Lee, J., Chambers Iv, E., Chambers, D. H., Chun, S. S., Oupadissakoon, C., & Johnson, D. E. (2010). Consumer acceptance for green tea by consumers in the United States, Korea and Thailand. *Journal of Sensory Studies, 25*, 109–132. https://doi.org/10.1111/j.1745-459X.2010.00287.x

Leersnyder, J. D., Mesquita, B., & Kim, H. S. (2011). Where do my emotions belong? A study of immigrants' emotional acculturation. *Personality and Social Psychology Bulletin, 37*(4), 451–463. https://doi.org/10.1177/0146167211399103

Leersnyder, J. D., Mesquita, B., & Kim, H. (2013). Chapter 18. Emotional acculturation. In D. Hermans, B. Rimé, & B. Mesquita (Eds.), *Changing emotions* (pp. 127–133). Psychology Press.

Lenth R (2023)._emmeans: Estimated Marginal Means, aka Least-Squares Means_. R package version 1.8.9, <https://CRAN.R-project.org/package=emmeans>.

Meyners, M., & Castura, J. C. (2016). Randomization of CATA attributes: Should attribute lists be allocated to assessors or to samples? *Food Quality and Preference, 48*, 210–215. https://doi.org/10.1016/j.foodqual.2015.09.014

Meyners, M., & Hasted, A. (2022). Reply to Bi and Kuesten: ANOVA outperforms logistic regression for the analysis of CATA data. *Food Quality and Preference, 95*, Article 104339. https://doi.org/10.1016/j.foodqual.2021.104339

Mielmann, A., Le Roux, N., & Taljaard, I. (2022). The impact of mood, familiarity, acceptability, sensory characteristics and attitude on consumers' emotional responses to chocolates. *Foods, 11*(11), 1621. https://doi.org/10.3390/foods11111621

Mintel. (2018). Dairy consumption trends. China, March 2018 [Executive summary]. Retrieved May 21, 2020 from Mintel Reports database.

Nestrud, M. A., Meiselman, H. L., King, S. C., Lesher, L. L., & Cardello, A. V. (2016). Development of EsSense25, a shorter version of the EsSense Profile®. *Food Quality and Preference, 48*, 107–117. https://doi.org/10.1016/j.foodqual.2015.08.005

Ng, M., Chaya, C., & Hort, J. (2013). Beyond liking: Comparing the measurement of emotional response using EsSense Profile and consumer defined check-all-that-apply methodologies. *Food Quality and Preference, 28*(1), 193–205. https://doi.org/10.1016/j.foodqual.2012.08.012

Nguyen, H., & Wismer, W. V. (2020). The influence of companion foods on sensory attribute perception and liking of regular and sodium-reduced foods. *Journal of Food Science, 85*(4), 1274–1284. https://doi.org/10.1111/1750-3841.15118

Ogarkova. (2016). Chapter 23. Translatability of Emotions. In H. L. Meiselman (Ed.), *Emotion Measurement* (pp. 575–599). Woodhead Publishing. https://doi.org/10.1016/B978-0-08-100508-8.00023-0.

Ou, H., & Zhang, H. (2018). Study and countermeasures on the relationship between packages, drinking ways and yoghurt residue. *Modern Food, 5*, 158–164.

Peryam, D. R., & Pilgrim, F. J. (1957). Hedonic scale method of measuring food preferences. *Food Technology, 11*, 9–14.

Prescott, J., & Bell, G. (1995). Cross-cultural determinants of food acceptability: Recent research on sensory perceptions and preferences. *Trends in Food Science & Technology, 6*(6), 201–205. https://doi.org/10.1016/S0924-2244(00)89055-X

Prescott, J., Young, O., O'Neill, L., Yau, N. J. N., & Stevens, R. (2002). Motives for food choice: A comparison of consumers from Japan, Taiwan, Malaysia and New Zealand. *Food Quality and Preference, 13*(7), 489–495. https://doi.org/10.1016/S0950-3293(02)00010-1

R Core Team. (2020). *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. Retrieved from https://www.R-project.org/.

Satia-About, J. (2003). Dietary acculturation: Definition, process, assessment, and implications. *International Journal of Human Ecology, 4*(1), 71–86.

Sekaran, U. (1983). Methodological and theoretical issues and advancements in cross-cultural research. *Journal of International Business Studies, 14*, 61–73. https://doi.org/10.1057/palgrave.jibs.8490519

Son, J.-S., Do, V. B., Kim, K.-O., Cho, M. S., Suwonsichon, T., & Valentin, D. (2014). Understanding the effect of culture on food representations using word associations: The case of "rice" and "good rice". *Food Quality and Preference, 31*, 38–48. https://doi.org/10.1016/j.foodqual.2013.07.001

Spinelli, S., Masi, C., Dinnella, C., Zoboli, G. P., & Monteleone, E. (2014). How does it make you feel? A new approach to measuring emotions in food product experience. *Food Quality and Preference, 37*, 109–122. https://doi.org/10.1016/j.foodqual.2013.11.009

Spinelli, S., & Jaeger, S. R. (2019). What do we know about the sensory drivers of emotions in foods and beverages? *Current Opinion in Food Science, 27*, 82–89. https://doi.org/10.1016/j.cofs.2019.06.007

Spinelli, S., Hopfer, H., Moulinier, V., Prescott, J., Monteleone, E., & Hayes, J. E. (2024). Distinct sensory hedonic functions for sourness in adults. *Food Quality and Preference, 116*, Article 105152. https://doi.org/10.1016/j.foodqual.2024.105152

Sulmont-Rossé, C., Drabek, R., Almli, V. L., van Zyl, H., Silva, A. P., Kern, M., McEwan, J. A., & Ares, G. (2019). A cross-cultural perspective on feeling good in the context of foods and beverages. *Food Research International, 115*, 292–301. https://doi.org/10.1016/j.foodres.2018.12.012

Thompson, J. L., Lopetcharat, K., & Drake, M. A. (2007). Preferences for commercial strawberry drinkable yogurts among African American, Caucasian, and Hispanic consumers in the United States. *Journal of Dairy Science, 90*(11), 4974–4987. https://doi.org/10.3168/jds.2007-0313

Torrico, D. D., Fuentes, S., Gonzalez Viejo, C., Ashman, H., & Dunshea, F. R. (2019). Cross-cultural effects of food product familiarity on sensory acceptability and non-invasive physiological responses of consumers. *Food Research International, 115*, 439–450. https://doi.org/10.1016/j.foodres.2018.10.054

Tu, V. P., Valentin, D., Husson, F., & Dacremont, C. (2010). Cultural differences in food description and preference: Contrasting Vietnamese and French panellists on soy yogurts. *Food Quality and Preference, 21*(6), 602–610. https://doi.org/10.1016/j.foodqual.2010.03.009

O'Mahony, M., & Ishii, R. (1986). A comparison of English and Japanese taste languages: Taste descriptive methodology, codability and the umami taste. *British Journal of Psychology, 77*(2), 161–174. https://doi.org/10.1111/j.2044-8295.1986.tb01991.x

van Zyl, H., & Chaya, C. (2021). Chapter 23. Emotion in beverages. In H. L. Meiselman (Ed.), *Emotion Measurement* (Second Edition, pp. 731–771). Woodhead Publishing. https://doi.org/10.1016/B978-0-12-821124-3.00023-5.

Wang, H. (2022). With ambient yoghurt on the rise, can chilled yogurt regain its former glory? *Dairy and Human, 2*, 20–26.

Weerawarna, M. N. R. P., Godfrey, A. J. R., Ellis, A., & Hort, J. (2021). Comparing temporal sensory product profile data obtained from expert and consumer panels and evaluating the value of a multiple sip TCATA approach. *Food Quality and Preference, 89*, Article 104141. https://doi.org/10.1016/j.foodqual.2020.104141

Yao, E., Lim, J., Tamaki, K., Ishii, R., Kim, K.-O., & O'Mahony, M. (2003). Structured and unstructured 9-point hedonic scales: A cross cultural study with American, Japanese

and Korean consumers. *Journal of Sensory Studies, 18*(2), 115–139. https://doi.org/10.1111/j.1745-459X.2003.tb00379.x

Yao, V. (2016). Investigating consumption-related emotions elicited by selected dairy products using product emotion measurement. *International Journal of Marketing Studies, 8*(1). https://doi.org/10.5539/ijms.v8n1p86

Yeh, L. L., Kim, K. O., Chompreeda, P., Rimkeeree, H., Yau, N. J. N., & Lundahl, D. S. (1998). Comparison in use of the 9-point hedonic scale between Americans, Chinese, Koreans, and Thai. *Food Quality and Preference, 9*(6), 413–419. https://doi.org/10.1016/S0950-3293(98)00028-7

Zhang, X. Y., Guo, H. Y., Zhao, L., Sun, W. F., Zeng, S. S., Lu, X. M., Cao, X., & Ren, F. Z. (2011). Sensory profile and Beijing youth preference of seven cheese varieties. *Food Quality and Preference, 22*(1), 101–109. https://doi.org/10.1016/j.foodqual.2010.08.007