

SENSORY PERCEPTION AND CONSUMER PROFILE IN RELATION TO BOVINE MEAT PACKED IN MODIFIED ATMOSPHERE PACKAGING

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Abstract

The objective of the present study was to evaluate the influence of the socioeconomic profile of 338 people who answered questions about knowledge, consumption, determining factors in the acquisition, frequency of consumption, place of purchase, evaluation of general aspects by the consumer and repetition of the purchase of beef packed with modified atmosphere packaging (MAP). The generalized linear model methodology, GENMOD, was used with a probit link function to test the interaction of the questions with the socioeconomic profile and for all significant variables. The risk was calculated using the odd ratios (OR) with a confidence interval of 95%. Only age and education influenced consumers' disposition regarding the questions raised in the questionnaire. Most of the people who answered the questionnaire had never consumed any product packaged with MAP, but they are very interested in trying it out. Among consumers who had already consumed some product packaged with MAP, the vast majority consumed beef. Consumers over the age of 50 showed a greater tendency to consume beef with MAP more than once a week. Appearance was the main factor for decision making during the purchase and the supermarket is the main place of purchase of the product. The vast majority of consumers liked and would buy beef packed with MAP again.

Keyword

general aspect, consumer, socioeconomic profile, preferences, supermarket.

PERCEPÇÃO SENSORIAL E PERFIL DO CONSUMIDOR EM RELAÇÃO A CARNE BOVINA EMBALADA EM ATMOSFERA MODIFICADA

Resumo

Objetivou-se avaliar a influência do perfil socioeconômico de 338 pessoas que responderam questões sobre o conhecimento, consumo, fatores determinantes na aquisição, frequência de consumo, local de aquisição, avaliação dos aspectos gerais pelo consumidor e repetição de aquisição da carne bovina embalada com embalagem com atmosfera modificada (EAM). Foi utilizada a metodologia de modelos lineares generalizados, GENMOD, com função de ligação probit para testar a interação das questões com o perfil socioeconômico e para todas as variáveis significativas foi calculado o risco por meio da *odd ratios* (OR) em um intervalo de confiança de 95%. Apenas a idade e a escolaridade influenciaram na disposição dos consumidores quanto às questões levantadas no questionário. A maioria das pessoas que respondeu o questionário nunca havia consumido nenhum produto embalado com EAM, porém possuem grande interesse em experimentá-lo. Dentre os consumidores que já haviam consumido algum produto embalado com EAM, a grande maioria consumiu carne bovina. Os consumidores com idades acima de 50 anos mostraram uma maior tendência a consumir carne bovina com EAM por mais de uma vez por semana. A aparência foi o principal fator para a tomada de decisão durante a compra e o supermercado é o principal local de aquisição do produto. A grande maioria dos consumidores gostou e compraria novamente a carne bovina embalada com EAM.

Palavras-chave

aspecto geral, consumidor, perfil socioeconômico, preferências, supermercado.

INTRODUCTION

Meats in Brazil are commonly sold in supermarkets, butchers and boutiques, most of them "*in natura*". The product can be purchased at the self-service where the cuts are packaged and displayed at refrigerated counters for easy choice and purchase by the consumer, or at personalized counters.

"*In natura*" meat is a highly perishable product, and its loss of quality is due to easy microbial growth, loss of color, dehydration and consequently, its degree of deterioration. The packaging, in addition to enhancing the marketed product, also serves as barriers against dirt and contamination, moisture loss, contact with oxygen and light, increase the product's useful life, reduce economic and environmental losses, as well as facilitate industry trade up to the consumer (SARANTÓPOULOS and DANTAS, 2014).

One method of preserving fresh meat that can be used is that of modified atmosphere packaging (MAP), which consists of a combination of gases that prolongs the shelf life by inhibiting the development of microorganisms (MANTILLA et al., 2010). This method replaces the air in common packaging with different optimized proportions of gases, such as oxygen (O₂), carbon dioxide (CO₂), and nitrogen (N₂) (SINGHI et al., 2011).

Each gas used in the packaging has a different function, with CO₂ having a bacteriostatic action and inhibiting effect on the development of microorganisms, and this control is directly related to the amount of gas present in the packaging. O₂ is responsible for the development of the bright red color, making the product more attractive to the consumer and N₂ is a chemically inert gas and is used as a filler in the free space of the packaging (MANTILLA et al., 2010).

The combination of MAP gases, in addition to stabilizing the color of the meat, also decreases the development of microorganisms, reduces the growth of pathogenic bacteria, ceases the need for preservatives and improves the presentation of the product. In this mixture of gases, carbon monoxide (CO) can also be used, however, due to its toxic effect it must be present in low quantities. When present in the mixture it causes the formation of carboxymyoglobin, which is more resistant to oxidation, guaranteeing the stabilization of the red color and increasing the useful life of the meat (SANTOS and OLIVEIRA, 2012).

Although there are many studies worldwide on the use of this type of packaging for meat conservation (ARVANITOYANNIS and STRATAKOS, 2012; STASIEWCZ, et al., 2014; WANG et al., 2019), there is a shortage of material evaluating how the consumer perceives the MAP product for purchase, what its buying criteria are and mainly what requirements directly interfere with the purchase.

There are studies on the consumer's perception of beef and what criteria define the purchase, but without information on the purchase of products in MAP. Henschion (2017) and collaborators conducted a review on the consumer's perspectives in relation to the attributes of meat quality. Among these attributes we have sensory aspects, product origin, place of purchase, color, softness, type of production and some other evaluated items, being price, certification, meat brands and product information the items considered most important at the time of purchase. In another study also trying to identify which sources of information consumers used to define their decision to buy beef, it was concluded that the sources used to choose the product were culinary sources, such as television programs and also personal sources (GUTKOWSKA et al ., 2018). However, these authors do not mention the meat aspects with MAP.

Thus, the objective of the present work was to evaluate the consumer's perception in relation to meat packaged with modified atmosphere packaging, especially beef.

MATERIAL AND METHODS

Initially, a questionnaire was prepared with 12 closed questions and 1 open question in order to characterize the sample population of the research. The questionnaire was applied via the Google Docs electronic form (Google Spreadsheets) and shared at random on several social networks and communication applications (Instagram, WhatsApp, Twitter, Facebook, E-mail and the University Forum), for 30 days, from 9 March 2017 to April 9, 2017. The data obtained took into account the socioeconomic and demographic variables, with the following factors being assessed: Gender (female and male); Age (up to 20 years old, between 21 and 30 years old, between 31 and 40 years old, between 41 and 50 years old, between 51 and 60 years old and above 60 years old); Education level (incomplete elementary school, complete elementary school, incomplete high school, complete high school, incomplete higher education, complete higher education, others and did not answer).

The answers to the questions "Do you know about modified atmosphere packaging for food products?", "Have you consumed any products packaged with modified atmosphere packaging?", "Do you consume packaged beef more than once a week?", "Did you like the beef packaged with modified atmosphere packaging?" and "Would you buy beef packaged with modified atmosphere packaging again?" characterized by binary expression. For example, for the question "Do you know about modified atmosphere packaging for food products?" the successful answer (1) is the one where the respondents answered yes, and the failure (0), those who answered no. Some questions and answers from the questionnaire were transformed in order to identify new questions.

The statistical analysis of the questions mentioned above were analyzed in the SAS

University Edition (SAS Institute Inc., Cary, NC, USA) using the GENMOD procedure, assuming binomial data distribution, with a probit link function to a normal adjacent distribution. The probabilities of success (1) for each of the questions are given by, Φ^{-1} , where Φ is the accumulated normal distribution function. The "Relative Risk" (Odds Ratios) was calculated in order to obtain information on the ratio between the chances of failure to answer questions asked to respondents for the socioeconomic effects that were significant ($P < 0.05$). For a socioeconomic effect with two classes, the odds ratio equal to 1 indicates no difference between the two classes, that is, both have the same chance of occurrence. For all the questions analyzed, the reasons between the odds were constructed in relation to the first class for the socioeconomic effects of age and education level.

RESULTS AND DISCUSSION

Collected were 338 responses during the period of dissemination of the research on social networks. Most consumers who answered the questionnaire were women, aged up to 40 years, with an income of up to 5 minimum wages (R\$ 4,685.00) and who had completed high school. Although it seems like a reduced amount of information, due to the population size of Brazil, this type of work can be considered as a sign of trends, considering that there are very few researches in Brazil that map the knowledge and consumption of meat products packaged with modified atmosphere packaging (MAP). Research indicates that consumer behavior is changing and that it has started to pay attention to extrinsic characteristics of the product, such as food irradiation, organic production, biotechnology techniques, use of antibiotics in animals, pesticides and growth hormones (UNNEVEHR et al. 2010).

Of the total questionnaires answered, 188 people (56%) never consumed any product packaged with modified atmosphere packaging. When questioned about the interest in consuming this product, 168 (89%) stated that yes, they would be interested in consuming some product packaged with a modified atmosphere packaging; 19 (10%) stated that they might consume; and only one person (1%) stated that they would not be interested in consuming it ([Figure 1](#)). This result shows a great interest in the consumption of products with MAP, given that 89% of consumers are interested in trying it out. The reasons for these people never consuming a product with this type of packaging was not evaluated in the present research.

Of the 338 questionnaires, 181 (54%) are familiar with the modified atmosphere packaging, but only 150 consumers (44%) stated that they have already consumed some product (meat, vegetables, others) packaged with MAP. Indications of age, sex and income did not show any significant difference regarding the knowledge and consumption of products with this type of packaging, however, schooling was a determining factor ($P = 0.01$) for these

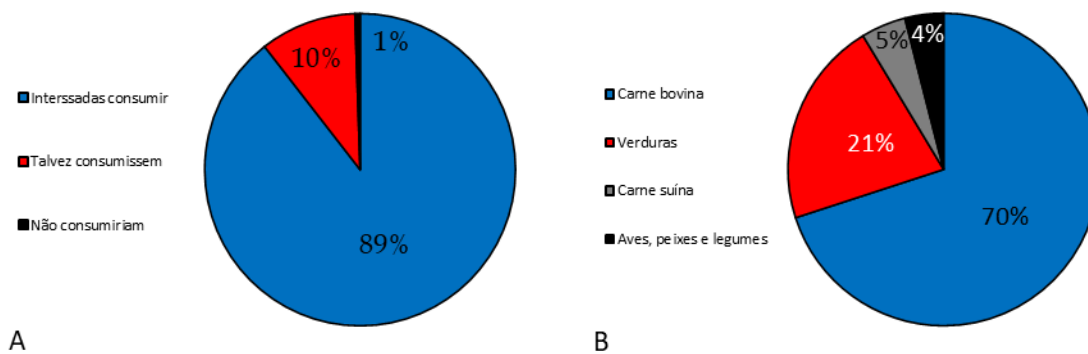


Figure 1. Percentages of individuals who responded as to the interest in consuming product packaged with modified atmosphere packaging (A) and which products were consumed (B).

questions (Table 1). Consumers who know and have already consumed a product with MAP have, for the most part, have completed higher education, and consumers who have completed higher education are 2.29 times more likely to know products with MAP and 2.17 times more likely to consume them than consumers who have just completed high school.

Table 1. Questions on knowledge and consumption of products packaged with modified atmosphere packaging

Question*	Schooling	Response			Odds Ratio	IC95%
		Yes	No	Total		
Do you know about any product packaged in modified atmosphere packaging?	Up to high school completed	17 (36%)	30	47	1.00	-
	Incomplete higher education	39 (50%)	39	78	1.59	0.94 - 2.68
	Higher education completed	102 (62%)	62	164	2.29	1.43 - 3.68
	Others	23 (47%)	26	49	1.36	0.78 - 2.38
Have you already consumed any product packaged with modified atmosphere packaging?	Up to high school completed	13 (28%)	34	47	1.00	-
	Incomplete higher education	31 (40%)	47	78	1.45	0.85 - 2.49
	Higher education completed	87 (53%)	77	164	2.17	1.33 - 3.52
	Others	19 (39%)	30	49	1.41	0.80 - 2.51

95% CI - 95% confidence interval * Multiple logistic regression estimated by Generalized Estimation Equations; there are only the factors that remained with a statistically significant association in the final model (P = 0.01);

Bruhn et al. (2015) also found that schooling was a determining factor, noting that people with complete high school or postgraduate education are more likely to know about meat with certification of origin and are more likely to accept paying more for a product. For

Magalhães et al. (2016), the level of education was also decisive when assessing the knowledge of differentiated products, in which more than 75% of the interviewed consumers who knew beef screened, or with certification of origin, had a complete high school or postgraduate degree.

It was observed with the present study that, of the 150 people (44%) who already consumed some product with MAP, 105 (70%) consumed beef, 32 people (21%) consumed vegetables, 7 (5%) consumed pork and the rest (4%) consumed poultry, fish and vegetables (Figure 1). For these 105 beef consumers, the factors age, sex, income and education level (classified as socioeconomic profile) did not influence the choice of this product for consumption. As for the other products, the statistics were not evaluated. However, in a review by Henchion et al. (2017), the authors conclude that socio-cultural, economic, technological and political aspects can be determinant in the preferences of meat consumers.

Regarding the frequency of consumption of beef with MAP, 75 people (71%) do not consume this product frequently and 30 people (29%) say they consume it more than once a week. Within socioeconomic factors, age was determinant ($P = 0.06$) for the consumption of this product more frequently on a weekly basis (Table 2), with people over 50 years of age tending to be 4.85 times more likely consuming meat with MAP than people aged up to 30 years. However, consumer income did not affect the frequency of consumption. This finding is surprising, as it was expected that the incomes of these consumers would influence a higher frequency of consumption of this product, as found by Diniz et al. (2012) who found that consumers in 5 municipalities in the state of Pernambuco have beef as their purchase preference and justify that consumer income and the price of meat were the limiting factors in purchasing the product.

Table 2. Question about weekly frequency of consumption of beef in packaging with modified atmosphere packaging.

Question*	Age	Response			Odds Ratio	95% CI
		Yes	No	Total		
Do you consume packaged beef with modified atmosphere packaging more than once a week?	Up to 30 yrs old	14 (23%)	47	61	1	-
	From 31 to 40 yrs old	5 (24%)	16	21	1.16	0.52 - 2.59
	From 41 to 50 yrs old	5 (38%)	8	13	1.73	0.68 - 4.40
	Over 50 yrs old	6 (60%)	4	10	4.85	1.43 - 16.45

95% CI - 95% confidence interval * Multiple logistic regression estimated by Generalized Estimation Equations; there are only the factors that remained with a statistically significant association in the final model ($P = 0.06$);

In relation to what led consumers to purchase beef packed with MAP, “curiosity” was the justification of 21 people (20%), which may explain the low frequency of weekly consumption by consumers. The cost-benefit was taken into account by 14 consumers (13%) when purchasing this product. Another 14 consumers (13%) replied that they consumed beef with MAP due to other factors, the following being: only availability at the place where the product was purchased; and food security due to the technology and low handling of the product since it is packed in the refrigerator and remains intact until the consumers' homes. However, appearance was a determining factor in the purchase of the product by 56 people (54%).

Magalhães et al. (2016) concluded, in a survey carried out in Minas Gerais in the city of Belo Horizonte, that color was the item that most influenced the purchase of beef and that women are 3.327 times more likely to choose meat by color than men. Although male respondents believe that the extrinsic and intrinsic characteristics of meat are important at the time of purchase, for women these attributes have an even greater value.

The color item has a relevant value when choosing meat. When researching the color of meat packaged in a modified atmosphere, German and American consumers are willing to pay more for ground beef when it is cherry red and shiny, mainly because it extends their shelf life (GREBITUS et al., 2013).

For Lopes et al. (2017) the most important intrinsic attributes in the decision making when buying beef in the city of Rio de Janeiro were color, tenderness and texture of the meat, odor and low amount of fat.

When evaluating extrinsic factors (prices, certifications and information on labels) and intrinsic factors (visible fat, color and general appearance of the meat) in defining the choice of meat, visible fat and color are the most considered intrinsic attributes (HENCHION et al., 2017).

Supermarkets were the places where consumers most bought packaged beef with modified atmosphere packaging, with 98 people (93%) out of the 105 people who have already consumed beef with MAP. Consumers also purchased this product in butchers (2 people) and meat boutiques (5 people), but in less quantity than in supermarkets. The preference for the place to buy meat can vary considerably, as verified by Chong et al. (2019) when assessing the preference of meat consumers in Northern Ireland, the Republic of Ireland and Great Britain. Consumers in Great Britain have supermarkets as their preferred place of purchase while those in the Republic of Ireland and Northern Ireland prefer to buy meat directly from suppliers or small butcher shops. According to the authors, this may have happened due to the reduced availability of alternative sources of purchase in Great Britain and Irish consumers to associate smaller places of purchase, such as places of direct purchase or local butchers,

with better quality meats.

Socioeconomic factors were not decisive for the acquisition of beef with MAP in butchers, meat boutiques and supermarkets.

The evaluation of the general aspect of the product and its consumption are of paramount importance for marketing actions and product appreciation by companies and retailers. Given that, of the total number of people (105) who consumed beef with MAP, 95 of them (90%) said they liked the product they consumed; and 92 (88%) would buy the meat again with this packaging.

Thus, it can be inferred that the consumed product pleases consumers to the point of arousing their interest in purchasing it again. About 10% stated that they did not like the product and would not buy it again, this may be due to lack of interest in the product, poor availability of the product, or changes in color and / or increased exudate inside the packaging etc., however, it was not possible to measure this information in the present research.

Within the socioeconomic factors, schooling stood out in terms of consumer impression factors for beef with MAP ($P = 0.06$). Of the 95 people (90%) who liked beef with MAP, those with incomplete higher education are 5.56 times more likely to like the product with MAP than people who have completed high school. The same occurs with the fact that if these people would buy beef again with MAP ($P = 0.06$), people with incomplete higher education are 5.89 times more likely to buy this product again than people who have schooling up to complete high school (Table 3).

Table 3. Questions on consumer general assessment and repeat purchase of the product packaged with modified atmosphere packaging.

Question*	Schooling	Response			Odds Ratio	IC95%
		Yes	No	Total		
Did you like the beef packed with modified atmosphere packaging?	Up to high school completed	8 (73%)	3	11	1.00	-
	Incomplete higher education	24 (96%)	1	25	5.56	1.34 - 23.04
	Higher education completed	52 (91%)	5	57	3.89	1.23 - 12.24
	Others	11 (92%)	1	12	4.22	0.93 - 19.03
Would you buy beef packaged with modified atmosphere packaging again?	Up to high school completed	8 (73%)	3	11	1.00	-
	Incomplete higher education	23 (92%)	2	25	5.89	1.39 - 24.84
	Higher education completed	51 (89%)	6	57	3.48	1.12 - 10.75
	Others	10 (83%)	2	12	4.38	0.97 - 19.60

95% CI - 95% confidence interval * Multiple logistic regression estimated by Generalized Estimation Equations; there are only the factors that remained with a statistically significant association in the final model ($P = 0.06$);

The difficulty in discussing the data found occurred due to the few publications with this product. MAP, despite its long existence, has been little explored in Brazil, thus presenting a wide possibility for improvement and growth, especially when used in meat conservation.

CONCLUSION

A little more than half of the consumers consulted know about products sold with modified atmosphere packaging, and have even consumed this type of product. Of the consumers who had never consumed any product with MAP, the vast majority would be interested in consuming it, demonstrating that there is a large market to be explored with the supply of this type of product.

Consumers over the age of 50 and with a higher education level are more likely to purchase and consume beef packaged in modified atmosphere packaging, with the appearance of the product being the main factor taken into account at the time of purchase.

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