The effect of fat content on visual attention and choice of red meat and differences across gender

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Abstract

In this paper, we study the effect of fat content on visual attention and choice of red meat, as well as differences across gender. In an eye-tracking study, conducted with 105 Portuguese meat consumers, we find that fat content has an impact on visual attention, choice reaction time and choice of red meat products. Consumers paid more attention and chose more often meat products with lower fat content. This impact was further gender specific, with female consumers paying more attention and requiring less time to choose meat products with lower fat content. In contrast, male consumers paid more attention to red meat products with higher fat content, but spent more time choosing red meat products with lower fat content. We discuss managerial and theoretical implications in relation to marketing of red meat products.

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Introduction

Red meat is one of the most controversial food products for consumers. Studies show that the varied levels of fat content in red meat products often results in consumers having difficulties in evaluating its quality, which subsequently impacts their final choice (Banović et al., 2012; Banović et al., 2009, 2010; Brunsø et al., 2005; Grunert, 1997; Grunert, 2006; Grunert et al., 2004). Although these studies measure consumer response to the fat content of red meat, it is not still clear if consumers actually pay attention to the fat content and, if so, whether this interaction has a subsequent impact on consumers' product choice. It is further acknowledged that consumer preferences toward fat content in red meat products are gender specific (Kiefer et al., 2005; Kubberød et al., 2002; Ueland, 2007; Wardle et al., 2004). Even though these studies bring valuable insights regrading gender specific preferences toward red meat products, they fail to measure if male and female consumers differ in their visual attention to fat content, and if this difference explains variation in their choices.

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In this paper, we intend to examine theimpact of fat content on consumer visual attention and choice of red meat products. We further investigate if this impact differs between male and female consumers. Our objective is to identify if male and female consumers differ in their visual attention when exposed to red meat products with varying fat content and how visual attention subsequently influences their choice. Our study has several contributions. First, we provide insight into the role of visual attention on the effectiveness of red meat visual characteristics. Second, we provide support of the relationship between visual attention and choice of red meat products, taking into account gender differences. Third, we give future research directions for studies related to food choice and gender differences, and demonstrate the potential contribution of eye-tracking in marketing of red meat products.

Theoretical background

Visual search and attention play a vital role in perception and product choice (Rosa 2015; Wedel & Pieters, 2008). In relation to food product choice, only few studies take into account visual search and attention (Bialkova et al., 2014; Bialkova & van Trijp, 2010, 2011; Graham et al., 2012), while hardly any study has been conducted with focus on visual attention and choice of meat in general or red meat in particular. Previous research on meat and red meat products have pointed out that consumer perception is affected by its visual characteristics, such as fat content (Banović et al., 2009, 2010; Grunert, 1997; Grunert et al., 2004). In addition it has been shown that overall choice reaction time improves over repeated representations of stimuli (Banović et al., 2014; Hidalgo-Sotelo et al., 2005) and that this repetition and familiarity with the red meat product impacts consumer perception process (Banović et al., 2012; Bredahl, 2004). However, despite the fact that visual attention represents an important element of consumer perception and choice, it is still not clear whether and how visual search and attention to fat content determine choice of red meat products.

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Significant gender differences have been found in visual attention, reaction time and frequency of choice (Bayliss et al., 2005; Coley & Burgess, 2003; Ellis, 2011; Shen & Itti, 2012), where female consumers outperform male consumers in verbal tasks, react faster to stimuli recognition and have more frequent spontaneous buying choices. Additionally, it has been shown that male and female consumers differ in their perceptions and preferences of red meat products (Kähkönen & Tuorila, 1999; Rozin et al., 2012). For example, previous studies demonstrate that when compared to female consumers, male consumers prefer red meat with strong and rich taste, high colour intensity and chewier texture (Kubberød et al., 2002; Kubberød et al., 2002). An explanation behind these differences is that female consumers have more negative attitudes towards consumption of red meat (Kubberød et al., 2002; Rozin

et al., 2003), such as being fatty and less healthful (Wardle et al., 2004). Another explanation is that female consumers are more concerned with following a healthy diet, and thus avoid red meat products or prefer white meat products instead (Kiefer et al., 2005; Kubberød et al., 2002).

With the present research, we seek to gain a comprehensive understanding of consumers' visual attention and choice with regard to red meat products. Using a bottom-up approach, we investigate how consumers react to different fat content (measured through fat marbling, fat rim and their combination), in terms of their visual attention (measured by the fixation count) and their product choices (measured by the choice reaction time and frequency of product choice), as well as to investigate how fat content interacts with visual attention to determine product choice. We finally introduce gender as a moderating variable to account for differences in the above described relationships between male and female consumers. We provide a graphical conceptual representation in Figure 1.

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Research hypotheses

Early research shows that consumers spend more time looking at products that are about to be chosen (Pieters & Warlop, 1999; Wedel & Pieters, 2008), yet repeated presentation decreases choice reaction time (Hidalgo-Sotelo et al., 2005). Among the drives of visual attention and choice are the visual characteristics of the product (Bialkova et al., 2014). Similarly, consumer attention to red meat products depends on its visual characteristics, such as fat content, which consequently may influence their choice. In fact, fat content influences consumer perceptions of meat's quality and purchase intention (Banović et al., 2009), with consumers searching more often for red meat products with lower fat content (Grunert, 1997), which are characterized by absence in fat rim and fat marbling (Brunsø et al., 2005). Familiarity with red meat products and repeated exposure improves visual attention and

decreases choice reaction time (Banović et al., 2012; Hidalgo-Sotelo et al., 2005). We therefore assume that red meat products that vary in their fat content will produce different patterns in visual attention and product choice. Therefore:

> H_{1a}: Fat content has an impact on consumer attention, with consumers paying more attention to red meat products with lower fat content;
>
> H_{1b}. Fat content has an impact on consumer choice frequency, with consumers choosing more often red meat products with lower fat content;
>
> H_{1c}. Fat content has an impact on consumer choice reaction time, with consumers choosing faster red meat products with lower fat content.

In a diverse set of experimental paradigms on visual attention, males and females perform differently (Ellis, 2011; Fairweather, 1976; Halpern, 2013). Females have a better verbal ability and perform better in memory tasks involving object recognition (Yonker et al., 2003). Females show lower fixation count, whereas males tend to scan more visual space (Bayliss et al., 2005). Given that gender differences regarding visual search and attention exist, we expect that female consumers outperform male consumers in their reaction time needed to verbalize their product choice (Shen & Itti, 2012), even when overall search performance improves for both males and females over repeated presentations of stimuli (Hidalgo-Sotelo et al., 2005). We further expect male consumers to examine more visual space than female consumers as shown by a higher fixation count (Ellis, 2011).

Given that consumer perceptions and preferences to red meat products differ across gender (Kähkönen & Tuorila, 1999; Rozin et al., 2012), and as a result of its fat content (Banović et al., 2009; Brunsø et al., 2005; Grunert, 1997), we expect that similar differences will exist in their visual attention and choice. We therefore hypothesize that female consumers will pay more attention and choose red meat products with lower fat content. Therefore:

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H_{2a}. Female consumers pay more attention to red meat products with lower fat content compared to male consumers;

H_{2b}. Female consumers choose more often red meat products with lower fat content compared to male consumers;

H_{2c}. Female consumers choose faster red meat products with lower fat content compared to male consumers.

Visual attention has an impact on consumer choice, with products that are noticed more often having higher probability to be chosen (Banović et al., 2014; Wedel & Pieters, 2008). Thus, fat content will impact consumer choice of red meat products only when fat content is noticed. Moreover, fat content that drives more consumer visual attention will have a greater impact on consumer choice and this will be more evident among female consumers (Kiefer et al., 2005). Therefore:

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H_{3a}. The impact of fat content of red meat products on frequency of choice is higher (vs. lower), when attention to these products is higher (vs. lower);

H_{3b}. The impact of fat content of red meat products on choice reaction time is higher (vs. lower), when attention to these products is higher (vs. lower);

H_{4a}. The impact of fat content of red meat products on frequency of choice is even higher (vs. lower) among female consumers (as compared to male consumers), when attention to these products is higher (vs. lower);

H_{4b}. The impact of fat content of red meat products on choice reaction time is even higher (vs. lower) among female consumers (as compared to male consumers), when attention to these products is higher (vs. lower).

Method

The research paradigm

For the purpose of the study, we combined a visual search paradigm with a choice paradigm. We presented participants with a set of red meat products that were systematically varied in terms of fat content (i.e., fat rim and fat marbling), and asked them to make a choice. For this task, we asked participants to choose the red meat product suitable for a healthy meal. The reason behind this decision was to make this choice more specific and thus minimize any potential bias that might arise from asking participants about their preferences in general (which may introduce additional motives, such as hedonic ones). In fact, health and general preference tasks influence consumer visual attention differently (Bialkova & van Trijp, 2011). In addition red meat products are judged for their healthiness, and thus health is an important motive of choice.

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During this process, an eye-tracking device recorded participants' visual attention. This approach allowed us to generate three types of measures (Bialkova & van Trijp, 2011): a) eye-tracking (i.e., number of fixations); b) frequency of choice (i.e., the final product chosen from the stimulus set); and c) choice reaction time (i.e., the time from the appearance of the stimulus set until a choice is made). Furthermore, this approach resembled a realistic shopping situation (Wedel & Pieters, 2008), and thus increased the external validity of our findings.

Stimuli

We conducted a 2 (fat rim: present vs. absent) by 2 (fat marbling: present vs. absent) within-subjects design. Fat rim and fat marbling as well as the interaction of the two factors were treated in the analysis as independent measures. To increase realism, we asked an expert butcher to provide us with the four cuts of beef steaks for which fat rim and fat marbling levels varied according to the design. We further asked the butcher to provide the cuts from

three different carcasses, which resulted in 12 beef steaks in total. We then took pictures of the meat products and edited them to generate the stimulus sets. An example of a stimulus set is presented in Figure 2.

-- Figure 2 here—

Each stimulus set consisted of the four meat products of the same carcass. In total, each participant viewed 12 repeated trials (4 stimulus sets x 3 carcasses). Low-level features of each picture, such as apparent luminance and contrast (RMS) as well as area size, in pixels, were analysed via Image J. v1.49 software. There were no significant differences for luminance $\chi^2_{KW}(3) = 1.513$, $p = .679$; contrast $\chi^2_{KW}(3) = 1.923$, $p = .589$ or area size $\chi^2_{KW}(3) = 1.872$, $p = .599$ across pictures

The presentation of meat products on each stimulus set and the order of the trials were randomized following a Latin square design. This procedure allowed us to control for order-effect and position-effect bias (Duchowski, 2007; Rosa, Esteves & Arriaga, in press).

Participants

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In total, 105 Portuguese participants (38% males; mean age for males = 28.5 years; SD = 5.6 years; mean age for females = 26.5 years; SD = 6.8 years; F (103) = 2.395; $p = 0.13$) participated in the experiment. During recruitment, we paid particular attention on having a balanced distribution between males and females in terms of age, consumption and shopping behaviour of red meat. Inclusion criteria were as follows: participants were responsible for groceries shopping within their households and 2) direct purchaser of red meat products. Participants who had eaten or those thatmentioned to have gastric disorders, food allergies or colour blindness were excluded.

Participants were not informed of about the actual purpose of the study, but instead it was mentioned that the study aimed at measuring attention to food products. We provided each participant with a written consent and informed them that they were free to withdraw at any time. Finally, participants were ensured that the study results would be treated anonymously.

Design and procedure

We conducted the experiment on a Tobii-T60 Eye Tracking System (Tobii Technology AB, Sweden), integrated into a TFT 17" monitor, and connected to an Intel core2duo 6550 desktop computer. Eye movements were binocularly measured with a temporal resolution of 60Hz with a spatial accuracy of 0.5º. in a single session, in a isolated lab room with constant illumination (42 lux). The distance between participants and the screen was approximately 60 cm. Each set of images were presented on a black background (RGB: 0, 0, 0). Each image subtended 14.83º x 12.15º of visual angle. Four rectangular areas of interest (AoI) were drawn around each image , equal to the number of meat products presented. We further used a red dot (diameter 0.5º) as a fixation point.

We instructed the participants that during the experiment they would be presented with different vegetables, meat and fish products. Vegetables and fish products were used as distractors, in order to avoid participants understanding the actual purpose of the experiment. Participants were asked to choose the most preferred vegetables, fish and meat products, with the overall aim to prepare a healthy meal.

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The experiment started with a practice phase which allowed participants to familiarize with the equipment and the procedure. During the practice phase, four stimulus sets of vegetables, followed by four stimulus sets of fish products were presented to the participants. The actual experimental phase consisted of 12 trials of meat products combined with 12 trials of vegetables used as fillers (i.e., one trial of vegetables followed a trial of meat products).

Each trial started with a fixation point that was presented for 500ms. Next, the stimulus set followed on the screen for 6 seconds. A blank black slide followed next and participants were asked to indicate the position (top: left/right: bottom: left/right) of the most preferred product, which was recorded. Once they indicated their choice, we asked them to press 'continue' in

order to proceed. A black screen was presented for 5 seconds, and then participants were presented with the next trial.

Dependent measures

We assessed overt visual attention in terms of *number of fixations* (Ferreira et al., 2011; Gamito et al., 2014; Wedel & Pieters, 2008), which measures the number of times a participant fixated on the area of interest (AOI). Since each stimulus was defined as a separate AOI, we calculated the number of fixations for each stimulus (Duchowski, 2007). We further assessed choice with *frequency of choice* and *choice reaction time. Frequency of choice* measures the number of times each participant chose each stimulus. *Choice reaction time* represents the time each participant took to verbalize his/her choice (Up: Left/Right; Down: Left/Right).

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Results

To test our hypotheses H_1 and H_2 arepeated measures mixed-ANOVA was performed using the number of fixations, frequency of choice and choice reaction time as dependent variables, and the fat rim, fat marbling and gender as independent variables (Table 1).

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With regards to number of fixations, we find a significant main effect of fat rim ($F(1,365) = 25.64$, $p < 0.001$) and fat marbling ($F(1,365) = 62.59$, $p < 0.001$), as well as a significant interaction effect between fat rim and fat marbling ($F(1,365) = 13.09$, $p < 0.001$). Products with absent fat rim or fat marbling received higher number of fixations ($M_{fr} = 3.51$; $M_{fm} = 3.68$), whereas products with present fat rim or fat marbling received lower number of fixations ($M_{fr} = 2.90$; $M_{fm} = 2.73$). In addition, when fat rim was absent, the number of

fixations was higher for products where fat marbling was also absent (Figure 3a; general effect). We thus support hypothesis H_{1a}.

We further find a significant interaction effect between gender and fat rim ($F(1,365) = 10.48$, $p < 0.001$), gender and fat marbling ($F(1,365) = 13.68$, $p < 0.001$), as well as an interaction between gender, fat rim and fat marbling ($F(1,365) = 5.00$, $p = 0.026$). Compared to male consumers, female consumers showed higher number of fixations for products with absent fat rim or fat marbling (*Males*: $M_{fr} = 3.39$; $M_{fm} = 3.53$; *Females*: $M_{fr} = 3.64$; $M_{fm} = 3.84$), while they further showed lower number of fixations for products with present fat rim or fat marbling (*Males*: $M_{fr} = 3.17$; $M_{fm} = 3.02$ *Females*: $M_{fr} = 2.64$; $M_{fm} = 2.44$) (Figure 3a; two-way interaction). Furthermore, for products with both fat rim and fat marbling absent, female consumers showed greater number of fixations, compared to male consumers (Figure 3a; three-way interaction). We thus support hypothesis H_{2a}.

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--Figure 3 here--

With regards to frequency of choice, we find a significant main effect of fat rim ($F(1, 330) = 52.31$, $p < 0.001$) and fat marbling ($F(1,330) = 107.66$, $p < 0.001$), as well as a significant interaction effect between fat rim and fat marbling ($F(1,330) = 40.66$, $p < 0.001$). Products with absent fat rim or fat marbling were chosen more frequently ($M_{fr} = 4.09$; $M_{fm} = 4.57$), whereas products with present fat rim or fat marbling were chosen less frequently ($M_{fr} = 1.91$; $M_{fm} = 1.43$). In addition, when fat rim was absent, the frequency of choice was higher for products where fat marbling was also absent (Figure 3b; general effect). Therefore we support hypothesis H_{1b}. We further find a significant interaction effect between gender and fat rim ($F(1,330) = 23.36$, $p < 0.001$), gender and fat marbling ($F(1,330) = 13.51$, $p < 0.001$), as well as an interaction between gender, fat rim and fat marbling ($F(1,330) = 16.48$, $p < 0.000$). Compared to male consumers, female consumers chose more often products with absent fat rim or fat marbling (*Females*: $M_{fr} = 4.82$; $M_{fm} = 5.12$; *Males*: $M_{fr} = 3.36$; $M_{fm} = 4.01$), while

they further chose less often products with present fat rim or fat marbling (*Females*: M_{fr} = 1.17; M_{fm} = 0.88; *Males*: M_{fr} = 2.64; M_{fm} = 1.99) (Figure 3b; two-way interaction). Furthermore, compared to male consumers, female consumers chose more often products with both fat rim and fat marbling absent (Figure 3b; three-way interaction). We thus support hypothesis H_{2b}.

In relation to choice reaction time, we only find a significant main effect of fat marbling ($F(1,145) = 5.81$, $p = 0.017$), while the effect of fat rim ($F(1,145) = 0.38$, $p = 0.538$) and the interaction effect between fat rim and fat marbling ($F(1,145) = 0.10$, $p = 0.751$) were found insignificant. Participants needed less time to choose products with absent fat marbling (M_{fm} = 3.25), compared to red meat products with present fat marbling (M_{fm} = 3.00; Figure 3c; general effect). We thus partially reject Hypothesis H_{1c}. However, we find a significant interaction effect between gender and fat rim ($F(1,365) = 4.51$, $p = 0.035$), gender and fat marbling ($F(1,365) = 19.83$, $p < 0.001$), whereas the interaction between gender, fat rim and fat marbling was insignificant ($F(1,365) = 0.09$, $p = 0.766$). Differences between male and female consumers are especially evident in the absence of fat marbling, when female consumers showed much lower reaction time (i.e. chose faster) when compared to male consumers (*Females*: M_{fm} = 2.49; *Males*: M_{fm} = 3.52). On the other hand, both male and female consumers showed almost equal reaction times when fat marbling was present (*Females*: M_{fm} = 3.31; *Males*: M_{fm} = 3.19) (Figure 3c; two-way interaction). Furthermore, for products with both fat rim and fat marbling absent, female consumers showed lower choice reaction time, compared to male consumers (Figure 3c; three-way interaction). We thus partially accept H_{2c}.

To test our hypotheses H_3 and H_4 we run repeated measures mixed-ANOVA performed with frequency of choice and choice reaction time as dependent variables, and number of fixations, fat rim, fat marbling and gender as independent variables (Table 2).

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--Table 2 here--

With regards to frequency of choice, we find a significant interaction effect of fat rim and number of fixations ($F(1,382) = 15.98$, $p < 0.001$), fat marbling and number of fixations ($F(1,390) = 35.65$, $p < 0.001$), as well as a significant interaction effect between fat rim, fat marbling and number of fixations ($F(1,376) = 16.03$, $p < 0.001$). Figure 4 graphically displays the interactions effect between number of fixations and fat rim, and number of fixations and fat marbling on frequency of choice. It is evident from this graph that the higher the number of fixations the higher the frequency of choice for products with absent fat rim or fat marbling. We thus confirm hypothesis H_{3a}.

We further observe a significant interaction effect of gender, number of fixations and fat rim on frequency of choice ($F(1,378) = 11.73$, $p < 0.001$), whereas the interaction effects between gender, number of fixations and fat marbling ($F(1,379) = 0.95$, $p = 0.332$), as well as the interaction between gender, number of fixations, fat rim and fat marbling ($F(1,375) = 2.86$, $p = 0.092$), were insignificant. Figure 5 shows that when fat rim or fat marbling are absent, the impact of the number of fixations on frequency of choice was higher, impacting more inon female than male consumers. These results partially support hypothesis H_{4a}.

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--Figure 4 and 5 here--

In relation to reaction time, nosignificant interaction effect between the number of fixations, and fat trim or fat marbling, with the exception of a marginal significant interaction effect between fat rim, fat marbling and number of fixations ($F(1,71) = 2.15$, $p = 0.049$). We thus reject hypothesis H_{3b}. We further do not find any significant interaction effect between gender, number of fixations, and fat rim or fat marbling. We thus reject hypothesis H_{4b}.

Discussion and Conclusion

Our results show that fat content (measured through fat marbling, fat rim and their combination) has an impact on consumer visual attention and choice of red meat products, with consumer paying more attention and choosing more often red meat with lower fat content. These findings give support to earlier studies suggesting that fat content is an important characteristic of red meat products affecting consumer perception and preference (Banović et al., 2012; Banović et al., 2009, 2010; Brunsø et al., 2005; Grunert, 1997; Grunert, 2006; Grunert et al., 2004). In addition, we further show that the more attention consumers pay for fat content the more often they choose red meat products with lower fat content, but this choice is not made any faster. We should acknowledge that the fact that lower fat content plays an important role, could be a drive from the choice task we assigned our participants to. In fact, fat content has been proven to be a major factor influencing consumer perception of red meat healthfulness (Van Wezemael et al., 2010).

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The impact of fat content on visual attention and choice is further gender specific, with female consumers paying more attention, choosing more often and faster red meat products with lower fat content. In addition, we show that compared to male consumers, the more attention female consumers pay to fat content the more often they choose red meat products with lower fat content, but this choice is not made any faster. We thus conclude that the low fat content is more important among female consumers than male consumers. An explanation behind this finding is that female consumers have different perceptions about red meat products, finding products with low fat content as more healthy compared to male consumers (Kiefer et al., 2005; Rozin et al., 2012; Wardle et al., 2004).

Even though the individual impact of fat rim and fat marbling on consumer visual attention and choice is almost similar, their combined impact is stronger. Yet, this combined impact is even more pronounced among female consumers, for both visual attention and choice. Apart

from the fact that consumers, and especially female consumers, look for and choose red meat products with absent fat rim or fat marbling, they also look for and choose red meat products which have both types of fat absent. In other words, the absence of both types of fat is a more favourable choice criterion, especially for female consumers. Nevertheless, the more attention male consumers pay to fat marbling the more often they choose red meat products with absent fat marbling. Therefore, fat marbling is more of a decisive criterion of choice among male consumers, whereas fat rim is not.

Managerial implications and limitations

Fat content is a product characteristic that drives consumer attention and choice. From a managerial point of view, this has implications in the production and marketing of red meat products. For example, production methods that emphasize the rising of animals with lower fat content (e.g., turning more to grass-fed animals) show an increasing trend and a higher consumer acceptance in the market place as a result of their added benefits such as being healthier and of better quality (McNeill, 2014; Van Elswyk & McNeill, 2014). However, such production methods have consequences on the final price and therefore may affect consumer demand and response (Marian et al., 2014). Provided that consumer acceptance of red meat ultimately depends on the product-related attributes and expected added benefits, these consequences could be counterbalanced by the fact that consumers look for meat products with lower fat content and thus create a trade-off between cost and fat content.

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Our study has further implications in how red meat products should be displayed in-store. Given that lower fat content influences consumer attention, trimming of fat rim or using special cuts where fat marbling is less visible, should be done prior to displaying the product to consumers. In this way, such products would have less visible fat and therefore would have better success in the market, especially among female consumers. In addition, gender

differences found lead to the possibility of tailoring red meat products for male and female consumers, only when fat content is taken into strategic consideration.

Our study is not free of limitations. First, our results are bound to the choice task that was driven by a healthy motive and should be interpreted as such. Although we believe that such a choice task helped to minimize bias from other motives (e.g., hedonic ones), introducing a broader preference task might have introduced more mixed results. In fact, goal-oriented attention, such as health, plays a significant role in decision making (Orquin & Mueller Loose, 2013; Rosa, 2015). Future research could also explore the impact of fat content on tasks driven by other motives. Second, our measure of attention is limited to the number of fixations and thus additional measures could be used to assess visual attention and their impact on choice. Finallyour results should be interpreted in the context of where this study took place and the type of meat product we used to develop our stimuli.. Future studies with wearable eye tracking (e.g., Tobbi glasses 2) in real-world decision making contexts would bring more reliable evidence. Moreover, other extraocular movements such as ocular saccades (Rosa, Esteves & Arriaga, 2014; Rosa, Gamito, Oliveira, & Morais, 2011) or intraocular movements such as pupil size (Rosa, Caires, Costa, Rodelo, & Pinto, 2014) can be explored and may be a rich source of data information. Furthermore, and since the amplitude of the P1 and multiple N1 cortical componentes increases when directing attention to a given stimulus (Hillyard Anllo-Vento, 1998), the combined use of eye tracking with EEG can offer more robust results rather than using only eye tracking.

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List of Tables

Table 1. Effect of fat content and gender on attention, frequency of choice, and choice reaction time

Factor	Number of fixations			Frequency of choice			Choice reaction time		
	F	***p***	**Hypothesis**	**F**	***p***	**Hypothesis**	**F**	***p***	**Hypothesis**
Gender	1.31	0.253		0.00	1.000		31.84	0.000	
Fat rim (FR)	25.64	0.000	H_{1a}	52.31	0.000	H_{1b}	0.38	0.538	H_{1c}
Fat marbling (FM)	62.59	0.000		107.66	0.000		5.81	0.017	
FR*FM	13.09	0.000		40.66	0.000		0.10	0.751	
Gender*FR	10.48	0.001	H_{2a}	23.56	0.000	H_{2b}	4.51	0.035	H_{2c}
Gender*FM	13.68	0.000		13.51	0.000		19.83	0.000	
Gender*FR*FM	5.00	0.026		16.48	0.000		0.09	0.766	

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Table 2. Effect of attention on frequency of choice and choice reaction time

Factor	Frequency of choice			Choice reaction time		
	F	***p***	**Hypothesis**	**F**	***p***	**Hypothesis**
Number of fixations (NF)	531.18	0.000		0.28	0.598	
Fat rim (FR)*NF	15.98	0.000	H_{3a}	0.76	0.385	H_{3b}
Fat marbling (FM)*NF	35.65	0.000		0.05	0.820	
FR*FM*NF	16.03	0.000		2.15	0.049	
Gender*FR*NF	11.73	0.001	H_{4a}	0.67	0.416	H_{4b}
Gender*FM*NF	0.95	0.332		1.24	0.267	
Gender*FR*FM*NF	2.86	0.092		0.14	0.871	

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List of Figures

Figure 1. Conceptual framework of the study

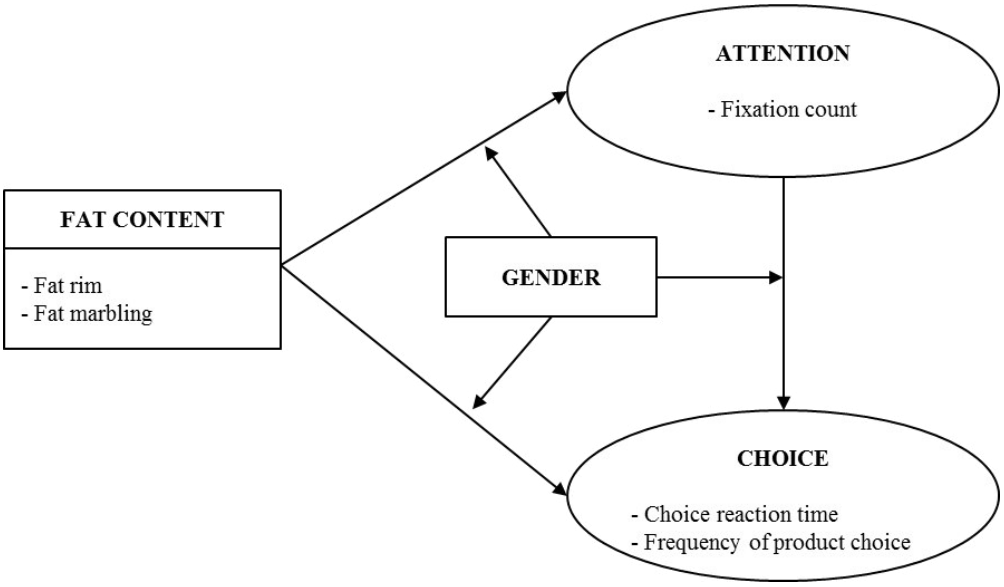

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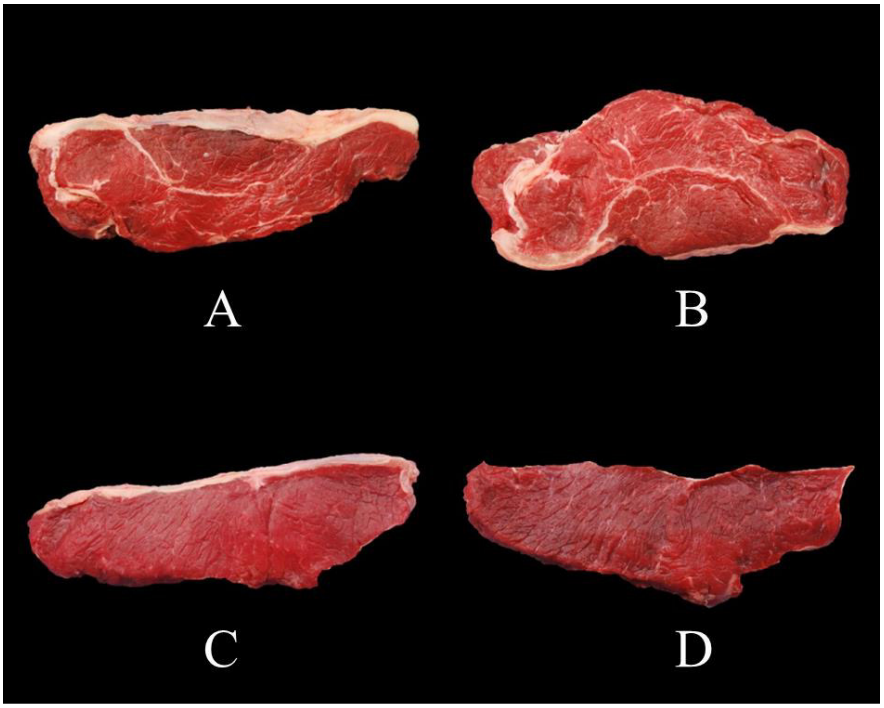
Figure 2. Product stimuli and example of choice set



Note: A) fat rim: present; fat marbling: present); B) fat rim: absent; fat marbling: present); C) fat rim: present; fat marbling: absent); D) fat rim: absent; fat marbling: absent.

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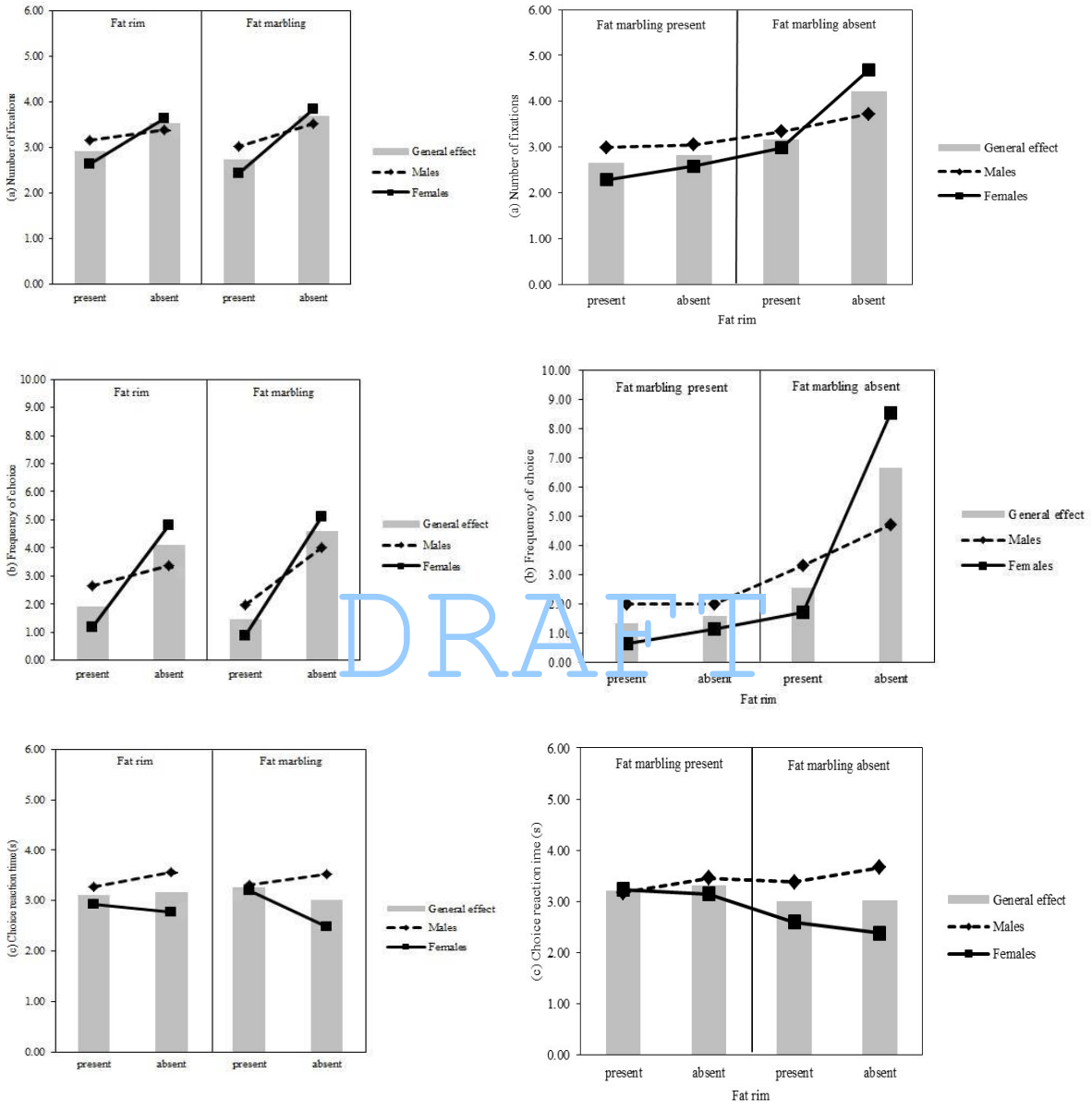
Figure 3. Estimated marginal means of visual attention, frequency of product choice and choice reaction time on: (a) Number of fixations, hypotheses H_{1a} and H_{2a}; (b) Frequency of product choice, hypotheses H_{1b} and H_{2b}; (c) Choice reaction time, hypotheses H_{1c} and H_{2c}



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Note: Left side: two way interactions; Right side: three way interactions.

Figure 4. Interaction effects between number of fixations and fat content (fat rim and fat marbling) on frequency of choice, hypothesis H_{3a}.

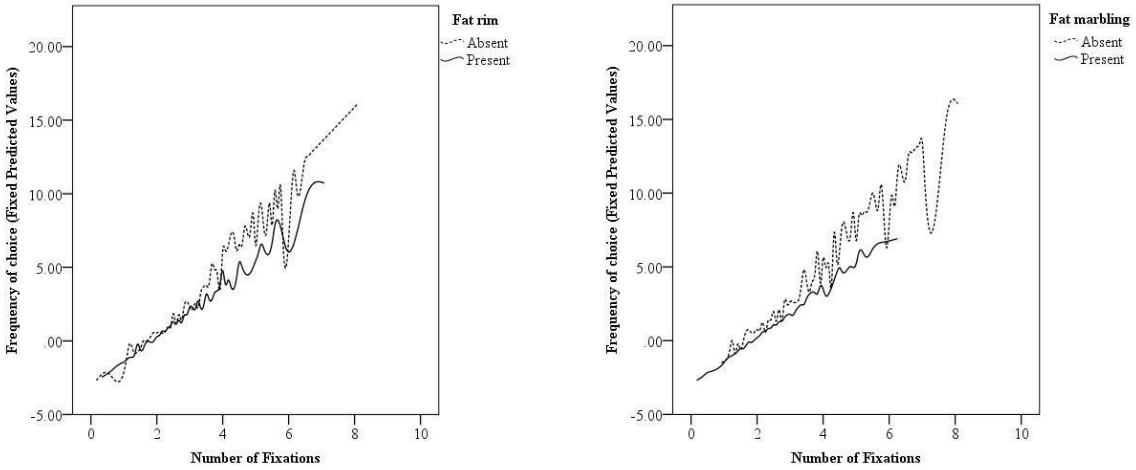

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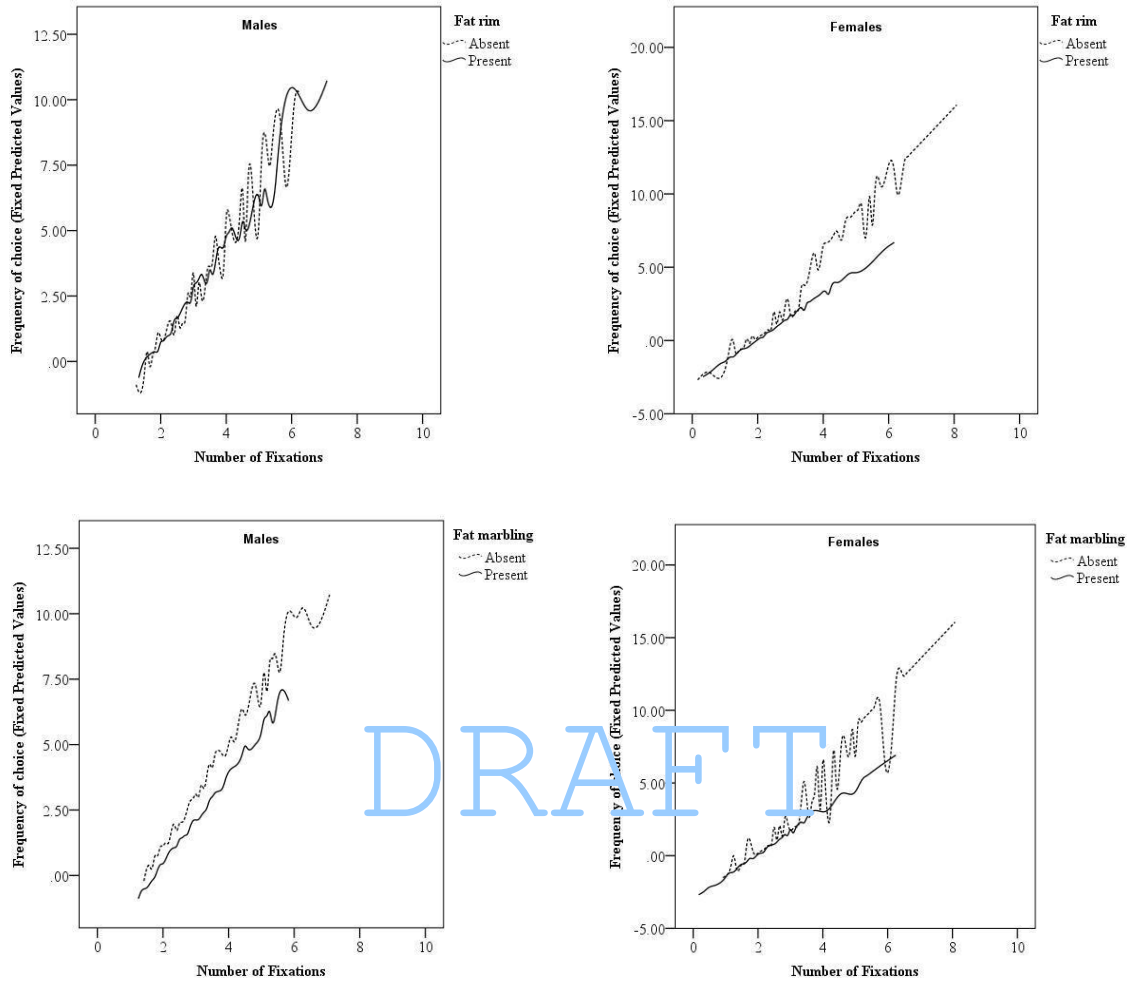
Figure 5. Interaction effects between number of fixations and fat content (fat rim and fat marbling) on frequency of choice across male and female consumers, hypothesis H_{4a}.



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