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SHORT COMMUNICATION

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Can children use the A-not a test?

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Abstract

Sensory scientists have adapted several sensory methods to fit children's cognitive abilities. Although several discrimination methods have been reported with children, the A-not-A test has not been studied yet. The aims of this work were to: (i) evaluate the feasibility of using the A-Not-A test with school-aged children, and (ii) compare how the framing of the question (overall differences vs. differences in liking) may influence the results. A total of 126 children were involved in the study. They participated in three sessions, each composed of a familiarization task with a visual stimuli and sample tasting with one of three dairy products (vanilla milk desserts, chocolate-flavored milk, and vanilla-flavored yogurt). Half of the children evaluated the samples in terms of overall differences and the other half in terms of differences in liking. Results from the familiarization step showed that children correctly identified the visual reference in the A-not-A test regardless of how the question was framed, suggesting that they were able to understand the methodology. In the case of tasting samples, children were significantly more likely to correctly identify the reference in two of the three studied dairy products, when the question was based on liking, as compared to the framing based on overall differences.

Practical Applications

Results from the present work showed that 8–13 year-old children were able to understand the A-Not-A test and use it to differentiate visual stimuli and tasted samples. However, the framing of the task had a significant effect on their performance. Framing the A-not-A task based on liking may show a higher ability to discriminate samples and provide more accurate results.

1 | INTRODUCTION

Over the last few years, sensory and consumer methods have been used for the development and optimization of foods that meet children needs and wants (Laureati et al., 2015). For this purpose, sensory scientists have adapted several sensory methods to fit children's cognitive abilities according to the different developmental stages they undergo as they grow (Guinard, 2000; Popper & Kroll, 2011).

Traditional hedonic methods have been the most popular methodologies to obtain children-based insights during product development and optimization (Laureati & Pagliarini, 2018). Examples involving the use of paired comparisons, ranking, Check-All-That-Apply and hedonic scales can be widely found in the literature (Cordelle et al., 2005; Estay et al., 2020; Laureati et al., 2020; Laureati & Pagliarini, 2018; Liem & de Graaf, 2004; Liem, Mars, & De Graaf, 2004a; Popper & Kroll, 2011). In addition, analytical methods such as paired comparison, ranking, triangle tests and tetrad tests have also been used with children to evaluate their ability to detect differences among products (Garcia et al., 2012; Guinard, 2000; Liem, Mars, & de Graaf, 2004b; Lima et al., 2018). Nevertheless, the use of

such methods has been constrained by children's age due to their higher cognitive demand (Nicklaus, 2015).

The A-not A test is a relatively new discrimination method which has been claimed to have a higher ecological validity that other discriminative methods, since it better represents the situations consumer face in real life (Ares & Varela, 2017). It is an overall difference test where participants are first familiarized with the reference product. Then, they evaluate one test product at a time and decide whether it is identical to the reference or not (Van Hout et al., 2011). Traditionally, the A-not A test has been used with trained assessors but applications with adult consumers also exist (Christensen et al., 2011). However, only one application of this discriminative method with children has been reported (Velázquez et al., 2021).

Previous research has highlighted that children show a better discrimination ability when analytical methods are framed as hedonic tasks due to their lower cognitive demand (Liem et al., 2004b; Vennerød et al., 2017). For instance, ranking tests and paired comparisons framed as hedonic tasks have been successfully applied with children (Cordelle et al., 2005; Laureati et al., 2016; Léon et al., 1999; Vennerød et al., 2017). In addition, Lima et al. (2018) has recently reported that school-age children showed a higher hedonic sensitivity toward sugar reduction than adults despite their lower ability to detect differences in their sensory characteristics using a check-all-that-apply question. These results suggest that the framing of the A-not-A task may influence children performance.

In this context, the aims of this work were to: (i) evaluate the feasibility of using the A-not-A test with school-aged children, and (ii) compare how the framing of the question (overall differences vs. differences in liking) influences the results. It was hypothesized that children would be able to use the A-not-A test to assess both visual and food stimuli and that they would be able to better discriminate samples if the test was framed in terms of overall differences (Liem et al., 2004b; Vennerød et al., 2017).

2 | MATERIALS AND METHODS

Data were collected in a study composed of two main parts: (i) familiarization step with visual and food stimuli, and (ii) sensory evaluation of dairy products. The present work is only focused on the familiarization step, whereas results from the sensory evaluation for the hedonic-framed A-not-A task are discussed in Velázquez et al. (2021).

2.1 | Participants

A convenience sample of 126 school-aged children (52% girls, 8 to 13 years old -M = 10.6 ± 1.3-) participated in the study. Children were recruited from one school and two social clubs in Montevideo, Uruguay. One of the parents of every child signed an informed consent form to allow their child's participation in the study, which involved three sessions. Children provided informed assent to participate through the software used for data collection. Ethical approval was obtained from the Ethics Committee of the School of Chemistry of Universidad de la República. Some children were unable to participate in all sessions since they took place in different days: 54 children evaluated the vanilla milk dessert, 64 the chocolate-flavored milk and 76 the vanilla yogurt samples.

2.2 | Samples

Three dairy products were studied: vanilla milk desserts, chocolate-flavored milk and vanilla-flavored yogurt. For each product, a regular sample and one with a different flavor profile were formulated. To create a different flavor profile the sugar content and the vanilla flavoring type and concentration were varied. Although the vanilla flavoring type was changed in the three products, the concentration was only modified in the chocolate flavored milk following pilot tastings. In addition, the sugar content was modified from 11–12% w/w to 7% w/w in the vanilla yogurts and desserts. Full details of sample preparation are provided in Velázquez et al. (2021).

2.3 | Experimental procedure

Children participated in three sessions to evaluate the three categories of dairy products using the A-not A test, one per product category. The order of evaluation of each product category was randomized across sessions in the different places where the study was conducted. Each session comprised a familiarization step with the method, using visual stimuli, followed by sample tasting. The study was framed as a memory game to stimulate children engagement. Children were told they would face three memory challenges where they would use all their senses. Instructions for each task were given using explanatory videos featuring a cartoon character (alien). After each video, a researcher verbally repeated the instructions and asked the children if they had any question.

The study was conducted in a separated quiet room in each of the institutions. Groups of 5–6 children performed the task with the assistance of 3 researchers. Data were collected in Ipads (Apple Inc., Cupertino) using Compusense Cloud (Compusense Inc, Guelph, Canada). Each session lasted a maximum of 15 minutes.

Children were randomly divided in two groups. One group was asked to evaluate the samples in terms of overall differences (*"Is this image/formula identical to the reference?")* and the other group in terms of differences in liking (*"Do you like this image/formula as much as you liked the reference?")*. Children who completed the A-not-A task based on overall differences were asked to indicate whether the test stimulus was identical to the reference or not, whereas those who completed the task based on differences in liking were asked to indicate whether they liked the test stimulus as much as they liked the reference. The response options were "Yes", "No", or "I don't know."

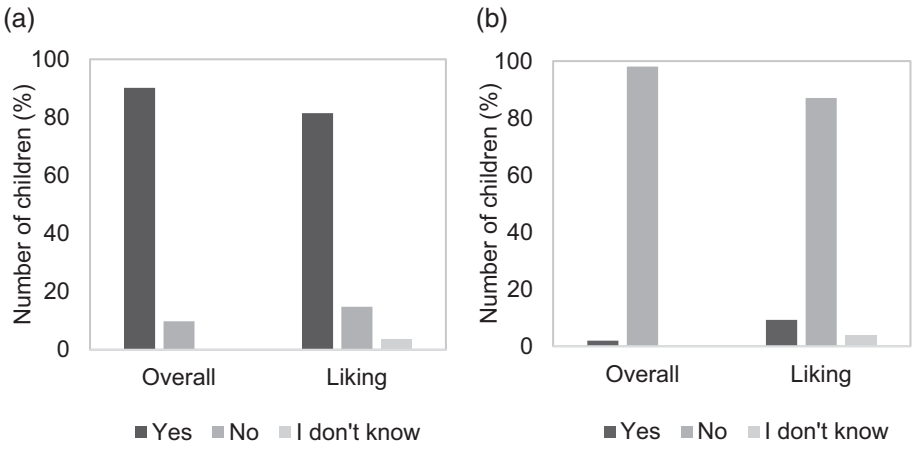

FIGURE 1 Percentage of children who provided different responses to the A-not A task during the familiarization task with apple images for the overall and liking frames: (a) reference and (b) defective apple

2.3.1 | Familiarization

Children were familiarized with the methodology through the evaluation of apple images: a bruised apple versus an intact one. First, an image of the reference apple (intact one) was presented. Children were asked to observe it carefully and to try to remember its characteristics. Then, the reference apple image and a bruised apple image were presented monadically. Children performed the familiarization task before each session, which means that children who participated in the three sessions (one session per product category) performed the familiarization task in triplicate. Only the image of the bruised sample was changed across the sessions.

2.3.2 | Sample tasting

Once children finished the evaluation of the visual stimuli, a reference sample named "secret formula" was presented. Children were asked to taste it and to remember its characteristics. Then, the reference sample and the sample with different flavor profile were presented monadically. Children could re-taste the reference sample if needed. Then, children evaluated six samples (the reference and five sugar-reduced samples). The results of the evaluation of these samples for the hedonic-framed task are discussed in Velázquez et al. (2021).

Children received 20 g of each sample in plastics cups coded with 3-digit random numbers at 8°C. For the vanilla milk desserts, a plastic spoon was provided per sample. Still mineral water was used for rinsing between samples.

2.4 | Data analysis

For the familiarization and sample tasting steps, the percentage of children who provided each response option ("Yes", "No", or "I don't know") were computed. Data analysis was performed separately for each session and product category. The chi-square test was used to investigate the existence of a statistically significant association in the distribution of the responses between the two question frames. A significant level of 5% was considered for the analysis. The test was performed using R software version 3.6.2 (R core Team, 2019).

3 | RESULTS AND DISCUSSION

Results from the familiarization step showed that children correctly identified the visual reference in the A-not-A regardless of how the question was framed, suggesting that children were able to understand the methodology. No significant differences were found in the distribution of children's responses between the liking and overall differences frames in all the sessions for both the reference and the defective apple ($p \geq 0.274$). As an example, Figure 1 shows results of the familiarization task performed before the vanilla milk dessert evaluation: over 80% of the children correctly identified the reference apple image in the overall difference and liking question frames.

Table 1 shows the distribution of children's responses to the A-not A test for the three dairy categories evaluated based on overall or liking differences. Children were significantly more likely to correctly identify the reference of the vanilla dessert and chocolate milk when the question was based on liking as compared to when framed on overall differences (Table 1). As shown, the percentage of children who answered *I do not know* to the task tended to be higher for the task based on overall differences compared to the task based on liking, suggesting that they found it more difficult to answer the question based on the former framing. These results are in line with Liem et al. (2004b), who showed that young children discriminated better the sweetness of orange beverages with rank and paired comparison tests framed as a hedonic task compared to an analytical task. These authors attributed this behavior to the higher cognitive demand of the analytical task and the limited cognitive skills of the children. Although research shows that school-aged perform better with analytical tasks than younger children as their cognitive skills increase with age (Garcia et al., 2012; Guinard, 2000; Laureati & Pagliarini, 2013; Popper & Kroll, 2011), the intuitive and engaging nature of the hedonic tasks seems to improve children's performance. The increased percentage of children incorrectly detecting the reference sample may lead to a decrease in the statistical power of the test,

TABLE 1 Distribution of children's responses to the A-not A test for the vanilla dessert, chocolate milk and vanilla yogurt samples based on overall differences or liking and results of the chi-square test[a]

Product	Stimuli	Task	*N*	Yes (%)	No (%)	I do not know (%)	*p*-value
Vanilla dessert	Reference	Overall difference	51	**41**	47	12	**0.011**
		Liking	54	**70**	24	6	
	Other	Overall difference	51	22	75	4	0.153
		Liking	54	39	57	4	
Chocolate milk	Reference	Overall difference	60	**31**	51	19	**0.000**
		Liking	64	**69**	36	3	
	Other	Overall difference	60	15	76	8	**0.000**
		Liking	64	48	50	2	
Vanilla yogurt	Reference	Overall difference	76	**61**	30	9	0.542
		Liking	76	**67**	22	11	
	Other	Overall difference	76	18	76	5	**0.019**
		Liking	76	38	55	7	

[a]Highlighted in bold are the percentage of children who correctly identified the reference sample.

reducing the ability of the test to detect differences between samples (Bi & Ennis, 2001). In the present study, most of the children (>78%) were aged between 10–13 years old, who generally can perform well several discrimination tasks. Given the large influence of age in children's cognitive skills, future studies should explore the feasibility of using the A-not-A test with different age groups.

Interestingly, there was no significant difference between the two tasks when children evaluated the vanilla yogurt. As shown in Table 1, a similar percentage of children were likely to identify the reference in the overall frame and the liking one. This behavior may be a product-specific effect, since familiarization results showed that children understood the methodologies equally across the sessions. It is possible that children found more attractive or novel the yogurt samples, which enabled them to remember better their sensory characteristics and improve their performance in the analytic task (Laureati et al., 2011; Morin-Audebrand et al., 2012).

In the present study, >65% of the children participated in more than one A-not A familiarization session and sample tasting. Nevertheless, a limitation of the present study is that the training in the methodology may be uneven between the products since some children were unable to participate in the three sessions. However, we did not see a session effect (data not shown), as most children were able to correctly perform the A-not-A test since the first session. Given that previous studies have shown that A-not A test performance improves over repetitions (Van Hout et al., 2011), it is possible that children who evaluated more products may have shown a better performance.

Regarding the evaluation of the sample with a different flavor profile, a high percentage of children correctly rejected the modified samples, which is not surprisingly since people are more likely to detect deviations from their expectations (Köster et al., 2004; Laureati et al., 2011; Laureati & Pagliarini, 2013; Møller et al., 2007). Nevertheless, a direct comparison between the overall and liking frame tasks is not possible. Children may have detected the difference but still like the sample as much as they liked the reference.

4 | CONCLUSIONS

Results from the present work showed that 8–13 year-old children were able to understand the A-Not-A test and use it to differentiate visual stimuli and tasted samples in three product types. However, the framing of the task had a significant effect on the obtained results. Children were more able to accurately detect the reference sample when tasting in the case the task was framed on liking as compared to base on overall differences. This suggests that framing the A-not-A task based on liking may show better sample discrimination ability and could provide more accurate results.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon request.

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