

**Consumers' expectations and acceptability for low saturated fat "salami":
healthiness or taste?**

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Abstract

BACKGROUND: Nutritional properties of meat and meat products are becoming very important in purchasing behavior because consumers are even more concerned about healthiness. The present study aimed to examine the influence of health information on the expected and informed acceptability of salami. Traditional salami and two low saturated fat salami produced with a partial or total substitution of pork backfat with extra-virgin oil were evaluated.

RESULTS: Perceived acceptability was the lowest in salami with total animal fat substitution. In both low saturated fat salami expected acceptability was significantly higher than in the perceived, while in traditional salami it was lower. Consumers completely assimilated their liking in direction of expectations for salami with partial animal fat substitution, whereas an incomplete assimilation was observed for salami

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with total animal fat substitution. Results also revealed that some socio demographic characteristics discriminate consumer clusters from each other.

CONCLUSION: The present study highlights that nutritional information is not enough to satisfy consumers' expectations if the product is not sensory acceptable. Findings about the relevance of information and consumers' segmentation could have important implications for policymakers and for the industry of meat products.

Keywords: low saturated salami, sensory properties, consumer expectations, informed acceptability, consumers' segmentation

INTRODUCTION

Food demand is influenced by many and heterogeneous drivers and is characterized by continuous evolution over time because consumers are becoming more different in their quality perception¹. The provision of quality signals, such as information, labeling, advertising, claims, warranties, can transform some attributes (place of origin, healthiness, ethic concerns, organic, etc.), classified as "credence attributes" because they cannot be verified even after the consumption of the food product, into "search attributes" whose presence can be verified by consumers before the purchase^{2,3}. Information about health could be used by consumers as quality signal influencing their expected acceptance of food products^{4,5} and increasing consumer's motivation to try them. The result of the interaction between information and consumers' attitudes and beliefs can influence the perceived healthiness leading to differential changes in sensory ratings of labelled stimuli products⁶⁻⁸.

The correlation could be positive but, in some cases, it could result in a lower or negative expectation of the sensorial experience⁹. Recently, food companies consider the information about healthy characteristics as part of their marketing strategy following the increasing concerns about the potential health risks associated with food consumption, particularly in high income countries. This has led researchers to study the possibility of modify food products by adding ingredients considered beneficial to health or by eliminating or reducing components that are considered harmful (fat, salt, sugar, alcohol, etc.). Research findings and consumers health concerns related to the association between the fat content in red meat products and the effect on cholesterol levels and on cancer risk, have had a negative effect on consumer perception of the healthiness of meat products¹⁰ and, consequently, have stimulated industrial interest in developing healthier products with low saturated fatty acids. Manufacturing and marketing of such novel products could benefit the image of the meat products sector¹¹, taking into account the relevant role played by information in influencing consumers' preferences^{12,13}. However, the way consumers perceive information, strongly affected by personal attitudes, could turn health information into a negative expectation barrier and reduce the hedonic value to purchasers^{14,15}. As reported by Fernández-Ginés *et al.*¹⁶, sometimes the use of some ingredients for adding functional properties to meat products results in lower sensory and physicochemical quality. Such differences in consumers' reactions could make difficult to set up effective marketing strategies for companies planning large-scale production of novel healthy food, as in the case of low saturated fatty acids meat products. The aim of this paper is to analyze the effect of information on consumers' preferences for a meat innovative product with healthy properties, the Italian salami with low saturated fat content. The assessment of the acceptance by consumers of Italian salami with healthy ingredients has been analyzed in previous studies, considering the addition of probiotic cultures¹⁷, the sodium chloride reduction replaced by combinations of potassium chloride and calcium chloride¹⁸, the addition of

canola oil¹⁹ and the use of propolis as a replacement for the synthetic antioxidant sodium erythorbate²⁰. Following on results of an our study concerning technological aspects of the replacement of the pork backfat with extra virgin olive oil in Italian typical salami to produce a healthier product²¹, the present work considers consumers' evaluation of such product in terms of expectation induced by information and sensorial experience. To achieve such purpose the sensory expectation model has been applied¹² which refers to the assimilation/contrast theory to explain the discrepancy, if any, between expectation and actual experience in consumers' evaluation of the product. Such approach, based on three consecutive steps (blind, expected and informed acceptability) allows the assessment of the relationships between consumer's expectations (conditioned by physiological and psychological aspects), information and sensory perception^{22,23}. Segments of consumers which differ in the relationship information/sensory evaluation were also identified.

EXPERIMENTAL

Products

Three different salami formulations were prepared in a meat processing company (Carni SUS, Foggia, Italy) by using an industrial process. Traditional salami (TS) was produced using 90% pork meat of autochthonous breed (Apulian black pig) and 10% pork backfat, whereas low saturated fat “salami” were produced by substitution of pork backfat with 60% and 100% of whey protein soaked in extra-virgin oil for 30 min (SS60 and SS100, respectively) as described by Del Nobile *et al*²¹ in a previous study. After ripening time, all samples (30 salami for each formulation) were collected for descriptive sensory analysis and consumer test. Animal fat or olive oil were added to achieve 31.50% of fat content in traditional salami and 25.45%, 22.64% of fat content in SS60 and SS100 salami, respectively. Saturated fatty acids percentage in TS was 43.37% whereas in SS60 and SS100 salami was 28.55 % and 23.81%, respectively.

Panel training and Quantitative Descriptive sensory Analysis

An eight-member trained panel performed the sensory analysis. The assessors were selected for their sensory ability and their previous experience in performing sensory profiling on other cured meat products (hams and sausages). Six preliminary sessions were performed to develop the list of attributes and their definition and to train panellists for the attributes intensity evaluation and for the scale use²⁴. The sensory definition and references for each attribute are shown in Table 1.

A Quantitative Descriptive sensory Analysis²⁵ was used to assess the three different salami formulations. Tests were performed in a sensory analysis laboratory, equipped with individual booths and under red lighting to mask colour differences in the samples, except during the evaluation of salami appearance, when white fluorescent lighting was used. For every session, salami samples from the three different formulations were offered to each panellist. Samples were coded with a three-digit random number and two slices (4 mm thick) of each salami were served to every panellist in random order according to sample. During sensory evaluation, panelists were asked to drink a sip of still water (at room temperature) and to eat unsalted crackers between samples to purge the palate of residual flavor. The panellists rated the attributes on the basis of 100 mm unstructured lines with anchor points at each end (0 = absent and 100= very strong) as reported by Braghieri *et al.*²⁶.

Consumer test

Consumers survey and experimental design

In order to setting up the consumer test, two hundred and fifty consumers were recruited in the towns of Foggia and Bari (Apulia region, Southern Italy). All subjects were interviewed and were asked about their frequency of consumption of cured meat products at home (1 = never; 2 = once a year or less; 3 = 3–5 times a year; 4 = at least

once a month; 5 = more than 2 times a month; 6 = at least once a week) and their food related lifestyle (e. g. importance of product information, consumption of fatty products). One hundred and ninety-six consumers were selected using predetermined screening criteria based on consumption of cured meat products with a frequency of at least once a month.

Before participating in the study, all consumers were informed about the presence of milk or milk derived products in the salami and signed a written consent form stating the participants expected contribution and rights, including the right to opt out during the research period; moreover, they were paid for their time.

The experiment was planned in three tests which differ for stimulus presentation, type of evaluation and type of rating. At the beginning of each evaluation, oral instructions were given to consumers about how to conduct the test. In addition, consumers completed a form with personal data and some questions about the consumption habits of fatty food. All samples have been sliced and then offered to the subjects in individual booths, located away from the sample preparation area. Each sample was assigned with a three-digit random number and one slice (4 mm thick) of each typology of salami was presented to each consumer. A glass of a still water and unsalted crackers were provided to each consumer to cleanse the palate among samples evaluations.

Perceived, expected and informed acceptability

In the first test, the traditional, the SS60 and the SS100 salami in a balanced order of presentation were offered to each consumer. They were asked to taste the salami and to rate their liking receiving no information on the products (Perceived acceptability). In the second test the subjects received only a sheet with information concerning the nutritional properties of the products (traditional, partial and total substitution of fat) and their effects on human health. They were asked to carefully read the information and to give their liking expectation for that product (Expected acceptability). The first

and the second tests were performed in the same day. The day after, the third test was performed: the consumers received all types of salami (TS, SS60 and SS100) together with the information sheet. They were instructed to read the information before tasting the sample and invited to express their liking (Informed acceptability). Consumers rated their liking on a nine-point hedonic scale labelled at the left end with “extremely unpleasant”, at the right end with “extremely pleasant” and at the central point with “neither pleasant nor unpleasant”.

In tests 2 (expectations generated by information) and 3 (acceptability generated by information and by tasting the product) the following information concerning the nutritional properties and their effects on human health was given to consumers:

(1) *Traditional salami TS: salami manufactured with pork backfat using traditional protocol, this product has about 32% of fat with more than 43% of saturated fatty acid content.*

(2) *SS60: salami manufactured with a partial (60%) substitution of pork backfat with extra virgin olive oil (low saturated fat salami). This product has 25% of fat with 28.5% of saturated fatty acid content and good nutritional indices (atherogenic, thrombogenic indices and polyunsaturated/ saturated ratio reach the recommended threshold values)*

(3) *SS100: salami manufactured with total (100%) substitution of pork backfat extra virgin with olive oil (very low saturated fat salami). This product has 23% of fat with about 24% saturated fatty acid content and very good nutritional indices (atherogenic, thrombogenic indices and polyunsaturated/ saturated ratio reach values lower than the recommended threshold).*

Statistical analysis

Data were analyzed using the GLM procedure of the SAS statistical software²⁷.

A preliminary analysis of variance was carried out for each attribute to monitor panel performance using assessor, product, replication and the interactions as factors.

Subsequently sensory profile data were subjected to ANOVA with product as fixed

effect, when significant differences were found (at $P < 0.05$ unless otherwise noted), the Student *t*-test was used to locate significant differences between means.

The analysis of variance was carried out using the MIXED procedure of the SAS system for perceived (P), expected (E) and informed (I) liking with product as fixed effect and consumer included as a random effect. To evaluate the effect of information on the consumer acceptability, the difference between expected and perceived liking score (E-P) as well as the differences between informed and perceived liking scores (I-P) and between informed and expected liking scores (I-E) were calculated. Paired *t* tests were then performed in order to establish if those differences were significantly different from zero²⁸. Clusters were performed by agglomerative hierarchical clustering (AHC) test using the Euclidian distance with Ward's method as aggregation criterion. The number of clusters was selected from the dendrogram. Socio-demographic consumer data and additional questions were summarized using the FREQ procedure and statistical differences were tested using the chi-square statistical test (χ^2) of the SAS system, when appropriate. The level of significance was set at 5% ($P < 0.05$) in all cases.

RESULTS AND DISCUSSION

Descriptive sensory analysis

A preliminary analysis of variance showed that the interactions product \times replication and product \times assessor were not significant highlighting ability to discriminate, reproducibility and consistency among assessors. Salami sensory profile is reported in Table 2. The percentage of fat replacement significantly affected the sensory evaluation. Concerning appearance and texture attributes, salami manufactured with 100% replaced fat showed the lowest color uniformity ($P < 0.01$), cohesiveness of the slice ($P < 0.01$) and hardness ($P < 0.001$) and the highest moisture ($P < 0.01$), and greasiness ($P < 0.05$) compared to traditional and SS60 salami. In addition, trained panelists perceived a

lower overall flavor intensity in salami manufactured with 100% replaced fat ($P < 0.05$) compared to other salami. The highest score for the moisture parameter could be due to the excess of olive oil in the mixture that did not completely enclose inside but collected under casings. As a consequence, in the SS100 salami, the slice appeared heterogeneous and salami showed bad sliceability and casing separated from fermented meat. Even if the highest moisture of SS100 salami affected negatively its appearance, on the other hand, this parameter accounted for texture attribute giving rise to a more tender product. No significant differences between traditional and SS60 salami were found except for hardness that showed lower value in SS60 than TS salami in agreement with previous studies^{29,21} that found an acceptable appearance and very soft texture for salami with pork fat replaced with olive oil.

Comparison between different information conditions on salami acceptability

Table 3 shows the results of perceived, expected and informed acceptability of salami. No differences between control and salami with 60% olive oil were observed for perceived acceptability, whereas salami with 100% olive oil showed the lowest value ($P < 0.05$). Both modified salami showed an higher expected acceptability than control salami ($P < 0.001$). In both modified salami the expected acceptability was significantly higher than the liking expressed in blind conditions ($P < 0.01$), whereas in traditional salami the expected acceptability was significantly lower ($P < 0.05$), thus indicating that a disconfirmation took place in both cases. In particular, consumers perceived control salami better than expected (positive disconfirmation), whereas they found modified salami worse than expected (negative disconfirmation). Therefore, information about nutritional properties had a marked impact on consumer expectancy; indeed, healthy products are associated with expected high quality. This result is in agreement with previous studies³⁰ that found nutritionally modified products highly acceptable, both

when consumers try them for the first time and under conditions of repeated use over time.

For 60% and 100% modified salami the informed liking was higher compared to blind acceptability ($P < 0.05$): the actual liking moves towards the expectations, thus indicating that information affects the actual liking of the product. The effect of information can be explained on the basis of the assimilation model, which appears when the informed liking of the product moves in the direction of the expectations as also showed in previous studies on consumers' behaviour^{31,7}. In the present study, the information about healthiness of modified salami generated a positive impact on actual liking even if the expectancy for SS100 salami was significantly higher than actual liking ($P < 0.05$), highlighting that consumers did not completely assimilate their liking in the direction of expectations for this modified product. The incomplete assimilation observed for this product could be due to the influence of the sensory properties of salami in the determination of the actual liking. Indeed, if the product is not acceptable in terms of sensory properties, information about nutritional characteristics could not be enough to induce consumers to gain a more positive perception of the product and to increase its acceptability. This result highlights that taste is the main barrier in making healthy food choices by consumers who are not willing to exchange food taste for health benefits according to previous study³². In addition, we suppose that if the expected liking was much greater than the perceived liking, could not be easy to move the totally informed liking toward the expected liking level. Previous studies^{28,31} suggested that if consumers do not completely assimilate the discrepancy between their expectation and actual product quality, they should revise their expectations after repeated exposure. The lack of any assimilation for the control salami could be attributed to the consumers' opinion that a normal salami contains high saturated fatty acids. Consequently, although information concerning control salami affected the expected acceptability of this

product, the effect of the sensory property linked to consumers' aptitude prevailed on the effect of information in the determination of the informed liking.

Cluster analysis results

A cluster analysis was applied to classify respondents according to the acceptability scores. Consumer segments were identified highlighting a number of differences which can be explained with regard to socio-demographic characteristics of respondents and to their consumption and purchase habits. Table 4 reports the socio-demographic characterization of the selected consumers for the whole sample and for the three clusters identified on the basis of their responses. Among the three clusters, no differences were observed in gender, age and activity, while significant differences were found for product information prior to purchase ($P<0.05$) and for consumption of cured meat products ($P<0.001$) and fatty food ($P<0.05$).

The first cluster, representing 28.06% of the sample, consisted of consumers who eat meat products several times a month (52.7%), aged 18 - 35 years. Components of this group may be referred as 'occasionally meat products consumers', therefore, less able to identify differences among meat products. Moreover, this group evidenced the highest percentage of respondents not trying to avoid fatty food (43.6%) and not carefully reading labels (49.1%), if compared with other clusters, showing a less interest in health concerns:

As shown in Table 5, in the blind test the consumers of this group perceived TS and SS100 in the same way, while they revealed the highest perceived liking ($P<0.05$) for salami with 60% of fat substitution. The score recorded by SS60 in this group is also the highest when compared with clusters 2 and 3 in the blind test. All products generated expectations, and, in particular, in both modified salami the expected acceptability was significantly higher than the liking expressed in blind conditions ($P<0.01$), while, in control salami the expected acceptability was significantly lower ($P<0.05$). This

indicates that a disconfirmation took place in both cases, consistently with data exposed in Table 2. Although product information affected consumers' liking, a lack of assimilation was observed during the informed acceptability test. Respondents of this cluster have the lowest familiarity with meat products in the three clusters. Consumers who eat meat with a lower frequency may likely be less appropriate to evaluate meat sensorial characteristics by relying on intrinsic cues; in fact, they have high expectations as demonstrated by high scores in expected liking for SS60 and SS100. The relevance of extrinsic cues in evaluating quality characteristics for consumers with low familiarity with a product, that results in uncertainty and clear difficulty in quality appraisal, is underlined in past studies^{33,34}.

The second cluster, representing 23.98% of consumers, was composed of people who eat cured meat products several times a week in almost 72.3% of cases. The group presented the highest percentage of members with an inclination to healthy food (72.3%) and to read product information (70.2%), if compared with other clusters. As a consequence, these consumers could be typecast as 'healthy food lovers' because they like to eat meat but prefer to avoid fat and they are used to read food labels carefully. In the blind test consumers revealed the same preference for both SS60 and SS100 and a slightly higher score for TS. It is worth to note that SS60 and SS100 scores for expected acceptability were higher than traditional salami, showing the higher consumer expectation for "healthy" salami with reduced backfat (negative disconfirmation). In all modified salami a complete assimilation was observed; indeed, informed liking was higher than perceived, indicating that information affects the actual liking of the product. In this cluster, moreover, there were no significant differences for the traditional salami in all tests, so it is important to highlight that this product is the only not influenced by information. These results evidence that for health conscious consumers of this group the provision of information about healthy salami deserved attention. In other words, they were experienced in meat consumption and already knew

traditional salami, so providing information did not add anything new; on the other hand, SS60 and SS100 were new products presenting characteristics they were interested in, so the provision of information was worth because they were more prone to safeguard their health.

The third cluster was the largest representing 47.96% of the whole sample. It was characterized by the highest frequency of cured meat consumption (68.1% several times a week and 24.5% daily). These so-called 'cured meat product lovers' were interested in carefully reading labels of products and almost two third of them declared to avoid fatty food. In particular, in the blind test, consumers were able to perceive significant differences among all tested salami, recording the highest acceptability for traditional salami ($P < 0.001$). Such results could be the consequence of their greater confidence with the product, confirmed by the highest score recorded by TS compared with other groups. In the expected test, information about healthiness generated a similar expectation for both modified salami (SS60 and SS100) which is higher compared to the traditional product, so showing an interest in health concerns. On the other hand, when we look at the informed test, consumers changed their opinion for SS100 salami showing an incomplete assimilation ($P < 0.05$). This cluster has the highest familiarity with meat products and for this reason consumers were able to evaluate the product on the basis of intrinsic cues, appreciating sensorial differences among samples. They had high expectations for new products, as a consequence of the provided information, even if lower compared to the other clusters, but the informed liking revealed the prevalence of the sensorial aspect.

Results from the cluster analysis provide suggestions about salami consumer preferences associated with healthy meat products and prove that some socio-demographic features discriminate consumers' clusters from each other. Such discrimination could be very useful for identifying consumers' segments which should

be considered when studying purchasing habits and consumers' attitudes towards meat attributes, particularly for the development of innovative products.

CONCLUSIONS

Results highlight that information about nutritional properties of salami has a marked influence on consumer expectancy but it does not always impact on actual liking, so indicating that informed liking needs to be evaluated in relation to the sensory properties. The cluster analysis demonstrates that consumers are not homogeneous in accepting a product. A great expectation for low saturated fat salami is shown in the three considered segments, with different reactions to information and sensory evaluation. Subjects of the first segment, "occasionally meat product consumers", are not able to appreciate intrinsic cues, so information plays a relevant role in forming their opinion. The second segment consists of consumers with higher experience and more sensitive to health concerns, "healthy food lovers". They take care over food consumption giving great attention to information, particularly concerning new products. Information provided by producers could deeply influence the buying decisions of this typology of consumers. In the last segment there are heavy meat consumers accustomed to the meat taste, called "cured meat lovers", who, despite their interest in information, disclose the prevalence of sensorial aspects in the informed liking.

Results could provide useful indications for food policy makers, food companies and consumers. Policy makers could be interested in consumers' reactions to information about healthy novel products in their ongoing commitment to implement regulations and communication campaigns aiming at achieving healthier food choices. Companies could get useful suggestions for the development of new products, as low fat salami, considering well known high failure rates of innovative products at market introduction.

Cluster results suggest that the provision of information can be used as an influential

marketing tool to differentiate meat products but it should take into consideration the two most important variables: health reasons and taste preferences. Moreover, the launch of a new product with health characteristics could improve the image of the red meat sector. Finally, taking advantage from policymakers' and companies' activities, consumers will be allowed to choose a new product and to make better informed decisions in line with their preferences.

Since few studies have examined the influence of healthy information about fat content of salami and consumers' liking, further researches are encouraged, taking into account limitations of the present paper. The analysis has considered an Italian region, so it would be interesting to extend it to the whole country or to several countries in order to compare consumers' differences. In such case more variables for market segmentation should be considered: geographic, demographic, psychographic and behavioralistic.

References

1. Font-i-Furnols M and Guerrero L, Consumer preference, behaviour and perception about meat and meat products. An overview. *Meat Sci* **98**:361–371 (2014).
2. Fernqvist F and Ekelund L, Credence and the effect on consumer liking of food– A review. *Food Qual Prefer* **32**:340–353 (2014).
3. Siegrist M, Factors influencing public acceptance of innovative food technologies and products. *Trends Food Sci & Technol* **19**(11):603–608 (2008).
4. Carrillo E, Varela P and Fiszman S, Effects of food package information and sensory characteristics on the perception of healthiness and the acceptability of enriched biscuits. *Food Res Int* **48**: 209–216 (2012).
5. Schouteten JJ, de Steur H, de Pelsmaeker S, Lagast S, de Bourdeaudhuij I and Gellynck X, An integrated method for the emotional conceptualization and sensory characterization of food products: The EmoSensory® Wheel. *Food Res Int* **78**:96–107 (2015).

6. Napolitano F, Braghieri A, Piasentier E, Favotto S, Naspetti S, and Zanolli R, Effect of information about organic production on beef liking and consumer willingness to pay. *Food Qual Prefer* **21**(2): 207-212 (2010).
7. Morales R, Aguiar APS, Subiabre I and Realini CE Beef acceptability and consumer expectations associated with production system and marbling. *Food Qual Prefer* **29**:166-173 (2013).
8. Piqueras-Fiszman B and Spence C, Sensory expectations based on product-extrinsic food cues: An interdisciplinary review of the empirical evidence and theoretical accounts. *Food Qual Prefer* **40**: 165-179 (2015).
9. Norton JE, Fryer PJ and Parkinson JA, The effect of reduced-fat labelling on chocolate expectations. *Food Qual Prefer* **28**:101–105 (2013).
10. Santarelli RL, Pierre F and Corpet DE, Processed meat and colorectal cancer: a review of epidemiologic and experimental evidence. *Nutr Cancer* **60**(2), 131–144 (2008).
11. Grunert KG, Sustainability in the food sector: A consumer behaviour perspective. *Int J Food System Dynamics* **2**: 207–218 (2011).
12. Kallas Z, Realini CE, and Gil JM, Health information impact on the relative importance of beef attributes including its enrichment with polyunsaturated fatty acids (omega-3 and conjugated linoleic acid). *Meat Sci* **97**(4): 497-503 (2014).
13. Realini CE, Kallas Z, Pérez-Juan M, Gómez I, Olleta JL, Beriain MJ, Albertí P, and Sañudo C, Relative importance of cues underlying Spanish consumers' beef choice and segmentation, and consumer liking of beef enriched with n-3 and CLA fatty acids. *Food Qual Prefer* **33**: 74–85 (2014).
14. Lähteenmäki L, Claiming health in food product. *Food Qual Prefer* **27**(2):196–201 (2012).
15. Verbeke W, Pérez-Cueto FJ, de Barcellos MD, Krystallis A and Grunert KG, European citizen and consumer attitudes and preferences regarding beef and pork. *Meat Sci* **84**:284–292 (2010).
16. Fernández-Ginés JM, Fernandez-López J, Sayas-Barberá E and Pérez-Alvarez JA, Meat products as functional foods: a review. *J Food Sci* **70**(2):37-43 (2005).

17. Ruiz JN, Villanueva NDM, Favaro-Trindade CS, and Contreras-Castillo CJ, Physicochemical, microbiological and sensory assessments of Italian salami sausages with probiotic potential. *Scientia Agricola* **71**(3): 204-211 (2014).
18. de Almeida MA, Villanueva NDM, Saldaña E, Pinto JS, Fadda SG, and Castillo CC, The use of Just-About-Right (JAR) scales to identify drivers of customer acceptance for low-sodium Italian salami. *Meat Sci* **112**: 112 (2016).
19. Backes ÂM, Terra NN, Milani LIG, Rezer ADS, Lüdtké FL, Cavalheiro CP, and Fries LLM, Physico-chemical characteristics and sensory acceptance of Italian type salami with canola oil addition. *Semina: Ciências Agrárias* **34**: 3709-3720 (2013).
20. Bernardi S, Favaro-Trindade CS, Trindade MA, Balieiro JCC, Cavenaghi AD, and Contreras-Castillo CJ, Italian-type salami with propolis as antioxidant. *Italian J Food Sci*, **25**(4): 433 (2013).
21. Del Nobile MA, Conte A, Incoronato AL, Panza O, Sevi A and Marino R, New strategies for reducing the pork back-fat content in typical Italian salami. *Meat Sci* **81**:263-269 (2009).
22. Oliver RL, A Cognitive Model of the Antecedents of Satisfaction Decisions. *J Marketing Res*, **17**: 46-49 (1980).
23. Deliza R and MacFie HJ, The generation of sensory expectation by external cues and its effect on sensory perception and hedonic ratings: a review. *J Sens Stud*, **11**(2): 103-128 (1996).
24. Stone H and Sidel JL, Sensory Evaluation Practices. Academic Press Inc., New York, NY (1985).
25. Murray JM, Delahunty CM and Baxter IA, Descriptive sensory analysis: Past, present and future. *Food Res Int* **34**:461–471 (2001).
26. Braghieri A, Piazzolla N, Carlucci A, Bragaglio A and Napolitano F, Sensory properties, consumer liking and choice determinants of Lucanian dry cured sausages. *Meat Sci* **111**:122–129 (2016).
27. SAS Institute, SAS/STAT user's guide (version 9.2). Cary, NC: Statistical Analysis System Inst (2011).

28. Lange C, Rousseau F and Issanchou S, Expectation, liking and purchase behavior under economical constraint. *Food Qual Prefer* **10**(1):31-39 (1999).
29. Murgueza E, Fista G, Ansorena D, Astiasaran I and Bloukas JG, Effect of at level and partial replacement of pork backfat with olive oil on processing and quality characteristic of fermented sausages. *Meat Sci* **61**:397-404 (2002).
30. Stubenitsky K, Aaron JI, Catt SL and Mela DJ Effect of information and extended use on the acceptance of reduced-fat products. *Food Qual Prefer* **10**:367-376 (1999).
31. Cardello AV and Sawyer FM, Effects of disconfirmed consumer expectations on food acceptance. *J Sens Stud* **7**:253–277 (1992).
32. Verbeke W, Functional foods: Consumers willingness to compromise on taste for health? *Food Qual Prefer* **17**: 126-131 (2006).
33. Bredahl L, Cue utilisation and quality perception with regard to branded beef. *Food Qual Prefer* **15**(1): 65-75 (2003).
34. Papanagiotou P, Tzimitra-Kalogianni I and Melfou K, Consumers' expected quality and intention to purchase high quality pork meat. *Meat Sci* **93**:449-454 (2013).

Table 1. Attributes and reference frame used for quantitative descriptive sensory analyses.

Attributes	Definition	Intensity	
		Low	High
<i>Appearance</i>			
Color uniformity	Presence of a darker external halo in the slice due to anomalous drying process	Two month seasoned sausages ¹	Bresaola ¹
Cohesiveness of the slice	Degree to which salami can be deformed before the first bite	Cubed cooked ham ¹	Dry sausage ¹
<i>Flavour and taste</i>			
Global flavour	Intensity of the sum of all flavors	Fifteen-day seasoned sausage ¹	Napoli salami ¹
Rancidity	Intensity of rancid odor perception of the sample during chewing	Bacon fat	Oxidized back-fat at 50°C for 24 h
<i>Texture</i>			
Greasiness	Perception of oil or fat in the mouth when chewing	Cubed dry cured ham ¹	Cubed pancetta ¹
Hardness	The force required to bite the sample with the molars	Cubed hungarian salami ¹	Two month seasoned cubed sausages ¹
Moisture	The amount of wetness felt in the mouth after the first bite	Dry sausage	Cooked ham

¹ Braghieri et al. (2016).

Table 2. Effect of fat replacement on sensory profile of salami manufactured with traditional formulation (TS) and with substitution partial (SS60) and total (SS100) of pork backfat (means \pm SEM).

	TS	SS60	SS100	SEM	Effect-P value
Color uniformity	7.51a	7.06a	6.04b	0.25	**
Cohesiveness of the slice	7.42a	7.00a	6.012b	0.28	**
Global flavor	7.30a	6.95a	6.08b	0.24	*
Rancidity	4.55	5.01	5.11	0.22	NS
Greasiness	6.11b	6.30b	7.02a	0.18	*
Hardness	6.83a	5.95b	5.22c	0.21	***
Moisture	5.95b	6.57b	7.50a	0.22	**

NS= not significant; *= P < 0.05; **= P < 0.01; ***= P < 0.001.

Table 3. Acceptability scores (means \pm SE) for perceived, expected and informed tests and their score differences by different “salami” .

	Perceived liking	Expected liking	Informed liking	E-P	I-P	I-E
TS	6.70 \pm 0.16b	6.09 \pm 0.10c	6.91 \pm 0.11	-0.61* Positive disconfirmation ^a	0.21 ^{NS}	0.82
SS60	6.5 \pm 0.14b	7.18 \pm 0.13d	6.97 \pm 0.12	0.68** Negative disconfirmation ^b	0.47* Assimilation ^c	-0.21 ^{NS} Complete ^d
SS100	6.05 \pm 0.12a	7.27 \pm 0.15d	6.74 \pm 0.14	1.22*** Negative disconfirmation ^b	0.69* Assimilation ^c	-0.53* Incomplete ^e

E = expected liking mean scores; P = perceived liking mean scores (baseline); I= informed liking mean scores (with information); different letters in the column indicate significant differences: a, b = P < 0.05; c,d = P < 0.001.

NS= not significant; *= P < 0.05; **= P < 0.01; ***= P < 0.001.

^aThe product experience is better than expected.

^bThe product experience is worse than expected.

^c Informed liking moves towards the expectations.

^dAssimilation occurs, and informed liking is not different from expectations.

^eAssimilation occurs, but informed liking is lower than expectations.

Table 4. Socio-demographic characteristics of consumers and additional questions about consumption and preference regarding healthy food.

Consumer Characteristics	Total		Cluster 1		Cluster 2		Cluster 3		Effect-P value
	n	%	n	%	n	%	n	%	
Gender									
Male	92	46.9	27	49.1	19	40.4	46	48.9	NS
Female	104	53.1	28	50.9	28	59.6	48	51.1	
Age									
18-35	87	44.4	31	56.4	15	31.9	41	43.6	NS
36-59	85	43.4	19	34.5	25	53.2	41	43.6	
> 60	24	12.2	5	9.1	7	14.9	12	12.8	
Activity									
employed	109	55.6	28	50.9	25	53.2	56	59.6	NS
student	80	40.8	24	43.6	20	42.6	36	38.3	
unemployed	7	3.6	3	5.5	2	4.3	2	2.1	
Consumption of cured meat products									
several times a month	45	23	29	52.7a	9	19.1b	7	7.4c	***
several times a week	120	61.2	22	40.0c	34	72.3a	64	68.1b	
Daily	31	15.8	4	7.3b	4	8.5b	23	24.5a	
Do you try to avoid fatty food?									
No	71	36.2	24	43.6a	13	27.7c	34	36.2b	*
Yes	125	63.8	31	56.4c	34	72.3a	60	63.8b	
Do you read carefully label?									
No	77	39.3	27	49.1a	14	29.8c	36	38.3b	*
Yes	119	60.7	28	50.9c	33	70.2a	58	61.7b	

NS= not significant; *= P< 0.05; ***= P< 0.001.

Table 5. Acceptability scores (means \pm SE) for perceived, expected and informed tests and their score differences by different “salami” per cluster

	Perceived	Expected	Informed	E-P	I-P	I-E
<i>Cluster 1 n = 55</i>						
TS	6.51 \pm 0.11b	5.95 \pm 0.13b	6.81 \pm 0.12	-0.56* positive disconfirmation ^a	0.30 ^{NS}	0.85
SS60	6.91 \pm 0.12a	7.56 \pm 0.12a	7.15 \pm 0.14	0.65** negative disconfirmation ^b	0.25 ^{NS}	-0.41
SS100	6.55 \pm 0.13b	7.81 \pm 0.12a	6.88 \pm 0.14	1.26*** negative disconfirmation ^b	0.34 ^{NS}	-0.93
<i>Cluster 2 n = 47</i>						
TS	6.41 \pm 0.14	6.25 \pm 0.13b	6.95 \pm 0.14	-0.16	0.54	0.70
SS60	6.10 \pm 0.13	6.93 \pm 0.14a	6.85 \pm 0.12	0.83** negative disconfirmation ^b	0.75** assimilation ^c	-0.08 ^{NS} complete ^d
SS100	6.05 \pm 0.13	7.29 \pm 0.13a	6.95 \pm 0.14	1.24*** negative disconfirmation ^b	0.90** assimilation ^c	-0.33 ^{NS} complete ^d
<i>Cluster 3 n = 94</i>						
TS	7.19 \pm 0.12a	6.05 \pm 0.13b	7.05 \pm 0.13a	-1.12** positive disconfirmation ^a	-0.11	1.01
SS60	6.51 \pm 0.12b	7.14 \pm 0.13a	7.05 \pm 0.14a	0.63** negative disconfirmation ^b	0.54* assimilation ^c	-0.09 ^{NS} complete ^d
SS100	5.60 \pm 0.12c	7.00 \pm 0.13a	6.55 \pm 0.13b	1.44*** negative disconfirmation ^b	0.94** assimilation ^c	-0.49* incomplete ^e

E = expected liking mean scores; P = perceived liking mean scores (baseline); I= informed liking mean scores (with information); different letters in the column indicate significant differences: a, b = $P < 0.05$; c, d = $P < 0.001$.

NS= not significant; * = $P < 0.05$; ** = $P < 0.01$; *** = $P < 0.001$.

^aThe product experience is better than expected.

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^c Informed liking moves towards the expectations.

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^eAssimilation occurs, but informed liking is lower than expectations.