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Relevant elements on biscuits purchasing decision for coeliac children and their parents in a supermarket context

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ABSTRACT

The aim of this work was to study the behaviour and motivations of coeliac children and their parents when purchasing biscuits. Four groups (n = 30) of participants differing in coeliac condition (coeliac and non-coeliac) and age (children and parents) were studied. Participants were asked to "purchase" biscuits, either for themselves (children) or for their children (parents), in a simulated supermarket aisle that included twelve commercial biscuits (six gluten-free and six regular ones). Eye-tracking technique was used to register visual attention during the purchasing exercise and laddering interviews were used to obtain the self-reported reasons for their choice. The number of fixations received by biscuits and label elements were analysed and most of them varied depending on the coeliac condition, the age or both. In comparison with the non-coeliac children, coeliac children fixated more on the ingredients, gluten-free words and symbols, and fixated less on the biscuit image. Parents of coeliac children put more attention on the ingredients and the certified gluten-free symbol, and less attention on the biscuit image, product name, cartoon, and nutritional information than non-coeliac parents. According to the chains of reasons (attribute-consequence-value), all children looked for pleasure as the final value, but only coeliac children showed interest in the brand and in unknown products they want to try. Parents differed on the attributes linked to health that were certification logo and a short ingredient list for coeliac group, and low sugar or fat contents for non-coeliac one. Trust and economy were relevant only for parents of coeliac children.

1. Introduction

Coeliac disease is a disorder characterized by the inflammation of the intestine because of gluten ingestion. Therefore, it is essential to exclude wheat, barley, spelt, and rye (Jnawali, Kumar, & Tanwar, 2016; Lebwohl, Sanders, & Green, 2018). According to a recent *meta*-analysis review (Singh et al., 2018), estimated global prevalence of coeliac disease is 1.4 % (based on serologic diagnosis) and 0.7 % (based on biopsy diagnosis), and it is greater in children than in adults (0.9 % *vs* 0.5 %). Lifelong adherence to a gluten-free diet is the only effective therapy for coeliac disease. Therefore, those with coeliac disease must ensure that their food does not contain gluten or has not been cross contaminated with gluten-containing products. Those with coeliac disease show high adherence to the gluten-free diet, but they find obstacles that impact on everyday living and quality of life. In children starting a gluten-free diet, problems have been reported, such as difficulty in determining whether foods were gluten-free, finding allowed foods, and anger about having to follow a special diet (Rashid et al., 2005). Likewise, a more recent survey showed availability, poor quality, poor labelling, and cost of products are the major barriers for Canadian coeliac children and adolescents trying to follow a gluten-free diet (MacCulloch & Rashid, 2014).

The gluten-free products market size has grown in recent years, due to the increase in coeliac disease incidence (mostly due to a rise in recognition of coeliac disease and improvement on diagnosis tests) and the interest in gluten-free diet of tolerant consumers who consider it is a healthier option—even if this is not evidenced. The global gluten-free products market size is estimated to reach USD 8.3 billion by 2025 (MarketsandMarkets™, 2020). The compound annual growth rate (CAGR) of the gluten-free food market shows increases of 5.2 % for breakfast cereals, 7.5 % for biscuits and 12.3·% for pasta from 2018 to 2022 (Statista, 2020). As consequence, food industry is making efforts on the development of gluten-free versions in different food categories. Gluten is present in most of bakery products and the lack of gluten results in sensory properties that differ from those of the regular product and are less appealing to consumers. Thus, most research has focused on improving the texture of gluten-free products to resemble regular

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products (Juhász, Colgrave, & Howitt, 2020; Di Cairano, Galgano, Tolve, Caruso, & Condelli, 2018) and to improve the sensory quality and acceptance (Ávila, Cardozo, Alves, Gularte, Monks, & Elias, 2019; Morais, Cruz, Faria, & Bolini, 2014). However, food choice is determined by sensory properties and liking, as well as other factors like the extrinsic properties of product (label information, brand, and price); furthermore, consumers' characteristics and attitudes (age, health concerns, expectations, or past experiences) must be considered to understand their decision (Costell, Tárrega, & Bayarri, 2010; Köster, 2009). In today's competitive market, food labels and packages display a wide range of visual features (colours, illustrations, logo, and shapes) to attract the consumer's attention to the product, but also provide information for consumers interested in some specific aspects of quality (sensory or nutritional). Coeliac condition and age can thus affect how all these characteristics are perceived, its relevance, and which of them drive purchase or consumption decision. However, there is little information on how the drivers of choice of non-gluten (coeliac) consumers, specifically children, differ from gluten (non-coeliac) ones. In a recent study, Pontual et al. (2017) showed that sensory expectations created by different gluten-free pizza concepts did not differ among coeliac and non-coeliac adult consumers, but health and novelty aspects were more relevant to the group of coeliac participants.

Food choices and consumption in childhood have been the object of research in studies focused on facing overweight issues and promoting healthy diets in children (Keller et al., 2012; Graham, Lucas-Thompson, Mueller, Jaeb, & Harnack, 2017). In pre-adolescent children, parents hold a primary role in food choices, purchases, and preparation (Gross, Pollock, & Braun, 2010; Pliner, & Saunders, 2008). Thus, it is interesting to examine how parents make food choices for their children, as this can influence what they will eat. Despite the different sociological perspectives for conducting research in children (Punch, 2002), adapting methods to participants' interest and ability is important to assure their engagement. Using a combination of techniques, not relying exclusively on verbal methods (interviews), and including other observational or participatory tasks, is especially recommended when children are participants (Grønhøj & Gram, 2020). Furthermore, when focusing on food consumption, many choices and decisions are part of routines, often unnoticed, and therefore, are difficult to be spontaneously verbalized. Participatory methods, such as situational tasks, can remind what would happen in a particular situation of choice, thus triggering participants' experiences.

Using retail or supermarket environments is frequently found in studies analysing consumer choice and purchasing intention of products. Real supermarket experiments that allow observing customer experience are usually used in studies aiming to determine the number and type of products selected, the money spent or consumer response to price, promotions, healthy products selection, or shelf display options in a real purchasing situation (Camargo, Farias, Mazzonetto, Dean, & Fiates, 2020; O'Brien et al., 2015; Pechey, & Monsivais, 2015; Terblanche, 2018). In a laboratory setting, using simulated supermarket environments (products arranged on a store shelf) allows participants to get immersed in the purchasing experience while researchers can control the variables or factors to be studied. Both physical or virtual simulated supermarkets are useful to study how consumer choice is affected by product characteristics (brand, price, nutritional information, label information, claims), environment aspects (position, lighting, scents), and individual consumer factors (attitudes toward health, vegan, etc.) (Ballco, de-Magistris, & Caputo, 2019; Hashim, McWatters, Rimal, & Fletcher, 2001; van Herpen, van den Broek, van Trijp, & Yu, 2016).

In simulated purchasing exercises in supermarkets, participants' behaviour is usually analysed by direct observation of how they spontaneously behave. Interviewing participants about their choice reasons, just after being made, can help to understand their behaviour. Eye-tracking is an observational technique that allows identifying where and how someone is looking (Duerrschmid & Danner, 2018). It is widely used in consumer and marketing studies to register the unconscious and spontaneous response of consumers toward products and marketing messages. In food products, eye-tracking has been applied for packaging or labels design, to know the elements and traits that capture consumer attention (Antúnez, Vidal, Sapolinski, Giménez, Maiche, & Ares, 2013; Ares, Giménez, Bruzzone, Vidal, Antúnez, & Maiche, 2013; Bialkova, Grunert, Juhl, Wasowicz-Kirylo, Stysko-Kunkowska, & van Trijp, 2014, Piqueras-Fiszman, Velasco, Salgado-Montejo, & Spence, 2013). Wearable eye-trackers (built as a kind of glasses) allow subjects to move around and interact with objects and are optimized to analyse consumer's fixations and choice behaviour in real or simulated purchasing contexts. Laddering is an interview technique for investigating motivations behind people's behaviour. It is based on the Means-End Chain Theory that considers decisions are based in a hierarchy of perceptions at three levels: "Attribute," "Consequence," and "Value" (Reynolds & Gutman, 1988). In consumer research, laddering has been used to explore the drivers of purchasing decisions (Arcia, Curutchet, Costell, & Tárrega, 2012; Nielsen, Bech-Larsen, & Grunert, 1998). It comprises consecutive why-questions that facilitate participant self-analysis of their behaviour and allows gathering the three-level chain of reasons, providing more detailed information than conventional open questions.

The goal of this study was to analyse the factors that drive biscuits choice in children with coeliac disease and their parents, as compared to their non-coeliac counterparts through an approach that combines direct measurement of visual attention (eye-tracking) and self-reported motivations (laddering) of consumers when purchasing biscuits in a simulated supermarket context.

2. Materials and methods

2.1. Participants

A total of 120 participants, sixty children and sixty adults took part in the study. A group of thirty children with coeliac disease and another group of thirty non-coeliac children were recruited. The thirty parents of the coeliac children and the thirty parents of the non-coeliac children also participated in the study. The sample size is low compared to what is expected in a consumer study but this is due to the difficulty of recruitment when targeting a group with a specific medical condition. The age range of children was 8–13. The coeliac children (23 girls, and 7 boys), and the non-coeliac children (14 girls, and 16 boys) came to the facilities accompanied by their mother or father, and one family per session participated at a time.

The recruitment of coeliac participants was through an advertisement in a local coeliac association (ACECOVA), and non-coeliac children were recruited by posting announcements in local schools. Parents gave informed consent and received a gift as compensation for participating. This study was approved by the Ethics Committee of CSIC (Ref. number 050/2019).

2.2. Samples

Twelve commercial biscuits were used in this study. Six gluten-free biscuits of four types (with chocolate chips, sandwich—"Oreo" like type, animal-shaped, and "María" type) were purchased in local supermarkets. Six regular (gluten-containing) biscuits of the same four types were also used (Table 1). The four types of biscuit were included to have a representative selection of the gluten-free and the regular biscuits in the Spanish market.

2.3. Experimental procedure

2.3.1. Eye-tracker recording when choosing biscuits in a supermarket context

The first part of the experiment took place in a room that contained a supermarket shelf (length: 270 cm, height: 180 cm) simulating a

Table 1
Biscuit characteristics used in the study.

Group	Biscuit type	Biscuit code	Main ingredients	Images and symbols	Price (€)	Weight (g)
Gluten-free	Chocolate chips	GF-Cho1	Corn starch, palm oil, cornmeal, choco chips, cacao powder, cacao butter, emulsifiers, sugar, soybean flour, gasifiers	Biscuit image, gluten-free symbol	2.65	200
	Chocolate chips	GF-Cho2	Corn starch, palm, coconut and sunflower oil, cornmeal, choco chips, emulsifiers, acidifying, sugar, choco chips, cocoa paste, cacao butter, eggs, gasifiers	Biscuit image, cartoon character, certified gluten-free symbol	2.10	220
	Chocolate chips	GF-Cho3	Choco chips, sugar, cocoa paste, cocoa butter, emulsifiers, corn flour, sunflower and coconut oil, starch flour, eggs, gasifiers	Biscuit image, gluten-free symbol, lactose-free symbol	1.75	220
	Sandwich ("Oreo" like)	GF-San	Cream, sugar, palm oil, emulsifiers, corn flour, potato starch, cocoa powder, vanilla, gasifiers	Biscuit image, certified gluten-free symbol, lactose-free symbol	4.35	300
	Animal-shaped	GF-Ani	Corn starch, sugar, sunflower oil, cocoa powder, corn flour, potato starch, rice flour, emulsifiers, gasifiers	Biscuit image, cartoon character, gluten-free symbol, lactose-free symbol, oleic oil symbol	2.10	250
	"María" type	GF-Mar	Corn starch, sugar, rice flour, sunflower oil, emulsifier, corn flour, pea protein, gelling agents' oil, emulsifiers, gasifiers	Biscuit image, gluten-free symbol	1.30	200
Regular	Chocolate chips	Cho1	Wheat flour, choco chips, emulsifier, sugar, palm oil, glucose syrup, butter, gasifiers	Biscuit image	0.85	225
	Chocolate chips	Cho2	Sugar, wheat flour, vegetable oil, cocoa paste, cocoa butter, milk powder, emulsifiers, gasifiers	Biscuit image,GDA symbol	3.40	400
	Sandwich ("Oreo" like)	San	Wheat flour, sugar, palm oil, rapeseed oil, cocoa powder, wheat starch, glucose and fructose syrups, emulsifier, salt, gasifiers	Biscuit image,GDA symbol, promotional toy announcement	3.08	440
	Animal-shaped	Ani1	66 % of cereals (wheat flour, rye flour, wheat starch, wheat bran), sugar, sunflower oil, milk, glucose syrup, gasifiers	Biscuit image, cartoon character, GDA symbol, sunflower oil symbol	1.40	330
	Animal-shaped	Ani2	Wheat flour, sugar, sunflower oil, whey, glucose syrup, emulsifier, vitamins (a, b), gasifiers	Biscuit image, cartoon character, sunflower oil symbol	1.39	600
	"María" type	Mar	Wheat flour, sugar, sunflower oil, whey, glucose and fructose syrup, emulsifier, gasifiers	Biscuit image, sunflower oil symbol	0.99	800

supermarket aisle. The biscuits in the study (eight products per sample) were placed on the two central shelves. One shelf was located at an appropriate eye-level for children and the other shelf at an appropriate eye-level for parents. Other products (different from biscuits) occupied the other shelves (the top and the bottom shelves). As often found in supermarkets, gluten-free and regular biscuits were grouped. The placement of the biscuits and the groups on the shelf was changed among participants to avoid the potential effect of product placement (Atalay, Bodur & Rasalofoaruson, 2012; Gidlöf, Anikin, Lingonblad, & Wallin, 2017).

Each parent and his/her children attended the session together but conducted the activities individually (parents before children). First, the parent was provided with a Pupil mobile eye-tracking headset (Pupil Labs GmbH, Berlin, Germany) equipped with a binocular camera system that recorded the participant's eye and another camera that recorded the participants' field of vision. Gaze fixations between 100 and 400 ms of duration and 1° of visual angle dispersion were registered for studying visual attention, as previously described (Bialkova & van Trijp, 2011; Salvucci & Goldberg, 2000). The information captured by the cameras was registered and recorded using the Pupil Capture Software Version 1.11 (Pupil Labs GmbH). The cameras' positions were adjusted for each participant to detect their pupils and accommodate distances for obtaining a wide field of view. Once the eye-tracker system was established, the participant was asked to imagine being in a supermarket to buy biscuits. He/she was provided with a basket, placed in front of the supermarket aisle and asked to choose the biscuit that would buy for his/her child. Once the biscuit was chosen, the participant was asked to select a second option.

Once the parent had finished, his/her child performed the same purchasing activity wearing the eye-tracker glasses. He/she was asked to imagine being in a supermarket with his/her parents buying biscuits and to put inside the basket the biscuits he/she would choose. Then he/she was asked to select his/her second option.

2.3.2. Laddering interview to register the reasons for choosing biscuits

After the participant finished the purchasing task, the eye-tracking glasses were removed and he/she was interviewed about the motives for choosing each biscuit (first and second option) using the laddering technique. It consists in asking a series of "why"-questions to obtain attributes, consequences and final values behind the decision. Thus, the participant was first asked, "Why did you choose this biscuit?" and then "why is that important to you?" and then "why is the latter important to you?". This same procedure was followed to interview parents and children.

2.4. Data analysis

Two researchers independently analysed the eye-tracker video recordings using Pupil Player Software Version 1.11 (Pupil Labs GmbH). A first inspection of the videos was performed to determine the relevant elements of products (package characteristics and price) that received the attention of participants during the purchasing task. Accordingly, a list of elements was established by consensus. A second inspection of the videos registered the time to choose the first biscuit, the first element that received fixation on a package, the number of fixations toward each biscuit, and the number of fixations received by each element of the package. The elements considered were *biscuit image*, *product name* (e.g., "Oreo," "María," "Chips' Ahoy"), *cartoon character*, *gluten-free words*, *brand name*, *list of ingredients*, *price*, *gluten-free symbol*, *lactose-free symbol*, *sunflower oil symbol*, *oleic oil symbol*, *GDA—Guideline Daily Amount—symbol, lactose-free words, nutritional information, weight, promotional toy announcement, sunflower oil symbol, best before date, fibre symbol, and nuts-free symbol.* The joint information registered by both researchers from each video was contrasted, and if differences or discrepancies were found between researchers, the video was watched again to reach consensus.

The effects of parent/child group (children and their parents), coeliac condition (coeliac and non-coeliac), and its interaction on the number of fixations on the gluten-free biscuits, on the regular biscuits, and on each element of the package were analysed using General Linear Model (GLM) analysis with a Poisson distribution. Differences between mean values were analysed through Bonferroni test. The variation in the time to choose the first biscuit was analysed using ANOVA. These analyses were conducted in IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA).

Information collected during the interviews using the laddering

technique of each participant was first categorized into the categories: attribute, consequence, and value (A-C-V) (Reynolds & Gutman (1988; Arcia et al., 2012) independently by two researchers. By consensus, the final A-C-V chains and their frequencies in each consumer group were established. The obtained chains were used to construct the Hierarchical Value Map (HVM). The cut-off or link between A-C-V used for chains was 10 % of the size. Therefore, only chains with at least three mentions were considered for the graph.

3. Results

3.1. Consumers' attention when choosing a biscuit in a supermarket context

The time to choose the first biscuit was registered and it vary greatly among participants. ANOVA showed it did not significantly depend on the coeliac condition or parent/child group ($p > 0.05$), and it was more related to the individual behaviour of subjects during the purchasing task, that followed three patterns. (1) Some participants located themselves in the middle of the room and quickly scanned the biscuits from both shelves' sides, without spending time on each one, then they went straight to choose their first option. These were the participants with the quickest choice. (2) Others also first scanned all biscuits, and went straight to one side of the aisle, where their interest type of biscuits was located (gluten-free or regular biscuits), and then they looked more in detail at that group of biscuits until they decided which one to choose. (3) Some participants looked at all the biscuits one by one—and compared them—until they chose one.

The total fixations on the gluten-free biscuits and on the regular biscuits was registered and according to GLM, significantly depended on the coeliac condition and parent/child group ($p < 0.05$). Fig. 1 shows the mean values of the number of fixations received by the totality of biscuits of each type for each group of participants. The number of fixations on gluten-free biscuits did not significantly differ among coeliac children and their parents ($p < 0.05$), and as expected, they were higher than for non-coeliac groups. The number of fixations on regular (non-gluten-free) biscuits was higher for non-coeliac groups, but children showed lower number of fixations than parents. Coeliac children were those that less fixated on the regular biscuits.

The element of the package that received the first fixation from the participant when they looked at each product was also registered. The distribution of the first fixation among the different elements (Fig. 2)

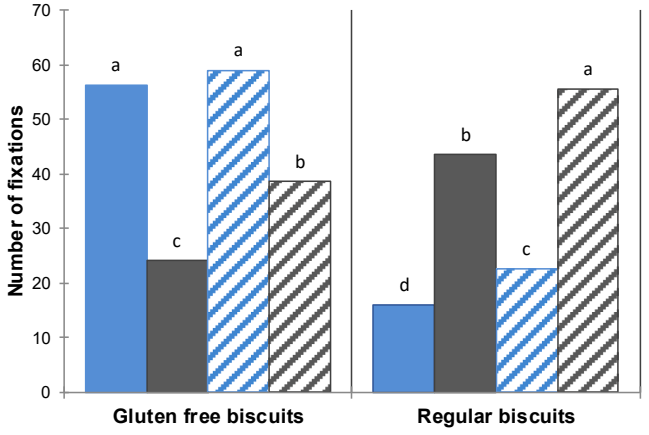

Fig. 1. Mean values of the number of fixations dedicated to the totality of biscuits of each type (gluten-free biscuits or regular biscuits) by each group of participants: coeliac children ( ), non-coeliac children ( ), parents of coeliac children ( ), and parents of non-coeliac children ( ). For each biscuit type, letters above the bars indicate significant differences among values according to Bonferroni test ($p < 0.05$).

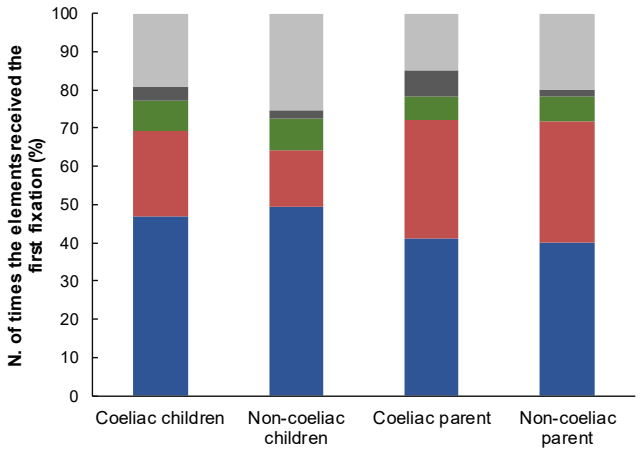

Fig. 2. Number of times the element was the first item fixated on. Elements considered: Biscuit image ( ), Product name ( ), Cartoon character ( ), Gluten-free symbol ( ), and others ( ).

was similar for the four groups of participants. *Biscuit image* and *product name* were the elements that caught participants' first fixation more frequently (41–52 %). *Cartoon character* received fixations with a frequency of 6–8 %. The rest of the elements were first looked at in<5 % of cases, except for the *gluten-free symbol* that in 7 % of cases was the first element that parents of the coeliac-children group fixated on.

For the different elements of the biscuit packages on the supermarket shelves, the fixations of participants during the purchasing task were also studied. First, the percentage of participants that looked at the element at least once (fixations ≥ 1) was counted to evaluate how many participants paid attention to it (Fig. 3). During the purchasing task, all the participants looked at the *biscuit image* and the *product name*. The *cartoon character* and *brand name* received fixations from at least 70 % of the participants in all the four groups. *Price* and *gluten-free words* were observed by 40 to 75 % of participants, depending on the group. *Certified gluten-free symbol*, *list of ingredients*, and *gluten-free symbol* captured the attention from 20 to 49 % participants, with differences among groups. Finally, other elements of the biscuit packages such as *lactose-free words*, *lactose-free symbol*, *nutritional information*, *weight*, *promotional toy announcement*, *GDA symbol*, *sunflower oil symbol*, *best before date*, *fibre symbol*, and *nuts-free symbol* captured attention from<20 % of participants.

The number of fixations on each element of the biscuit packages was also registered, and GLM analysis was used to determine the effects of parent/child group (children *vs* parents) and coeliac condition (coeliac *vs* non-coeliac) on each element (Table 2).

For *price*, the number of fixations varied significantly only with the parent/child group (children *vs* parents) ($p < 0.001$); it was lower for children than for parents (Table 3). For the elements *biscuits image* and *certified gluten-free symbol*, the number of fixations varied significantly only with the coeliac condition ($p \leq 0.001$). Coeliac children and their parents dedicated more fixations to the *certified gluten-free symbol* and fewer fixations to the *biscuits image* than the corresponding non-coeliac groups.

For *nutritional information*, the number of fixations showed to depend on both parent/child group and coeliac conditions ($p = 0.001$ and $p = 0.003$, respectively). The parents fixated more than their children, with the non-coeliac parent group putting more attention on this element.

For the rest of the elements, the interaction was significant ($p < 0.05$), indicating that the effect of the parent/child group (children *vs* parents) depended on the coeliac condition and vice versa. *Gluten-free symbol* and *gluten-free words* received more fixations by the coeliac than non-coeliac group but only with children. The *list of ingredients* received

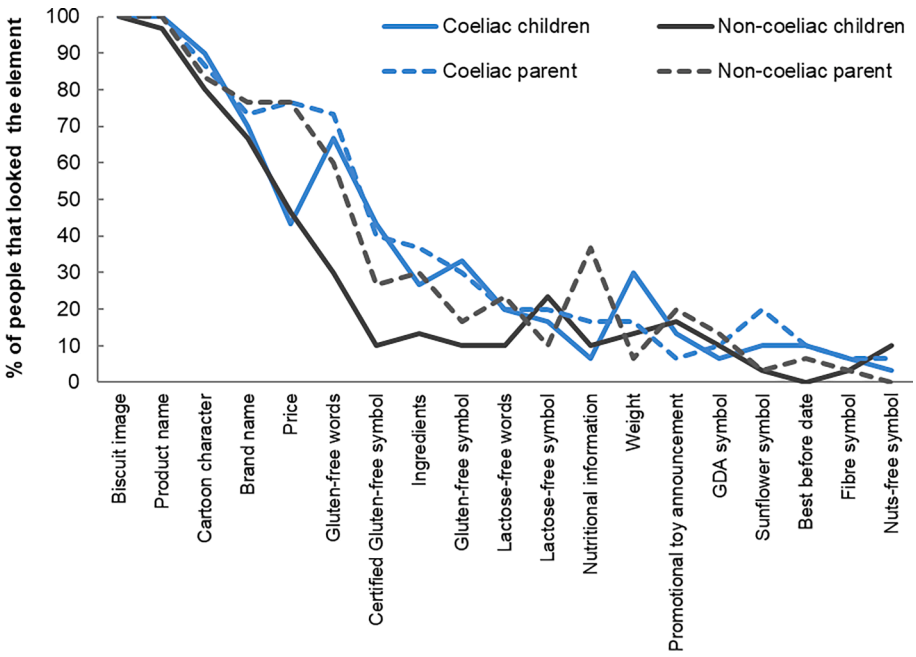

Fig. 3. Elements looked during the purchasing task for each group of participants.

Table 2
Effects of parent/child group (children *vs* parents), coeliac condition (coeliac *vs* non-coeliac), and their interaction on the number of fixations received by each element during buying task.

Elements	Parent/child group		Coeliac condition		Interaction	
	Wald-X^2	P-value	Wald-X^2	P-value	Wald-X^2	P-value
Biscuit image	2.78	0.095	10.45	0.001	0.58	0.447
Product name	83.55	<0.001	2.15	0.143	9.13	0.003
Cartoon character	3.32	0.069	0.59	0.444	8.83	0.003
Gluten-free words	17.52	<0.001	29.05	<0.001	14.87	<0.001
Brand name	4.46	0.035	0.22	0.637	9.49	0.002
List of ingredients	53.78	<0.001	45.50	<0.001	8.98	0.003
Price	20.28	<0.001	0.36	0.547	1.78	0.182
Gluten-free symbol	0.22	0.637	12.91	<0.001	11.36	0.001
Nutritional information	10.38	0.001	8.59	0.003	0.43	0.513
Certified gluten-free symbol	1.19	0.276	22.33	<0.001	0.96	0.326

Table 3
For each group of participants, mean values of the number of fixations on each of biscuits element.

Elements	Coeliac children	Non-coeliac children	Coeliac Parents	Non-coeliac parents
Biscuit image	18.60^{a}	20.57^{ab}	19.30^{a}	22.70^{b}
Product name	10.97^{a}	10.13^{a}	14.97^{b}	18.80^{c}
Cartoon character	3.30^{ab}	2.63^{a}	2.93^{a}	4.30^{b}
Gluten-free words	2.53^{b}	0.60^{a}	2.67^{b}	2.10^{b}
Brand name	2.27^{ab}	1.43^{a}	2.00^{ab}	2.80^{b}
List of ingredients	2.10^{b}	0.37^{a}	4.57^{c}	2.33^{b}
Price	1.37^{ab}	1.23^{a}	2.13^{bc}	2.80^{c}
Gluten-free symbol	1.23^{b}	0.10^{a}	0.43^{ab}	0.40^{a}
Nutritional information	1.10^{a}	1.53^{a}	1.60^{a}	2.70^{b}
Certified gluten-free symbol	0.90^{b}	0.13^{a}	0.93^{b}	0.27^{a}

For an element (row), frequency values not sharing letters are significantly different according to Bonferroni test ($p < 0.05$).

more fixations from the coeliac group and more fixations from parents than children. Parents of coeliac children put more attention on the *list of ingredients* than the other three groups. *Product name* received fewer fixations from children than parents, and for coeliac parents, the number of fixations was lower than for non-coeliac parents. *Brand name* and *cartoon character* received fewer fixations from children than from parents, but only in the non-coeliac group. For both coeliac children and their parents, the number of fixations on these two elements was between those obtained for non-coeliac children and their parents.

Summarizing, coeliac children fixated significantly more on the *list of ingredients*, *gluten-free words* and *gluten-free symbols* than the non-coeliac children and fixated significantly less on the *biscuit image*. Furthermore, it was observed that the profile of fixations of coeliac children changed little from their parents, whereas for non-coeliac children, it differed greatly from their parents.

Parents of coeliac children also showed differences from parents of non-coeliac children. They fixated less on the *biscuit image*, *product name*, *cartoon character*, and *nutritional information*, and put more attention on the *list of ingredients* and on the *certified gluten-free symbol* than the parents of non-coeliac children.

3.2. Motivations for biscuit choice

In the first choice, coeliac children selected mainly biscuits containing chocolate (GF-San, 33 %; GF-Cho1, 27 %; GF-Cho3, 20 %) and the second choice was more diverse, including besides those containing chocolate, others like animal-shaped (GF-Ani) and "María" type (GF-Mar). Likewise, their parents first selected the biscuits containing chocolate chips (GF-Cho3, 27 %; GF-Cho1, 23 %), but also those animal-shaped (GF-Ani 23 %). For the coeliac group, 30 % of the parents selected the same biscuit as their children as the first choice.

Furthermore, non-coeliac children chose biscuits containing chocolate Cho2 (40 %) and San (30 %) as the first option, and the second option was more diverse, including besides biscuits containing chocolate chips (Cho1, Cho2), animal-shaped (Ani1, Ani2) and "María" type (Mar). Their parents bought the same biscuits Cho2 (27 %) and San (23 %) at first, but also those animal-shaped (Ani2, 17 %). In the non-coeliac group, only 3 % of parents selected the same biscuit as their children for the first option.

To understand the motives underlying the choice of biscuits, responses to laddering interviews were converted into the three-level chains (Attribute/Consequence/Value) and they were represented in a laddering map for each group of participants. As shown in Fig. 4, all motivation chains elicited by children (coeliac and non-coeliac) led to the same ultimate value, pleasure. Different attributes and consequences led to this same ultimate value. For both coeliac and non-coeliac children, product characteristics such as having cream, chocolate, a good texture, good taste or being a known product were the attributes that made them think they would like the biscuit, and thus, would get the pleasure they expected. However, coeliac children elicited other attributes and consequences not found for non-coeliac children. Being unknown biscuits he/she would like to try or being a product from a known brand would give the feeling of a good product. In addition, a product that can be eaten in small bites, allowing to eat greater quantity of biscuits, or being a product like the regular one he/she would like, were the other reasons that coeliac children gave for choosing the biscuit.

Fig. 5 shows the chains of reasons given by parents when choosing the biscuits for their children. Like their children, the biscuit characteristics (good taste or texture, having cream or chocolate, appealing appearance, or being a known product) were the attributes the two groups of parents indicated for choosing the biscuit their children would like and enjoy. Parents of coeliac children also mentioned being a product like the regular one, and being an unknown product that their children would like to try.

Besides pleasure, parents' choice showed to be driven by other final values. Healthiness was a reason for parents of both coeliac and non-coeliac children. Parents of coeliac children that looked for providing healthiness to their children chose the biscuits having fewer ingredients or the certified gluten-free symbol, as they considered they were healthier and safer, respectively. However, for parents of non-coeliac children looking for healthiness, the attributes they considered important were having less sugar or fat content. For parents of coeliac children, a more complex response was observed, including trust and economy, as the values underlying their biscuit choice. Some parents of coeliac children chose the biscuit of a certain brand they already knew for having a product of good quality that conferred trust to them. Finally, the price was also a reason stated by parents of coeliac children looking to spend less money and better family economy.

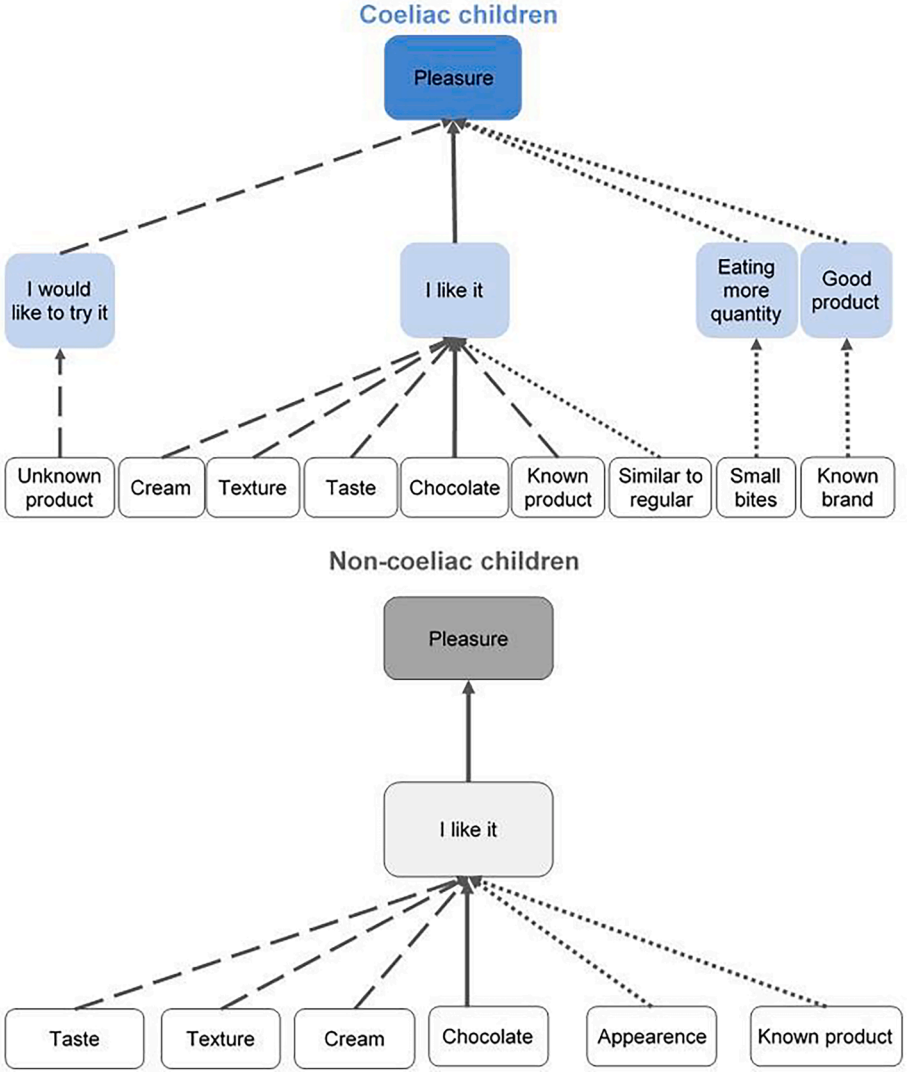

Fig. 4. Motivations of coeliac children and non-coeliac children for choosing biscuits. Laddering plot showing the motivation chain: attribute (▭), consequence (▭, ▭), and value (▭, ▭) Frequency of mention of each relation is indicated by the arrow line style: ≤4 times (•••••), 5 to 14 times (▬ ▬), and > 15 times (▬▬).

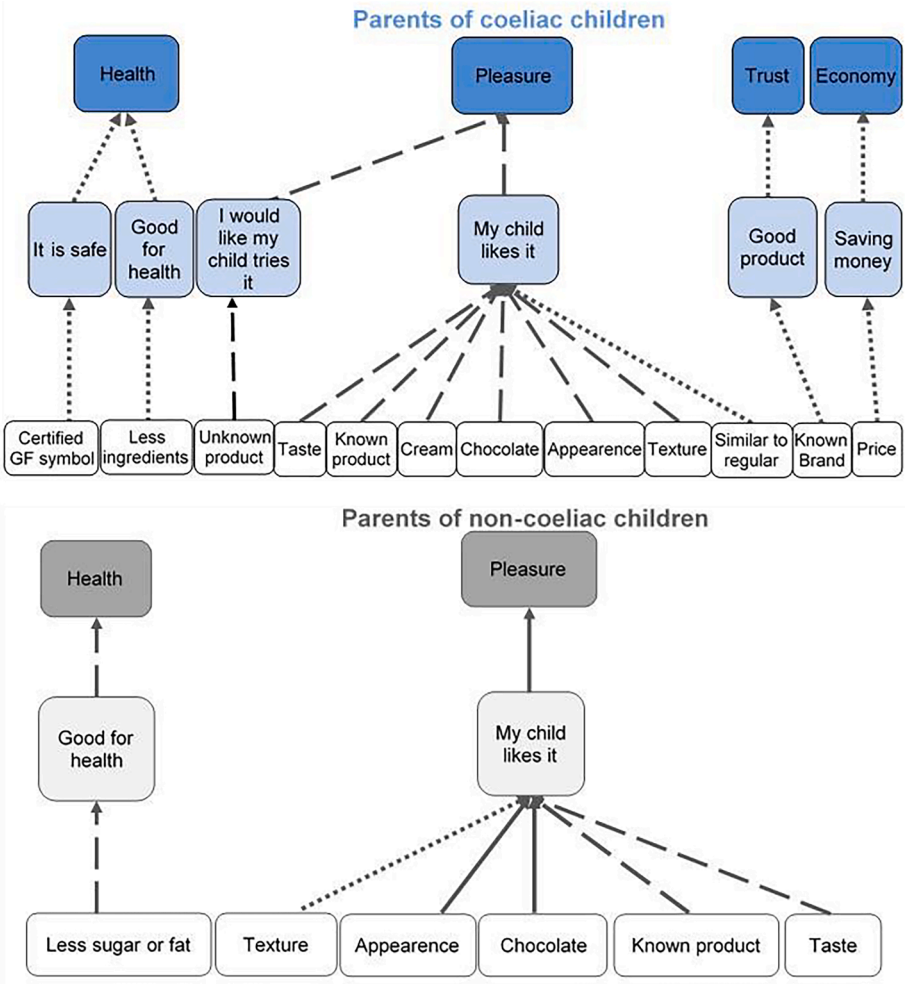

Fig. 5. Motivations of parents of coeliac children and parents of non-coeliac children for choosing biscuits. Laddering plot showing the motivation chain: attribute (▭), consequence (▭, ▭), and value (▭, ▭). Frequency of mention of each relation is indicated by the arrow line style: ≤4 times (●●●●●), 5 to 14 times (▬ ▬), and > 15 times (▬▬).

4. Discussion

4.1. Relevant elements and motivations of coeliac children and their parents compared to those non-coeliac

Product characteristics that caught participants' visual attention during the purchasing task were first studied. For the four groups of participants, *biscuit image*, *product name*, and *cartoon character* were the elements on the biscuits packages that caught participants' first fixation and that were looked at (at least once) by most participants during the purchasing task. It should be considered that in eye-tracking studies, part of the recorded eye movements is driven by the intention or interest of the subject (top-down attention) but there is also an important part of movements driven by the stimulus properties (bottom-up attention) as more salient elements receive visual attention even if the consumer is not searching for them.

For the biscuit packages in this study, these three elements (*biscuit image*, *product name*, and *cartoon character*) had those characteristics that can maximize visual attention, such as large surface size, centred or top position on the front of the package, and colour contrast (Bialkova, & van Trijp, 2010; Chen & Pu, 2010; Peschel & Orquin, 2013; Varela, Antúnez, Silva Cadena, Giménez, & Ares, 2014; Wedel, & Pieters, 2007). The saliency of these elements capturing bottom-up attention would explain the high number of fixations received by these elements compared to the others. However, a goal-directed intention from consumers when fixating on these elements cannot be discarded. The number of fixations was especially high for *biscuits image* and *product name*, as these elements communicate its sensory traits, providing information that the consumer needs to make the choice decision. In previous studies, some have observed that, of all packaging elements, the image of a product provides quick and easy information to the consumer (García-Madariaga, López, Burgos, & Virto, 2019) and are the main element capturing consumers' attention (Pieters & Wedel, 2004). This is confirmed by the self-reported motivations of participants to choose the biscuit in the laddering interview. Common to all four groups, attributes such as having chocolate, cream, good appearance, taste, or texture are features that the consumer can obtain observing the biscuit image and product name, and were the reasons of many participants to choose the biscuit they would like and enjoy.

For the other less salient elements, such as *brand name*, *list of ingredients*, *nutritional information*, *claims*, *symbols*, and *price* the number of fixations received were lower and were mainly driven by the interest (goal-driven attention) of consumers as there were significant differences among the groups of consumers. Coeliac condition significantly affected the number of fixations on the elements related to gluten-free (*words* and *symbols*) and to the *list of ingredients*, which were in general higher for coeliac participants, especially when comparing the children groups. The need to avoid gluten in their diet explains the goal-driven attention paid by coeliac participants on these elements to check the product is suitable for them and minimize risk. Children with coeliac

disease have reported to have difficulties in following a gluten-free diet (Fernández-Miaja, Martín, Treviño, González, & García, 2021) as they, and their parents, struggle to determine if food is gluten-free (Rashid et al., 2005; Gutowski et al., 2020). Therefore, when asking coeliac sufferers under 16 years old how to improve their life quality, they first mentioned to have better labelling of gluten-free food (Rashid et al., 2005).

The *list of ingredients* was also more relevant for coeliac participants. The type of flour can provide information to check the suitability of the product but also about its sensory quality, as coeliac consumers are concerned or interested about alternative flours for elaborating gluten-free products (Puerta, Laguna, Vidal, Ares, Fiszman, & Tárrega, 2020). However, healthiness seems to be the reason behind this attention to the *list of ingredients,* as consumers only refer to this element in the laddering task to declare choosing the biscuits with fewer ingredients because they are good for their children's health. Ares et al. (2013) have shown that ingredients were relevant for consumers for estimating the healthfulness and willingness to purchase products. Because fixations on the *list of ingredients* was higher for parents also supports that healthiness is the reason behind the attention paid to ingredients, as healthiness greatly concerns parents and their food choices (Ford, Eadie, Adams, Adamson, White, & Stead, 2020), but not children, that are more driven by the pleasure of eating a food product (Laureati, & Pagliarini, 2018).

Likewise, the number of fixations on *price* was higher for parents than children because they are more concerned about price. The parent of both groups of children looked at price similarly, but when they reported reasons for their choice, only parents of coeliac children mentioned the price. This is not strange as the price of gluten-free biscuits was two or three times the price of regular biscuits. The high price of gluten-free products (Capacci, Leucci, & Mazzocchi, 2018; Xhakollari, Canavari, & Osman, 2019) has been already reported as one of the main difficulties encountered by coeliac consumers to adhere to a gluten-free diet.

Coeliac children looked at the biscuits package differently to non-coeliac children, with a more goal-driven attention on ingredients and gluten-free words and symbols, and more like their parents than non-coeliac children. They showed to make a more informed or complex decision, which is corroborated when observing laddering plots of coeliac children that showed more attributes and reasons than non-coeliac children.

4.2. Comparing the information provided by eye-tracking and laddering in the purchasing context

As described in the previous section, the relevance of the different elements of packages based on the eye-tracking records were related to the attributes, consequences, or final motivations they elicited in the laddering technique. However, some aspects were only registered by one technique, providing additional information on how these factors influence the decision.

According to eye-tracking records, gluten-free words and symbols were relevant for coeliac children as they observed them more than non-coeliac children, probably to check that the biscuit was suitable for him/her (this is supported by none of the 30 coeliac children chose a regular biscuit). None of these aspects appeared when coeliac children stated the reasons behind their choice. Coeliac children looked at gluten-free indications to select the biscuit but during the interview they did not include this as a reason for the selection. Laddering did not reflect the relevance of being gluten-free as an attribute of choice of coeliac children, probably because they have assimilated that being gluten-free is a condition and it is not an option, so they verbalize the reasons to choose the biscuit among those that are gluten-free and suitable for them (which is reflected in the low attention coeliac children paid to regular biscuits).

The laddering technique reflects the relevance of unknown products for both coeliac children and their parents, and their willingness to try new products. This behaviour can be related to the range of gluten-free products in the market being limited (lower than for regular products) and usually with a poor sensory quality that according to Do Nascimento, Fiates, Dos Anjos, & Teixeira (2014), have two main consequences in coeliac individuals: food choice is restricted and their diets become monotonous. In this study, an additional consequence has been found as coeliac children are more open to try new or unknown products. Recently, Xhakollari, & Canavari (2019) have also described the interest of coeliac adults in trying new gluten-free products. Notably, aspects such as the response to unknown products that are related to past experiences, familiarity to the product, or attitudes of participants are relevant in the decision of consumers but cannot be registered by unconscious techniques such as eye-tracking, and can be only obtained when are self-reported by the participant.

Although it was not the objective of this study, the comparison of eye-tracker and laddering data also gave relevant information about children's behaviour during the experiment (what they looked at and the motivations they reported). In consumer research for children's products, adults were initially used to test their food, however their preference and needs are different, that is why is important to conduct the test with children (Laureati, Cattaneo, Lavelli, Bergamaschi, Riso, & Pagliarini, 2017; Laureati, & Pagliarini, 2018). There is controversy regarding what methods to use and how to adapt them, or if this adaptation is needed. The main argument to use adapted methods is that children do not have the same competences as adults, and for example, their answers are few and short because they cannot express or verbalize their behaviour or ideas when they are complex. In this study, laddering plots for non-coeliac children were much less complex than for the other groups (coeliac children and adults), showing only few attributes and consequences behind the motivations of their choices. The number of fixations of these children during all the purchasing exercises was low. They mainly looked at the salient elements such as *biscuit image*, *product name*, and *cartoon character*, and hardly looked at the other elements. This indicates that the reason for the low complexity in the response of children is not due to a poor capability to verbalize their reasoning, but because they paid attention to only few elements and included fewer factors in their decision of biscuit selection. As also pointed out by Banister & Booth (2005), it is important to allow children to use their vocabulary and expressions in what they term "child-centric" approaches. These authors suggested children can be incredibly keen, able, and useful research participants when encouraged to get involved in the activity in an appropriate context, and an environment away from the influence of parents.

A limitation of this study was the low number of participants, due to the difficulty in recruiting coeliac children. However, it allowed drawing distinctive features in coeliac people behaviour during purchasing. Another limitation is that data were obtained in a simulated laboratory setting that allowed to control experiment conditions, but at the same time, could also lead to not fully reflect the real environment. As an example, supermarket included same number and variety of gluten-free and regular biscuits, that is not what consumers usually find at the supermarket aisle, which could have modified their behaviour. Further studies including more consumers and in a more real purchasing context might provide more representative and ecological results and stronger conclusions about coeliac consumers' behaviour.

5. Conclusions

This study conducted in a supermarket aisle context has shown what captures attention to coeliac children and their parents during the choice of biscuits and their motivations compared to non-coeliac ones.

In the purchasing context, coeliac children exhibit more goal-driven attention than non-coeliac children. They were more focused on the gluten-free information (words and symbols) and the list of ingredients and with a fixation profile closer to their parents. However, when reasoning the motives of their choice, coeliac children did not include being gluten-free but, similarly to non-coeliac children, they mainly

included sensory attributes or ingredients they related to liking and pleasure. Different to the others, coeliac children were interested in the brand of the product and trying new products.

Parents of coeliac children were more concerned with the price of biscuits than those of non-coeliac children, but also differed in the biscuit attributes they associated to healthiness. Those parents of coeliac children looking for healthiness, chose biscuits with a gluten-free certification symbol and a short list of ingredients but they did not mention low fat and sugar content, which were the main concerns of the parents of non-coeliac children.

Combining eye-tracking and laddering techniques has proven to provide different and complementary information about consumer behaviour in a situational activity. It allows to better understand purchasing decisions and which factors affect consumer's decisions unconsciously and consciously.

CRediT authorship contribution statement

P. Puerta: Data curation, Formal analysis, Methodology, Writing – original draft. **L. Laguna:** Formal analysis, Writing – review & editing. **A Tárrega:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Supervision, Writing – review & editing. **E. Carrillo:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft.

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.

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