



## “I don't like wonky carrots”- an exploration of children's perceptions of suboptimal fruits and vegetables



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### ARTICLE INFO

#### Keywords:

Suboptimal produce  
Food appearance  
Children  
Qualitative research  
Food acceptance

### ABSTRACT

Children's perceptions of suboptimal fruits and vegetables have not been studied in the suboptimal foods domain. Using two qualitative research methods, this study investigates children's (N = 97) edibility perceptions of suboptimal produce with varied appearance defects. The results show that unlike adult samples previously studied, children are more accepting of suboptimal produce. Defects in shape, size, and certain colour defects were positively perceived, reflecting retailers' opportunities to market suboptimal produce. High levels of brown discolorations and superficial blemishes were not acceptable, implying that produce with such defects could be repurposed as ingredients in foods prepared and sold in-store. These implications reflect retailers' opportunities in marketing suboptimal produce to children, who by their familial influence may also be able to get families to buy and consume suboptimal produce. The importance of familiarity in improving suboptimal food acceptance is also recognised for future research to explore.

### 1. Introduction

Modern food consumption is arguably unsustainable because food production is resource intensive (Foley et al., 2005), and 30–50% of all food grown is wasted (Gustavsson et al., 2011, Institution of Mechanical Engineers, 2013). A major cause of food waste is food rejection due to outdated labels, defective packaging and consumers' misperceptions of food edibility because of non-standard appearance. Aschemann-Witzel et al. (2015) named foods which consumers reject or discard as suboptimal foods and define suboptimal produce as fresh fruits and vegetables that “consumers perceive as relatively undesirable as compared to otherwise similar [produce] because they ... deviate (visually or in other sensory perception) from what is regarded as optimal (usually equal to what is perceived as “normal”)” (Aschemann-Witzel et al., 2015, pp. 6458–6459). Appearance cues assist in forming expectations about the edibility of food (Steenkamp, 1990) and are particularly pertinent in determining choice and quality inferences regarding fresh produce (Olson, 1978) because fresh produce is typically sold loose or in clear packaging (Deng and Srinivasan, 2013), and often lacks date labels. Hence, physical appearance becomes an important determinant of fruit and vegetable choice (Cardello, 1994).

Consumer perception of suboptimal fruits and vegetables as inedible or undesirable is estimated to generate an avoidable waste of 45%

(FAO, 2017). Resultantly, researchers have examined how best to increase consumer purchase and consumption of suboptimal foods by drawing strategies from consumer research, such as drawing attention towards suboptimal products (Helmert et al., 2017), familiarising customers with suboptimal foods in-store (Aschemann-Witzel, 2018a) and at home (Symmank et al., 2018), and nudging consumers through price discounts and communication/positioning strategies (Aschemann-Witzel, 2018b; Louis and Lombart, 2018; Rohm et al., 2017, Van Giesen and De Hooge, 2019).

In response to increasing public concern regarding food waste, retailers have initiated selling suboptimal produce in-store (Aschemann-Witzel et al., 2016b, 2018; Louis and Lombart, 2018). Retailer campaigns marketing suboptimal produce often emotionalise them as the ‘loveable underdogs’ that are too good to be wasted (Aschemann-Witzel et al., 2017, 2018), thereby evoking sympathy and liking for suboptimal produce (Ketron and Naletelich, 2019). The campaigns include animated visuals, imagery, and catchy slogans aimed at educating consumers about food waste, whilst encouraging more end-users of suboptimal produce (Aschemann-Witzel, 2018a; Aschemann-Witzel et al., 2016b; Louis and Lombart, 2018). Given that children are strong influencers in socialising their families to adopt sustainable lifestyles (Grønhoj, 2016; Watne and Brennan, 2011), the marketing of suboptimal fruits and vegetables as “fun foods” raises the question of

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<https://doi.org/10.1016/j.jretconser.2019.101945>

Received 16 December 2018; Received in revised form 24 July 2019; Accepted 5 September 2019

Available online 17 September 2019

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whether suboptimal fruits and vegetables could appeal to children, and whether this could influence families to buy, and consume, suboptimal produce. Research has shown how adults perceive appearance cues of suboptimal foods, however, this paper is the first to explore how children use appearance cues to judge the edibility of suboptimal produce; thus providing practical insight into how retailers could market suboptimal produce to children. This, in turn, could influence families to purchase and consume suboptimal produce, potentially reducing food waste.

### 1.1. Consumer perceptions of appearance cues in suboptimal fruits and vegetables

Although appearance standards do not officially exist for fresh fruits and vegetables (since 2009), cosmetic standards continue to be widely practiced by retailers (Gustavsson et al., 2011). Atypical appearances in suboptimal fruits and vegetables include shape, size, and colour defects, and the presence of blemishes or a general non-standard unfamiliar appearance (Gustavsson et al., 2011; Stuart, 2009). As food appearance is pivotal in the acceptance of fresh fruits and vegetables, deviations in appearance may imply poor quality (Cardello, 1994).

Research demonstrates that adults find blemishes or bruises in fresh produce unacceptable (Bunn et al., 1990; Jaeger et al., 2016; De Hooge et al., 2017; Yue et al., 2007, 2009) because they make the produce less tasty and safe (De Hooge et al., 2017). Low value for money or the inconvenience of eating blemished produce are strong barriers that inhibit consumption of blemished produce (Jaeger et al., 2018). Hence, Jaeger et al. (2016) note that while price discounts could be used to sell blemished produce, the condition of the produce at the point of consumption is important to prevent waste as blemishes entail the perceived risk of contamination (Aschemann-Witzel, 2018a, De Hooge et al., 2017). Likewise, children perceive contamination as undesirable and disgusting (Fallon et al., 1984), hence we hypothesize that like adults, children too will be unwilling to accept blemished produce.

Whilst moderate shape defects are accepted (De Hooge et al., 2017; Loebnitz et al., 2015), extreme shape abnormality is still perceived as unacceptable (Loebnitz and Grunert, 2015; Loebnitz et al., 2015). Helmert et al. (2017) and Van Giesen and De Hooge (2019) suggest providing price discounts in combination with product positioning strategies to further the acceptance of misshaped produce. Unlike adults, children might be more accepting of extreme shape abnormalities. Research has shown children's fruit and vegetable consumption increases when they are cut into "cute", unusual, but fun shapes (Branen et al., 2002; Olsen et al., 2012).

Colour is another appearance cue that affects taste perceptions (Koch and Koch, 2003). Consumers prefer foods with greater chromatic vibrancy, perceiving them to taste fresher (Lee et al., 2013). Consumers specifically find any degree of browning unacceptable (Schifferstein et al., 2018). While adults show scepticism towards unfamiliar colours in foods (Leksrisompong et al., 2012; Paakki et al., 2016), children have shown liking for familiar foods with atypical colours (Dovey et al., 2012), or foods that are their favourite colours (De Moura, 2007). Thus, children may prefer fruits and vegetables with atypical colours.

Size, as an appearance cue, has received less attention in the suboptimal produce context. Research finds consumers typically prefer average or regular-sized produce as opposed to very small or very large-sized produce (Jaeger et al., 2011). Hence why size standards are imposed by many supermarkets (Mena et al., 2011; White et al., 2011). For children, obesity research shows they typically prefer smaller portions of fruit and vegetables on the plate (Colapinto et al., 2007) and regular to small-sized whole fruits and vegetables (Olsen et al., 2012), and are more likely to eat fruit and vegetables when they are cut into smaller pieces (Kirby et al., 1995). Therefore, we can assume that children are likely to prefer small-to-regular sized produce over very large ones.

Of all the stakeholders in the food supply chain, supermarket

retailers in particular play a significant role in influencing consumer decisions through marketing mix elements (Halloran et al., 2014). Thus retailers have the opportunity to influence consumer decisions to buy and consume foods that may otherwise be wasted.

### 1.2. Suboptimal foods in supermarkets

With increasing societal interest in saving suboptimal produce, retailers have come under scrutiny for imposing cosmetic standards. Supermarkets around the world have implemented initiatives to sell suboptimal fruits and vegetables, in an effort to curb their waste and familiarise consumers with produce that deviate from the norm (Aschemann-Witzel, 2018a; Aschemann-Witzel et al., 2017; Clayton and Carnegie, 2017; Louis and Lombart, 2018; Mortimer, 2015). Examples include the French retailer Intermarché's *Inglorious fruits and vegetables* and American retailer Whole Foods' *Misfit fruits and vegetables*. These initiatives involve selling non-standardised produce that would otherwise be wasted at discounted prices with eye-catching imagery and slogans. Interestingly, these initiatives were well received by the public and also started a *buzz* around food waste, furthering consumer awareness and commitment to stamp out food waste (Louis and Lombart, 2018). Creative campaigns, such as Intermarché's initiative naming suboptimal produce such as the "grotesque apple" or the "ridiculous potato", have led to increased footfalls and stocks selling out (Intermarché, 2014). Likewise, in Australia and New Zealand, Woolworths offered the "Odd bunch" to fight food waste and also support local growers (Love Food Hate Waste New Zealand, 2017; Turner, 2014). Thus we find that retailer involvement has created an opportunity for changing consumer perceptions of suboptimal foods.

### 1.3. Retailers and children

Research has recognised children as the future generation of sustainable consumers who successfully influence their families to adopt sustainable lifestyles (Grønhoj, 2016; Stuhmcke, 2012). Children are highly involved in family grocery trips and play a significant role in family food decisions in-store and subsequently family consumer behaviour (Bertol et al., 2017; Marshall, 2014). Likewise, supermarkets provide the atmospherics for children to actively engage with the products and promotional strategies available in store (Ayadi and Cao, 2016), thereby serving as an agent of consumer socialisation (John, 1999). Fitting the supermarket services and store layout for families with children has become imperative for retailers to retain them as grocery shoppers (Page et al., 2018). Therefore, the combination of children's participation in grocery shopping and retailer efforts to sell suboptimal foods in-store and inform consumers about the food waste problem leaves scope for retailers to actively engage this young market. In fact, we are increasingly seeing visuals, imagery, slogans, and animated graphics for suboptimal produce which could appeal to children. For example, when the "odd bunch" was launched in New Zealand in 2017, children reported that the wonky produce would be "more fun to eat" than regular ones (Clayton and Carnegie, 2017). Food waste activist, Jordan Figueiredo, reports that children from all around the world are more responsive, actively engaged, find humour in, and sympathise with, suboptimal produce, which has led to the campaign "Kids Love Ugly Fruit" (Figueiredo, n.d.). Further, research suggests that owing to less stable food appearance preferences, children are more likely to prefer abnormal or atypical, over normal or typical (Poelman and Delahunty, 2011). These reports reflect the untapped potential of this consumer cohort for retailers trying to encourage the consumption of suboptimal produce.

Therefore, contrary to adults who have expressed negative attitudes towards suboptimal foods and need to be incentivised to accept suboptimal produce (Aschemann-Witzel et al., 2016a, 2017; De Hooge et al., 2017; Graham-Rowe et al., 2014; Jaeger et al., 2018; Watson and Meah, 2013), children could be more accepting of suboptimal produce.

However, research to date has not studied how this consumer segment perceives suboptimal fruits and vegetables, a question addressed by the current study. Specifically, this paper reports on the appearance cues children use to determine the acceptability of suboptimal fruits and vegetables, and how such cues are used to make both positive and negative inferences about the edibility of suboptimal produce. The implications of these findings shed light on how retailers and food marketers can direct suboptimal food waste avoidance initiatives to children, in the hope of indirectly getting families to consume suboptimal produce and change edibility perceptions.

## 2. Materials and methods

### 2.1. Study design

This study involved an observational shopping activity and focus group discussions. Qualitative methodologies provide authentic and detailed information when obtaining data from children (Darbyshire et al., 2005), and using multiple methods provides complementary insights to understand a phenomenon from a range of perspectives (Darbyshire et al., 2005; Lucchini, 1996; Morrow, 2001). The purpose of the shopping activity was to observe how children make choices between suboptimal and optimal produce and the arguments they construct to justify their preferences, while also getting them to talk about the appearance of the produce as they made their choices. Observational studies are considered 'well-suited' for capturing realistic and actual behaviours (Rust, 1993) and have previously been used to observe children's shopping behaviour (Atkin, 1978; Gaumer and Arnone, 2009). The focus group interviews were used to explore children's attitudes towards, and their perceptions of suboptimal produce in greater depth. Focus group discussions are a popular technique for collecting data from children; they enable the researcher to explore children's experiences, knowledge and perceptions in a manner that makes the child participants feel comfortable when sharing their consumption stories (Gibson, 2007, 2012; Heary and Hennessy, 2002, 2006; Kennedy et al., 2001). The study had ethical approval from the University of Otago, and both parents and children gave their written and informed consent.

### 2.2. Participants

Participants included 97 children aged between 5 and 11 years, recruited through a large (enrolment approximately 500) co-educational, central, state school, and with a socio-demographic distribution parallel to the New Zealand population. To reduce selection bias, the teachers distributed information and consent forms to 170 children and 102 were returned (60% acceptance rate), although 5 children were absent from school during data collection. To enable a socio-demographic description of the sample, parents provided age, gender, and ethnicity information of their child [Table 1]. The dominance of the European ethnic group over the other ethnic groups is representative of the NZ population, hence we did not find that this affected the nature of the responses obtained from the study.

### 2.3. Stimuli

The shopping activity combined children's shopping scripts (Drenten et al., 2008) and choice experiments, used in most suboptimal food waste research (e.g., De Hooge et al., 2017). However, unlike past research where the degree and type of suboptimality was controlled using pictures (e.g. De Hooge et al. (2017), Jaeger et al. (2016); Loebnitz et al. (2015) etc.), we used real produce where the degree and type of suboptimality was not controlled. This allowed a real-life perspective of children's perceptions through their 'live' reactions. The stimuli used in the observation shopping activity were adapted from Drenten et al. (2008) and included four types of fruits (apples, pears,

**Table 1**

Socio-demographic characteristics of the participant.

Sample properties (N = 97)	Frequency (n)	Percentage (%)
<b>Gender</b>		
Boys	46	47.4
Girls	51	52.6
<b>Age</b>		
5	3	3.1
6	10	10.3
7	19	19.6
8	22	22.7
9	18	18.6
10	18	18.6
11	7	7.2
<b>Ethnicity</b>		
European	70	72.2
Māori	2	2.1
Asian	4	4.1
European & Māori	6	6.2
European & Asian	5	5.2
European, Māori & Pacific Peoples	1	1
Māori & Pacific Peoples	2	2.1
MELAA	1	1
Others	3	3.1
Not stated	3	3.1

oranges, and lemons) and four types of vegetables (carrots, capsicums, tomatoes,<sup>1</sup> and potatoes) that varied in appearance (optimal versus suboptimal). The produce was selected based on the seasonal varieties available in New Zealand. Non-seasonal produce was not used as it could affect the level of sub-optimality. The produce was procured from a local green grocer who determined the (sub)optimality, similar to past research (Symmank et al., 2018). To keep track of children's choices (optimal vs sub optimal), stickers with even or odd numbers were attached to the produce to indicate optimality. The children were provided with a shopping basket and shopping list to carry out the shopping activity. Each shopping list contained the name and quantity of the fruit and vegetable to be chosen.

Researchers recommend using stimuli when conducting focus groups with children to keep their attention and to help them express their thoughts (Krueger and Casey, 2009; Stewart and Shamdasani, 1990). The stimuli used for the group discussion included a suboptimal and optimal carrot and apple. These stimuli were used to initiate the discussions using one open question, "which of these would you choose and why?" Using a real carrot and apple that varied in optimality helped anchor children's discussion of their attitudes and perceptions of edibility based on appearance.

### 2.4. Procedure

The study was piloted prior to data collection to refine the procedure. The pilot revealed that it was important to ask children questions at the point of their decision making during the shopping task. For the focus group discussions, replacing words such as 'opinions' with 'thoughts' helped children understand the questions better.

The participants were allotted into 1-h sessions according to their age (Table 2). Based on a random draw of shopping lists, the shopping activity required children to choose two quantities of a fruit and two quantities of a vegetable from a large assortment of the aforementioned produce displayed on a table. Field notes were taken on the way children made their choices (e.g. swapping, commenting, and/or careful inspection of the produce) and the participants were questioned about their behaviour while they made their choice (e.g., "What type of

<sup>1</sup> Botanically tomato is a fruit. Legally, however, it is classified as a vegetable because consumers use them in savoury foods (Nix v. Hedden 149 (U.S. Supreme Court 1893)).

**Table 2**  
Age groups used for data collection.

Age group	Total	Number of focus groups	Number of children in each focus group	Duration (minutes)
5–6 year olds	13	2	7, 6	21, 23
7 year olds	19	2	9, 10	25, 24
8 year olds	22	2	11, 11	25, 26
9 year olds	18	2	9, 9	30, 29
10–11 year olds	25	3	9, 8, 8	36, 35, 35

apples are you looking for?”). The shopping activity lasted for approximately 10–15 min for every age group.

The focus group discussions followed the shopping activity. Each age group was divided to form a manageable number of focus group members comprising 6 to 11 children (Table 2), similar to past research with children (Bertol et al., 2017). The group discussion rules were explained, alongside additional information about the anonymity, confidentiality, recording of the session, and that there were no right or wrong answers. The focus group discussions were based on a pre-determined question protocol and were conducted by trained facilitators. Strategies were employed to include all participants, for instance, asking groups with dominant participants to raise their hands before answering and specifically asking quieter children questions directly. The group discussions were prompted by showing an optimal [A] and a suboptimal [B] carrot or apple and asking the participants to choose one. For example, “I’ve got two apples. This is Apple A and this is Apple B. Let us imagine that you can have one of them, which one would you pick?” upon providing an answer, the children were probed further to explain their choice. For example, “Why not B?” and “Why do you think that A is riper and fresher?” The discussions lasted approximately 25–35 min (see Table 2). The data collection took place on the school premises, the environment was familiar, which contributed towards children feeling at ease at the time of data collection (Gibson, 2007, 2012; Krueger and Casey, 2009).

2.5. Coding

The qualitative data obtained comprised field notes, video and audio transcripts. This data was transcribed verbatim, and content analysis was used to inductively code responses into an exhaustive list of sub-themes, which were then merged into meaningful themes (Braun and Clarke, 2006; Elo and Kyngäs, 2008). All four authors reviewed the data to ensure consistency across the themes. The themes identified were based on the appearance cues children used to perceive the edibility attributes and the acceptability of suboptimal fruits and vegetables. The justifications provided to explain why one type of produce was preferred over another type revealed the edibility attributes inferred from the appearance cues. Preferences for, or against, the suboptimal varieties were used to classify the appearance cues into either positive (acceptable) or negative (not acceptable) perceptions. A similar approach of using choice based preferences for determining either positive or negative attitudes has been used in earlier studies on suboptimal foods (De Hooge et al., 2017; Yue et al., 2009). In total, four themes were identified as perceptions of the appearance cues (see Table 3 theme definitions).

3. Results

With the aim to provide a holistic account of how children perceive the appearance of suboptimal produce, the results compile the findings from both studies and present it as themes. The appearance cues are discussed in terms of how they were used in judging the produce - to either **accept** or **reject** the suboptimal produce. Thus reflecting either positive or negative attitudes based on the presence of the cue, and the

**Table 3**  
Table of themes.

Overarching theme	Theme	Definition	Example	
			Positive	Negative
Appearance cues	Shape	Shape perceptions include the acceptance or rejection of misshaped produce along with shape personifications to justify the reasons for the acceptance or rejection.	“I like how it is twisted”	“I don’t like it cause it’s got a weird shape”
	Colour	Colour perceptions include the perceptions of the colour saturation, discolorations and bi-colourations used to infer edibility perceptions of the suboptimal produce.	“This I’ll take cause it is orange-er”	“I don’t like that because it is all brown”
	Blemishes	Blemishes include the presence of superficial marks, scars and bruises on the outer surface of the suboptimal produce.	“... it just means that it’s scraped. I’d still eat the whole thing”	“I’m looking for one orange that doesn’t have so much dots on it.”
	Size	Size perceptions include the acceptance or rejection of suboptimal produce that are either too large or too small, or simply deviate from the average or moderate size.	“I went for big ones because I really like potatoes.”	“It’s a bit too small”

edibility perceptions which were inferred from the appearance cues.

### 3.1. Shape perceptions

Shape was the most frequently mentioned appearance cue for the suboptimal produce. Personal liking or preference for the produce in general, or specifically liking the shape defect, influenced children's suboptimal choice. During the focus group discussions, Nate (8) said, "I like it, I like how it's bent because I like all sorts of carrots". Annie (6), who chose a suboptimal carrot during the shopping activity, pointed to the misshaped end of the carrot and said, "I like that bit coming out of the bottom". Shape defects imparted a unique appearance which led children to prefer suboptimal over optimal. For example, in the 10–11 year old group discussions, one of the girls said, "I like the ugly one (carrot)" and another girl added, "It's different, it's different and it's twisted".

Misshaped produce were perceived to resemble inanimate objects and even personified to have human-like characteristics. Such perceptions sparked interest in the misshaped produce. During the shopping activity, a child in the 5–6 year old group chose a suboptimal pear as she found the shape to resemble a phone, "It's a phone! A mini phone!" Personifying misshaped produce into fun characters also led to positive taste inferences. For example, while shopping for pears, Minnie (6) personified the shape of a suboptimal pear to look like an alien, "It's an alien! It's yummy!" During the group discussions, children used these personifications to share their past experiences with buying and eating misshaped produce, implying liking for misshaped produce. Isabel (9) exclaimed, "I buy 'carrot people'! Once mum got this one that really-really looked like a person! (Laughs)". Selena (6) recalled, "My pop had a carrot and they were two carrots stuck together like they were friends". These experiences were used to derive positive taste perceptions. For example, some children felt that the taste would not be significantly different, as Isabel (9) stated, "I would [eat it] ... It won't taste terrible. I-I tell you I have done that!" Likewise, Stan (6) explained, "I-I ate pears before, but I'm not sure if I've eaten a pear like that. But I know it will still taste the same because all pears in New Zealand will be the same because it doesn't matter if it's being turned [shape defect], it will still be yummy".

Some children mentioned the shape defect to justify their rejection of misshaped produce. Personal liking for fruits and vegetables to adhere to the normal/typical shape reflected children's dislike for misshaped produce. During the shopping activity, Olly (8) swapped a suboptimal carrot for an optimal one because he wanted a straight carrot, "Yeah like straight ones", then showing another misshaped suboptimal carrot he said, "This one I'll definitely not take". He explained this later during the group discussion, "Well I like every carrot, but-um I need to say that the B [suboptimal] one is quite bad because it's bent and I like straight carrots." [I: How come you like straight carrots better?] "Easy to eat!" Similarly, during the group discussions Tina (9) shared that she would not choose the suboptimal carrot because, "Carrot B is wonky. I don't like wonky carrots because they are a different shape." [I: What don't you like about the different shape?] "Uh ... Cause I'm very organised".

A few children perceived shape defects to negatively affect taste, "I would eat [carrot] A, because A looks more yummy, and B would be, uh maybe, B is a little bit off-tasting", said Ava (10) during the group discussions. Connotations of disgust was used to describe these negative taste perceptions: While shopping, two boys in the 5–6 year old group discussed why they would not choose a misshaped orange, "This is a bum (Laughs)! The skin would taste like a bum ... It will still taste like a bum [on the inside]". Shape defects were also used to infer safety. For example, during the shopping activity Adam (9) said when swapping a suboptimal orange for an optimal one, "There is a big crease so it might be bruised on the inside ... It's got that [the shape defect] there so it's not going to be okay".

Some children confessed that although the shape had little to do with the edibility of the produce, they would still reject it. For instance, Tom (11) shared with the focus group that he did not find the suboptimal carrot less nutritious, yet he rejected it, "I would choose A. Well,

they both look healthy, but B looks different, it's twisted, but there's no difference in the healthiness". Likewise, some children agreed during the group discussion that choosing misshaped produce is an irrational thing to do, "It looks pretty disgusting because of the bent (shape defect). I think if I could choose a disgusting looking one and a very smart one, I would probably choose a smart one. It's like you have a Christmas present, which would you choose ..." (Boy, 7).

### 3.2. Colour perceptions

The acceptance of suboptimal fruits and vegetables was linked with underlying positive colour perceptions. When shown an apple with green and yellow patches during the group discussions, the seven year olds relied on their past experiences that have shaped their preference for sour-tasting apples: "They're really good, I like those", "I'd buy all of them, yum!" and "It's sour, yes sour ... It's good I want to eat it". Previous taste experiences led children to confirm that colour deviations do not affect taste. For example, Betty (8) said, "I would choose either one cause to me every apple tastes the same" and Katie (8) clarified "I would eat both of them cause this one, it just looks different but tastes the same".

Colour saturation and vibrancy of the produce was used to determine choice. During the group discussions, Teddy (6) compared the colour of the optimal carrot with that of the suboptimal carrot to justify his preference for the optimal carrot, "I would pick number A. It's more orange-er because that one [B] has got a little brown in it". Similarly, in another focus group, a girl (9) stated, "It (the suboptimal apple) doesn't look as appealing like the other (optimal) apple. It doesn't look as bright". When a fruit or vegetable did not have the most appropriate colour or pigment, it was perceived as not good enough. This was observed for produce which were bi-coloured. For example, Carl (8) commented on the colour "green" on several suboptimal produce while choosing produce to infer them as "bad". For example, he told his friends while shopping, "Peppers, I know the difference that's green and bad (pointing to a predominantly yellow suboptimal capsicum). And the green here (showing a suboptimal tomato) is bad, means it's not fully grown yet and it has lots of green. That-that's green and that's got all the nasty bites in it." Sage (9) compared the colour of apples to explain why she chose the most optimal (red) apple during the shopping task, "Because it's quite red than the other [suboptimal apple] cause the other is quite green". When these discolourations leaned towards brown, most children reacted negatively, and inferred negative taste and safety perceptions which affected final choice, "Because it's all brown it won't taste that good" said Minnie (6) as she returned a suboptimal orange while shopping. Rob (5) picked up the same orange and said "It's got brown, lots of brown because it's mouldy" and put it back on the table.

### 3.3. Blemish perceptions

Blemishes on suboptimal produce were largely perceived negatively. An instinctive dislike for fresh produce with blemishes made it easier to reject blemished produce. For example, during the group discussions Gabby (10) said she wouldn't choose the suboptimal carrot because, "there's little marks and it's a little scarred". During the shopping activity, Ken (7) mentioned, "I'm looking for one orange that doesn't have so much dots on it. For me I don't really like one's with dots" and Wren (9) said, "These all (carrots) have cracks in them ... probably I'm going to get ones without them". The presence of blemishes affected taste perceptions, which in turn determined choice: "Cause I don't like it when fruits have like those big bruises cause it means that they don't taste very good", explained Becky (7) while she chose the produce on her shopping list.

Suboptimal produce with blemishes were described as "ugly" and "disgusting" during the focus group discussions. For example, Tom (11) compared a suboptimal carrot with an optimal one, "One is really-really ugly because it has brown things on it, and it's got scars on it. And the other one's pretty" and Pete (10) supported Tom's opinion, "I also think it is ugly because it looks really old and dirty cause it's got all those spots in it. And

then, the A looks like a normal fresh carrot". Similarly, Steffi (7) said she would not choose a bruised apple, "Because it doesn't look very appetizing".

Children also inferred the freshness of the suboptimal produce from the presence of blemishes. For example, during the shopping activity, Sean (8) said that he was "looking for ripe one's ... (picks up a suboptimal orange) No this is not ripe cause it's got marks on the skin". Many participants conveyed concerns about the safety of consuming suboptimal produce due to the presence of blemishes during the group discussions. For example, Ken (7) perceived a health risk from eating a slightly bruised apple, "... and you might get sick ... Yeah cause it might have bugs in it". Similarly, Sage (9) did not choose a suboptimal orange because she was certain that the blemishes made the orange unsafe to eat, "Not exactly cause this one has (points out to a marks on the outside) ... I can see that it's quite rotten on the inside". The word "dirt" was also used to infer contamination or risk to food safety, "There could be dirt or things like that. It's just on the outside but you don't know what's gross on the inside. So, I probably wouldn't eat it" (Sarah, 11). Similarly, Aron (8) suspected the safety of consuming a blemished carrot, "Because it's quite damaged and bacteria can get it".

Children accepted blemished produce when they were regarded as the "loveable underdogs". For example, during the focus group discussions a group of girls in the 10–11 year group insisted against the other group members that the suboptimal carrot was not ugly. One of them, Nadine (10), perceived the blemishes to add to its aesthetic appeal, "B is pretty ... No B is cute! B is pretty! It's pretty because it looks cute [because] it has scars on it". Blemished produce was also accepted when the marks/bruises were perceived to not affect the edibility of the produce. During the group discussions a child in the 5–6 year old group evaluated the freshness of a suboptimal orange to counter argue: "Wait! I would still eat it because that doesn't mean that it's old, it just means that it's scraped. I'd still eat the whole thing". The past experience of eating blemished produce helped children confirm that even the presence of blemishes will not affect the taste of the produce, Boy (9) stressed during the group discussions: "... its food so why wouldn't I eat it ... why would it taste different? It's just a carrot with marks on it". Similarly, Bella (8) explained during the discussions, "It doesn't really matter, it's only the outside [of a blemished carrot] that's damaged".

### 3.4. Size perceptions

References to size were made only during the shopping activity. Suboptimal sizes were considered acceptable depending on individual size preferences. For example, Jade (5) preferred smaller (suboptimal) pears, "I am looking for small pears, this (basket) is heavy". Field notes from the observational study show that Hailey (8) used size as a parameter to choose the produce on her shopping list, irrespective of the other appearance cues: Hailey has to pick two potatoes and two lemons. She finds the potatoes, chooses one and says "big". She chooses another one and says "big". She then looks at the lemons and says "big" choosing the largest two of the lot. Hailey chose all suboptimal produce. The participants also preferred large sized produce especially when a fruit or vegetable was a personal favourite. Nate (8) explained why he chose very large suboptimal potatoes, "I got two big ones because I really like potatoes".

With regards to negative size perceptions, small sized produce were considered the obvious rejects. For instance, Carl (8) compared the size of the two apples, "... and (the suboptimal apple) it's smaller than that (the optimal) one" to explain why he preferred the optimal one and inferred that the smaller ones are less nutritious than larger ones, "It is small, doesn't give you much protein but that, that's bulgy and rich". Another Girl (8) explained why she swapped a small suboptimal carrot for a larger optimal one during the shopping task, "Well, it's a bit small, so it won't last me more".

## 4. Discussion

The results show that children use appearance cues, namely defects in shape, size, blemishes, and colour, to infer the edibility and acceptability of suboptimal produce. More importantly, the findings reveal that although children largely reject produce that is blemished or brown, children are accepting of suboptimal produce that is misshapen or an atypical colour (other than brown). Furthermore, experience with consuming suboptimal produce was found to be a strong driver of acceptance and favourable taste perceptions of suboptimal produce. This is the first empirical study to show how children perceive suboptimal produce and the findings highlight opportunities for retailers to market suboptimal produce based on different appearance defects, a method recommended by past research (De Hooge et al., 2017).

Out of all the appearance cues, children were most tolerant of shape defects and least tolerant of blemishes, aligning with past research with adults who were found to be more willing to buy, and demanded the lowest discount for, a bent cucumber as opposed to a blemished apple (De Hooge et al., 2017). However, unlike adult samples (Loebnitz and Grunert, 2015; Loebnitz et al., 2015), most children instinctively used the extreme shape defects to personify misshaped produce into "fun" shapes and objects (e.g., "alien", "phone"), to derive positive taste perceptions and express their preference for misshaped produce. This finding aligns with past research showing children's vegetable consumption increases when cut into fun shapes (Olsen et al., 2012; Branen et al., 2002). The finding that children generally perceive misshaped produce as appealing and tasty, provides retailers with the opportunity to market such produce to children. Marketing misshaped produce as "different" confers an attribute of uniqueness, which adds value to the produce by giving them a personality, and allows consumers to sympathise with them as the "loveable underdogs" (Aschemann-Witzel et al., 2016b), thereby encouraging the purchase of suboptimal produce (Ketron and Naletelich, 2019). The *Imperfect Picks* is one such project that uses cartoon characters to encourage children to try suboptimal fruits and vegetables (Youth AgSummit, 2017). Retailers could do the same by using friendly cartoons of suboptimal produce to appeal to children along with marketing them as the "misfits" and 'rebels' (Louis and Lombart, 2018).

Size preferences for produce was a matter of personal preferences. Some children always chose large sized produce because it was considered a rational or normal thing to do, which could stem from how they have been normalised to choose produce in store (Pettersson et al., 2004). While some children in the youngest age group (5–6-year olds) preferred small sized produce, the older children perceived them to be of less value. This finding is opposite to our expectation that children would prefer smaller sized produce as fruits and vegetables are less preferred foods (Colapinto et al., 2007). Typically, consumers prefer larger portion sizes (Vermeer et al., 2010) because of the greater value obtained for the price paid. Given that the underlying principal of choice likelihood is value perception (Zeithaml, 1988), retailers could sell larger-sized suboptimal produce as they are likely to be perceived to have better price value. Further, retailers could also sell small-sized produce as pre-bagged varieties to younger children who have smaller appetites (Bruhn, 1995). Therefore, retailers have the opportunity to appeal differently sized suboptimal produce to different young consumer cohorts.

In support of our assumption, blemishes were the least tolerated appearance cue by most children as they were perceived to affect the freshness and safety of the produce. Likewise, previous literature supports that adults too perceive blemished fruit as unsafe to consume (De Hooge et al., 2017) and that improving value perception is imperative to increase its choice likelihood (Jaeger et al., 2016; Yue et al., 2007, 2009). Of importance, children who have been exposed to, or have eaten blemished produce, were less fussy about cosmetic blemishes and perceived that blemishes do not affect the taste. As food waste is the outcome of food devaluation and exaggerated safety concerns (Graham-

Rowe et al., 2014; Watson and Meah, 2013), and given that some children who have had the experience of eating blemished produce perceived them positively goes to show that food experiences (such as eating blemished fruit) are valuable for demystifying food misperceptions. However, only a few children perceived blemishes to add to the aesthetic appeal of fresh produce. Thus, we posit that marketing blemished produce could be challenging for retailers and an alternative approach would be to repurpose them as ingredients in dishes (such as baked goods, smoothies, and salads) sold in-store (Havercamp, 2015).

Children used the chromatic brightness of the produce to determine choice, an appearance cue which is similarly used by adults (Lee et al., 2013). Discoloured/bi-coloured produce were perceived to taste sour, which some children liked (while others disliked) and likewise lead to its acceptance (or rejection), respectively. This finding partly supports our assumption that children would prefer fresh produce with atypical colours. We found that children who had experienced eating atypical coloured produce, or sour tasting fruits, were more likely to appreciate the perceived sour taste. Research finds repeated exposure to sour tasting fruits develops children's liking for sour flavours (Daniel, 2016). Therefore, increasing children's familiarity with discoloured produce could potentially improve taste perceptions. However, the presence of the colour "brown" and in some cases the colour "green" deemed produce as unacceptable regardless of experience. Thus, alongside previous research we found children have less stable colour preferences for fresh produce (Poelman and Delahunty, 2011) and retailers could therefore market discoloured (with the exception of green or brown discolorations) produce to children. The commercial success of selling discoloured produce as is would take long-term reformative policies that change consumer perceptions about atypically coloured produce (Schifferstein et al., 2018), in the meantime retailers would benefit from repurposing suboptimal produce with predominantly "brown" and "green" discolorations as ingredients in pre-prepared meals.

The limitations of this study are recognised. The data was collected from a single school. Owing to the sampling procedure, the number of children in the age groups were unequal, which posed as a disadvantage for comparing the findings. Additionally, the shopping activity set-up was relatively unnatural compared to the real in-store environment in an actual supermarket – it is therefore likely that other factors, such as store atmospherics, price, and parental/caregiver influence, may also affect final choice in the real world. Future research, could carry out more realistic observations of families with children choosing produce in-store. Although past research notes consumer perceptions of suboptimal produce to socio-demographically differ (Rohm et al., 2017; Stuart, 2009), no such differences were observed for the study which stands as a limitation. However, it would be worthwhile for future research to explore such socio-demographic differences in young consumers' perceptions of suboptimal produce. Another potential limitation is that the data was self-reported from children. However, we also recognise that studying consumer behaviour through the eyes of children provides honest and valuable insights into consumer decision-making processes (Gelman and Echelbarger, 2019), given that children are induced into consumerism from an early age (Buckingham, 2007). While the study has recognised the advantages of having children who are of the same age range and within the same grade, it could also pose as a disadvantage because the possibility of children replicating or agreeing to answers by their peers to maintain a favourable image of themselves post data collection remains. Future research could build on this research by conducting a much larger study across a wider age range to study the factors that lead to the socialisation of appearance-based preferences for fresh fruits and vegetables. The discussion around the sociological influences that train consumers to form appearance preferences should be further studied to understand the most effective ways to normalise consumers from a young age to be more accepting of suboptimal fruits and vegetables, which in the long run could address the problem of suboptimal fruit and vegetable waste. Future research could potentially explore these food socialisations, particularly with

regards to the effects of suboptimal food exposure and increased food involvement. It is also recommended that research using more rigorous quantitative and/or experimental methods should be used to study children's suboptimal food perceptions to validate our findings.

## 5. Implications

Broader research implications are recognised. Although children were accepting of atypical shapes, sizes and colours, most produce with blemishes, or the colour "brown", or in some cases "green", were perceived as "dirty", "bad", "disgusting", or "ugly", resonating with Douglas' sociological philosophy on the classification of clean or pure and dirty or danger (Cappellini, 2009; Blichfeldt et al., 2015). Douglas' (2003) societal classification of clean and dirty can be applied to the suboptimal food waste context where produce that do not fit with the optimal/typical appearance are deemed "dirty", "bad", "disgusting" and "ugly", need to be removed or in this case rejected, because the unfamiliar appearance renders the food unsafe or contaminated. The intolerance of natural defects in fruits and vegetables has little to do with the quality and edibility of the food (Stuart, 2009). However, given that the social world uses the classification of dirty and clean (Douglas, 2003), sensitivity to appearance defects in fresh produce could originate from this sociological impact on the expectation of perfect-looking produce, which if not met, entails perceptions of inedibility, contamination, and distaste, and ultimately leads to the rejection of edible imperfect produce. In support, research finds that safety concerns about consuming foods with superficial packaging damages increases the rejection of foods in supermarkets (White et al., 2016), and children too consider food inedible and non-food when a question of contamination and distaste arises (Fallon et al., 1984). This rejection could also emerge from consumers' "beauty is good" bias, wherein consumers perceive aesthetically appealing familiar foods to taste good (Wansink and Payne, 2010). For some children in this study, an atypical appearance alone sufficed for the rejection of the suboptimal produce irrespective of positive edibility perceptions, thus reflecting the indoctrination of the "beauty is good" bias or, in this case, the "normal is acceptable" heuristic when making choices. It is therefore imperative to inform and reassure consumers that appearance defects in fresh produce have little to do with the safety and edibility of suboptimal produce.

Providing information about the safety and edibility of suboptimal produce has been found to significantly improve consumer acceptance (Bunn et al., 1990; Yue et al., 2009). For example, the New Zealand supermarket Countdown sells "The odd bunch" of suboptimal fruits and vegetables with a tagline "looks odd, tastes great" to reassure consumers that the suboptimal appearance does not affect taste (Love Food Hate Waste New Zealand, 2017). Consumer acceptance of atypical food is also reliant on supermarkets' willingness to sell them (Devin and Richards, 2016; Osborn, 2016). Therefore, creating shelf space for produce with suboptimal appearance, along with effective communication of food waste avoidance and a guarantee of food quality, is constructive towards increasing suboptimal food familiarity and acceptance (Kulikovskaja and Aschemann-Witzel, 2017).

## 6. Conclusion

Food waste is a sustainability problem with social, economic and environmental consequences (Gustavsson et al., 2011; Cicatiello et al., 2016), thus it is important to avoid food waste to prevent its negative consequences in the near and distant future (Papargyropoulou et al., 2014). By understanding children's perceptions of suboptimal foods, this paper has taken the first step suggested by previous research for the inclusion of a sociological understanding of food appearance preferences in the context of food waste (Block et al., 2016). Our findings show that children use the same appearance cues as adults to perceive the edibility of suboptimal produce, but children emphasise these

perceptions differently. Specifically, shape, colour, and size abnormalities were mostly perceived positively while at large, blemishes were perceived negatively. For the number of children who perceived suboptimal produce negatively, unfamiliarity was the main reason for the non-acceptance of suboptimal produce; conversely, the positive edibility perceptions emerged from previous experiences and exposure to suboptimal foods, which in turn developed into preference and liking. This suggests that appearance-based preferences for produce are socialised through exposure, which we recommend future research to explore.

The novelty of appearance defects appealed to most children, which can be leveraged by retailers by targeting suboptimal foods to children (Marshall, 2014; Pettersson et al., 2004). Retailers could gain from stronger brand associations and improved brand image from young consumers through such sustainability-driven initiatives (Loussaief et al., 2014). Hence, there lies immense potential in addressing the sustainability problem of suboptimal food waste through children, as they are more likely to accept them and also influence their families' produce buying and consumption habits (Grønhøj, 2016; Wilson and Wood, 2004). Most communication and pricing strategies have limited impact on food valuation and choice, thereby making interventions that normalise suboptimal produce more effective (Aschemann-Witzel, 2018a). To leverage the movement towards improved value perception of suboptimal produce (e.g., change edibility misperceptions), it is imperative for retailers and the wider community to target younger children to train them into future consumers, who value food irrespective of appearance. The interventions could be applied through school-run and community programs that seek to increase children's food engagement through growing and cooking food. For example, food activists are working to encourage children to accept suboptimal fruits and vegetables (Figueiredo, n.d.). Creating food experiences through suboptimal food exposure could increase familiarity and acceptance of suboptimal produce.

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