

The influence of packaging on consumers' quality perception of carrots

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Abstract

The aim of the present research was to investigate the influence of packaging design on consumers' perception of quality of fresh carrots. We adopted a conjoint analytic approach in which 251 Danish consumers rated the perceived quality and value (expected price) of nine packaging images, obtained by systematically varying packaging type (plastic bag, plastic box, cardboard paper) and label color (blue, brown, grey). The results revealed that the main attribute influencing the perceptions of the consumer was packaging type. Specifically, the box packages (both plastic and cardboard) were associated to carrots of significantly higher perceived value and quality compared to the plastic bag packages. Furthermore, the study identified the most important aspects consumers attend to when purchasing carrots. A transparent packaging, allowing consumers to inspect the produce, was mentioned as the most important aspect. Being organic and local were identified as the second and third most important, respectively.

Practical applications

Packaging is an important extrinsic product attribute that can influence consumer perceptions of fresh produce. The results have implications for retailers and producers with respect to the choice of packaging and label design. Specifically, consumers associated box packages to higher quality produce, suggesting that carrots in this type of package may command higher price and/or be preferred to bagged alternatives at a similar price point. The study further indicated the importance of using a transparent packaging that clearly allow consumers to inspect the produce, and also suggest that "organic" and "local" are important drivers of purchase for this product category.

1 | INTRODUCTION

1.1 | Influence of packaging on consumer perception of fresh carrots

The role of packaging for ensuring the quality of carrots has received some attention in the literature, particularly in relation to how the pre- and post-harvest factors, washing and packing factors, as well as how the packaging during transportation of carrots affect the final quality (Albaar, Budiastira, & Hariyadi, 2016; Seljåsen, Hoftun, Selliseth, & Bengtsson, 2004; Seljåsen et al., 2013). Conversely, little attention has been given in previous research published regarding *consumers' perception* of the quality of carrots.

With regards to food, packaging can influence the consumers both during the purchase in form of visual stimuli (Clement, Kristensen, & Grønhaug, 2013), as well as increasing the acceptance and experience of the product after the purchase (Gómez, Martín-Consuegra, &

Molina, 2015). The role of packaging has also been investigated for many different types of foods, from everyday commodities to premium products with own label food brand, with studies reporting that over 70% of the consumers rely on their respective packaging to aid in the purchase decision process (Löfgren, Witell, & Gustafsson, 2008; Wells, Farley, & Armstrong, 2007).

In general, packaging elements can be classified into two main categories (Ampuero & Vila, 2006): graphic elements—including color, font type, the shape, size, and type of images introduced—, and structural elements—including the shape, size of the containers and the materials used to manufacture them. The influence of individual packaging elements on consumers' experiences and product evaluations has been studied in a number of publications that have documented how the design of the packaging is linked to consumer preferences and emotions (e.g., Honea & Horsky, 2012; Labrecque & Milne, 2012; Westerman et al., 2013), product familiarity and appropriateness for use (e.g., Giacalone et al., 2015; Giacalone & Jaeger, 2016), sensory expectations

(e.g., Rebollar, Lidón, Serrano, Martín, & Fernández, 2012), ergonomics, and functionality (Venter, van der Merwe, de Beer, Kempen, & Bosman, 2011). More to the point, the effect of packaging attributes on the perceived quality (PQ) of food has been investigated by various researchers in different product categories (e.g., Löfgren & Witell, 2005; Piqueras-Fiszman & Spence, 2012). Some authors have proposed to study these effects by having consumers evaluating specific combinations of packaging attributes using a conjoint design (e.g., Ares & Deliza, 2010; Mueller & Szolnoki, 2010). Conjoint analysis is a survey-based method used to investigate how consumers value different product attributes (see Moskowitz & Silcher, 2006 for a review). It is an effective method to investigate the effect of packaging through the creation of artificial (but realistic) package images created through statistically optimized experimental designs (Deliza, Macfie, & Hedderley, 2003). Examples of recent applications can be found in several product categories such as meat (McLean, Hanson, Jervis, & Drake, 2017), dairy (Hubbard, Jervis, & Drake, 2016; McCarthy, Parker, Ameerally, Drake, & Drake, 2017), and fresh produce (Oltman, Jervis, & Drake, 2014). Several types of conjoint analysis exist—such as full-profile conjoint analysis, adaptive conjoint analysis, menu-based conjoint, and adaptive choice-based conjoint (see Jervis, Ennis, & Drake, 2012 for a discussion)—with the main differences pertaining to the task (e.g., choice versus rating), the of stimulus (e.g., product or attributes), the type of experimental design (e.g., full versus fractional), and the type of analysis performed on the data.

When working with a limited number of attributes and levels, full-profile conjoint analysis is especially relevant as this method is based on presenting a combination of levels from all the target attributes to the consumers, who are then asked to rank or rate the products they are shown. An example of this approach, relevant in the context of the present work, is a paper on chewing-gum by Rebollar and colleagues (Rebollar et al., 2012) who investigated the effect of packaging color and shape (each broken down into three levels) on the expected sensory experience, functionality, and willingness to pay for the product.

1.2 | Aims of the present research

Although product packaging has been demonstrated to influence the PQ of foods and beverages, including fresh produce, existing research on the topic has three main limitations that are important to mention in the present context. The first one is that the majority of these earlier studies has focused on the consumption situation (i.e., post purchase), and has often used expert sensory assessors to assess the perceptual quality, though ample evidence suggests that this is a risky practice as experts and consumers perception of quality often do not overlap (Fillion & Kilcast, 2002; Giacalone, Fosgaard, Steen, & Münchow, 2016). The second limitation is that, while sensory eating quality is clearly the most important at the consumption stage, consumers do not ordinarily have the possibility to taste the product before purchase. Therefore, other elements, such as the packaging and the price are likely to be more important “quality cues” at the purchase stage. In particular, the packaging of fresh produce is considered to be a very important element for defining product quality (Venter et al., 2011). The third limitation is

that research on packaging attributes for fresh produce is relatively rare (compared to, e.g., processed food). Particularly, to the best of our knowledge no authors have investigated the effect of packaging design on consumers' quality perception of carrots.

To address this gap in the literature, this study seeks to investigate the quality and value perceptions of the consumers regarding carrots as affected by variation in two key packaging attributes: label color and packaging type. As PQ has been shown to affect perceived value (PV) (Chang & Wildt, 1994), we also investigated how packaging affected consumers' expected price in relation to other fresh carrot products. Additionally, information on the importance of different packaging elements when purchasing carrots was explored in order to get a more complete understanding of what packaging cues are currently most important in this product category.

2 | METHODS

2.1 | Design factors

The study was conducted in Denmark. To identify the most frequently used packaging designs for carrots a thorough field study was conducted in the six most popular Danish grocery retailers,¹ collectively representing more than 70% of the market. The field study suggested that the main packaging differences in the Danish market concerned shape, material, label (color and graphical design), carrot size, and brand. To narrow down the scope of the research, the focus was kept on the first three aspects. Furthermore, as graphical design tended to differ a lot between products, it was decided to restrict the focus on color variation in this research.

The two main shapes of the packaging were found to be either bag or box, mainly made from plastic, which were therefore included in the present research. Several high-end Danish supermarkets (like Kvickly, Føtex, and SuperBrugsen) also displayed cardboard packages, usually containing a mix of carrots and other vegetables. Therefore, cardboard packaging was considered as well. The three most commonly found colors were brown, blue, and dark grey, which were therefore included in this study.

To summarize, based on the field study on Danish grocery retailers, two experimental design factors (with three levels each) were included in this research:

- Label Color (three levels): blue, dark grey, brown
- Package type (three levels): plastic bag, plastic box, cardboard box

By systematically varying these factors, nine test images were developed, as shown in Figure 1. The images were photographs of real packages, as making virtual packages was found to be less realistic than using already existing packages, due to the way that plastic behave. The original images were then modified in Photoshop where a fictional label was added. As the influence of brand was not in focus in this

¹Kvickly” (Coop), “Super Brugsen” (Coop), “Føtex” (Dansk Supermarked), “Bilka” (Dansk Supermarked), “Netto” (Dansk Supermarked), “Rema” (Reitan group).

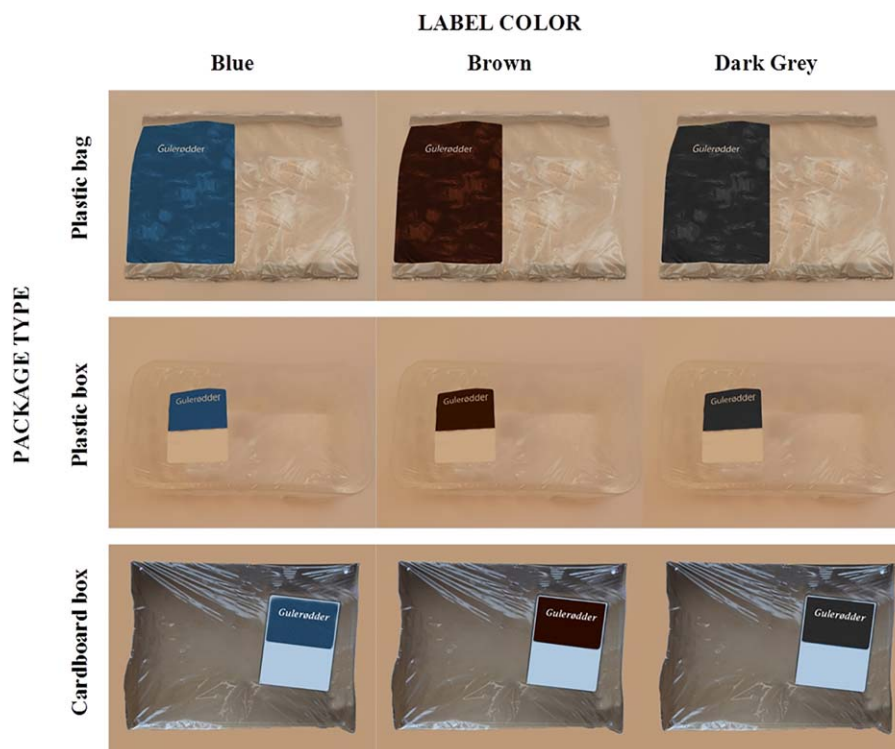


FIGURE 1 The nine images used in the consumer survey representing systematic variation in color, material, and packaging

research, the fictional brand “Gulerødder” (the Danish word for carrots) was shown on all labels.

2.2 | Experimental procedures

All data was collected through an online survey in Denmark using the online service Survey Xact (Ramboll A/S, Århus, Denmark). The survey was conducted in the local language and distributed over different social media sites and networks. A total of 260 individuals responded, out of which 251 completed the survey entirely. Basic background information on the participants are given in Table 1. Although no specific selection criteria with regards to purchase frequency were enforced, Table 1 shows that all participants were

TABLE 1 Background characteristics of the consumer sample participating in the main survey (N = 252)

Background variable	%
Gender	
Men	21
Women	79
Age in years	
18–35	60
36–55	30
56+	10
Carrot consumption frequency	
Low (\leq once a week)	15
Medium (Once or twice a week)	37
High (\geq Three times a week)	44
Other/Do not know	4

consumers of carrots, and over 66% consumed carrots at least twice a week.

The survey opened with a brief introduction and had two main parts: a full-profile conjoint survey and a “pick-any” task (Driesener & Romaniuk, 2006). For the conjoint analysis part, the participants evaluated each picture monadically in a random order, and were asked to evaluate the PQ of the carrots associated with each of the nine packages. Specifically, they were asked to imagine each packaging picture contained fresh carrots, and then to rate the expected quality on a 7-point scale, ranging from 1: very low to 7: very high. Participants were likewise instructed, at the beginning of the survey, that all of the packages would contain the same amount of carrots. The PV was operationalized as the price expectation from the consumers relative to other fresh carrots alternatives. Specifically, to evaluate the PV participants were asked to indicate how much they thought the carrots in each package would cost compared to other packages of carrots (again using the same 7-point scale).

After they had evaluated all the nine images, the participants completed a “pick-any” task where were asked to consider a list of attributes relevant to purchase of carrots, and to pick the three they personally considered as most important. The list was developed based on pilot work; this consisted of a focus group conducted with five regular carrot consumers, as well as two researchers (one moderator and one observer). The focus group, which lasted approximately 1 hr, had a semi-structured format where participants were probed with several questions concerning their carrot consumption and purchase behavior. The session was fully recorded and the transcript were analyzed following a stepwise procedure described in Taylor-Powell and Renner

TABLE 2 Mean ratings for perceived quality and value across each of the nine images

Image	Mean quality	Image	Mean value
Brown box	4.08 ^a	Brown box	4.23 ^a
Dark grey box	4.04 ^a	Dark grey box	4.20 ^a
Dark grey cardboard	4.03 ^a	Blue box	4.12 ^a
Brown cardboard	4.03 ^a	Dark grey cardboard	4.11 ^a
Blue cardboard	4.00 ^a	Brown cardboard	4.08 ^a
Blue box	3.95 ^a	Blue cardboard	4.05 ^a
Brown bag	3.36 ^b	Dark grey bag	3.26 ^b
Dark grey bag	3.26 ^b	Brown bag	3.25 ^b
Blue bag	3.13 ^b	Blue bag	2.90 ^b
<i>F</i> (8, 2259)	21.58	<i>F</i> (8, 2259)	36.38
<i>p</i>	<.001	<i>p</i>	<.001

The last two rows report *F* and *p* values for the factor "Image" in the respective ANOVA models. Means that do not share superscript letters are significantly different (Tukey $p < 0.05$).

(2003) to identify common themes among the participants quotes. This resulted in 11 factors relevant to carrot purchase, which were included in the pick-any task of the survey: "A transparent packaging that allows me to clearly see the carrots," "The carrots have the right color," "I know the brand," "The carrots are a locally grown," "The carrots are Danish," "The carrots look nice and clean," "The carrots have a consistent size," "The packaging is environmentally friendly," "The carrots are organic," "The carrots look appealing," "The price of the carrots."

2.3 | Data analyses

To determine the effect of the experimental design factors on consumers' evaluation of PQ and value, a two-way Analysis of Variance (ANOVA) was conducted using Packaging Type, Label color, and their interactions, as fixed effects. An additional one-way ANOVA was conducted with image as fixed effect. As the survey included repeated measures from the same individuals, both models included participants as random effect. When significant differences were found, the analysis was followed by post hoc pairwise comparisons using Tukey's HSD

TABLE 3 Mean ratings for perceived quality and value for each packaging type

Packaging type	Mean quality	Packaging type	Mean value
Plastic box	4.02 ^a	Plastic box	4.18 ^a
Cardboard box	4.02 ^a	Cardboard box	4.08 ^a
Plastic bag	3.24 ^b	Plastic bag	3.14 ^b
<i>F</i> (2, 2258)	84.10	<i>F</i> (2, 2258)	139.20
<i>p</i>	<.001	<i>p</i>	<.001

The last two rows report *F* and *p* values for the factor "Packaging type" in the respective ANOVA models. Means that do not share superscript letters are significantly different (Tukey $p < 0.05$).

TABLE 4 Mean ratings for perceived quality and value for each label color

Color	Mean quality	Color	Mean value
Brown	3.82	Dark grey	3.86 ^a
Dark grey	3.77	Brown	3.85 ^{ab}
Blue	3.69	Blue	3.69 ^b
<i>F</i> (2, 2258)	1.78	<i>F</i> (2, 2258)	3.80
<i>p</i>	0.17	<i>p</i>	0.02

The last two rows report *F* and *p* values for the factor "Color" in the respective ANOVA models. Means that do not share superscript letters are significantly different (Tukey $p < 0.05$).

test. Differences were considered significant at $p < .05$. Furthermore, correlation coefficients between the PQ and value were calculated to evaluate the degree of correspondence between these two variables, both at an overall level and at the level of individual images.

Consumers' responses to the second part of the survey were analyzed by means of descriptive statistics (frequency of mention for each response option) to identify the most frequently mentioned factors influencing carrots purchase.

3 | RESULTS

3.1 | Effect of design factors on consumers' perception of carrots quality and value

ANOVA results for the three fixed factors (image, packaging type, and color) are shown in Tables 2–4 together with the mean ratings for quality and value obtained by each factor level. With respect to PQ, a significant effect for both image and packaging type was found, but not for color. The two-way interaction term between color and packaging type was also not significant (F (4, 2258) = 0.37, $p = .82$).

Post hoc analyses showed that the images could be clustered into two clear groups, one of lower PQ (ranging 3.13–3.36 on a 7-point scale), including the three plastic bag images, and one of higher quality (3.95–4.08), including all remaining images (Table 2). Packaging type therefore seemed to be the main driver of difference in PQ between the nine images. Consistently with these first results, post hoc results for this experimental factor clearly indicated that the two box packages (either cardboard or plastic) were perceived as of being of higher quality compared to the plastic bag package (Table 3).

With respect to value, a significant effect of all three experimental factors was found. Post hoc comparisons for Image and Packaging type showed identical grouping of the factor levels observed in the model for PQ (Tables 2 and 3). Mean ratings for this response variable spanned a slightly larger range, suggesting that it was easier for consumers to differentiate between the images on the basis of expected price than on quality.

With respect to color, the Dark grey and Brown labels were perceived as significantly more expensive compared to the Blue label, though it should be noted that effect of color was substantially smaller than that of image and packaging type (Table 4). The same ranking with

TABLE 5 Correlation coefficients and associated significance between perceived value (PV) and perceived quality (PQ) for each image ($N = 252$, rows 1–9) as well as overall ($N = 2268$, bottom row)

Image	<i>r</i>	<i>p</i>
Blue bag	0.59	<.001
Brown bag	0.73	<.001
Dark grey bag	0.76	<.001
Blue box	0.79	<.001
Brown box	0.76	<.001
Dark grey box	0.81	<.001
Blue cardboard box	0.90	<.001
Brown cardboard box	0.90	<.001
Dark grey cardboard box	0.90	<.001
Overall	0.83	<.001

respect to label color was observed for PQ as well, but in that case the mean ratings were too close for the difference to reach statistical significance. Again, no significant interactions between color and packaging were found ($F(4, 2258) = 1.33, p = .26$).

The results of the correlation analysis are shown in Table 5. Recall that this analysis was conducted to shed light on whether or not consumers used different thought processes for PQ and value. Looking at the coefficients in Table 5, it can be seen that the overall correlation between these two variables was high ($r = 0.83$). However, the strength of the correlation varied quite a bit between individual packaging images. While very high for the three cardboard packages ($r = 0.90$), it was somewhat lower for the other packages (Table 5). The correlation was especially low for the blue plastic bag image ($r = 0.59$) indicating that quality and price estimates were to a certain degree independent on each other for this particular package.

Finally, we also checked whether any of the consumer background demographics (gender, age) and behavioral (frequency of consumption of carrots) had any effect on the two dependent variables. We found a small but statistically significant difference between men and women, with women on average giving higher ratings than men for both PQ ($M_{\text{Women}} = 3.8, M_{\text{Men}} = 3.61, t(2266) = 2.55, p = .01$) and value ($M_{\text{Women}} = 3.84, M_{\text{Men}} = 3.65, t(2266) = 2.43, p = .01$). For age, we found significant differences between the three age groups (see Table 1) for PV ($F(2, 2264) = 3.1, p = .04$), but not for PQ ($F(2, 2264) = 1.97, p = .13$). For the former variable, post hoc testing revealed that the difference was due to young (18–35) respondents having a slightly lower mean (0.16 on a 5-point scale) than those in the 36–55 age bracket. Frequency of consumption also significantly affected average PQ ($F(2, 2166) = 8.1, p < .001$) and value ($F(2, 2166) = 4.8, p = .007$).² In both cases

this was due to averages for the high frequency carrot consumers (consuming carrots three or more times a week, cf. Table 1) being approximately 0.20 higher than those for the other two groups.

3.2 | Attributes important for consumers' choices of carrots

The second part of the survey concerned the packaging elements consumers mostly attend to when buying carrots. Figure 2 shows the frequency of mention (in percentage) of each of the elicited attributes, sorted by most to least mentioned.

The results shown in Figure 2 confirm, first and foremost, that the packaging plays an important role in consumers' choice of carrots, as "a transparent packaging that allows me to clearly see the carrots" was the most frequently mentioned option, with 64% of the participants saying that they are considering this aspect when buying a package of carrots. The carrots being organic and of Danish origin were mentioned as the second and third most important attributes, with respectively 51 and 50% of the participants reporting that they consider that during the purchase. "The carrots look nice and clean" was also considered important by a sizeable proportion of the participants (47%), while the carrots having consistent size and the right color were both mentioned by 34%. Surprisingly, the price of the product was mentioned by only 25% of the participants, almost as (in)frequently as "locally produced" with 23%. The least mentioned options were that the carrots not be too small (19%), whether the packaging is environmentally friendly (15%), and that the brand is known beforehand (3%). Two final response options (not included in Figure 2) were "other" and "do not know": they were mentioned by 5 and 0% of the participants, respectively.

4 | DISCUSSION

The first aim of this study was to investigate the influence of packaging on PQ and price expectations for carrots, using a conjoint analytic approach based on systematic variation of label color and packaging type. The results showed that packaging type was an important element in driving quality perception, and in particular it was found that consumers associated plastic bags with carrots of relatively lower quality compared to carrots in box packages (either in plastic or in cardboard). The label color instead did not exert a large influence on quality, although this could be due to the familiar and relatively narrow range of colors employed (recall, however, that the three colors were chosen based on the fact that they were the most common colors for carrot label in the Danish market).

The effect of packaging on PV (in terms of price expectations) was substantially the same as for PQ, with packaging type being again the main factor driving consumers' evaluation. Again, consumers associated plastic bags with cheaper products, and the two box packages with more expensive products. Contrasting these results with our notes from the field search in Danish supermarkets done while preparing the main study, it is interesting to notice a few things. Consumers correctly expected the plastic bags as the

²The within-groups degrees of freedom are fewer than in previous models because respondents that checked "Other/Don't know" regarding frequency of carrot consumption (see Table 1) were excluded.

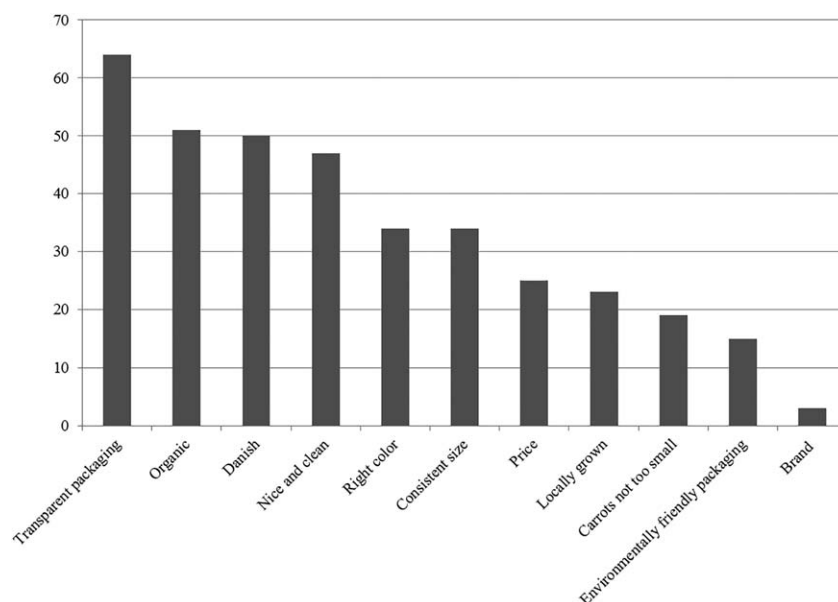


FIGURE 2 Frequency of mention (in %) of elements considered by the participants when purchasing carrots

cheapest products, and this is largely consistent with the reality in Danish supermarkets. However, they did not pick a difference between the plastic box and the cardboard box and expected to be sold at approximately the same price, whereas in reality carrots in cardboard boxes in Danish supermarket tend to be sold at a much higher price (almost twice as much) than those in plastic boxes according to our field observations. One possible reason for consumers not picking up on this difference, however, is that carrots packaged in cardboard boxes in Denmark are typically only sold in the more high-end supermarkets, and thus this packaging type may have been unfamiliar to many consumers. Conversely, all supermarkets would typically have both carrots in plastic bags and plastic boxes, so it is more likely that consumers would have “correct” (i.e., realistic) expectations for these two packaging types.

The color of the label had a significant effect on PV. Consumers associated a blue label with a cheaper product, but the size of the effect was so small (amounting to 0.15 on a 7-point scale) that it does not seem to be of practical significance. An overall moderate to strong correlation between PQ and value (expected price) was found, suggesting that the consumers closely associate one with the other, in line with earlier findings (Chang & Wildt, 1994).

The second aim of the research was more exploratory and concerned the most important factor participants (self-reportedly) attend to when purchasing carrots. The results in a way confirmed the importance of packaging as having a transparent packaging that allows consumers to clearly see the carrots was by far the most frequently mentioned element. However, while packaging seems essential in the way that it should allow the consumers to visually see the product before the purchase, ultimately the appearance of the carrots may be much more important than the design of the packaging. Accordingly, the carrots looking “nice and clean” was another often-mentioned option. Organic was mentioned as an important element by over half of the sample. This makes sense in

light of the fact that Denmark is one of the top countries in the world for per capita consumption of organic produce and the market share for organic agriculture has been quickly and steadily growing in recent years (Willer & Lernoud, 2016).

4.1 | Limitations and directions for future research

This study has several limitations that is important to point out to correctly qualify the findings. First, the nine images used as stimuli only portrayed the packages without any content. As explained in the paper, this choice was due to practical reasons and was useful to isolate the packaging elements which were the focus of this research. However, its downside was that it lowered the ecological validity of the images and therefore there is a risk that the results may not have been exactly the same had the actual carrots been present as well. Additional research may be warranted to fully confirm the present results.

Second, this research was limited to a specific location and consumer population (Denmark) and thus the results may not readily generalize to other geographical and cultural contexts.

Third, with respect to the second part (elements important during purchase of carrots), we note that the conclusions are based on self-reported data with all inherent limitations. For example, the high importance assigned to the carrots being organic and the comparatively low importance assigned to price may be in part to some social desirability bias in the participants' answers. To ascertain whether this is the case, future studies could adopt a less explicit approach and use, for example, eye-tracking data (Clement et al., 2013) in a real or simulated supermarket aisle to investigate what consumers actually attend to when purchasing carrots. Additionally, specific claims (organic, Danish, etc.) could themselves been included in a future conjoint study and be evaluated in the proper packaging context, as opposed to being considered in isolation.

5 | CONCLUSION

This research investigates the way in which with consumers' perception of quality of fresh carrots is affected by two different packaging design elements—label color and packaging type—using a conjoint analytic survey in which packages images obtained by systematic variation of these two factors were evaluated by a representative sample of Danish carrot consumers. The results showed that packaging type (regardless of color) was the main driver of difference between the images. Specifically, consumers associated higher quality and higher value to the two box packages (regardless of color), whereas the plastic bag packages were associated with carrots of lower quality. Furthermore, the study identified the most important determinants of carrot choice at point of purchase. The results showed that a transparent packaging, which allows the consumers to evaluate the quality of the produce, was the most important aspect consumers consider when choosing between fresh carrots alternative. Being organic, local (of Danish origin), and the sensory quality of the carrots were identified as the second, third, and fourth most important determinants, respectively.

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