



Intensive vs. free-range organic beef. A preference study through consumer liking and conjoint analysis



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ARTICLE INFO

Article history:

Received 3 August 2015

Received in revised form 27 December 2015

Accepted 28 December 2015

Available online 30 December 2015

Keywords:

Organic production

Beef

Extensive rearing system

Consumer liking

Conjoint analysis

ABSTRACT

This paper evaluates consumer liking and preferences towards organic beef from two production systems allowed by EU regulation: i) free-range and ii) intensive (fattened in feed-lot with organic feedstuff) as compared with conventionally produced beef.

Data were obtained in April–May 2014 with a sample of 150 regular beef consumers who completed two tasks: firstly a sensory test where consumers tasted and rated the meats and secondly a conjoint analysis to study beef purchasing preferences. Willingness-to-pay for the different meats was also calculated from conjoint results.

Results show that consumers preferred organic-from-concentrate beef at sensory level while organic beef from animals fed on grass was preferred when process characteristics (i.e. farming system) or attributes perceived at the point of purchase (i.e. colour) were evaluated. It was also found that the price-premium for organic beef is over 40%, with organic-fed-on grass beef preferred slightly over that fed-on-concentrate.

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1. Introduction

In 1997, in its conclusions for shaping an agriculture for the future (Agenda 2000), the EU's Council of Ministers defined a model for the development of a European agriculture that should be "multifunctional, sustainable and competitive, and responds to consumer concerns and demands regarding food quality and safety, environmental protection and maintaining animal welfare."

These objectives were largely obliged by consumers' growing mistrust of traditional agriculture, motivated by successive food scandals. This was particularly evident in foods of animal origin due to the various crises that had occurred in Europe (BSE, the use of banned substances in fattening, abuse of antibiotics, FMD outbreaks, etc.), and which had received massive attention in the media, causing consumers great concern. As a result, consumer habits changed, with the consequent implications for the productive sectors.

Consumers are becoming even more aware of the facts about foods of animal origin, especially meat, and are demanding that livestock production processes respect animal welfare, avoid all forms of environmental contamination, and do not misuse synthetic or chemical substances and additives that may pose a potential risk to health. One result in the European market is a growing demand for organic products. An ever greater number of consumers are convinced that organic produce means that they have access to safe, nutritious food of good

organoleptic value, and which will help increase their quality of life (Magnusson, Arvola, Koivisto Hursti, Åberg, & Sjöden, 2003).

The organic label on meat not only provides safety to the consumer, but it also carries implicit other factors such as animal welfare and environmental care. Indeed, these factors can be regarded as an added value to the quality of products of animal origin.

The importance and characteristics of organic meat production vary widely among the different countries of Europe (Hovi, Sundrum, & Thamsborg, 2003). Although the term organic is often associated with free-range raised livestock (Mesías, Martínez-Carrasco, Martínez, & Gaspar, 2011) the regulation in force on organic production – Council Regulation (EC) No. 834/2007 of 28 June 2007 – allows not only the use of extensive production systems based on free grazing, but also feed-lot rearing with organic concentrate. Obviously, while any production system that meets EU organic regulation will produce organic certified meat, the quality is most likely to differ from one system to another.

In Southwestern Europe, organic beef production is based on traditional, extensive, grassland systems (rangelands known as *dehesas*¹ in Spain), with diet relying on free grazing, and which have been transformed into organic production systems. This transformation has been facilitated by the initial existence of many extensive farms located in

¹ The *dehesa* is a managed, agrosilvopastoral ecosystem whose soils are acidic, shallow, and easily eroded. Holm and cork oak form the most representative tree cover. The climate is semi-arid Mediterranean. The pasture that grows in these soil and climate conditions comprises many species, most of which are annuals. Cattle form the predominant livestock, with breeds of high rusticity that are able to thrive in this difficult environment.

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these areas of little environmental imbalance and low contamination. Under these conditions, it has been possible to develop organic livestock farming by introducing minor changes to the farms' health and management practices (Caballero & Mata, 1996). The typically seasonal nature of pastures, often involving periods of food shortage due to the dependence on annual variations in climate conditions (García-Torres, Espejo Díaz, Izquierdo Cebrián, & Vasco Pérez, 1997) is one of the problems that these producers face. It has led some organic beef farmers to adopt another way of fattening their animals which is more intensified although compliant with the norms of organic production. The procedure is to fatten calves using organic concentrate as basis, which shortens the fattening period and ensures a carcass with an optimal degree of fat, thus avoiding quality losses due to possible frostbite.

Despite these changes in production systems, the price of organic food in general, and of meat in particular, is substantially higher than that of the conventional counterparts. Nevertheless, numerous studies have found that consumers are willing to pay this premium because of the beneficial effect of organic production on human health, on the protection and conservation of the environment, and lastly, and for reasons of animal welfare (Jensen et al., 2001; Wier & Calverley, 2002). However, if consumers perceive that these production systems, even though organic, are similar to conventional intensive systems (animals are confined to feed-lots and fed with concentrate, without access to pastures), they may assume that some of the expected benefits have been lost, and will therefore be less willing to pay a premium for organic food.

Furthermore, to respond effectively to the continuing growth in the market for organic meat it is also essential to determine the sensory attributes (taste, appearance, texture, and smell) which form the consumer's search and experience processes and which provide to organic beef a differentiation from other meats (Lee & Yun, 2015). One must bear in mind that, while direct experience with the product plays a major role in the purchasing process, indirect experience (product descriptions, information from other consumers, ...) is also of considerable importance (McCabe & Nowlis, 2003). It is necessary to determine how relevant are the various types of information (such as the origin and feeding of the animal, how it was raised, its age, slaughtering, veterinary certification, etc.) in conditioning consumer behaviour. Consequently, one has to identify which aspects are important for the consumer, using market research tools to quantify their relative importance.

Several studies have detected different patterns of behaviour towards organic food according to socio-demographic variables (Padilla Bravo, Cordts, Schulze, & Spiller, 2013; Squires, Juric, & Cornwell, 2001). It has also been stated that considering a uniform preference function for all the population can be misleading, as preferences for food may vary widely among consumers (Pouta, Heikkilä, Forsman-Hugg, Isoniemi, & Mäkelä, 2010). All this evidence supports the need to identify different types of consumers in order to deepen the present study.

This work aims therefore to analyse consumers' preferences for two types of organic beef (grass-fed and concentrate-fed animals) by comparing both types with conventionally produced beef usually found in supermarkets. We have used two methodological approaches – sensory evaluation and conjoint analysis – together with a cluster analysis. This will provide a complementary view about expectations and experience in organic meat consumption.

2. Materials and methods

2.1. Material

Meat samples from *Longissimus thoracis* from three production systems were evaluated. All animals were Retinto male calves and were raised under different production systems: organic fed on grass, organic fed on concentrate and conventional production. Both organic systems complied with organic European regulations.

- Organic fed on grass (OG). 15 Retinto calves were fattened in Valdesequera experimental dehesa farm (Extremadura Regional Government, Badajoz, Spain). During the fattening phase from weaning to slaughter the diet was based on organic natural grass – free grazing – and organic concentrate at times of pasture shortage.
- Organic fed on concentrate (OC). 15 Retinto calves were reared in the feedlot "Divino Salvador Coop." (Cádiz, Spain). After weaning, the animals were housed in pens of 20 × 10 m, according to the specifications of Council Regulation 834/2007, and fed with organic concentrate and 60% organic forage (barley straw and grasses silage).
- Conventional production (CP). 15 Retinto calves were confined in pens of 10 × 10 m and fed with conventional concentrate and barley straw ad libitum and without access to pasture.

Animals were slaughtered in an industrial slaughterhouse with organic certification. Slaughter live weight was 530 ± 20 kg with age at slaughter ranging from 12 months (OC and CP) to 15 months (OG). Carcasses were stored at $2-4 \pm 1$ °C for 24 h. Meat cutting was realized at 24 h post-mortem and a portion of the *Longissimus thoracis* muscle was removed and stored at $2-4 \pm 1$ °C for 7 days of ageing. Samples were later sliced into pieces of 2.5 cm of thickness, vacuum packed in plastic bags/polyethylene (O_2 permeability, 9.3 ml $O_2/m^2/24$ h at 0 °C) and frozen at -20 °C until their analysis.

2.2. Subjects

The study was developed with 150 untrained consumers who volunteered to participate. This figure is in line with that of other studies using untrained individuals. The use of untrained consumers is more common in studies about food preferences than in those dealing with sensory analysis. Nevertheless, a literature review shows abundant sensory research using untrained panellists (Waldrop & Ross, 2014; Ross, Bohlscheid, & Weller, 2008; Lim, Miller, Park, & Park, 2014; Kerth, Harbison, Smith, & Miller, 2015).

Participants had to be regular consumers of beef and were recruited in the city of Badajoz (SW Spain). The evaluation process was carried out between February and May 2014 in the Sensory Lab of the Extremaduran Regional Government. Each consumer completed two tests, first a sensory analysis and secondly a conjoint analysis. A limited amount of information – about type of meat, ageing time and breed – was provided during the sensory analysis in order to reduce potential bias. Subsequently, consumers received detailed information about the different rearing systems (e.g. diet, stocking rate, free/confined rearing) under analysis and the conjoint analysis was developed. Consumers also provided some data regarding their demographic and purchasing habits.

The combination of both methodologies allowed evaluating the preferences at the purchase location – those defined essentially by extrinsic attributes, such as price and product origin – and which result in the decision to purchase. On the other hand, the preferences regarding actual consumption were also evaluated – preferences based on a combination of intrinsic attributes of the product such as colour, taste, texture or juiciness and which are largely responsible for the confirmation of the decision to purchase and its future repetition (Banović, Aguiar Fontes, Grunert, & Barreira, 2009).

2.3. Sensory analysis

Samples were thawed at 4 °C for 24 h. For the cooking, the samples were placed on heating plates at 150 °C for 6 min, reaching an internal temperature of 75 °C, as measured by a portable T200 thermometer (Digitron Instrumentation Ltd., Merd Lane, Hertford, UK). Rectangular pieces of approximately 3 × 2 cm from the centre of the chop were obtained and placed immediately on a warm plate to maintain the temperature until they were presented to the participants in the balanced

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