UTJECAJ DRUŠTVENIH ZAHTJEVA NA POTROŠAČKI ODABIR MESA CRNE SLAVONSKE SVINJE

Jelić Milković, Sanja

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Co-supervisor: PhD Maurizio Canavari**,** Full Professor of the Alma Mater Studiorum - University of Bologna Department of Agricultural and Food Sciences

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Sanja Jelić Milković, MEngSc Agriculture

Thesis performed at Faculty of Agrobiotechnical Sciences Osijek, University of Josip Juraj Strossmayer in Osijek
Supervisor: PhD Ružica Lončarić, Full professor
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The main objective of the dissertation was to obtain an overview of consumers attitudes and beliefs towards some aspects related to social concerns (sustainability, biodiversity and rural development, and animal welfare) and examine influence of information (about production system, colour, geographical information) on consumer choice in favour of local pig breeds, in this case, the Black Slavonian Pig breed, but also to provide knowledge support to producers, national agricultural food policy makers and retailers. Croatian consumers were randomly assigned to one of two treatment options (control or information) in an online survey. Consumers (n = 410) answered questions about their purchase intentions, perceptions and beliefs. A hypothetical choice experiment was used to examine participants' preferences and willingness to pay (WTP) for fresh meat of the Black Slavonian Pig breed reared outdoors and semi-indoors. The results show that the consumers have a notable preference for fresh boneless ham from the Black Slavonian Pig produced in both production systems and labelled as reared in continental Croatia + PDO (Protection of Designation Origin) compared to fresh boneless ham produced from pigs reared in conventional rearing system (intensive – indoor) without a label. Information treatment also proved to be important, as the results show that the information given to the consumers about the production system (that is in line with animal welfare, environmental protection and preservation of biodiversity) meat colour and geographical information positively influenced the consumers' decisions giving great importance to investigated social concerns regarding sustainability, preservation of biodiversity and animal welfare. It is evident that appropriate labelling and information on the product could positively influence consumer preferences, indicating the importance of highlighting the traditional characteristics (production system, darker colour of the meat and production area) of fresh meat from the Black Slavonian Pig on the label in promotional activities.

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Sanja Jelić Milković, mag.ing.agr.

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Komentor: prof. dr. sc. Maurizio Canavari

Cilj disertacije bio je dobiti pregled stavova i uvjerenja potrošača prema nekim od aspekata društvenih zahtjeva (održivost, biološka raznolikost i ruralni razvoj te dobrobit životinja) te ispitati utjecaj informacija (o proizvodnom sustavu, boji mesa i zemljopisnim oznakama) na izbor i ponašanje potrošača u korist lokalne pasmine svinja, u ovom slučaju pasmine crne slavonske svinje, ali također pružiti potporu u znanju proizvođačima, kreatorima nacionalne poljoprivredno prehrambene politike i trgovcima. Hrvatski potrošači su nasumično raspoređeni u jedan od tretmana (kontrolni ili informacijski) u online anketi. Potrošači (n = 410) su odgovarali na pitanja vezana o kupovnim namjerama, percepcijama i uvjerenjima. Hipotetski eksperiment odabira korišten je za ispitivanje preferencija potrošača i njihove spremnosti za plaćanje (WTP) premium cijene za svježe meso crne slavonske svinje uzgojene u otvorenom i poluotvorenom sustavu držanja. Dobiveni rezultati pokazuju da hrvatski potrošači preferiraju svježi but bez kosti od crne slavonske svinje uzgajane u oba sustava i označen s oznakom kontinentalna Hrvatska + ZOI (zaštićena oznaka izvornosti) u odnosu na svježi but bez kosti proizveden od svinja uzgajanih na konvencionalni način (intenzivni – zatvoreni sustav proizvodnje) bez oznake. Tretman s informacijom također se pokazao važnim, jer rezultati pokazuju da su informacije dane potrošačima o proizvodnom sustavu (koji je u skladu s dobrobiti životinja, zaštitom okoliša i očuvanjem bioraznolikosti), boji mesa i zemljopisnim oznakama pozitivno utjecale na odluke potrošača dajući veliku važnost istraživanim društvenim zahtjevima u vezi s održivošću, očuvanjem biološke raznolikosti i dobrobiti životinja. Evidentno je da bi odgovarajuće označavanje i informacije na proizvodu mogle pozitivno utjecati na preferencije potrošača, što ukazuje na važnost isticanja tradicionalnih karakteristika (sustav proizvodnje, tamnija boja mesa i područje proizvodnje) svježeg mesa crne slavonske svinje na ambalaži u promotivnim aktivnostima.

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CONTENT

1. INTRODUCTION

Pig production in the Republic of Croatia is a significant branch of livestock production in the supply of the market with high-quality meat (Kralik et al., 2017). Croatia has a long tradition of pork production, which is organised on family farms and large pig farms (Wellbrock et al., 2010; Kralik et al., 2012), primarily in intensive production systems. According to the same pig meat scenario, continuous development in pig production worldwide has been taking place for the last 40 years, resulting in genetically improved and more productive breeds of pigs. This situation caused the spread of genetically improved productive pig breeds on a global scale and reduced the number of pigs of many local (indigenous) breeds that have shown less success in intensive breeding and are currently threatened with extinction (Kušec et al., 2015). According to Kušec et al. (2015), the most important reason for such intensive production is economic factors. However, the intensive pig rearing systems are becoming more socially unacceptable due to the general environmental protection issues, animal welfare, suffering and stress of farm animals together with pain management (Delsart et al., 2020). Intensive pork production emits 668 m tonnes CO_2–eq of greenhouse gases each year and is regarded as one of the largest polluters of the environment. Thus, the imperative in livestock breeding today is the development of alternative systems that can provide the right balance between sustainability and food security (McAuliffe et al., 2017). Sustainable pig production together with the preservation of biodiversity are among the significant challenges of modern society. Additionally, conventionally used intensive pork production has encountered lower product quality, animal resistance, animal waste management, and animal welfare, which is increasingly crucial for consumers' quality, health, and food safety (Kušec et al., 2015). In line with this, initiatives have been introduced to preserve local pig breeds and search for ways to make them as competitive as possible in current market conditions.

Black Slavonian Pig is one of the Croatian indigenous pig breeds. Rearing of this breed is more economical and profitable compared to cosmopolitan breeds due to its longevity, resistance, and adaptability to extensive rearing conditions (Kralik et al., 2013), but also low cost of accommodation facilities, modest food demand and excellent quality of meat and fat, usually used for the production of high-quality meat and traditional products (Kralik et al., 2013; Budimir et al., 2014; Kralik et al., 2017; Muñoz et al., 2018). Furthermore, it is

suitable for rearing outdoors, in areas unsuitable for other forms of livestock or crop production (Budimir et al., 2014; Kralik et al., 2017). This way of rearing positively impacts the pig's health, reduces the breeding cost, is environmentally acceptable, and is altogether in line with sustainable pork production (Margeta et al., 2013; Kralik et al., 2017). Due to these advantages over modern pig breeds, meat from this breed has been recently protected with PDO (Protection of Designation Origin) label at the national level (EU level pending) (Ministry of Agriculture, 2021).

Almost every country in the European Union has several domestic breeds of pigs. According to Santos Silva and Tirapicos Nunes (2013), the Northern Mediterranean countries have about 35 local pig breeds, or even more. The advantage of products from these breeds is that they have high gastronomic and economic features, such as unique quality, ecological gains, cultural and ethnic benefits, that consumers appreciate and value (Santos Silva and Tirapicos Nunes, 2013; Lončarić et al., 2015). Typical Mediterranean cured meat products are internationally recognised and protected by PDO labels (Santos Silva and Tirapicos Nunes, 2013). Traditional products and activities in rural areas have a significant impact on the rural regions' economic, social, and functional structure (Lončarić et al., 2013).

Consumer preferences and purchasing choices are mainly based on taste and convenience, but they are also influenced by many other factors such as animal welfare, ecological factors and health concerns. Nowadays, a large number of consumers do not buy food only because of their primary function, but also because of external signs of intrinsic values, such as naturalness, authenticity, origin and tradition (Valkaj et al., 2013; Fenger et al., 2015; Cerjak et al., 2017; Lončarić et al., 2018). Furthermore, in many countries, the public's interest in sustainable, high-quality, and safe food has been particularly affected by scandals and food-related crises over the last decade (Grunert et al., 2018). Therefore, many consumers take into account intrinsic (visible product properties), extrinsic characteristics (brand, label, price, origin, production, and nutrition information) when choosing pork products, but also animal welfare and other ethical and social factors (Grunert et al., 2018). EU consumer attitudes are similar in terms of animal welfare (breeding, space allowance, transport, etc.), but they are not the same in every country. They differ among EU countries and are mainly influenced by the economic and educational level, especially when it comes to knowledge on animal welfare, and paying higher prices for pork reared under better welfare conditions (Martelli, 2009).

Previous research about pork products in the Republic of Croatia has been mainly concerned with consumer preferences regarding the purchase of organic or conventional pork products, frequency of purchase, place of purchase and satisfaction with the supply of such products, and only a few studies investigated Croatian consumer's preferences for social and altruistic attributes of the pork products, animal welfare and sustainability (Radman et al., 2008; Kallas et al., 2019; Čagalj et al., 2020; Mesić et al., 2020). However, with better insight into consumer preferences for production attributes, it is possible to open new marketplaces between traditional and organic production, focusing on product attributes related to animal welfare, traceability, and health-care products (Napolitano et al., 2010). Additionally, Napolitano et al. (2010) suggest that by knowing the consumer preferences farmers will be able to distinguish their products and production systems in order to increase their competitiveness. Nowadays, it is not only essential to produce a higher quantity of the final products, but also to meet the needs and specific consumer preferences at the same time. Croatian consumers are not yet sufficiently familiar with the impact of animal welfare on meat quality, but their awareness is rising, and they increasingly require transparency in food production. Generally, they want to know more about the origin and traceability of the meat they buy to maximise utility and make informed purchasing decisions (Mikuš et al., 2017). According to Tomasevic et al. (2020) it is important to provide the information to consumers to improve their knowledge about what is going to ensure animal welfare at farm and slaughter plant level, to show them the importance of the humane treatment of animals, and to show the effect of animal treatment on meat quality. Information on consumer wishes and needs should be important to manufacturers to produce products that consumers are willing to pay for; therefore, their target should be to have the right products for the right customer.

This dissertation is focused on the examination of consumer's preferences and habits regarding the purchase and consumption of fresh pork regarding attributes that affect their purchasing decisions. Factor and cluster analysis were conducted to segment Croatian consumers. The differences between the obtained consumers segments regarding the attributes that affect their purchasing decisions were determined based on their socio-demographic characteristics, purchasing and consumption behaviour, and knowledge about the pig breed by the chi-square test (χ^2). Factor analysis was also used to reduce the number of variables regarding consumers' attitudes about purchasing and social characteristics when buying fresh pig meat from the Black Slavonian Pig breed, after which significant differences between obtained factor scores and consumers' sociodemographic

characteristics, consumption and purchasing behaviour were identified. The dissertation hypothesises that consumers are aware of the concept of social concerns when purchasing pork and that there is a significant difference between sociodemographic characteristics, purchasing and consumption habits as well as the respondent's knowledge of the pig breed and attitudes towards animal welfare, environmental impact, preservation of biodiversity and rural development.

Additionally, the dissertation focuses on identifying the most relevant attributes (price, colour and geographical information) of Black Slavonian Pig meat consumers prefer during purchase and the amount of money they are willing to pay for the product. A choice experiment was used to measure consumer preference for the selected agricultural product fresh meat of the Black Slavonian Pig. Fresh meat from Black Slavonian Pig was selected for this research given that Black Slavonian Pig fresh meat was in the process of protection of the product name "Black Slavonian Pig meat" with the mark of origin at the national level in time of the questionnaire creation (Margeta et al., 2018) and now it is in process of protection on the EU level (Ministry of Agriculture, 2021). Also, the production system for rearing of Black Slavonian Pigs is in accordance with the social criteria such as animal welfare, environmental protection issue, lower rearing cost and is in line with good livestock practices representing a part of the historical, traditional, and cultural identity of the Republic of Croatia (Margeta et al., 2013; Kralik et al., 2017; Meso crne slavonske svinje - Oznaka izvornosti Specifikacija, 2019). Choice experiments (CE), also known as discrete choice experiments (DCE) or Conjoint Choice Experiments (CCE), is a recognised method that was first applied by Louvière and Woodworth (1983), and has developed considerably since its inception (Aizaki, 2012). The choice experiment is the most commonly used method of perceptions analysis because it enables simultaneous multiple attribute estimation and is consistent with Lancaster's consumer theory and McFadden's random utility theory (De-Magistris and Gracia, 2016). Numerous studies have also been carried out in Europe concerning the assessment of consumer preferences for agri-food products, including consumer preferences for origin, production (conventional, integrated, or ecological), food safety and food quality, animal welfare and the effect of providing information through product declarations (Liljenstolpe, 2005; Martelli, 2009; Verbeke, 2009; Tawse, 2010; Heerwagen et al., 2014; Akaichi et al., 2016; Wongprawmas and Canavari, 2017; Grunert et al., 2018; Silva et al., 2018).

In the thesis, for the purpose of scientific research, a variety of scientific methods were used. In accordance with the thesis's research objective, primary and secondary data were used. The primary data were collected by the method of sample survey using a highly structured survey instrument. The survey instrument was designed to elicit consumer preferences regarding fresh meat of Black Slavonian Pig in a hypothetical situation. Ryan and Huges (1997) gave five stages of the development of a choice experiment: determination of attributes, assigning the levels to the attributes, construction of the choice set, collection of responses and econometric analysis of data. Secondary data were collected using the available relevant and recent literature of the subject area of research.

In the continuation of the thesis are described survey instruments, discrete choice experiment design, survey procedure, estimation methods and statistical analysis. In the fourth and fifth sections, findings are presented and discussed, and conclusions are drawn regarding research objectives.

1.1. References Overview

1.1.1. Pork production in the European Union and the Republic of Croatia

According to the HAPIH (Croatian Agency for Agriculture and Food) Annual report (2021), pig production in Croatia is based on family farms with 5 or 10 sows (16.0 %) and 84.0 % of pig production is based on large farms. This is in accordance with the European Union countries where 80.0 % of pigs are reared on farms with 400 or more animals. Data on the number of animals on farms show that production is steady and that the trend of pig production at large farms prevails in the world (1.5 % of large pig farms produce 75.0 % of pig's meat) (Kralik et al., 2017; Augère-Granier; 2020).

According to USDA Foreign Agricultural Service (2019), the largest meat producers in the world are China (54,150,000 tons), the European Union (24,100,000 tons), Brazil (3,675,000 tons) and Russia (3,235 thousand tons). Since 2014, pork production in the European Union has increased from 22.1 million tonnes to 23.3 million tonnes (254.7 million heads) in 2017. The largest pig producers in the European Union from 2016-2020 are Germany with a share of 22.9 %, Spain 11.2 %, France 9.5 %, Poland, Denmark, and the Netherlands with a share

of 22.4 % (Agri-food Data Portal, 2020). According to the European Commission data (2017), demand for pork in most countries is rising, and further growth in pork imports is expected worldwide. The largest importer of pork is China, with an average consumption per capita of 55.7 kg, followed by European Union countries where the average consumption of pork per capita is 33.4 kg (European Commission, Short term outlook 2017-2030; 2020-2030.). The European Union (EU) is currently the world's top exporter of pork products. Its exports have been boosted by the fall in production in Asia, where African swine fever (ASF) decimated millions of animals and increased demand for EU pork pushed prices to a peak in early 2020 (Augère-Granier; 2020; European Commission, Short term outlook 2020-2030). According to European Commission (2020) predictions, the EU will remain the global leader in pork export (38.0%) 2020-2030.

In the total value of agricultural production of the Republic of Croatia in 2020, livestock production accounts for 38.5 %, while plant production share in total agricultural production is 61.5 % (Croatian Bureau of Statistics, 2021). The number of pigs in the Republic of Croatia decreased from 2010 to 2020 (Figure 1). In 2020 the number of pigs decreased by 16.1 % compared to 2010 (Croatian Bureau of Statistics, 2021). However, the number of pigs increased by 1.05 % in 2020 compared to 2019 (Figure1).

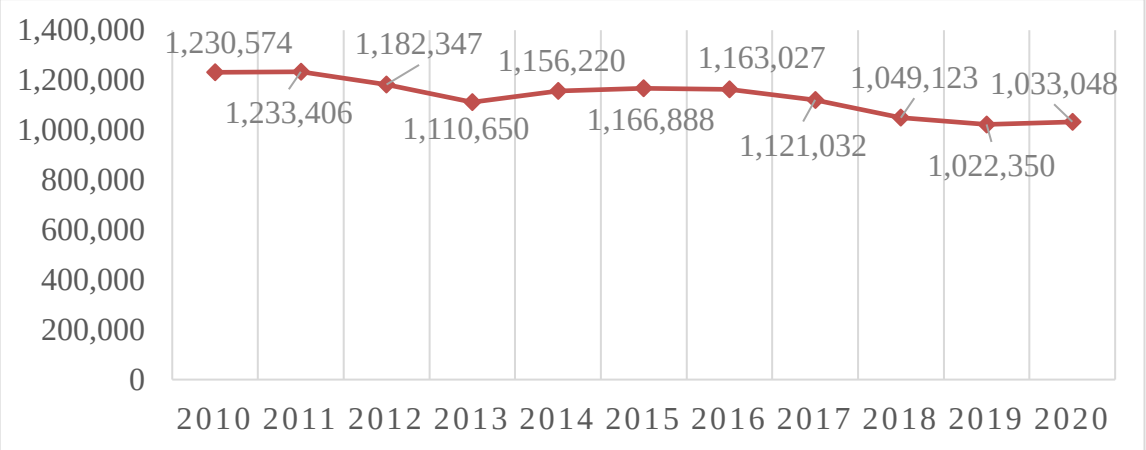

Figure 1 Number of pigs in the Republic of Croatia

Source: Croatian Bureau of Statistic, 2020

About 84.0 % of sows in productivity control are reared on large farms (400 - 3,000 sows), and 16.0 % on family farms. The most common are hybrid PIC (45.9 %) and Topigs (34.9 %) sows, while 10.2 % of sows belong to the indigenous breeds (Black Slavonian Pig,

Turopolje Pig and Banija Spotted Pig) (HAPIH Annual report, 2021). Production of pork in the Republic of Croatia does not meet domestic consumption, and about 50.0 % of the demand for pork is settled from imports (Grgić et al., 2015; Kralik et al., 2017). Kralik et al. (2013) believe that this is precisely due to the inadequate agricultural policy, the lack of infrastructure, the lack of organisation of small producers and the lack of new market conditions. Kranjac et al. (2018) predict that the number of pigs will continue to decline by 2022, but that by 2030 the sector will recover. The consumption of pork per capita in the Republic of Croatia from 2010 to 2017 on average was 47.0 kg, and Kranjac et al. (2018) indicate that demand for pork in the coming years (up to 2030) would increase by 10.6 %. The domestic seasonal consumption of pork is also positively influenced by the tourist season, with a rise in the number of guests and demand for meat and meat products (Grgić et al., 2015; Kralik et al., 2017; Kranjac et al., 2018). If the number of pigs and pig producers continues to decline and pork consumption grows, this trend will lead to more significant pork imports, as confirmed by previous research (Grgić et al., 2015; Kralik et al., 2017).

Fresh pork import and export are presented in Figure 2, where it is clear that in the period from 2010 – 2020, most fresh meat is imported and exported from the European Union countries (EU – 27). In the mentioned period, the highest import of fresh pork was in 2015 (442,000 kg) and in 2019 (337,900 kg), the import started to decline in 2020. According to the data in Figure 2, the export of fresh pork began to increase in the period from 2013 – 2020, the highest export of fresh pork to EU – 27 countries was recorded in 2019 (431,800 kg) and to countries outside of the European Union in 2017 (69,900 kg).

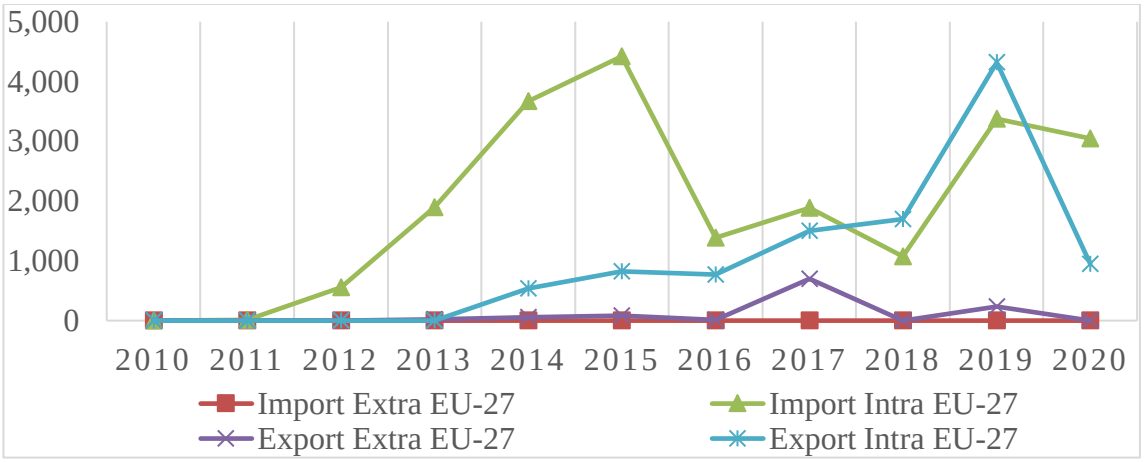

Figure 2 Import and export of fresh pork in the Republic of Croatia (100 kg)

Source: Eurostat, 2021

The level of self-sufficiency in the period from 2010 to 2016 is 61.0 % (Kranjac et al., 2018), which is not enough to meet the needs of the domestic population and also the needs of the processing industry for quality raw material (Grgić et al., 2015; Kralik et al., 2017). Therefore, producers are forced to settle with the importation of piglets (Grgić et al., 2015; Kralik et al., 2017). Additionally, the Republic of Croatia needs to develop a strategy for livestock breeding and pig production and focus more on increasing production and reducing imports (Kralik et al., 2017). Grgić et al. (2015) state that the small family farms should focus on cooperation and selecting the production of local breeds, such as the Black Slavonian Pig.

According to the European Commission (2020), sustainability, environmental, economic, and social concerns will play a more prominent role in shaping the EU meat market. The most influential trends could be evident by 2030, including lower production based on more efficient systems, along with fewer animals and reduced exports of live animals. In addition, consumers' concerns over environmental and climate changes mean that they pay more attention to the production processes (local markets, organic and other quality schemes, animal welfare, and environmental footprint). Furthermore, in today's market condition, there are present changes in consumers' consumption habits, health considerations, and convenience in food preparation (European Commission, Short term outlook 2020-2030). All these changes in the market, consumer behaviour and forecasts of the European Commission go in line with initiations supporting indigenous pig production.

1.1.2. Black Slavonian Pig production and meat quality

The indigenous and protected breeds of pigs represent the genetic heritage of a country, and the breeding of local indigenous breeds aims to preserve biodiversity, which is significant from the historical, economic, and cultural standpoint (HAPIH annual report, 2021). Black Slavonian Pigs have been reared for centuries in the Republic of Croatia. The Black Slavonian, also known as Fajferica, was developed by the earl Karl Pfeiffer in the second half of the 19th century in Slavonia (Hrasnica et al., 1958). Pfeiffer created the breed with more desirable economical traits (feed conversion ratio, daily gain, carcass traits) compared to breeds that were used in those days. The breed was economically successful and well known for its fat and meat production and one of the most abundant in the 1950s. Since then,

it has been slowly replaced by modern pig breeds, and the population of the Black Slavonian Pig drastically declined at the beginning of the 1990s (Hrasnica et al., 1958).

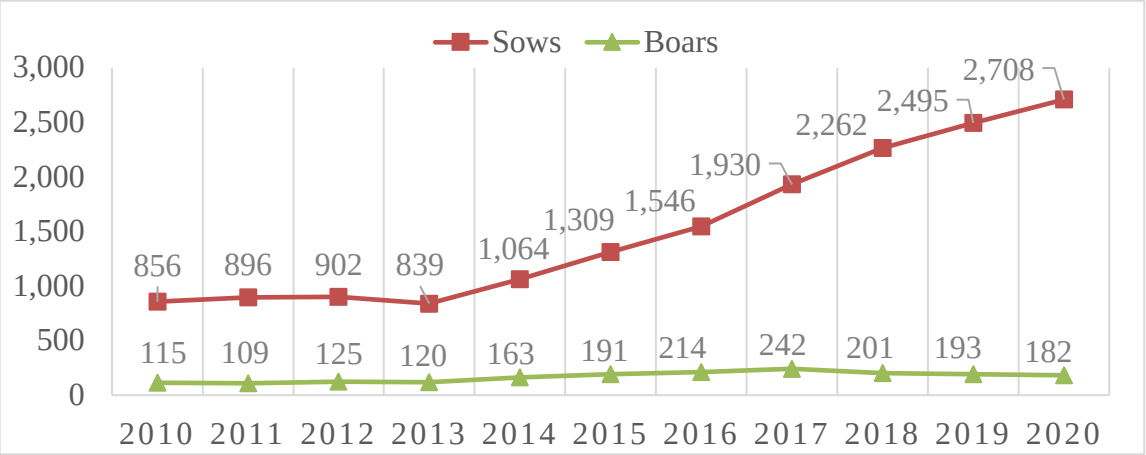

Figure 3 Trends in the total number of Black Slavonian Pigs in the period 2010 – 2020

Source: HPA, 2018; Ministry of Agriculture, 2019; HAPIH, 2020; 2021

Nevertheless, the population of the Black Slavonian Pig increased in the last ten years due to protection measures. According to the data in Figure 3 in the previous ten years (2010 – 2020), the number of sows of the breed increased by 1,852 sows and in 2020 there were 2,708 animals. The number of boars increased from 2010 – 2017 by 127 boars, but then declined from 2017 to 2020 to 182 animals.

Black Slavonian Pig is a fatty-lean type of pig usually used for the production of lard and bacon, but also traditional high-quality meat products (Djurkin Kušec et al., 2017). Its meat does not release excess water, and there is no appearance of pale, soft or watery meat (Senčić and Samac, 2017). Compared to meat from modern cosmopolitan breeds, the Black Slavonian Pig has considerably higher intramuscular fat content (on average 6.0 to 7.0 %), while modern pig breeds have 2.5 – 3.0 %. It is also darker and redder than meat from modern pig breeds (Karolyi et al., 2007; Uremović et al., 2004; Margeta, 2013; Salazar et al., 2013; Santos Silva and Tirapicos Nunes, 2013; Kušec et al., 2022). Its quantity and composition significantly determines taste and technological properties of the meat (Margeta, 2013; Senčić and Samac, 2017).

Traditionally it is reared outdoors on grassland (which includes utilisation of natural resources of pasture and oak) or semi-indoors to approximately 18 months of age or up to

130 – 150 kg live weight (Karolyi et al., 2007; Djurkin Kušec et al., 2017). Rearing pigs in the traditional outdoor system is cost- and labour-effective, and is environmentally and animal-friendly, resulting in improved meat quality traits and nutritional characteristics (Karolyi et al., 2007; Budimir et al., 2013; Kralik et al., 2013; Margeta, 2013; Djurkin Kušec et al., 2017; Senčić and Samac, 2017).

Production system significantly influences the growth characteristics of the Black Slavonian Pig (Frohlich et al., 2017; Senčić and Samac, 2017). Pigs reared indoors grow faster, but the growth is characterised by overproduction of fat. On the other hand, pigs reared outdoors grow slower, but have a more favourable lean/fat ratio. Pigs reared outdoors have higher pH values, and the meat has lower tenderness and increased juiciness compared to the meat from animals from the semi-indoor system (Senčić and Samac, 2017). According to Karolyi et al. (2007), Croatian consumers consider Black Slavonian Pig meat as organic products and they consider organic products very healthy, good quality, and tasty. According to that, meat and products from local breeds, like a Black Slavonian Pig, have a good image in the public and media. Still, consumers' attitudes toward fresh meat from the Black Slavonian Pig have not been yet investigated enough.

1.1.3. A literature review of Consumer preference, behaviour, and perception of meat and meat products

Food supply has greatly exceeded food demand, turning markets into demand-driven economies. The goal of exchange and marketing is to better meet consumer needs, demands, and preferences (Vanhonacker et al., 2007). Consumers are the last step in the production chain, so it is essential to understand factors affecting consumers' behaviour (Font i Furnols and Guerrero, 2014). Consumer preferences, behaviour and perception of meat and meat products are heterogenous. They depend not only on the appearance and sensory characteristics of the product but also on psychological (beliefs, attitudes, expectations, lifestyle and values), marketing aspects (price, label, availability) and environmental aspects (Font i Furnols and Guerrero, 2014; Marinova and Bogueva, 2019). Understanding the factors that determine consumers' perceptions of product value or cost is crucial to product innovation, choice of marketing strategy and maintenance of competitive advantage (Ngapo et al., 2003). It is hard for consumers to form quality expectations, especially for fresh meat

for which little information is provided. According to the research, expected quality seems to be one of the most critical factors in consumers' intention to purchase food (Font i Furnols and Guerrero, 2014). Quality cues can be intrinsic (colour, fat content, marbling) and extrinsic (price, origin, quality labels). Their role in developing expectations depends on the type of meat or meat products and the circumstance in which the product will be used or consumed. Furthermore, the authors stated that it is important to distinguish between experiential quality attributes such as convenience, freshness, or sensory characteristics experienced at the time of consumption. Moreover, the credence quality attributes such as traditional food, healthiness, naturalness, sustainability or environmental benefits cannot be directly evaluated, and they are part of the benefits expected by consumers (Font i Furnols and Guerrero, 2014; Caputo et al., 2018; Torquati et al., 2018).

A cross-national study (Germany, Ireland, Italy, Spain, Sweden and UK) conducted by Glitsch (2000) aimed to obtain information about consumers' perceptions of fresh meat quality. The author concluded that the place of purchase is very important for consumers, while the price was reported to be the least important. The colour of meat is the most important intrinsic quality cue for all three studied types of meat (beef, chicken and pork), and after purchase, respondents stated that flavour is the most important quality trait of the meat. Concerning meat safety, freshness is the most significant quality cue, so it would be advisable for producers and retailers to communicate better information about freshness to the consumers (Glitsch, 2000). Results of Lusk et al.'s (2018) study highlighted significant heterogeneity in consumer preference. Approximately 60.0 % of US consumers indicate that pork chop colour (darker colour) and the store where they buy it is very important and were used to assess likelihood that the product would be flavorful, juicy, and tender. However, 39.0 % of consumers still prefer a lighter meat colour, although it was indicated as lower quality meat in the study. Consumers associate the colour of pork mainly with the sensory characteristics of meat. Fresh pork is reddish-pink colour, has a compact structure, and dry meat surface; unusual and different meat colour and the release of the meat juice will be repulsive to customers (Karolyi, 2004). The preferences for the visual characteristics of meat differ between individuals, groups, and countries (Font i Furnols and Guerrero, 2014). Fortomaris et al. (2006) found that consumers under the age of 35 in Greece and Cyprus prefer dark-red, lean pork, while older consumers prefer either dark or lighter pork. Also, men showed a preference for dark red colour. At the same time, women liked the lighter red colour, and differences are also visible in urban consumers who preferred light-red, fatty

pork chops, while rural consumers preferred dark-red pork chops. In their study Ngapo et al. (2003) used focus groups from four countries (France, England, Sweden and Denmark) to obtain insights into the decision-making involved in the choice of purchasing fresh pork. In all four countries, respondents considered fat content, price, country of origin and place of purchase as good quality cues. Respondents mentioned the importance of having some fat cover for cooking moisture holding and taste but not too much because of health-related concerns. Regarding the price, some surveyed consumers were suspicious of the cheapest meat, questioning why it is most affordable, and others searched for this pork. All groups of respondents preferred meat that was from their respective countries and perceived better quality. Still, they stated that information about the origin is rarely available and thus little trusted, and the butcher is considered as the most trusted source of meat safety information (Ngapo et al., 2003; Grebitus and Bruhn, 2006; Font i Furnols and Guerrero, 2014). In research, Caputo et al. (2018) main drivers and deterrents for traditional food product-oriented consumers are sensory appeals and natural character, health and safety issues, origin, ethical concerns, price and convenience. Research in the Czech Republic has shown that there are significant differences between the sociodemographic characteristics of respondents (gender, age, education and responsibility when buying food) and attributes related to product quality and their correct declaration. Still, no significant difference between product declaration and income was observed (Velčovská and Del Chiappa, 2015). Wang et al. (2018) further state that higher income and education of respondents significantly affect the willingness to pay a higher price for pork with attributes that have a health certificate, a designation of origin and that the meat is antibiotic-free.

Given the increased interest of consumers, but also economic policymakers, Balogh et al. (2016) conducted a choice experiment. They investigated willingness to pay (WTP) and consumer preferences towards traditional Hungarian products (Mangalica salami). The authors selected the following attributes essential to consumers: retail price, quality, certification, retail channel, and meat origin (pure versus hybrids). The conducted choice experiment revealed that consumers generally prefer certified products; that quality is important to them, as is place of purchase and that the salami is made entirely of pure Mangalica meat. However, WTP values show significant variations in terms of respondents. The authors concluded that socio-economic characteristics, experience, income, and education significantly influence consumer choice and WTP. Through a real choice experiment, Kallas et al. (2017) investigated consumer preferences for traditional and

innovative pork products from three pig breeds in Spain, Italy, and Slovenia before (expected preferences) and after eating experience (experienced preferences). The results showed a high heterogeneity of preferences between countries. The authors explored breed, innovation, and price. The results of the expected preferences (before eating experience) in the non-hypothetical discrete choice experiment showed that the traditional and innovative products are likely to be purchased if the decision is based only on the product's characteristics. However, after eating experience, the expected purchasing preferences were affected significantly, especially in Italy and Slovenia, and the probability of buying innovative products increased. Using a choice experiment, Canavari et al. (2018) investigated consumer preferences when purchasing fresh and dry-aged pork meat, with respect to the country of origin and fat content. Results indicate that Italian consumers prefer pork loin cut and that dry ageing technique, origin, fat content, and price are all important attributes for them. Consumers preferred domestic over imported pork, with reduced fat content and young consumers preferred dry-aged pork but according to the author's information provision and communication with consumers are essential. Zanoli et al. (2012) used a hypothetical choice experiment to investigate the preferences and willingness to pay (WTP) of Italian consumers for organic, conventional and genetically modified (GM) beef, using intrinsic search characteristics (price, colour and visible fat), extrinsic characteristics and signs of trust. Results showed that consumers attached a higher value to organic meat which is attractive to consumers because it is associated with higher welfare standards and environment-related issues. The results of the Bavarian survey, which also included a choice experiment and assessments of WTP, confirm the importance of local production surveyed consumers, especially in interaction with organic production. The results lead to the conclusion that two production methods can support each other in achieving price premiums (Hasselbach and Roosen, 2015). In case of Iberian ham the price and origin label proved to be an essential attribute which provides additional benefit to consumers (Mesías et al., 2010). Where the designation of origin gives the consumers information about different feeding methods of Iberian pigs that consumers find difficult to verify and the degree of "purity" of the Iberian breed used for Iberian dry-cured ham production. Napolitano et al. (2009) conducted a study on the impact of information on organically produced beef and paying a higher price for it. They concluded that consumers are willing to pay a higher price for organic meat. The research provided valuable information to producers on how to differentiate their production on traditional farms.

1.1.3.1. Social concerns regarding animal farming: an overview

Social concerns refer to the social perception of animal farming, including social appearance and concerns about the animal production system (Boogaard et al., 2011). Authors stated that after the mid-1970s societal organisations raised their voices about unwanted effects of intensified agricultural systems on the environment and nature such as pollution, decreasing biodiversity and poor animal welfare of which people become more critical so they conducted research on Dutch and Danish citizens panels in order to investigate social concerns of Netherland and Denmark citizens perceptions towards pig production on conventional and organic farms. Before and after visiting a farm Dutch and Danish citizens filled the questionnaires about socio-cultural themes, aspects and issues of pig production and identified several social concerns about pig production which revealed that they are concerned about overexploitation of animals, housing system and the animals (such as injured pigs, castration, tail docking, limited possibilities to express natural behaviour, limited outdoor access etc.) but they appreciated the technological aspects of pig farms and entrepreneurial principles.

According to Tempesta et al. (2019), social attributes considered in food purchasing are animal welfare, good working conditions for farmworkers, support for family farms, preservation of local cultural landscape, regional and local production, protection of biodiversity, fair prices to farmers, the revival of tradition processing methods and fair product prices. Consumers' environmental and social concerns have been driving forces in the quest for more sustainable agricultural practice; and especially pig production has been researched to achieve economic, social and ecological goals (Krystallis et al., 2009). Further, environmental goals are related to the pig production system that can provide fair income and a decent living for the producers and fair prices for consumers. It is associated mainly with farm size. Intensive large-scale pig production can supply standard products with low cost versus extensive pig production systems that borrow their economic viability from quality differentiation and premium price. The social component of sustainability concerns refers to integrating pig production into society's priorities and needs, which form the basis for an appreciation and support for the sector from society and policymakers. Consumers' environmental concerns related to pig production are associated with an impact on nature (degradation of water, air and soil) and quality of life for humans (Krystallis et al., 2009). Petit et al. (2003) researched stakeholders (pig producers), activists (environmental and

consumer) and consumers' preferences and perceptions of social concerns regarding the environmental impact of current (intensive production) and alternative (organic or alternative) models of pig production through the closed and open-ended questionnaire. Respondents in the survey were asked to identify and rank the five concerns out of a list of nine they considered the most problematic regarding general environmental and social concerns, and then further perceived responsibility of pig farms with respect to environmental concerns were investigated using a 4-point Likert scale. Respondents had to select one of two options proposed for a future improved model of pig production (current or alternative). Authors concluded that all investigated groups (stakeholders, activists and consumers) considered unpleasant odour and water quality as the most serious environmental concern, then soil quality comes second followed by product safety and air quality while landscaping quality, biodiversity, product taste, animal wellbeing, noise and global warming are seen as less important. Also, the stakeholder groups preferred the current (intensive) model of pig production while activists and consumers preferred the alternative model.

Van Loo et al. (2014), using a choice experiment on chicken meat products, compared consumer preferences for four types of sustainability claims and social concerns related to organic meat, farming methods, animal welfare and greenhouse gas emissions. The authors concluded that the vast majority of consumers in Belgium (87.0 %) support the introduction of an animal welfare label on packaging at the EU level. Martelli (2009) presented the results of European and Italian research on consumers' perceptions about the animal welfare of farm animals; special attention was given to the opinion of consumers about the attributes related to animal welfare, the differences between the types of meat and among countries in terms of the perception of animal welfare and the willingness of customers to pay more for food that comes from animals reared in better conditions. Authors came to the conclusion that it is necessary to create a clear European label which identifies the level of welfare applied in the production and which is based on a scientific approach which could represent an effective marketing tool. There is no single definition of animal welfare, but certain agreements and principles can be applied to the entire livestock sector. The most commonly used indicators are animal health, productivity, physiology, and ethology (Liljenstolpe, 2005). Interpretation of the concept of animal welfare differs significantly between different interest groups, and the conceptualisation of benefit significantly influences beliefs, values, norms, knowledge, and interests (Vanhonacker et al., 2007). According to Tomasevic et al. (2020), almost half of the EU consumers believe that in the EU animal welfare and protection is better than in

other parts of the world and that products imported to the EU should comply with similar animal welfare standards. Liljenstolpe (2005) used the multinomial logit model and the random parameter logit model in data analysis and concluded that consumer preferences for the attributes characteristic for the animal welfare (such as transport, holding system, number of pigs in the box, enrichment of reservoirs, access to outlet, castration, etc.) are heterogeneous among respondents. With the above, Fiebig et al. (2010) stated that it is known that consumer choice and behaviour show significant heterogeneity. Ortega et al. (2016) investigate Beijing consumer's demand and willingness to pay for beef meat quality attributes (food safety, animal welfare, Green Food and Organic certification) considering the country-of-origin information. They find that Chinese beef consumers are willing to pay for quality attributes, including enhanced food safety claims, animal welfare practice information and organic food certificates. Also, they prefer Australian beef products over the US and domestic because Australian beef has enhanced food safety, good animal welfare practice and Green-Organic food practice. But relatively low marginal WTP for animal welfare information reveals that Chinese consumers are not currently ready to pay a higher premium price for that attribute (Ortega et al., 2016). Consumers in developing countries rather allocate their budget to products that benefit their own welfare instead of animals which is also in accordance with Tomasic et al. (2020) research where they find that Eastern European consumers care less for animal welfare than consumers in developed EU countries. Further, Liljenstolpe (2005) and Mayfield et al. (2007) state that consumers are willing to pay more for such products, but further market segmentation is needed for animals reared more or less following the recommendations on animal welfare legislation in comparison to the products of animals reared conventionally. The research of Heerwagen et al. (2014) states that the market requires the declaration of products of animals bred more or less in accordance with animal welfare recommendations and that animal welfare attributes are often mixed with other quality attributes. However, they will positively influence consumers to buy a product declared in this way related to a conventionally manufactured product. Verbeke (2009) states that consumers will recognise and value animal welfare on farms when integrated within a broader quality concept such as welfare assurance and sustainability programs. Research by Tawse (2010) and Yang et al. (2017) show that there is a high level of ignorance about pig production methods among surveyed consumers in the UK and suggest that producers should clearly define how pigs are reared to increase consumers concerns for social characteristics such as animal welfare and demand for pigs reared more or less in line with animal welfare recommendations. Kehlbacher et al. (2012) consider that

introducing certificates is also necessary. Declaring products with such a certified logo will benefit consumers, manufacturers, the manufacturing industry, and society (Kehlbacher et al., 2012; Wang et al., 2018).

Grunert et al. (2018) investigated by means of a choice experiment whether attributes related to the environmental aspect of pig production, safety, health and animal welfare affect consumer choice when buying pork in Germany and Poland compared to traditional product attributes such as fat content, the colour of the meat, origin and price. Authors came to the conclusion that individual benefits in terms of safety and health are still more appealing to consumers than social concerns in terms of animal welfare and environmental impact. The same attributes were used by Akaichi et al. (2016) in their research in Edinburgh. They concluded that most consumers have a positive view of animal welfare, organically and locally produced and low-fat meat, which can be a positive indicator for producers and economic policymakers interested in producing and marketing pork with these attributes. However, it is necessary to work on the proper declaration for the pigs reared more or less following the recommendations on animal welfare and meat produced organically and locally.

Gunnarsson et al. (2020) conducted systematic research on sustainability dimensions at the farm level in pig production and researched published papers between January 2000 and March 2020, authors concluded that when discussing sustainability there are three dimensions, environmental, economic and social. According to their research, animal welfare is the criterion of social sustainability and it is linked with social concerns regarding animal production; however, animal welfare itself includes many dimensions. The author further states that, for example, grazing animals are allowed to express their natural behaviour and thus should experience a higher level of animal welfare. Also, grazing animals help preserve biodiversity, which is part of the environmental dimension of social concerns and sustainable development. Animals are healthier, which reduces spending on veterinary treatments and labour requirements which is part of the economic and environmental dimension. So, they concluded that improved animal welfare is likely to improve social aspects of pig production which is part of the social concerns of sustainable development. The European Union supports measures to encourage improved value-added products to preserve local and endangered breeds of domestic animals. The potential demand for traditional and "unaltered" products from indigenous pig breeds may contribute to their

protection (Kallas et al., 2019). The authors further state that there is a niche market in which consumers value these high-quality products. The research has revealed a potential demand for traditional pig products, and preferences are based on consumer health beliefs and their hedonistic assessment. According to Pugliese and Sirtori (2012), Italian consumers are increasingly interested in niche products with high added value. The authors stated that the best example is the Iḅèrico pig breed, the most famous Spanish native breed whose products are renowned throughout Europe thanks to the strong cooperation between public institutions, producers and scientists. According to Čandek-Potokar et al. (2019), exploiting local breeds of pigs in their production systems, based on local food sources, provides products with the attributes that consumers are looking for and treasure which is the basis for sustainable chains. The economic potential of local or traditional breeds and their production systems are far from optimal utilisation and represents a challenge and opportunity for the pig sector in the future (Čandek-Potokar et al., 2019). Labelling products from indigenous breeds and creating a niche market is important to raise the local products value and support sustainable, regional, small-scale production systems and create extra value through traceability and market transparency (Marsoner et al., 2018).

In the Republic of Croatia, there is no research investigating consumers' attitudes and beliefs towards some aspects related to social concerns regarding fresh meat and fresh meat from the indigenous pigs in this case Black Slavonian Pig. Also, no research has been conducted either using choice experiments and discrete choice models regarding the influence of information about pig production systems which is in accordance with animal welfare and environmental criteria on consumers' choice for fresh meat from the Black Slavonian Pig. Similar research regarding innovations in traditional pork products using the mentioned method and model for Croatian indigenous breed was performed by Kallas et al. (2019) on the Turopolje pig breed. Regarding the Black Slavonian pig, several research focused on the analysis of the situation, economic profitability and production technology in the Republic of Croatia were performed (Kralik et al., 2012; 2013; Margeta et al., 2013; Budimir et al., 2014; Grgić et al., 2015; Kušec et al., 2015; Kralik et al., 2017 and Kranjac et al., 2018). Cerjak et al. (2011; 2017) investigated how much Croatian consumers know about traceability within the supply chain in ensuring food safety and examined the impact of information on pig nutrition on consumer acceptability and the likelihood of buying sausage from the indigenous Turopolje pig breed. The results showed that respondents in the Republic of Croatia are not sufficiently familiar with the concept of traceability as part of

food quality control and safety. Information on the use of traditional food in pigs has proven to be a helpful marketing tool that can encourage consumers to buy traditional products (Cerjak et al., 2011; 2017).

1.1.4. Theoretical and Empirical model

1.1.4.1. Choice experiment

In wealthy modern and postmodern societies, food choices appear to have a challenging task and consumers have to evaluate several product attributes whenever they select food items (Nocella et al., 2012). The authors also stated some of these attributes like price and organoleptic characteristics can be easily evaluated through choice experiments, but credence attributes, for example, are more difficult to judge, so modelling the choices of certain food attributes is complicated. The discrete choice experiments are based on the Lancaster consumers theory of utility maximisation (Lancaster, 1966). Products per se do not give utility to the consumers, according to the Lancaster (1966), products are composed of attributes and these attributes give rise to utility. Meaning that because products are composed of attributes, total utility gained from the product is the sum of individual utilities provided by attributes and attributes levels. In the standard discrete choice analysis, the respondents are asked to choose their most preferred alternative among a set of mutually exclusive options each described by a set of attributes of the product and each attribute varies at different levels. Respondents are not asked to report how much they prefer alternatives, nor even how much they value individual changes in an attribute; they are merely asked to identify which of a number of options they prefer (James and Burton, 2003). The econometric basis of the approach is the McFadden's random utility theory (Louviere et al., 2000; Bateman et al., 2004; Train, 2009; De-Magistris and Gracia, 2016; Mariel et al., 2021). Random utility theory assumes a utility maximisation principle: if an individual chooses one alternative over another, utility from the selected alternative is greater than from the unselected alternative (Vojáček and Pecáková, 2010). The researcher analyses the attributes of the chosen option relative to the other unchosen options to estimate the microeconomic theory-based preferences as well as the associated welfare estimates from these choices (Hu et al., 2022).

In order to identify consumer preference toward fresh meat of Black Slavonian Pig and the amount of money they are willing to pay for the product, choice experiment (CE) was applied. Aizaki (2012) states that the choice experiment (CE) - also known as the discrete choice experiment (DCE), is a recognised method that was first applied by Louviere and Hensher (1982) and Louvière and Woodworth (1983), and has developed considerably since its inception. Today it is an important research method in social sciences with application in several disciplines, such as market research, economics, agricultural economics, health economics.

The DCE is increasingly used today because it responds to numerous scientific and research questions that could not be adequately explained by the application of other methods, for example, providing insight into consumer preferences, quantifying the compromises that individuals are willing to make between different bids, money and non-money estimates, demand forecasts, etc. (Lancsar et al., 2017; Fiebig et al., 2010).

This study was developed using an alternative specific (labelled) discrete choice experiment (DCE), also known as a stated choice (SC), which is an attribute-based survey method in order to explore consumer preference for fresh meat of the Black Slavonian Pig breed and assess the economic value or willingness to pay (WTP) for fresh pork of indigenous pig breed. Discrete choice models work with indirect utility, and the theoretical model commonly used for analysing discrete choices is the random utility maximisation (RUM) model, based on the assumption of utility-maximisation behaviour of individuals (Mariel et al., 2021). Random utility theory (RUM) was originally developed by Thurston (1927) and was extended by McFadden (Train, 2009). Under the random utility model (RUM), individuals n out of N individuals faces with a choice among J alternatives in one or T repeated choice occasions the individuals n obtains from an alternative j in a choice occasions t a certain level of indirect utility U_{njt}, the alternative I is chosen by individual n in choice occasion t if and only if $U_{nit} > U_{njt}$, $\forall j \neq i$ (Train, 2009; Mariel et al., 2021). The researcher does not observe the individual's utility but observes only some attributes related to each alternative as some characteristics of the individual, so the utility U_{njt} is then decomposed as:

$$U_{njt} = V_{njt} + \varepsilon_{njt}$$

where ε_{njt} represents the unobservable or random (error) part that affect U_{njt} but are not included in V_{njt} also known as deterministic or representative utility, which include both observable of the alternatives (the choice attributes) and of the individuals (sociodemographic characteristics) (Train, 2009; Mariel et al., 2021).

RUM consider a situation in which decision-maker must make a discrete choice from a universal but finite number of alternatives, so utility possessed by an individual for alternative *j* present in choice set *n* may be expressed as:

$$U_{nj} = V_{nj}(x_{nj}|\beta_j) + \varepsilon_{nj},$$

All terms of the equation were defined earlier except x_{nj} which represent a vector of attribute levels for different alternative specific attributes $k = 1,2,\ldots K_j$ of alternative j and β_j denotes the vector of K_j parameter for each of alternative specific attributes (Bliemer et al., 2005). The subscript j in β_j allows estimation of alternative specific parameter estimates across utility *j* such that the number of estimated parameters is equal to $S_j K_j$, and in case of the unlabelled (generic) choice experiment for each attribute *K* a single parameter is estimated independent of the number of alternatives resulting in the estimation of only *K* parameter across all *j* alternative (Bliemer et al., 2005) which is presented in equations below:

$$V_{nj}(x_{nj}|\beta_j) = \sum_{k=1}^{K_j} x_{njk}\beta_{jk}, \text{ alternative specific attributes}$$
$$V_{nj}(x_{nj}|\beta) = \sum_{k=1}^{K} x_{njk}\beta_k, \text{ generic attributes}$$

According to Train (2009) and Louviere et al. (2010), the decision-maker chooses an alternative with the highest utility. Therefore, the probability that decision-maker *n* chooses the alternative *i* from choice set C_n can be mathematically written:

$$P(i|C_n) = P\left[(V_{ni} + \varepsilon_{ni}) > Max\,(V_{nj} + \varepsilon_{nj})\right], \text{ for all } j \text{ options in the choice set } C_n$$

Because there is a random component (ε_{nj}), utilities are inherently stochastic, so the researcher can predict the probability that individual *n* will choose alternative *i*, but not the exact alternative that individual *n* will choose (Louviere et al., 2010). Choice probabilities

are typically estimated through statistical models specifically designed to interpret the choice behaviour. In this study, the multinomial logit model (MNL), random parameter logit model (RPL) and error component random parameter logit model (RPL – EC) were applied.

1.1.4.2. Econometric models

Multinomial Logit model

The main advantage of the multinomial logit model (MNL), which belongs to the family of random utility maximisations models (RUM), is its simplicity in terms of both estimation and interpretation of the resulting choice probabilities and elasticities (Sarrias and Daziano, 2017). And the disadvantage of MNL is the lack of flexibility to allow for individual-specific preferences, and it imposes constant competition across alternatives as a consequence of the independence of irrelevant alternatives (IIA) property (Sarrias and Daziano, 2017). According to Hensher et al. (2005), that means the ratio of the probability of choosing one alternative over the probability of choosing the other should be independent of the presence or absence of unchosen third alternatives. MNL implies that all the random elements in the utility functions ε_{njt} are independent across the alternatives and share an identical distribution (IID) (Twaddle, 2011, Wongprawmas, 2013). The probability of consumer *i* choosing alternative *j* is equal to:

$$P_i = \frac{exp\ (V_i)}{\sum_{j=1}^{J} exp\ (V_j)}$$

The IID assumption requires that error terms associated with each alternative in the choice set have their unique mean value and are independent (with no cross-correlation term) and with the exact same distribution (identically distributed) (Jaeger and Rose, 2008). According to the authors, real choice problems tend to involve violations of IID assumption. MNL is rarely an appropriate model, and labelled choice experiments also violate the IID assumption. Because participants may use information behind the name given to the alternatives to infer missing information and because the inferences are usually correlated with the random component of the utility expression (Jaeger and Rose, 2008). Also, according to McFadden (1974), it is assumed that consumers have the same preferences and

homogeneous taste for observed attributes. According to Wang et al. (2018), the homogeneity assumption is likely to be violated; that is why it may be necessary to use a statistical model that relaxes this assumption.

Mixed logit models

The main limitation of the MNL model is the assumption of homogeneous preferences. Thus, extensions of the multinomial logit model are necessary to consider less stringent assumptions in this respect. One possibility is to consider the individual preference varying randomly around the estimated mean of the parameter; this approach is called the mixed logit model (MXL) or random parameter logit model (RPL). The use of the MXL model involves three main specifications issues: first the determination of which parameters should be modelled as randomly distributed, second the choice of mixing distribution for the random coefficients and third the economic interpretation of the randomly distributed coefficients (Hoyos, 2010). According to the Hoyos (2010), classical procedure to determine the random coefficients is to select among different model specifications using the likelihood ratio (LR) test, the mixing distribution of the parameters can be discrete or continuous if the mixing distribution is continuous a random parameter (RPL) or error component model can be derived from the MXL probability. An additional problem is a possibility that in the presence of a status quo alternative, the expected dispersion of the preferences is different for this specific alternative compared to the others. In this case, an error component random parameter logit model (RPL – EC) allows accounting for consumers' heterogeneous preferences and, at the same time, accounts for this specific issue. As already pointed out, in the MNL model, the estimated preference parameters are fixed. The MXL models allow preferences to vary across choices, individuals or both fully relaxing IIA assumption (Christiadi and Cushing, 2007; Mariel et al., 2021). The utility function is expressed in equation:

$$U_{nj} = \beta_n' X_{nj} + \varepsilon_{nj}$$

Where X_{nj} are observed variables that relate to the alternative and decision-maker, β_n is a vector of coefficients of these variables for person n representing that persons' taste, and like the MNL, an MXL assumes the error terms, ε_{nj} are IID with extreme value distribution (Christiadi and Cushing, 2007; Train, 2009). The MXL relaxes the restriction that β is the same for each individual, allowing it to be stochastic instead (Christiadi and Cushing, 2007;

Train, 2009). So the persons' utility is where β now differs across individuals representing preference heterogeneity. The MXL model can represent variations in individuals' utility functions. Each individual has their own value of β, implying that each person can have different weights for each attribute; according to that, the MXL model incorporates taste variations that exist across individuals (Christiadi and Cushing, 2007; Train, 2009).

Since MNL model assumes that all consumers have the same preferences in the dissertation, the random parameter logit model (RPL) and error component random parameter logit model (RPL – EC) are used, which relax that assumption and allow consumers' preferences to be heterogeneous across respondents. The random coefficients interpretation accounts for preference variations over the sampled individuals. On the other hand, the error component interpretations refer to the decomposition of the error term and account for different correlations patterns among utilities for various alternatives (Scarpa et al., 2005; Train, 2009; Marsh et al., 2011). RPL probabilities are the integrals of standard logit probabilities over all possible values of random parameters. RPL probability is presented in the equation below:

$$P_{ni} = \int \left(\frac{e^{\beta' X_{ni}}}{\sum_j e^{\beta' X_{ni}}} \right) f(\beta) d\beta$$

RPL probability is the weighted average of the logit formula evaluated at different values of β with the weights given by density, $f(\beta)$. This equation is a multi-dimensional integral so that it does not have a closed-form solution, and it must be solved through simulation (Christiadi and Cushing, 2007; Train, 2009; Wang et al., 2018). The most significant value of the RPL model can occur in using each parameter with other linked parameter estimates (Vojáček and Pecáková, 2010). According to the authors, the mean parameter estimate for a variable, an associated heterogeneity in its parameter, and the standard deviation of the parameter estimate represent this variable's utility associated with a specific alternative and individual.

A MXL model can be used without a random coefficients interpretation as simply representing error components that create correlations among the utilities for different alternatives. It is important to know that the mixing distribution, whether motivated with random parameter or error component, captures variance and correlations in unobserved

factors (Train, 2009). Utility in the RPL-EC model is specified as:

$$U_{nj} = \alpha' X_{nj} + \mu'_n Z_{nj} + \varepsilon_{nj}$$

where X_{nj} and Z_{nj} are vectors of observed variables relating to alternative j, α is a vector of fixed coefficient, μ is a vector of the random term with zero mean and ε_{nj} is IID extreme value. The terms in Z_{nj} are error components that, along with ε_{nj} define the unobserved part of utility (Train, 2009). The error component model accounts for correlation across alternatives by introducing error components shared between alternatives that are closer substitutes for each other or unique for the different alternatives (Scarpa et al., 2005; Mørkbak et al., 2010). The error components are normally distributed random variables with zero mean and standard deviation of $\sigma_{\mu i}$ where the estimated standard deviation is related either to the correlation between the alternatives or the variance of different alternatives (Mørkbak et al., 2010). A heteroscedastic model is specified if the utility function for the alternatives each contains a unique error component, and if alternatives one and two each have a common subset of the error component, then a nested system for three alternatives is specified (Scarpa et al., 2005; Mørkbak et al., 2010).

The MXL is not only able to determine the existence of heterogeneity around the mean parameter through estimation of the standard deviation but it can also indicate the source of heterogeneity through the interaction between a random parameter and other attributes (Rasciute and Pentecost, 2008). According to the Rasciute and Pentecost (2008) and Green (2010), interaction effect in nonlinear models is a function of not only the coefficients for the interaction but also coefficients for each interacted variable and the values of all the variables in the model. Exploratory variables included in the model in the thesis were divided into two groups: product attribute main effect variable and interaction terms. According to the Kjær (2005) it is beneficial to include interaction term variable in the utility function and interaction term can either be interaction between two attributes variable (X_1 * X_2) or interaction with additional variables such as person - specific variable (sociodemographic characteristics) (S_1 * X_2, where S denotes the vector of sociodemographic characteristics). By estimating interaction terms between attributes the CE approach also allows for exploration of how attributes are related to each other even though respondents are not asked to directly answer how important each attribute is to them (Ortega et al., 2016). Furthermore, Kjær (2005) stated that for example by inclusion of the sociodemographic variable in the

model it is possible to account for some of the heterogeneity in preferences between individuals which can yield very important information and to perform subgroup analysis.

1.2. Research objective

The increase in demand for pork in general and traditional products from indigenous breeds of pigs in the Republic of Croatia and the European Union opens the possibility of placing Black Slavonian Pig meat on the domestic and internal EU market. Successful market positioning requires the implementation of well-planned marketing activities. Creating an effective marketing plan requires knowledge of consumer habits and preferences, features and possibilities of customisation of products, and understanding of all other internal and external environment elements. For consumers, social concerns are becoming more important, and this can be used commercially to sell meat from the Black Slavonian Pigs.

Only a few studies in the Republic of Croatia have been carried out on consumer preferences for particular agricultural and food products through choice experiments. However, this method needs to be applied because it allows producers, retailers and economic policymakers to know precisely which product attributes are most valuable to consumers when purchasing food.

The main objective of the dissertation was to obtain an overview of consumers attitudes and beliefs towards some aspects related to social concerns (sustainability, biodiversity and rural development, and animal welfare) and examine influence of information (about production system, colour, geographical information) on consumer choice in favour of local pig breeds, in this case, the Black Slavonian Pig breed. This overarching objective will be achieved with these sub-objectives:

1. Define and determine how consumers evaluate social, ethical, and environmental requirements when purchasing pork.
2. Define the relative importance of product attributes (production system, colour, geographical information and price), which is needed to emphasise in promotional activities and in creating future marketing decisions.

3. Based on consumer preferences, provide producers and decision-makers with key information for placement and promotion of Black Slavonian Pig's meat.

Based on the determined research objectives, two hypotheses were set:

H1: More than 30.0 % of consumers are aware of the concept of social concerns when purchasing pork.

The assumption is that today's consumers are aware of the importance of social concerns when purchasing meat. The first hypothesis was tested through different statistical methods (descriptive analysis, multivariate analysis, parametric and nonparametric tests) and it is assumed that there is a significant difference between segments and factor scores according to variables sociodemographic characteristics, purchasing and consumption habits and respondents' knowledge of the pig breeds.

The auxiliary hypotheses that arise from the main hypothesis are:

H1a: Social concern attributes together with freshness, safety and appearance, have a positive effect on consumers purchasing decisions for fresh meat.

H1b: There is a significant difference between social concerns for fresh meat and the gender and age of the respondents.

H1c: Consumers' social concerns about animal welfare, local production and preservation of biodiversity are not equally distributed among the Croatian regions.

H1d: Consumers that pay a higher price for fresh pork tend to care more about social concerns related to animal welfare.

H2: It is expected that consumers will gain higher utility from the fresh boneless ham produced from the meat of the Black Slavonian Pig reared outdoors and semi-indoors over hybrid pig meat obtained from the conventional production system.

Since the market for indigenous pig meat is expanding, it is crucial to understand customer preferences. The choice experiment gives the consumer the option to choose the best variant between offered purchase alternatives. Each alternative includes several attributes with several levels. The results of the choice experiment and data evaluation will outline those attributes that give consumers greater value. Also, it will provide information for the producers that are already on the market or those considering entering the market.

For the specification of the model, auxiliary hypotheses that arise and build on the main hypothesis are:

H2a: Two design options (Black Slavonian Pig meat reared outdoors and semi-indoors) have a positive significant effect on choice probability.

H2b: The dark meat colour has a positive significant effect on choice probability.

H2c: The continental Croatia + PDO label attribute has a positive significant effect on choice probability while the continental Croatia label is expected to have negative effect.

H2d: Consumers who received the information about the production system of the Black Slavonian Pig value more Black Slavonian Pig meat reared outdoors and semi-indoors over consumers who did not receive additional information.

H2e: Consumers are willing to pay a premium price for the meat of the Black Slavonian Pig reared outdoor and semi-indoors over hybrid pig meat (regular pork).

H2f: Consumers are willing to pay a premium price for the meat of the Black Slavonian Pig labelled continental Croatia and continental Croatia + PDO over meat without label.

2. MATERIAL AND METHODS

2.1. Survey instrument description and methodological approach towards social concerns

The questionnaire contained 78 questions divided into five parts (twenty-four choice experiment questions, nine closed type questions, six open questions, five dichotomous questions, two multiple-choice questions, one numeric slider question, ten questions on Importance scale and twenty-one questions on Likert scale).

In this research, Croatian consumers were exposed to one of two treatment options in an online survey.

A hypothetical choice experiment was used to investigate participants' preferences and willingness to pay (WTP) for fresh meat of Black Slavonian Pig reared outdoors and semi-indoors which is in accordance with social concerns investigated in this dissertation. By leveraging the lack of information and knowledge on the fresh meat of Black Slavonian Pigs, this research also focused on the effect of information on consumer preferences. Using treatments, we evaluate whether information about the product could positively affect consumer opinion about the product and WTP. Prior to the online choice experiment, participants were randomly assigned to either control or information treatment. The control treatment did not include any additional text, only choice experiment instructions. Information treatment was used to inform participants about rearing systems of Black Slavonian Pigs and the impact of the traditional system (outdoor and semi-indoor) on animal welfare and the environmental effect regarding the conventional system (intensive production system - indoor). Using information treatment allows us to evaluate whether a good explanation of the production system and main characteristics of the Black Slavonian Pig could positively affect consumers' choice. Through information treatment was indirectly investigated the influence of information on social concerns since the production system of Black Slavonian Pig respects animal welfare and is in line with environmental protection. Also, information treatment gave information to participants regarding each attribute (colour of meat and geographical information). Specifically, information treatment was framed as follows:

T1: *Production system*

The outdoor comply with animal welfare criteria and environmental protection. This system

of rearing allows pigs to express natural behaviour. Animals can move freely and dig the ground, have access to fresh air and natural light and enough space to explore the environment, free movement and social contact, thus reducing aggression and anxiety.

The semi-indoor production system is also considered a system that respects animal welfare, and it is in line with environmental protection as the outdoor but in this system, animals are indoors, usually on litter, with outlets where they can go out.

Meat colour

The meat of the Black Slavonian Pig is darker in colour due to higher number of oxidative types of muscles than in modern breeds.

Geographical indication

Continental Croatia is a traditional region for breeding the Black Slavonian Pigs. The pigs are produced within the administrative borders of the following counties (Vukovar-Srijem, Osijek-Baranja, Brod-Posavina, Požega-Slavonia, Virovitica-Podravina, Bjelovar-Bilogora, Koprivnica-Križevci, Međimurje, Varaždin, Zagreb-Krapina, Sisak-Moslavina and Karlovac counties).

Continental Croatia + PDO marks the traditional meat production area of Black Slavonian Pig, and PDO (Protection of Designation Origin) label. Thus, it guarantees the consumer that it is a high-quality authentic product, produced in traditional production regions under controlled conditions and local origin. Other regions represent other regions of the Republic of Croatia in which Black Slavonian Pigs are not traditionally bred.

The attributes of meat colour and geographical indication were selected based on Specification for obtaining PDO sign (Meso crne slavonske svinje - Oznaka izvornosti Specifikacija, 2019). Table 1 shows the attribute and attribute levels evaluated in the choice experiment.

Price attribute includes three levels: 70.00 HRK, 120.00 HRK and 170.00 HRK per kilogram. Prices chosen for the choice experiment reflect market prices for one kilogram of fresh pork ham without bones (*Gluteus Medius*) originating from Black Slavonian Pig at the time of study (April 2021). And they could be found in the Croatian market in different market channels.

The colour of the meat refers to the colour of fresh meat of Black Slavonian Pig (dark and light

red colour). The colour of fresh meat is an important intrinsic characteristic of quality. The red colour of the meat from Black Slavonian Pigs is characteristic for this breed. In order to illustrate visual product appearance in the survey, pictures were used.

Geographical information attribute includes three levels: Continental Croatia, Continental Croatia + PDO, and other regions. Continental Croatia + PDO represents the traditional breeding region of the Black Slavonian Pigs. The rearing area is normalised by Product specification, and only meat from pigs reared in that part of Croatia in a specific production system can obtain a PDO label.

Table 1 Attributes and levels of fresh pork ham without bones used in the choice experiment

Product attribute	**Product level**
Price	70.00 HRK/kg
	120.00 HRK/kg
	170.00 HRK/kg
Colour	dark red
	light red
Geographical information	Continental Croatia
	Continental Croatia + PDO
	Other regions

Note: Croatian kuna (HRK), in April 2021, HRK 1 = EUR 7.572

According to Mariel et al. (2021), choice questions should be first in the questionnaire because, otherwise, questions about attitudes and norms might activate socially desirable responses, behaviour or direct attention to specific choice attributes. Taking into account the above after the choice experiment, consumers were asked in the second part of the survey about their habits regarding meat purchase, consumption and knowledge about pig breeds. Consumers were asked to answer closed and opened type questions about how often they consume meat, pork and cured meat products, where they buy fresh pork ham without bones, how much they pay for 1 kg of fresh pork ham without bones, for what breed of pig they heard, do they have knowledge about pig breed when buying pork and did they consume Black Slavonian Pig meat and if they did how often they consume it.

In the third part of the survey, consumers were asked about the most relevant attributes when

purchasing fresh meat. In order to measure attributes consumers usually consider when buying fresh meat, they were asked questions regarding price, the appearance of the meat, size of the package, country of origin, safety and the quality of the meat, freshness, convenience of preparation and three questions about social concerns regarding environmental impact, fairness in the supply chain, and animal welfare. These attributes were measured on an Importance scale where answer options ranged from not at all important to extremely important.

In the fourth part of the survey, consumers were asked to declare a degree of agreement with statements regarding purchasing behaviour and social concerns when purchasing fresh meat from the Black Slavonian Pig. Relevant social concerns (animal welfare, preservation of biodiversity, ecological aspects, positively impact on rural areas and the local community impact) for pork production were identified through a literature search (Blokhuis et al., 2008; Boogaard et al., 2011; Grunert et al., 2018; Alonso et al., 2020; García-Gudiño et al., 2021). Consumers were asked to rate their agreement with offer statements on a 5-point Likert scale where 1 indicates strongly disagree to 5 strongly agree. In the questionnaire, consumers attitudes toward certain social concerns (animal welfare, biodiversity and rural development) when buying pork were measured through the following ten statements:

1. Locally produced food is healthier and more natural (following the original production process).
2. Locally produced food helps preserve traditional breeds and production methods.
3. Breeding indigenous pig breeds (such as Black Slavonian Pig) promotes sustainability and supports local farmers.
4. The farm (indoor) breeding causes environmental problems (e.g., massive water consumption, energy consumption, greenhouse gas emission).
5. Rearing a Black Slavonian Pig outdoors is a more environmentally friendly production.
6. I am concerned about farm animal welfare.
7. Respect for animal welfare results in better meat quality.
8. I think intensive (indoor) pig rearing is cruel.
9. It does not matter how the pigs are reared because they do not know better.
10. Pigs should be able to express natural behaviour on-farm (trenching, rolling in the mud, etc.).

The last part of the survey contains questions regarding the sociodemographic characteristics

of respondents (gender, age, place of residence, connection with agriculture, region, labour situation and education).

2.2. Discrete Choice Experiment Design

Choice experiments are used to simulate a real-life retail environment where consumers choose between products with similar attributes and allowing researchers to estimate trade-offs among alternatives (Lusk et al., 2003; Khachatryan et al., 2021). In stated choice (SC) studies, participants make choices from mutually exclusive sets of alternatives over the number of hypothetically constructed scenarios. Because SC data are not observed in the actual market situation, participants tend to indicate a higher willingness to pay (WTP) in SC, so there is a question regarding the validity of the experiment (Jaeger and Rose, 2008; Tonsor and Shupp, 2011; Hensher, 2014). However, according to some authors, such concerns are unfounded, and choice experiments can be successfully used since marginal WTP is in general not statistically different across hypothetical and actual payment settings (Lusk and Schroeder, 2005; Jaeger and Rose, 2008; Scarpa et al., 2013; Van Loo et al., 2014; Van Loo et al., 2020.; Khachatryan et al., 2021). In any case, to minimise potential hypothetical bias in this research, following Cummings and Taylor (1999) and Tonsor and Shupp (2011), a cheap talk was administered prior to the choice experiment. According to the authors, the inclusion of cheap talk before the experiment influences the WTP estimate level and produces more reliable estimates (Tonsor and Shupp, 2011).

The final experimental design was structured using the software package Ngene version 1.2.1 (ChoiceMetrics., 2018) to design an efficient or D-optimal design, which minimises the element of the asymptotic variance-covariance matrix (Bliemer et al., 2005). In order to do so, it was necessary to obtain priors for each attribute level. Panel mixed logit model with D-error measure was applied, and effect coding was used in the design and model. Effect coding implies that the effect of attribute levels is uncorrelated with a constant term for the status quo alternative (Bech and Gyrd-Hansen, 2005). In effect coding L-1 variables are created for one qualitative level, the effect coded variable is set to 1 when the qualitative level is present, equal to -1 when the arbitrary reference level is present and equal to 0 otherwise (Bech and Gyrd-Hansen, 2005). The utility of the reference level is related to the utility of the L-1 attribute levels, defined as the negative sum of the L-1 parameter estimate (Mariel et al., 2021). The following utility function was used in the design:

$$U = f\{\text{Price, Colour, Geographical information}, \varepsilon\},$$

where attribute Price is the price for one kilogram of fresh pork ham without bones, and Colour and Geographical information are effect coded attributes. Taken the value +1 if the product is darker red colour and produced in Continental Croatia with PDO label, -1 if the product is lighter red colour and produced in other regions of Croatia, and 0 otherwise.

Efficient designs were constructed in the Ngene software using a panel mixed multinomial logit model, including priors (estimate of β) from the second pilot study, Halton draws, 500 repetitions, constants and Modified Federov algorithm (is needed for including require constraints that fixes the levels for the attributes in the reference alternative). The choice experiment design is efficient if it satisfies four principles: orthogonality, level balance, minimal overlap, and utility balance (Hubert and Zwerina, 1996). These principles are useful in understanding what makes CE efficient, but it is impossible to create a design that satisfies all these principles, so we use a simulation algorithm to minimise D-error (Zwerina et al., 1996). According to Carlsson and Martinsson (2003), an optimal design should fulfil two criteria in order to be D-efficient: orthogonality and level balance. A Modified Federov algorithm will through an iterative process exchange alternative in initial design with one from a list of candidate alternatives until it is not possible to reduce D-efficiency any further. Among evaluated designs for the final was chosen one which among evaluated designs (iterations) had the lowest D-error. If the D-error is low, that means that (co)variances of the estimated parameters are low, and the statistical efficiency is high (Bliemer et al., 2005; Bliemer et al., 2009). However, in order to calculate D-error, the prior parameter values should be set. The prior (estimate of β) are used to calculate the expected utilities as well as choice probabilities of each alternative. According to Bliemer et al. (2009), from these choice probabilities it is possible to calculate the asymptotic variance–covariance (AVC) matrix of the model to be estimated. Furthermore, authors stated that through manipulation of the design the analyst is able to minimise the elements of AVC matrix which in the case of the diagonals means lower standard errors and hence greater reliability in the estimates at a fixed sample size.

In order to create a D-efficient design, it was necessary to obtain priors for each attribute and to do so, two pilot studies (n = 69 and n =100) were conducted. The data from the pilot studies were used to improve the questionnaire's clarity and test model specifications. Design approach presented in Zwerina et al. (1996), Bliemer et al. (2005), Scarpa et al. (2008), Jaeger and Rose (2008) in the first phase was used, a more basic experimental design was used in the

pilot study (all parameter priors assumed to be zero since no prior information existed). The efficient (labelled) design with 2 alternative and specific constants (ASC) was used. Participants from the target population were involved in the pilot study. Parameter estimates results from the first pilot study are presented in Table 2.

Table 2 Estimated parameters of the MNL model for the main effect variables in the first pilot study

Mean estimates	Coefficients
	MNL
BS reared outdoors	0.8906***
BS reared semi-indoors	0.6322***
PRICE	-0.0065***
COLOUR (dark)	0.0952
GEOGRAPHICAL INFORMATION	
Continental Croatia	0.2672
Continental Croatia + PDO	0.0570
Number of respondents	69
Number of observations	828
Log-likelihood	-866.83
AIC	1750.26

Note: MNL – multinomial logit, LR test – log likelihood ratio test, AIC – Akaike information criteria, BS – Black Slavonian Pig meat, PDO – protected designation of origin; $p<0.1$, ** $p<0.01$, * $p<0.05$, *** $p<0.001$

Each participant in the pilot study responded to twelve choice situations and the β coefficients resulting from multinomial logit model (MNL) estimation of first pilot data provided priors for the second pilot study (Table 2). According to Johnson et al. (2013), model identification is an important step in constructing a choice experiment because it gives the researcher the ability to obtain unbiased parameter estimates from data for every parameter in the model and ensures the sufficient degree of freedom available for estimation of a choice model. Data from the first pilot study gave information on the parameter distribution used to generate a second efficient design (random parameter). This means that during the actual choice experiment, the pilot participants are used to estimate the final model and create a new design depending on the new parameter estimates (Zwerina et al., 1996). Table 3 presents the parameter estimates

results from the second pilot study.

Table 3 Estimated parameters of the MNL, RPL, and RPL-EC models for the main effect variables in the second pilot study

Mean estimates	Coefficients		
	MNL	RPL	RPL-EC
BS reared outdoors	0.9869***	1.0747***	3.4657***
BS reared semi-indoors	0.3385**	0.1473	2.3578***
PRICE	-0.0093***	-0.0109***	-0.0159***
COLOUR (dark)	0.0547	0.0763	0.0865
GEOGRAPHICAL INFORMATION			
Continental Croatia	0.3164386***	0.3647***	0.5314***
Continental Croatia + PDO	0.1472973	0.2200*	0.3813*
St. dev. of mean estimates (std. err.)			
COLOUR (dark)		0.4896***	-0.8005***
GEOGRAPHICAL INFORMATION			
Continental Croatia		0.3892**	0.6610***
Continental Croatia + PDO		0.7761***	0.9325***
Number of respondents	100	100	100
Number of observations	1200	1200	1200
Log-likelihood	-1226.5	-1178.6	-806.93
AIC	2466.01	2385.16	1649.86
BIC	2496.55	2456.42	1741.48

Note: MNL – multinomial logit, RPL – random parameter logit, RPL-EC – error component random parameter logit, LR test – log likelihood ratio test, AIC – Akaike information criteria, BIC – Bayesian information criteria, BS – Black Slavonian Pig's meat, PDO – protected designation of origin

. p<0.1, ** p<0.01, * p<0.05, *** p<0.001

In the third step, data from the second pilot study (Table 3) was used to estimate an error component random parameter logit model (RPL-EC) which coefficient estimates were used as random priors to generate the final random parameter design. The final design had a D-error of 0.04636 and included 24 choice tasks in total. However, in order to reduce participants' fatigue, the design was split into 2 blocks of 12 choices due to the fact that fatigue is likely to

happen if participants are being presented with approximately 15-20 choice sets (Wang et al., 2018). Participants were randomly assigned to one of the blocks. Each choice set was composed of two labelled product alternatives (Black Slavonian Pig reared outdoors and Black Slavonian Pig reared semi-indoors) and *status quo* (constant) alternative. Labelled choice experiments (alternative specific) are designed to explore different configurations of two or more named alternatives in which the name given to each alternative carry meaningful information for decision-makers (Jaeger and Rose, 2008). A useful feature of alternative specific designs with labelled alternatives is that they simultaneously create both alternative and choice questions, and status quo or constant alternative represents an alternative that has unchanging attribute levels in all choice questions (Johnson et al., 2013). Figure 4 shows an example of a choice set included in the choice experiment.

Based on the information in the pictures, which fresh pork ham would you buy?

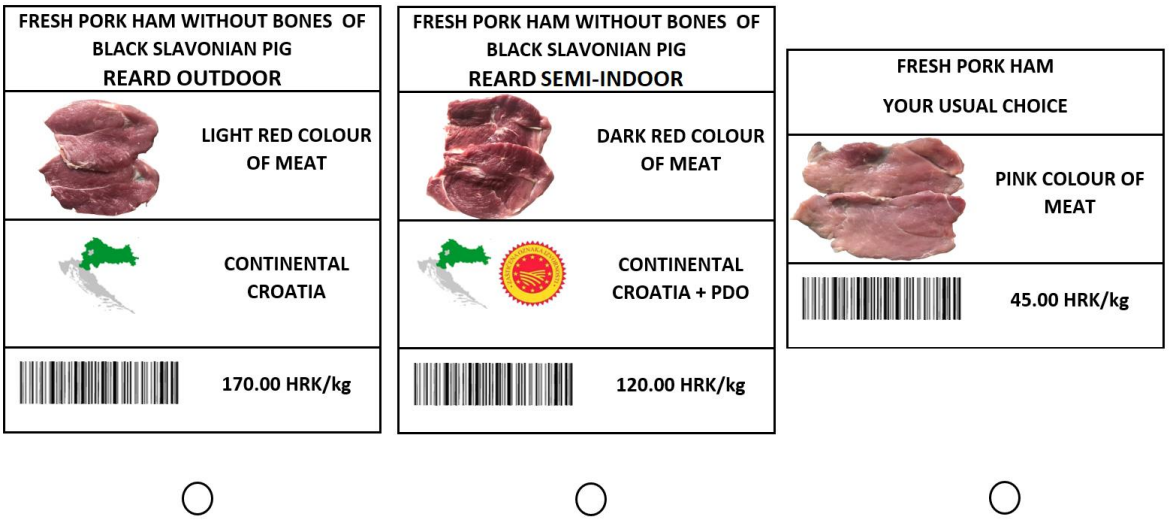

Figure 4 Example of choice-set

2.3. Survey procedure

The survey was conducted using online software because of the advantages over face to face, telephone or mail data collection, including sampling a broader geographic area, quick response time and reduced cost and less errors (Dillman et al., 2009; Khachatryan et al., 2021, Mariel et al., 2021). However, several disadvantages of using online survey exist, including availability of computer and internet access, problems regarding sampling coverage and sample representatives, non-response bias, together with the fact that online participants tend to read questions more quickly and are more inpatient (Bonnichsen and Olsen 2016; Mariel et

al., 2021). To eliminate potential sampling bias in this research post-hoc analysis response time or page timing was used. According to Vecchio et al. (2020), the individuals who had a survey completion and response time lower than five minutes were removed from the sample due to their inattention during the online survey, signifying that the respondents have finished the survey too fast or have answered the questions randomly. Participants who completed the survey in less than 5 minutes were removed from the sample.

Participants were recruited in June 2021 from the Qualtrics survey panel and distributed by the online survey company Qualtrics Inc. Following criteria for selection of consumers were used: gender, age and geographical region of the Croatian population. The number of respondents was found previously with company Qualtrics Inc. to represent the Republic of Croatia. The consumers were invited to participate randomly in a closed panel until age, gender and geographical regions quota were reached, representing the general population. Summary statistics for the characteristics of the sample and the population are presented in Table 4.

Table 4 Sample characteristics (%)

		Sample	Population
Gender	Male	49.0	49.3
	Female	51.0	50.7
Age	18 – 24	13.4	11.2
	25 – 34	20.5	17.7
	35 – 44	20.5	18.6
	45 – 54	18.8	18.7
	> 55	26.8	33.8
Region	Central Croatia	24.9	35.7
	North-western Croatia	24.6	12.6
	Eastern Croatia	21.5	18.8
	Northern Adriatic and Lika	15.9	13.0
	Middle and South Adriatic	13.2	19.9

Source: Croatian Bureau of Statistics, Croatian Census (2011)

Prior to the participation, participants were asked three screening questions regarding age (at least 18 years old), whether they consume pork, and whether they are responsible (at least partially) for purchasing food products in their household. The final survey took 15 minutes to

complete. Having in mind that depending on the complexity of the experimental design and the type of model applied, sample sizes of 300–500 respondents might be sufficient to obtain valid estimates for stated preferences (Marshall et al., 2010; Mariel et al., 2021), in total 410 Croatian consumers correctly completed the survey, mirroring a representative sample size for the Republic of Croatia with a 95.0 % confidence level. Once participants passed screening questions, choice questions were completed first. Participants were asked to select the most preferred option among three different fresh pork ham meat products from Black Slavonian Pig and hybrid pig breeds, representing *status quo* option and production system, which was treated as an alternative specific attribute. In accordance with the reviews by Marshall et al. (2010) and Johnson et al. (2013), three attributes with two and three levels were used in the hypothetical choice experiment. Each respondent evaluated 12 choice tasks in two treatments, and the Qualtrics software ensured that two blocks of twelve choice questions were presented to the same number of respondents (n = 205).

2.4. Statistical analysis and model specification

Collected data were analysed in three different steps. The data was analysed using descriptive statistic (frequency analysis, arithmetic means, mode, median and standard deviations), nonparametric test (chi-square test χ^2), parametric tests (independent samples t – test, one-way ANOVA), multivariate analysis (factor and cluster analysis, discriminant analysis) and choice experiment.

Descriptive statistics analysis was used to describe the sociodemographic characteristics of the sample, Croatian consumers' consumption and purchasing habits as well as opinions about social concerns. For the determination of consumer segments a combination of two multivariate analysis approaches: principal component analysis (PCA) and Cluster analysis (CA) was used. Factor analysis made it possible to reduce the number of consumer attitude variables to a smaller set of uncorrelated principal component factors. The cluster analysis was performed using extracted factor scores from principal component analysis to group consumers with similar attitudes (Marescotti et al., 2020).

Factor analysis was used with aim to reduce the number of variables into a smaller set of components (factors) regarding attributes that affect consumer decisions when buying fresh meat (general shopping habits, safety and quality perceptions, fairness in food supply chain,

environmental impact and animal welfare), and regarding consumers attitudes about purchase, local production, biodiversity, and animal welfare (social concerns). To investigate the appropriateness of each inter-correlation matrix for factor analysis, we executed the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) and Bartlett's test of sphericity. The extraction method used in factor analysis was principal component analysis, and we used factors with an eigenvalue greater than 1. For easier interpretation of each factor, the Varimax rotation was performed. In order to verify the reliability of the factor analysis, Cronbach's Alpha was computed.

The dimensions (factor scores) from the principal component analysis were used to identify and describe consumer segments in cluster analysis. First hierarchical cluster analysis with Ward's method (using squared Euclidean distance) was used to obtain the optimum number of clusters considering the distance between clusters, which indicates that the optimum number is three clusters. After that, K-mean cluster analysis was then used to obtain different consumer segments (clusters) for fresh meat, based on 410 valid cases. In order to validate cluster differentiation, canonical discriminant analysis was applied.

Chi-square test (χ^2), independent samples t-test and ANOVA were performed to identify the significant differences between segments according to consumers' sociodemographic characteristics, consumption habits, purchasing behaviour and knowledge about fresh meat and pig breeds. This methodology is common in segmentation of consumers (Barbosa Carvalho et al., 2015; Aprile et al., 2016; Haas et al., 2016; Kallas et al., 2019; Pejman et al., 2019; Schütz et al., 2019; Eldesouky et al., 2020; Ortiz et al., 2021). The data was analysed using the IBM SPSS Statistics V26 statistical software package.

Choice experiment data was analysed by a multinomial logit model (MNL), random parameter logit (RPL), and an error component random parameter logit model (RPL-EC) using the following packages: mlogit (Croissant, 2020), gmnl (Sarrias and Daziano, 2017), and the lmtest (Zeileis and Hothorn, 2002) in R (version 4.0.2).

All models were estimated from 4,920 choices made by 410 respondents who have individually performed 12 choice tasks. Exploratory variables included in the model were divided into 1) main effect variables, 2) information treatment variables, 3) clustered sociodemographic variables, and 4) clustered factor scores for fresh meat. The main effect variable includes the price and the alternative specific attributes (colour and geographical

indicator), and all variables except the price are effect coded.

Concerning the selected attributes and levels for the RPL-EC model, the utility function for the main effect variable is specified as follows:

$$U_{ijs} = ASC + \beta_1 PRICE_{ijs} + \beta_2 COL_{ijs} + \beta_3 GEO_{ijs} + \mu_i Z_{ijs} + \varepsilon_{ijs}.$$

Model specification for main effect and interaction term information treatment, clustered sociodemographic variable and factor scores variable is specified as follows:

$$\begin{aligned} U_{ijs} = ASC + \beta_1 PRICE_{ijs} + \beta_2 COL_{ijs} + \beta_3 GEO_{ijs} + \beta_4 COL_{ijs} * TreatmentINFO_i \\ + \beta_5 GEO_{ijs} * TreatmentINFO_i + \beta_6 COL_{ijs} * CluterSD_i + \beta_7 GEO_{ijs} \\ * CluterSD_i + \beta_8 COL_{ijs} * CluterF_i + \beta_9 GEO_{ijs} * ClusterF_i + \varepsilon_{ijs}. \end{aligned}$$

By this means, the ASC is an alternative specific constant (status quo variable), $PRICE_{ijt}$ represents the price of 1 kg of fresh boneless pork ham (*gluteus medius*) of the Black Slavonian Pig alternative *j*, COL_{ijs} represents the fresh meat colour (dark, light) of the alternative *j*, GEO_{ijs} represents a geographical information (continental Croatia, continental Croatia + PDO, and other regions) of the alternative *j*, COL_{ijs} and GEO_{ijs} * $TreatmentINFO_i$, COL_{ijs} and GEO_{ijs} * $ClutserSD_i$ and COL_{ijs} and GEO_{ijs} * $ClutserF_i$ (interaction terms) are colour and geographical information variables interacted with information treatment, sociodemographic clusters and consumers clusters for fresh meat, Z_{ijs} is a normally distributed zero mean error component, set to 0 in the utility of the status quo alternative (Wongprawmas and Canavari, 2017), and the ε_{ijt} is the error term.

In the random parameter logit (RPL) model and in the error component random parameter logit model (RPL-EC) model, all of the main effect variables except price were modelled as random parameters and assumed to be distributed normally. The RPL and RPL-EC models were estimated considering a panel data structure and using 1,000 and 100 Halton draws for simulation. Primarily the data were analysed using the baseline multinomial logit model (MNL). In summary, MNL, RPL and RPL-EC models with interaction terms (information treatment, sociodemographic cluster and consumers clusters for fresh meat) were estimated.

Willingness to pay is difference in Croatian kunas (HRK) between what the consumers are

willing to pay for a particular attribute level in comparison with the baseline reference level. Average willingness to pay (WTP) for alternative specific constant and each attribute level of geographical information was calculated as follows:

$$WTP_{i|ref} = -(\beta_i - \beta_{ref}) / \beta_{price}$$

where β_i represents the main effect parameter of the attribute i, β_{ref} represents the main effect parameter of the reference level of the attribute, and β_{price} is the coefficient for *Price*.

2.5. Sample description

A total of 410 respondents completed the survey; selected socio-demographic variables are presented in Table 5.

The sample consisted of 51.0 % female and 49.0 % male respondents. In total 41 % of respondents were in groups between 25 and 44 years of age, and 26.8 % of respondents were 55 or above 55 years of age. Predominantly respondents are from urban areas (78.5 %) and they are not connected with agriculture (55.6 %). Respondents were equally distributed by geographical regions. The majority of respondents are employed (in the private, public, or civil sector) (62.0%) and 75.4 % of them have higher education (university or professional studies) or a university degree (master's or PhD), and 24.6 % of them have secondary and lower education levels (elementary and high school diploma). The higher proportion of higher educated respondents in the sample might be because responses are collected online, and predominantly respondents are from urban areas, which is common for cities. The obtained results are in line with the Croatian Census (2011) according to which 22.9 % of Croatian population in urban areas are highly educated, while in rural areas only 8.5 % of the population is highly educated. The respondents mostly live-in families with 2 – 4 household members (82.7 %) with no children below 15 years of age (68.8 %) and with no elders more than 60 years of age (63.4 %) in the household. Respondents declare that their household monthly income group is average, family household monthly income is between 9,501.00 and 16,500.00 HRK (36.6 %), which is in accordance with data of Croatian Bureau of Statistics (2020).

Table 5 Principal descriptive statistic of the socio-demographic characteristics of the respondents

Characteristics		Percent of total (%)		
		Total sample (410)	Control treatment (204)	Information treatment (206)
Gender	Male	49.0	50.5	47.6
	Female	51.0	49.5	52.4
Age	18 – 24	13.4	14.2	12.6
	25 – 34	20.5	20.1	20.9
	35 – 44	20.5	20.1	20.9
	45 – 54	18.8	20.6	17.0
	> 55	26.8	25.0	28.6
Place of residence	Urban	78.5	80.4	76.7
	Rural	21.5	19.6	23.3
Connection with agriculture	No	55.6	56.4	54.9
	Yes	44.4	43.6	45.1
Region	Central Croatia	24.9	26.5	23.3
	North-western Croatia	24.6	24.5	24.8
	Eastern Croatia	21.5	19.6	23.3
	Northern Adriatic and Lika	15.9	17.2	14.6
	Middle and South Adriatic	13.2	12.3	14.1
Labour situation	Student	11.0	12.3	9.7
	Unemployed	8.0	8.8	7.3
	Employed part-time	4.1	5.4	2.9
	Employed	62.0	58.3	65.5
	Retired	14.9	15.2	14.6
Education	High school and lower education	24.6	24.5	24.8
	Higher education (university or professional studies, e.q. bachelor)	50.5	52.9	48.1
	University degree (master's and/or PhD)	24.9	22.5	27.2

Table 5 (continued)

Characteristics		Percent of total (%)		
		Total sample (410)	Control treatment (204)	Information treatment (206)
Number of household members	1	6.3	3.4	9.2
	2 - 4	82.7	85.8	79.6
	5 - 8	11.0	10.8	11.2
Number of children below 15 years in the household	0	68.8	65.7	71.8
	1	17.1	17.2	17.0
	≥ 2	14.1	17.2	11.2
Number of elders more than 60 years in the household	0	63.4	63.7	63.1
	1	22.9	21.1	24.8
	≥ 2	13.7	15.2	12.1
Household income group	Significantly below average	2.9	3.4	2.4
	Below average	17.1	17.6	16.5
	Average	58.8	57.4	60.2
	Above average	21.2	21.6	20.9
Household monthly income (HRK)	0.00 - 3,500.00	4.6	3.4	5.8
	3,501.00 – 5,500.00	6.6	6.4	6.8
	5,501.00 - 7,500.00	18.3	24.0	12.6
	7,501.00 – 9,500.00	16.8	13.2	20.4
	9,501.00 – 11, 500.00	14.4	12.7	16.0
	11,501.00 - 16,500.00	22.2	21.6	22.8
	16,5001.00 – 20,500.00	12.4	14.7	10.2
	> 20,500.00	4.6	3.9	5.3

3. RESULTS

Research results present the most important data, which are closely related to the objectives and hypotheses of the dissertation. Results show data regarding consumers' consumption frequency of fresh meat and fresh pork and their purchasing habits and knowledge about pig breeds when buying fresh pork ham. In this part of the dissertation, the results of consumers segmentation are presented based on factors that affect consumers purchasing decisions when buying fresh meat, and principal component analysis is made on statements regarding consumers opinions about purchasing and social concerns (local production, biodiversity, and animal welfare) of fresh pork from the indigenous pig breed. Also, a choice experiment estimated consumers' preferences and willingness to pay (WTP) for fresh pork ham without bones of the Black Slavonian Pig breed.

3.1. Purchasing and consumption behaviour for fresh meat and fresh pork

The frequencies of consumer responses regarding consumption, preparation and purchasing behaviour of fresh and cured meat products were calculated. Frequencies of fresh meat and cured meat products consumption in the week are presented in Figure 5.

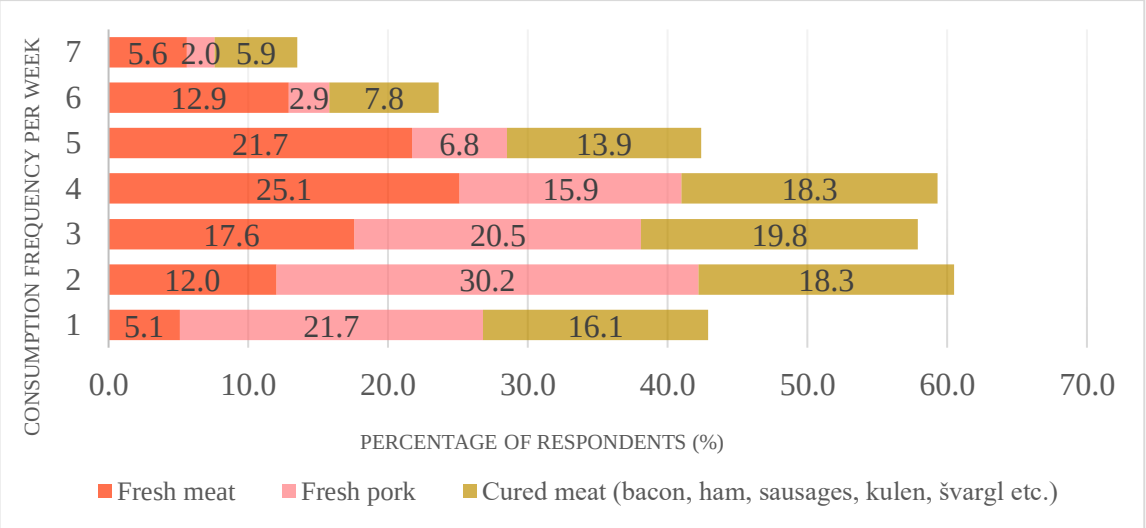

Figure 5 Consumption behaviour of the respondents

Results presented in Figure 5 showed that 25.1 % of respondents consume meat four times a week, and from that, they mostly consume pork (30.2 %) twice and cured meat products

(19.8 %) three times a week.

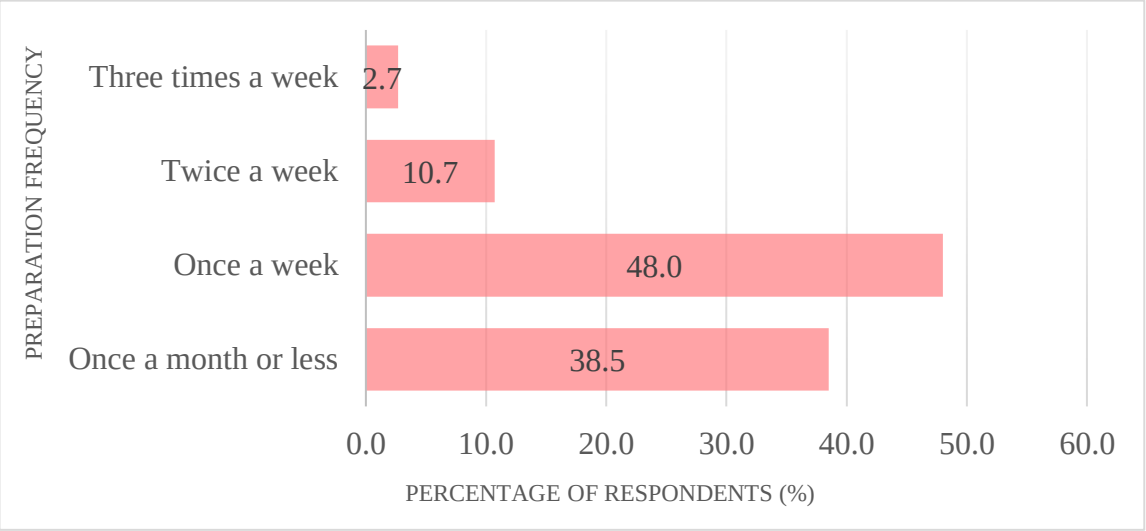

Figure 6 Frequency of preparation (%) of fresh boneless pork ham

According to the data in Figure 6, half of the Croatian consumers prepare boneless fresh pork ham (*Gluteus Medius*) once a week (48.0 %), with consumers having high preferences for purchasing fresh boneless pork ham at butcher shops (48.0 %) and supermarkets (44.6 %). The main reasons to buy fresh pork ham in a butcher shop or supermarket are convenient location, trust in local butcher regarding meat safety information, operating hours, and wide range of products. In addition, they can buy smaller quantities and different cuts of meat. More than half (53.2 %) of the Croatian respondents pay between 25 and 45 HRK/kg for fresh boneless ham and stated that they are not aware of the meat origin in terms of breed (82.2 %). In total 55.1 % of consumers occasionally consume fresh meat or cured meat products from the Black Slavonian pig, while 40.5 % of them have never tried fresh meat or cured products from this indigenous pig breed. When asked which breeds of pigs they have heard of, the respondents stated that they were most familiar with the Black Slavonian Pig (26.0%), Turopolje pig (20.5%), Yorkshire (17.7%) and Landrace (11.7%). On the question to state the main reason why they didn't consume or only occasionally consume fresh meat or cured meat products from the Black Slavonian Pig, they responded that they did not have the opportunity to try it (18.5 %); it is not easy to find (38.9 %); it is expensive (31.3 %) and for other reasons they mentioned that the taste of the meat is different than from the meat of hybrid pigs. In addition, the majority of respondents stated that there is a lack of information and labels on the product about the breed of pig the meat comes from, so they do not know which breed of pig they are consuming (Table 6).

Table 6 Purchasing behaviour of the respondents regarding the fresh boneless pork ham and their knowledge about the pig breeds

		Frequency	Percent (%)
Usual place of purchase	Direct from producer	30	7.3
	Butcher shop	197	48.0
	Hyper/supermarket	183	44.6
Usual paying price for fresh pork (HRK/kg)	25 - 45	218	53.2
	46 - 75	153	37.3
	≥ 76	39	9.5
Knowledge about the breed of pig from which the fresh meat originates	Yes	73	17.8
	No	337	82.2
Breeds the respondents heard about *	Yorkshire	258	17.7
	Landrace	171	11.7
	Duroc	67	4.6
	Pietrain	94	6.4
	Mangalitsa	85	5.8
	Black Slavonian Pig	379	26.0
	Turopolje pig	299	20.5
	Banija spotted pig	107	7.3
Consumption frequency of fresh meat or cured products from Black Slavonian Pig	Never	166	40.5
	Yes, occasionally	226	55.1
	Yes, frequently	18	4.4
Reasons not to consume or occasionally consume meat from Black Slavonian Pig *	I do not like it	18	3.2
	Too much fat content	21	3.8
	Not easy to find	216	38.9
	Not having the opportunity to try it	103	18.5
	Too expensive	174	31.3
	Other	24	4.3

Note: * Number of respondents does not match 410 because several options could be selected.

3.2. Consumer's preferences concerning the importance of certain attributes when buying fresh meat

The attributes that influence purchasing decisions when buying fresh meat (price, appearance, quantity, country of origin, safety and quality, freshness, convenience, fairness in supply chain and animal welfare) were analysed through ten attributes, and consumers attitudes were measured on a 5-point Importance scale where answer options ranged from not at all important to extremely important. The internal reliability coefficient of the Cronbach Alpha scale is 0.835. Based on the respondents' answers, the fundamental descriptive statistical indicators were calculated (arithmetic mean, median, mode and standard deviation) for each attribute, and the results are presented in Table 7.

Table 7 Consumer's opinions about the importance of certain attributes when buying fresh meat

	M	M_e	M_o	SD
Freshness (date of packaging and expiration date)	4.54	5	5	0.759
Safety and quality of the meat (high quality and safe to consume)	4.47	5	5	0.801
Appearance of the meat (e.g., colour, fat content, marbling, drip loss etc.)	4.21	4	4	0.797
Price (price you pay for fresh meat)	3.99	4	4	0.843
Country of origin (the meat is produced in the Republic of Croatia, or it is imported)	3.98	4	4	0.929
Animal welfare (well-being of animals used in food production)	3.72	4	4	0.987
Fairness in the supply chain (farmers, processors, retails, and consumers equally benefit)	3.65	4	4	0.973
Quantity of the meat (amount of packaged fresh meat)	3.63	4	4	0.829
Convenience (how fast and easy the meat can be prepared)	3.52	4	4	0.904
Environmental impact (effects of meat production on the environment)	3.48	3	3	0.997

Note: M = arithmetic mean, M_e = median, M_o = mode, SD = standard deviation

Based on arithmetic means, it can be concluded that Croatian consumers mostly pay attention and consider the following attributes when buying fresh meat: freshness (M = 4.54), high

quality and safe for consumption (M = 4.47), and appearance (e.g., colour, fat content, marbling, water loss etc.) (M = 4.21). Price (n = 323; 78.7 %) and country of origin (n = 304, 74.2 %) are very or extremely important attributes when buying fresh meat for Croatian consumers. On the other hand, the respondents on average gave the lowest importance to the attribute environmental impact of meat production (M = 3.48). This opinion is shared by 151 (36.8%) Croatian consumers. Other social concerns like the animal well-being (M = 3.72, n = 248, 60.5 %) and fairness in the supply chain (meaning farmers, processors, retails, and consumers) have equally benefited (M = 3.65, n = 237, 57.8 %) when buying fresh meat seems very or extremely important to them which supports auxiliary hypothesis H1a.

3.3. Factor and cluster analysis of attitudes related to consumer preferences towards fresh meat

Segmentation of respondents was performed using a combination of principal component analysis (PCA) and cluster analysis (CA). Principal component analysis was applied to the data with the aim of identifying a smaller number of factors to explain the interconnection of the variable representing consumers' attitudes about the importance of certain attributes when buying fresh meat. Table 8 presents ten variables included in the factor analysis and their factor scores. To test the suitability of the data for factor analysis, a Kaiser – Mayer Olkin (KMO) measure was applied. A value of 0.852 confirms that data are adequate for conducting the factor analysis. Bartlett's test of sphericity ($\chi^2 = 1555.842$, $p < 0.01$) also confirmed that data could be used in factor analysis. A three-factor solution was identified with initial eigenvalues greater than one which together represented 66.9 % of the explained variance. Rotation was performed via the Varimax method, using Kaiser normalization, where the variables are arranged according to the strength of the correlation with the first, second and third factors (Table 8). Cronbach's Alphas coefficients were calculated to verify the consistency and the reliability of principal component analysis and varied between 0.862 to 0.518. Although Cronbach's Alpha values in the third factor were lower according to the Bazzani et al. (2017), and Lin et al. (2019) studies, the Cronbach's Alpha values above 0.50 are acceptable. The obtained factors were interpretable, and all values were highly correlated with one of the three principal components. The three components obtained were named: sustainability performance, intrinsic quality and origin and economy and convenience.

Table 8 Consumers attitudes about the importance of certain attributes when buying fresh meat

	F1	F2	F3
Fairness in supply chain	**0.857**	0.180	0.101
Environmental impact	**0.827**	0.245	0.124
Animal welfare	**0.818**	0.190	0.065
Safety and quality of the meat	0.246	**0.818**	0.121
Freshness	0.242	**0.797**	0.181
Meat appearance	0.053	**0.754**	0.251
Country of origin	0.502	**0.583**	-0.039
Price	-0.156	0.193	**0.775**
Convenience	0.409	-0.031	**0.671**
Quantity of the meat	0.172	0.343	**0.566**
% Variance Explained	41.874	14.557	10.482
Eigenvalues	4.187	1.456	1.048
Cronbach's Alpha	0.862	0.807	0.518

KMO = 0.852, Bartlett's χ^2 = 1555.842, p = 0.000

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Note: sustainability performance (F1); intrinsic quality and origin (F2); economy and convenience (F3)

According to results presented in Table 8, the first factor explained 41.9 % of the variance, with the following participating variables: fairness in the supply chain, environmental impact, and animal welfare. If we look at the variable most strongly associated with the first factor, it is called *sustainability performance*, as it is explained by variables that express the importance of social concerns and credibility features when buying fresh meat. This component accounts for the largest share of the variance explained.

The second factor explains 14.6 % of the total variance. It contains variables: safety and quality of fresh meat, freshness, appearance, and country of origin. The second factor was called *intrinsic quality and origin* because variables that contain are related to the consumption based on experience and visual attributes.

The third factor contains variable price, convenience, and quantity of the meat in the package

and explains 10.5 % of the total variance. Overall, these variables present e*conomy and convenience.*

Cluster analysis was carried out based on the factors resulting from the Principal component analysis. To obtain the optimum number of clusters through dendrogram yielding three clusters hierarchical clustering analysis with Ward's method was applied, followed by K-mean cluster analysis for segmentation of consumers.

Table 9 shows results of the analysis of variance (ANOVA) procedure indicating which variables contribute the most to the cluster distribution. F values in the table show the greatest separation between clusters. According to the F values in Table 9, a sustainability performance variable contributed the most to the cluster separation (F = 247.294).

Table 9 Analysis of attributes when buying fresh meat between and within clusters, ANOVA

	Sum of squares between clusters	Sum of squares within clusters	*F*
Sustainability performance	224.367	184.633	247.294
Intrinsic quality and origin	182.349	226.651	163.723
Economy and convenience	60.405	348.595	35.263

In Table 10, the typical characteristics of each cluster are presented. Final cluster centres represent the arithmetic means of each variable within each final cluster.

The first cluster consists of *altruistic meat consumers* since they pay relatively more attention to social characteristics of fresh meat (animal welfare, environment and fairness in supply chain), and are also oriented on intrinsic and extrinsic characteristics (colour, marbling, freshness, origin, safety and quality) of fresh meat. Still, they are not oriented to price attributes (n = 208, 50.7 %).

The second cluster represents consumers that are less oriented to social characteristics of fresh meat (176, 42.9 %). Instead, the price, visual and experience characteristics of fresh meat are of utmost importance for them, so they are named *traditional meat consumers*.

The third and smallest cluster (n = 26, 6.3 %) tend to be generally uninterested or *inattentive meat consumers'* meaning they are below average in the importance assigned to the attributes

when buying fresh meat. Also, to this, consumers' visual characteristics and price of fresh meat are least important (Table 10).

Table 10 Final cluster profiles regarding attributes when buying fresh meat

	Custer 1 (n = 208) Altruistic meat consumers	Cluster 2 (n = 176) Traditional meat consumers	Cluster 3 (n = 26) Inattentive meat consumers
Sustainability performance	0.71563	-0.81412	-0.21410
Intrinsic quality and origin	0.22195	0.11518	-2.55529
Economy and convenience	-0.11275	0.31673	-1.24198

In order to be sure that identified factor scores influenced cluster differentiation, the canonical discriminant analysis was applied for verification of the data. To ensure proper clustering, the discriminant analysis was conducted on three factor scores and three clusters. In the discriminant analysis, we are trying to predict group membership on the results of group means and ANOVA. Between sustainability performance and economy and convenience separation is large according to mean differences and high F values which suggest that this could be good discriminators. Table 11 presents the first and second canonical discriminant functions (number of groups minus 1) explaining the results of the eigenvalues and Wilk's lambda.

Table 11 Eigenvalues and Wilks' lambda results for discriminant analysis regarding the importance of certain attributes when buying fresh meat

Function	Eigenvalue	Canonical Correlation	Wilks' Lambda	χ^2	p
1	1.456	0.770	0.184	688.340	0.000
2	1.219	0.741	0.451	323.560	0.000

Note: *p<0.05, **p<0.01

Discriminant functions had eigenvalue's 1.456 and 1.219 with canonical correlations 0.770 and 0.741. The first canonical function accounted for 54.4 % and the second function for 45.6 % of the discriminating ability. Eigenvalues are related to canonical correlation and describe how much discriminant ability a function possesses; large eigenvalues are associated with a strong function in this analysis. The canonical correlation is the multiple correlations between the independent variable (sustainability performance, intrinsic quality and origin and economy and

convenience) and the discriminant function and a high correlation indicates that functions discriminant well. Presented results show that both discriminant functions are statistically significant and that they have the discriminant ability. Wilk's lambdas indicate the significance of the discriminant function so Wilk's lambda testing both canonical correlations is 0.184 ($\chi^2 = 688.340$, $p < 0.01$) and the Wilk's lambda testing second canonical correlation is 0.451 ($\chi^2 = 323.560$, $p < 0.01$).

Table 12 presents the standardized canonical discriminant function coefficients for both discriminant functions. Standardize coefficients indicate the relative importance of each of the independent variables concerning the corresponding function. The standardised coefficients with higher absolute values correspond to the variable with a higher ability to discriminate the observed group. It is evident from Table 12 that in the first discriminant function, the standardized coefficients for sustainability performance have the highest relative importance than the coefficients for the other two groups. Thus, group sustainability performance will have the greatest impact of the three groups on the first discriminant function. In the second discriminate function variable with the highest relative importance are intrinsic quality and origin and economy and convenience.

Table 12 Standardized canonical discriminant function coefficients regarding the importance of certain attributes when buying fresh meat

Factors	Discriminant function	
	1	2
Sustainability performance	1.005	-0.123
Intrinsic quality and origin	0.276	0.961
Economy and convenience	-0.262	0.665

The structure matrix table presents the correlations of each variable with each discriminant function. In the structure matrix table, independent variables are arranged by absolute values of the coefficients. Based on the correlation coefficients in Table 13, it can be concluded which independent variables best describe each discriminant function. There is no variable that achieves a correlation with both functions. All variables achieve a strong correlation with the first or second discriminant function. In the first discriminant function, sustainability performance is the most strongly associated variable, and second discriminant function is most

strongly associated with variables that represent intrinsic quality and origin and economy and convenience (Table 13).

Table 13 Structure matrix regarding the importance of certain attributes when buying fresh meat

Factors	Discriminant function	
	1	2
Sustainability performance	0.907*	-0.123
Intrinsic quality and origin	0.203	0.782*
Economy and convenience	-0.125	0.351*

*Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions. Variables are ordered by the absolute size of correlation within the function. *Largest absolute correlation between each variable and any discriminant function*

The classification table (Table 14) shows the number of cases that were correctly classified. Rows represent the observed categories of the grouping variables, and columns are predicted categories. It was found that 98.8 % of original grouped cases were correctly classified.

Table 14 Discriminant function classification results regarding the importance of certain attributes when buying fresh meat

		Group	Predicted Group Membership			
			1	2	3	Total
Original grouped cases	Count	1	208	0	0	208
		2	1	175	0	176
		3	2	2	22	26
	%	1	100.0	0.0	0.0	100.0
		2	0.6	99.4	0.0	100.0
		3	7.7	7.7	84.6	100.0

Note: altruistic meat consumers (1), traditional meat consumers (2), inattentive meat consumers (3)

It can be noted from Table 14 that 208 cases fall into the consumer segment altruistic meat consumers, 176 into the traditional meat consumers group, and 26 into inattentive meat consumers group. In the first group (altruistic meat consumers), all 208 cases were predicted correctly. In the second group (traditional meat consumers), 175 cases were predicted correctly, and 1 incorrectly, and in the third group (inattentive meat consumers), 22 cases were correctly

predicted, while 2 were predicted incorrectly (1 was classified to altruistic consumers group, and 1 to traditional meat consumers group).

3.3.1. Segmentation analysis of fresh pork consumers

Associations between consumer segments and sociodemographic characteristics of consumers as well as purchasing, pork consumption behaviour and knowledge about the pig breed were determined using the (χ^2). Results of the chi-square test (χ^2) are presented in Tables 15 and 16.

Table 15 Consumer segments according to their socio-demographic characteristic (χ^2 test)

		Cluster (consumers %)				
		C1	C2	C3	χ^2	*p*
Gender	Male	45.2	50.0	73.1	7.308	0.026*
	Female	54.8	50.0	26.9		
Age	18 – 24	14.4	11.9	15.4	6.548	0.586
	25 – 34	20.7	20.5	19.2		
	35 – 44	20.7	18.8	30.8		
	45 – 54	15.9	21.6	23.1		
	> 55	28.4	27.3	11.5		
Place of residence	Urban	76.4	79.5	88.5	2.167	0.338
	Rural	23.6	20.5	11.5		
Connection with agriculture	No	53.4	62.5	26.9	12.447	0.002**
	Yes	46.6	37.5	73.1		
Region	Central Croatia	22.6	24.4	46.2	12.223	0.142
	North-western Croatia	24.0	26.7	15.4		
	Eastern Croatia	21.6	21.0	23.1		
	Northern Adriatic and Lika	14.9	17.6	11.5		
	Middle and South Adriatic	16.8	10.2	3.8		
Labour status	Student	11.5	10.2	11.5	14.731	0.065
	Unemployed	4.3	12.5	7.7		
	Employed part-time	4.3	2.8	11.5		
	Employed	62.0	62.5	57.7		
	Retired	17.8	11.9	11.5		

Table 15 (continued)

		Cluster (consumers %)				
		C1	C2	C3	χ^2	*p*
Education	High school and lower	22.1	27.3	26.9	2.288	0.683
	Higher education	53.8	46.6	50.0		
	University degree	24.0	26.1	23.1		
Number of household members	1	8.2	4.5	3.8	3.169	0.530
	2 - 4	79.8	85.8	84.6		
	5 - 8	12.0	9.7	11.5		
Number of children in household (< 15)	0	71.2	68.8	50.0	8.322	0.080
	1	18.3	14.8	23.1		
	≥ 2	10.6	16.5	26.9		
Number of elders in household (> 60)	0	65.9	60.8	61.5	13.555	0.009**
	1	26.0	21.0	11.5		
	≥ 2	8.2	18.2	26.9		
Household monthly income (HRK)	0.00 - 3,500.00	4.8	3.4	11.5	9.587	0.792
	3,501.00 – 5,500.00	5.8	7.4	7.7		
	5,501.00 - 7,500.00	17.8	18.8	19.2		
	7,501.00 – 9,500.00	19.7	13.1	19.2		
	9,501.00 – 11, 500.00	14.4	15.9	3.8		
	11,501.00 - 16,500.00	22.1	22.2	23.1		
	16,5001.00 – 20,500.00	11.1	14.2	11.5		
	> 20,500.00	4.3	5.1	3.8		

Note: **p<0.01, *p<0.05, altruistic meat consumers (C1), traditional meat consumers (C2), inattentive meat consumers (C3)

According to the data in Table 15, it is evident that there is a significant dependence between variables gender ($\chi^2 = 7.308$, $p < 0.05$), consumers connection with agriculture ($\chi^2 = 12.447$, $p < 0.01$) and the number of elders over 60 years old in a household ($\chi^2 = 13.555$, $p < 0.01$) with obtained clusters. In Table 16, statistically significant dependencies are presented between variables place of purchase ($\chi^2 = 10.994$, $p < 0.05$), consumption frequency of fresh pork ($\chi^2 = 22.090$, $p < 0.05$), consumption frequency of fresh or cured products from the Black

Slavonian Pig ($\chi^2 = 22.039$, $p < 0.01$), and awareness about the pig breed ($\chi^2 = 23.852$, $p < 0.01$) with the obtained clusters.

Table 16 Consumers' segments based on purchasing and consumption behaviour

		Cluster (consumers %)				
		C1	C2	C3	χ^2	*p*
Usual place of purchase	Direct from producer	9.1	5.1	7.7	10.994	0.027*
	Butcher shop	51.9	41.5	61.5		
	Hyper/supermarket	38.9	53.4	30.8		
Usual paying price for fresh pork (HRK/kg)	25 - 45	52.9	53.4	53.8	0.983	0.912
	46 - 75	36.5	38.6	34.6		
	≥ 76	10.6	8.0	11.5		
Pork consumption frequency	Once a week	21.6	23.9	7.7	22.090	0.037*
	Two times a week	29.8	32.4	19.2		
	Three times a week	19.7	19.9	30.8		
	Four times a week	16.3	14.8	19.2		
	Five times a week	7.7	5.7	7.7		
	Six times a week	2.4	1.7	15.4		
	Seven times a week	2.4	1.7	0.0		
Knowledge about the breed of pig from which the fresh meat originates	Yes	21.2	9.7	46.2	23.852	0.000**
	No	78.8	90.3	53.8		
Consumption frequency of fresh meat or cured products from Black Slavonian Pig	Never	35.1	51.1	11.8	21.039	0.000**
	Yes, occasionally	59.1	46.0	84.6		
	Yes, frequently	5.8	2.8	3.8		

Note: **p<0.01, *p<0.05, altruistic meat consumers (C1), traditional meat consumers (C2), inattentive meat consumers (C3)

The segment of altruistic meat consumers was the largest group formed (Table 15). Of the 208 consumers who formed this group, 54.8 % were females. This segment is characterised by a high percentage of consumers mainly from urban areas (76.4 %). 53.4 % consumers in this segment have no connection with agriculture and 46.6 % of them are connected with agriculture through parents, relatives, or they are farmers themselves. Consumers in this segment are

predominantly from the continental Croatia (Central Croatia (22.6 %), North-Western Croatia (24.0 %) and Eastern Croatia (21.6 %)). This segment is characterised by a lower percentage of consumers aged 45 – 54 and 18 - 24; all other age groups are equally represented. According to labour status, employed consumers dominated (62.0 %) in this segment and they have higher education (53.8 %). In this segment, consumers are classified to consumers with two to four house members (79.8 %), without children below 15 years of age (71.2 %) and households without family member older than 60 years of age (65.9 %) or with one member older than 60 years of age (26.0 %). Household income for the majority of the sample is between HRK 5,501.00 and 16,500.00 (Table 15). The individuals grouped here turned out to be consumers who consume pork one (21.6 %) or two times a week (29.8 %). They purchase meat from a butcher (51.9 %) and pay between HRK 25 and 75 for one kilogram of fresh meat. When buying pork, they don't know from which breed it is, and they occasionally consume fresh or cured meat products from the Black Slavonian Pig (Table 16).

The second segment comprises 176 traditional meat consumers. In this segment, men and women are equally represented (50.0 %); the most frequent age range was from 45 -54 years (21.6 %) and 55 years (27.3 %). This segment includes consumers from urban areas (79.5 %) who do not have any connection with agriculture (62.5 %), and they are equally represented in all regions, although a little less in the Northern Adriatic and Lika (17.6 %) and Middle and South Adriatic region (10.2 %). This segment is made up of employed (62.5 %) consumers with higher education (46.6 %). Traditional meat consumers group is larger in family size (2 – 4 members; 85.8 %), includes consumers without children younger than 15 years of age (68.8 %) and without elders (60.8 %). Household income oscillated from the lowest HRK 5,501.00 to the highest up to 16,500.00 and was not a defining characteristic of this segment (Table 15). Turning to the characteristics of purchasing and consumption presented in Table 16, most consumers in this segment consume pork once (23.9 %) or twice a week (32.4 %). They mainly purchase fresh meat in supermarkets (53.4 %) and pay HRK 25 – 75 for one kilogram. They do not have knowledge of what breed the meat is they buy (90.3 %), and they never tried fresh meat or cured meat products from the Black Slavonian Pig (51.1 %).

The smallest third segment of indifferent meat consumers is dominated by men (73.1 %), 35 – 44 years of age from urban areas. They have a connection with agriculture (73.1 %), and they are predominantly from Central (46.2 %) and Eastern Croatia (23.1 %). This segment is made up of employed consumers (57.7 %) who have higher education (50.0 %). The third segment groups consumers with two to four family members in the household (84.6 %) without children

younger than 15 years of age (50.5 %) and without (61.5 %) and with two or more family members older than 60 years of age (26.9 %). The income oscillated between HRK 5,501.00 and 9,500.00, and 23.1 % of them were above HRK 11,501.00. In this group, 30.8 % of the sample consume fresh pork four times a week. They purchase meat from the butcher (61.5 %) and pay it HRK 25 - 75.00 or more. During the meat purchase, they are aware from which breed of pig they purchase meat (46.2 %) compared to other segments. But still, the majority of consumers in this segment still do not have knowledge about the pig breed when buying fresh pork (53.8 %). Consumers in this segment occasionally consume fresh or cured meat products from the Black Slavonian Pig (84.6 %).

3.4. Consumer's opinions about fresh pork purchasing behaviour and social concerns

The recruited Croatian consumers were asked to voice their opinion on the twenty-one statements regarding purchasing, local production, preservation of biodiversity, and animal welfare for fresh boneless pork ham, which are presented in the table below (Table 17). The statements offered to the respondents were measured using a 5-point Liker scale ranging from 1 (strongly disagree) to 5 (strongly agree). The internal reliability coefficient of the Cronbach Alpha scale is 0.910. Based on the respondents' answers, the average score to the statements is 3.92 (somewhat agree). According to the data in Table 17, respondents most support the claim that freshness and the appearance of the meat are the most important (M = 4.28). A slightly lower degree of agreement was expressed with statements that breeding of indigenous pig breeds promotes sustainability and supports local producers (M = 4.26) and that locally produced food helps preserve traditional breeds and production methods (M = 4.22). With the statement that the product should be clearly indicated from which breed of pig meat originates, 190 (46.3 %) of respondents agree and 191 (46.6 %) of them agree with the statement that breeding of the Black Slavonian Pig outdoors is a more environmentally friendly production. Respondents, on average, expressed the lowest agreement with the statement that they are willing to pay a higher price for pork produced to higher animal welfare standards (M = 3.51). However, they agree with statements that indoor pig breeding is cruel (35.6 %), and they are concerned about farm animals (34.6 %). The given set of statements proved that consumers have a positive attitude and understand the positive benefits of breeding indigenous pig breeds which are particularly shown by the rather good average scores related to the claims about social concerns which supports auxiliary hypothesis H1a of doctoral dissertation.

Table 17 Consumer's opinions about purchasing behaviour of fresh pork and social concerns

	M	M_e	M_o	SD
When buying fresh pork, freshness and the appearance of meat (colour, marbling, drip loss) are important to me.	4.28	4	4	0.840
Breeding indigenous pig breeds (such as Black Slavonian Pig) promotes sustainability and supports local farmers.	4.26	4	5	0.846
Locally produced food helps preserve traditional breeds and production methods.	4.22	4	4	0.821
It should be indicated on the product whether the meat originates from an indigenous breed (such as Black Slavonian Pig) or other modern pig breeds.	4.14	4	4	0.851
Rearing a Black Slavonian Pig outdoors is a more environmentally friendly production.	4.12	4	4	0.819
I think that the taste of the meat is the most important.	4.07	4	4	0.785
It should be indicated on the product whether the pigs are reared to higher standards of welfare.	4.03	4	4	0.863
I always check the price when buying fresh boneless pork ham.	4.02	4	4	1.031
Locally produced food is healthier and more natural (following the original production process).	3.95	4	4	0.898
Pigs should be able to express natural behaviour on-farm (trenching, rolling in the mud, etc.).	3.94	4	4	0.838
Meat from indigenous pig breeds (such as Black Slavonian Pig) is tastier, juicier, softer and of better quality.	3.90	4	4	0.849
Respect for animal welfare results in better meat quality.	3.88	4	4	0.913
I find it important to know the location and how pork is produced.	3.87	4	4	0.851
The labels and information on the product are very important because they represent quality and safe meat.	3.87	4	4	0.884
The farm (indoor) breeding causes environmental problems (e.g., massive water consumption, energy consumption, greenhouse gas emission)	3.74	4	4	0.897

Table 17 (continued)

	M	M_e	M_o	SD
I prefer to buy locally produced food even though it is sometimes more expensive.	3.74	4	4	0.934
I think intensive (indoor) pig rearing is cruel.	3.63	4	4	0.985
I associate the quality of the meat with the geographical origin of the breed.	3.57	4	4	0.939
I am concerned about farm animal welfare.	3.57	4	3	0.954
It doesn't matter how the pigs are reared because they don't know better.	3.51	4	3	1.079
I do not mind paying a higher price for pork produced to higher animal welfare standards.	3.51	4	3	1.033

Note: M = arithmetic mean, M_e = median, M_o = mode, SD = standard deviation

3.5. Factor analysis of consumers opinions about fresh pork purchasing behaviour and social concerns

Factor analysis was performed to determine a smaller number of factors that represent the interrelationship among twenty-one statements regarding purchasing behaviour, local production, preservation of biodiversity, and animal welfare (Table 18). Principal component analysis was used considering eigenvalues greater than 1. Varimax rotation with Kaiser normalization was applied to improve the interpretation of factor scores obtained by factor analysis. In order to confirm that data are suitable for analysis, the Kaiser – Mayer Olkin (KMO) measure of sampling adequacy was applied and gave a value of 0.929, which is great and Bartlett's test of sphericity ($\chi^2 = 4745.022$, $p < 0.01$) also confirmed that data could be used in factor analysis. The factor analysis produced four factors (attention to animal welfare, supporting local production and biodiversity, origin and information and price and intrinsic quality) that explained 64.0% of the total variance. Calculated Cronbach's Alphas coefficients verified the consistency and the reliability of principal component analysis (0.875 to 0.668).

Table 18 Results of exploratory factor analysis of consumers opinions about purchasing behaviour of fresh pork and social concerns

	F1	F2	F3	F4
I am concerned about farm animal welfare.	**0.842**	0.079	0.163	0.089
I think rearing pigs in intensive systems is cruel.	**0.787**	0.115	0.054	0.061
Respect for animal welfare results in better meat quality.	**0.742**	0.166	0.181	0.180
I do not mind paying a higher price for pork produced to higher animal welfare standards.	**0.722**	0.152	0.413	-0.052
Pigs should be able to express on-farm their natural behaviour.	**0.700**	0.235	0.134	0.115
It should be indicated on the product whether the pigs are reared to higher standards of welfare.	**0.682**	0.326	0.252	0.082
The farm (indoor) breeding causes environmental problems (e.g., massive water consumption, energy consumption, greenhouse gas emission)	**0.501**	0.478	0.181	-0.029
It does not matter how the pigs are reared because they do not know better.	**0.450**	0.171	-0.371	0.120
Rearing indigenous pig breeds (such as Black Slavonian Pig) promotes sustainability and supports local farmers.	0.176	**0.783**	0.169	0.307
Rearing the Black Slavonian Pig outdoors is a more environmentally friendly production.	0.293	**0.781**	0.088	0.030
Locally produced food helps preserve traditional breeds and production methods.	0.181	**0.721**	0.221	0.402
It should be indicated on the product whether the pork is from an indigenous breed or other modern pig breeds.	0.247	**0.601**	0.395	0.154
Meat from indigenous breeds of pigs is tastier, juicier, softer and of better quality.	0.134	**0.598**	0.487	0.168
Locally produced food is healthier and more natural.	0.137	**0.564**	0.435	0.303

Table 18 (Continue)

	F1	F2	F3	F4
I associate the quality of the meat with the geographical origin of the breed.	0.163	0.277	**0.746**	0.030
I find it important to know the location and how pork is produced.	0.292	0.207	**0.699**	0.262
The labels and information on the product are very important because they represent quality and safe meat.	0.214	0.365	**0.586**	0.127
I prefer to buy locally produced food even though it is sometimes more expensive.	0.324	0.432	**0.551**	-0.152
I always check the price when buying fresh boneless pork ham.	-0.010	0.123	-0.179	**0.782**
When buying fresh pork, freshness and the appearance of meat are important to me.	0.227	0.241	0.237	**0.719**
I think that the taste of the meat is the most important.	0.137	0.186	0.423	**0.629**
% Variance Explained	41.367	10.474	7.300	4.812
Eigenvalues	8.687	2.200	1.533	1.011
Cronbach's Alpha	0.772	0.875	0.807	0.668

KMO = 0.929, Bartlett's χ^2 = 4745.022, p = 0.000

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Note: attention to animal welfare (F1), supporting local production and biodiversity (F2), origin and information (F3), price and intrinsic quality (F4)

According to the data in Table 18, the first factor explained 41.4 % of the variance. Considering the variable most strongly associated with the first factor, it was called *attention to animal welfare*, and this component accounts for the greatest variability of the variance explained. The second factor explained 10.5 % of the variance and groups the variables related to the sustainable production, preservation of biodiversity local production so this factor was called *supporting local production and biodiversity*. The third factor (*origin and information*) explained 7.3 % of the variance. The third factor is related to variables such as being willing to pay more for locally produced food, an association of the quality of meat with a geographical

region, and the importance of information and labels on the product. The fourth factor, called price and intrinsic quality, explains 4.8 % of the total variance and here are the variables related to the price, meat taste, appearance, and freshness.

3.5.1. Connection of sociodemographic characteristics of respondents regarding factor scores

The statistical significance of differences in the average values of factor scores between subjects' sociodemographic characteristics, purchasing and consumption habits of Croatian consumers, with respect to the determined factors, was examined using an independent t-test and analysis of variance (ANOVA).

Table 19 Testing the differences in the means of factor scores with regard to the gender of respondents

Factor	Male		Female		*t-test*	*p*
	M	SD	M	SD		
Attention to animal welfare	-0.13	1.053	0.13	0.930	-2.673	0.008**
Supporting local production and biodiversity	-0.04	1.072	0.04	0.927	-0.767	0.444
Origin and information	0.11	0.981	-0.10	1.010	2.117	0.035*
Price and intrinsic quality	-0.08	1.00	0.07	0.993	-1.503	0.134

Note: M = arithmetic mean, SD = standard deviation, ** $p<0.01$, * $p<0.05$

The results of a t-test for independent samples presented in Table 19 show that there is a significant difference between factors attention to animal welfare ($t = -2.673$, $p < 0.01$) and origin and information ($t = 2.117$, $p < 0.05$) regarding the gender of the respondents. The highest average value of factor scores in the case of the first factor was determined for female consumers meaning that female consumers pay more attention to variables express through factor attention to animal welfare (M = 0.13, 0.930) while male consumers variables in this factor are not important (M = -0.13, SD = 1.053). Other factor scores didn't prove to be statistically significant with respect to the gender of the respondents. However, according to arithmetic means, female consumers were more likely to consider the benefits of local production and preservation of biodiversity, and extrinsic and intrinsic attributes when buying fresh pork expressed by the factors supporting local production and biodiversity and price and intrinsic quality. In the case of the third factor, the highest average value of factor score was

determined for male consumers (M = 0.11, SD = 0.981) who were more likely than average to pay attention to the origin and information on the product, as expressed by the origin and information factor compared to female consumers.

Results presented in Table 20 show significant differences between the age of the respondents and second factor score related to variables supporting local production and biodiversity (F = 3.744, p < 0.01). The highest average value of factor score supporting local production and biodiversity was determined for consumers aged 45 to 55 and more (M = 0.20, SD = 1.057; M = 0.14, SD = 1.019), while younger consumers are more than average oriented on variables under factor origin and information. Young consumers also care more for variables under factor attention to animal welfare and to other traditional attributes like taste, price, the freshness of the fresh pork under the factor price and intrinsic quality.

Table 20 Differences between investigated factors scores with regard to the age of respondents

	Factor							
Age	F1		F2		F3		F4	
	M	SD	M	SD	M	SD	M	SD
18 – 24	0.01	1.048	-0.39	1.000	0.15	1.167	0.12	1.051
25 – 34	0.20	0.849	-0.09	0.835	0.07	0.910	0.00	0.822
35 – 44	-0.10	0.965	-0.02	1.008	-0.13	1.012	-0.13	1.035
45 – 54	-0.09	1.125	0.20	1.057	-0.09	1.056	0.04	1.315
> 55	-0.02	1.011	0.14	1.019	0.03	0.925	0.02	0.803
ANOVA	$F = 1.261$		$F = 3.744$		$F = 0.941$		$F = 0.607$	
	$p = 0.285$		$p = 0.005$**		$p = 0.440$		$p = 0.658$	

Note: M = mean, SD = standard deviation, ** p<0.01, * p<0.05, attention to animal welfare (F1), supporting local production and biodiversity (F2), origin and information (F3), price and intrinsic quality (F4)

In order to determine between which groups there is a statistically significant difference in average values of factor scores, multiple comparisons of arithmetic means were performed using the least significant difference (LSD) *post hoc* test (Table 21). The LSD test results show that only the difference in average factors scores determined in the case of the second factor (supporting local producers and biodiversity) and the youngest consumers group (18 – 24 and

25 -34 years old) is not statistically significant, while all other combinations are statistically significant.

Table 21 Results of the least significant difference (LSD) values for different age groups

Factor	Compared groups		*t*	*p*
Supporting local producers and biodiversity	18 – 24 years	25 – 34 years	-0.299	0.081
		35 – 44 years	-0.372	0.030*
		45 – 54 years	-0.593	0.001**
		> 55 years	-0.536	0.001**

Note: t = mean difference, ** p<0.01, * p<0.05

Table 22 Differences between investigated factors scores with regard to the region of respondents

Region	Factor							
	F1		F2		F3		F4	
	M	SD	M	SD	M	SD	M	SD
Central Croatia	0.17	0.890	-0.27	1.176	-0.02	1.011	-0.02	1.012
North-western Croatia	-0.02	1.015	0.05	0.995	-0.09	1.006	-0.18	1.081
Eastern Croatia	-0.34	1.104	0.14	1.081	0.04	0.997	0.01	1.080
Northern Adriatic and Lika	0.14	0.843	0.04	0.706	-0.07	0.969	0.22	0.785
Middle and South Adriatic	0.09	1.059	0.13	0.699	0.24	1.004	0.09	0.880
ANOVA	F = 3.841 p = 0.004**		F = 2.738 p = 0.028*		F = 1.130 p = 0.342		F = 1.720 p = 0.145	

Note: M = mean, SD = standard deviation, ** p<0.01, * p<0.05, attention to animal welfare (F1), supporting local production and biodiversity (F2), origin and information (F3), price and intrinsic quality (F4)

Table 22 shows differences between factor scores and region of respondents. Significant differences between factor scores attention to animal welfare (F1; F = 3.841, p < 0.01) and supporting local producers and biodiversity (F2; F = 2.738, p < 0.05) with respect to the region were observed. Consumers from central Croatia, Northern Adriatic, Lika and Middle and South

Adriatic are more than average oriented to variables under factor attention to animal welfare when buying pork. However, to Eastern Croatian consumers, variables described by factor attention to animal welfare seems to be not at all important, while preservation of biodiversity and local production variables in factor supporting local production and biodiversity are. Consumers from the Middle and South Adriatic region are more oriented to the origin and information expressed in the origin and information factor, while consumers from Northern Adriatic and Lika region are more oriented to traditional meat attributes (price and intrinsic quality) expressed in the price and intrinsic quality factor.

Table 23 Summary of the least significant difference (LSD) values for different region groups

Factor	Region	Compared groups	*t*	*p*
Attention to animal welfare	Eastern Croatia	Central Croatia	-0.512	0.000**
		North-western Croatia	-0.324	0.025*
		Northern Adriatic and Lika	-0.480	0.003**
		Middle and South Adriatic	-0.432	0.012**
Supporting local production and biodiversity	Central Croatia	Eastern Croatia	-0.328	0.019*
		North-western Croatia	-0.416	0.004**
		Northern Adriatic and Lika	-0.316	0.045*
		Middle and South Adriatic	-0.405	0.016*

Note: t = mean difference, ** $p<0.01$, * $p<0.05$

The results presented in Table 23 showed significant differences between all regions and factors attention to animal welfare (F1) and supporting local production and biodiversity (F2).

Results in Table 24 present a difference between the labour status of the Croatian consumers and factor scores. The highest average value of the factor score has been determined between the third factor score (origin and information) ($F = 2.505$, $p < 0.05$) and respondents' occupation. It can be observed from Table 24 that retired consumers are more oriented to origin and information, and they also more than other consumers groups are oriented on variables under factor supporting local production and biodiversity.

Table 24 Differences between investigated factors scores with regard to the labour status of respondents

Labour status	Factor							
	F1		F2		F3		F4	
	M	SD	M	SD	M	SD	M	SD
Student	0.07	1.067	-0.30	1.077	0.07	1.079	0.02	1.427
Unemployed	0.08	1.070	-0.06	1.139	-0.39	0.756	0.15	1.246
Employed part-time	0.18	0.832	-0.13	0.793	-0.35	1.098	0.05	0.793
Employed	-0.01	1.054	0.03	1.027	0.02	1.009	-0.02	0.933
Retired	-0.11	0.687	0.16	0.746	0.20	0.936	-0.02	0.801
ANOVA	$F = 0.425$		$F = 1.534$		$F = 2.505$		$F = 0.230$	
	$p = 0.791$		$p = 0.191$		$p = 0.042$*		$p = 0.922$	

Note: M = mean, SD = standard deviation, ** p<0.01, * p<0.05, attention to animal welfare (F1), supporting local production and biodiversity (F2), origin and information (F3), price and intrinsic quality (F4)

Results of the LSD test revealed that there is a significant difference between all compared labour groups within origin and information factor, except for unemployed and employed (part-time) consumers (Table 25).

Table 25 Results of the least significant difference (LSD) values for different labour status groups

Factor	Labour status Compared groups		*t*	*p*
Origin and information	Unemployed	Student	-0.462	0.043*
		Employed part-time	-0.040	0.892
		Employed	-0.410	0.026*
		Retired	-0.590	0.006**

Note: t = mean difference, ** p<0.01, * p<0.05

In Table 26, connection between factors scores and the number of children below 15 years of age in the household can be observed with a significant difference between third (origin and information; $F = 4.152$, $p < 0.05$) and the fourth factor (price and intrinsic quality; $F = 4.558$, $p < 0.05$). From the results presented in Table 26 it can be seen that consumers with one child

below 15 years of age (M = 0.29, SD = 0.988) are more than average oriented to origin and information on the product while price and intrinsic quality-oriented meat consumers are those without children below 15 years of age (M = 0.09, SD = 0.853). Consumers without children are also more than average oriented to variables expressed in factors attention to animal welfare and supporting local production and biodiversity than consumers with children, although we did not establish statistical significance for this factor scores.

Table 26 Differences between investigated factors scores with regard to the number of children in household

Number of children below 15 years in the household	Factor							
	F1		F2		F3		F4	
	M	SD	M	SD	M	SD	M	SD
0	0.07	0.988	0.02	0.957	-0.03	0.963	0.09	0.853
1	-0.12	1.037	-0.06	1.118	0.29	0.988	-0.07	0.975
≥ 2	-0.20	0.988	-0.01	1.069	-0.18	1.132	-0.34	1.509
ANOVA	F = 2.443		F = 0.176		F = 4.152		F = 4.558	
	p = 0.088		p = 0.839		p = 0.016**		p = 0.011*	

Note: M = mean, SD = standard deviation, ** p<0.01, * p<0.05, attention to animal welfare (F1), supporting local production and biodiversity (F2), origin and information (F3), price and intrinsic quality (F4)

Table 27 Results of the least significant difference (LSD) values for different number of children in the household

Factor	Number of children Compared groups		t	p
Origin and information	1	0	0.326	0.014**
		≥ 2	0.473	0.008**
Price and intrinsic quality	0	1	0.155	0.241
		≥ 2	0.422	0.003**

Note: t = mean difference, ** p<0.01, * p<0.05

Results presented in Table 27 showed significant differences between all compared groups within origin and information factor score, except for the groups without children and with one child below 15 years of age for the price and intrinsic quality factor.

Table 28 presents a comparison between the number of elders in the household according to factors scores. Significant difference ($F = 3.937$, $p < 0.05$) was found between factor price and intrinsic quality and the number of elders in the household. Households with one person older than 60 years of age (M = 0.12, SD = 1.045) are more than average oriented to price of the meat, freshness, marbling, fat content, colour etc. variables expressed in factor price and intrinsic quality than respondents without or with two and more elder persons in the household (Table 28).

Table 28 Differences between investigated factors scores with regard to the number of elders in household

Number of elders older than 60 years in the household	Factors							
	F1		F2		F3		F4	
	M	SD	M	SD	M	SD	M	SD
0	0.01	1.035	-0.03	0.966	0.08	1.007	0.03	0.897
1	0.10	0.863	0.02	1.091	-0.09	0.998	0.12	1.045
≥ 2	-0.22	1.034	0.12	1.003	-0.24	0.933	-0.33	1.289
ANOVA	*F* = 1.849		*F* = 0.596		*F* = 2.910		*F* = 3.937	
	p = 0.159		*p* = 0.551		*p* = 0.056		*p* = 0.020*	

Note: M = mean, SD = standard deviation, ** p<0.01, * p<0.05, attention to animal welfare (F1), supporting local production and biodiversity (F2), origin and information (F3), price and intrinsic quality (F4)

Table 29 Results of the least significant difference (LSD) values for different number of elders in household

Factor	Number of elders Compared groups		*t*	*p*
Price and intrinsic quality	≥ 2	0	-0.361	0.014**
		1	-0.453	0.007**

Note: t = mean difference, ** p<0.01, * p<0.05

Using the LSD post hoc test, a significant difference was found between all compared groups and factor score price and intrinsic quality (Table 29).

3.5.2. Differences between factor scores according to purchasing and consumption habits of respondents

The results of an independent t-test presented in Table 30 show that there is a significant difference between third and fourth factor scores origin and information ($t = 6.220$, $p < 0.01$) and price and intrinsic quality ($t = -2.792$, $p < 0.01$) regarding the respondents' awareness on the pig breed from which the meat is originating. The highest average value of factor scores in the case of factor origin and information was determined for consumers who have knowledge about the origin of the meat ($M = 0.63$, $SD = 0.943$), unlike average meat consumers who do not have the knowledge about the breed of pig from which the fresh meat originates ($M = 0.06$, $SD = 0.973$) and they consider as important variables described by factor price and intrinsic quality. Other factor scores didn't prove to be statistically significant with respect to the knowledge about the pig breed. However, consumers aware of the origin of fresh meat was considered as important on average variables described by factor supporting local production and biodiversity. While consumers who do not have knowledge about the breed origin of the meat support more variables described under factor attention to animal welfare from consumers who have knowledge about the breed of pig from which the fresh meat originates.

Table 30 Testing the differences in the means of factor scores with regard to knowledge about the breed of pig from which the fresh meat originates

Factors	Yes		No		*t-test*	*p*
	M	SD	M	SD		
Attention to animal welfare	-0.18	1.170	0.04	0.957	-1.670	0.096
Supporting local production and biodiversity	0.08	0.989	-0.02	1.003	0.788	0.431
Origin and information	0.63	0.943	-0.14	0.960	6.220	0.000**
Price and intrinsic quality	-0.29	1.076	0.06	0.973	-2.792	0.005**

Note: M = arithmetic mean, SD = standard deviation, ** $p<0.01$, * $p<0.05$

Table 31 Differences between investigated factors scores according to the usual place of purchase

Usual place of purchase	Factors							
	F1		F2		F3		F4	
	M	SD	M	SD	M	SD	M	SD
Producer	-0.09	0.936	0.29	0.947	0.33	0.953	-0.36	1.280
Butcher shop	0.03	0.969	-0.05	1.070	0.15	1.008	-0.16	1.015
Hyper/supermarket	-0.02	1.046	0.01	0.924	-0.21	0.960	0.24	0.877
ANOVA	F = 0.208		F = 1.555		F = 8.290		F = 10.254	
	p = 0.812		p = 0.212		p = 0.000**		p = 0.000**	

Note: M = mean, SD = standard deviation, ** p<0.01, * p<0.05, attention to animal welfare (F1), supporting local production and biodiversity (F2), origin and information (F3), price and intrinsic quality (F4)

Results presented in Table 31 show significant differences between the variable place of purchase and factor scores F3 (for origin and information; F = 8.290, p < 0.01) and F4 (price and intrinsic quality; F = 10.254, p < 0.01). Consumers who purchase meat directly from producers (M = 0.33, SD = 0.953) or at the butcher shop (M = 0.15, SD = 1.008) pay attention to origin of the meat and information on the product explained in factor origin and information, while meat consumers who look at price and intrinsic quality of the meat buy fresh pork at the supermarket (M = 0.24, SD = 0.877). Consumers who pay attention to variables explained by factor attention to animal welfare buy fresh pork at the butcher shop, while consumers who support statements under factor score supporting local production and biodiversity primarily buy fresh pork directly from producers.

Table 32 Results of the least significant difference (LSD) values for different place of purchase according to attention to origin and information and price and intrinsic quality factor

Factor	Usual place of purchase Compared groups		*t*	*p*
Origin and information	Hyper/supermarket	Producer	-0.544	0.005**
		Butchery	-0.363	0.000**
Price and intrinsic quality	Hyper/supermarket	Producer	0.602	0.002**
		Butchery	0.402	0.000**

Note: t = mean difference, ** p<0.01, * p<0.05

Results of the LSD test from Table 32 show significant differences between all compared groups (supermarket, producer, butcher shop) in regard to factors origin and information and price and intrinsic quality.

In Table 33, a significant difference was observed between factor score attention to animal welfare (F1) and usual paying price for fresh pork ($F = 3.843$, $p < 0.01$). It can be noticed that consumers who pay HRK 76.00 or more for one kilogram of fresh pork pay more than average attention to animal welfare as expressed in the factor attention to animal welfare (Table 33).

Table 33 Differences between investigated factors scores with regard to the usual paying price for fresh pork

Usual paying price for fresh pork (HRK/kg)	Factors							
	F1		F2		F3		F4	
	M	SD	M	SD	M	SD	M	SD
25.00 – 45.00	-0.08	1.000	0.01	0.957	-0.06	0.988	0.05	1.066
46.00 – 75.00	0.02	1.010	0.05	1.001	-0.01	1.020	0.00	0.939
≥ 76.00	0.39	0.881	-0.23	1.208	0.36	0.938	-0.30	0.799
ANOVA	$F = 3.843$ $p = 0.022$*		$F = 1.228$ $p = 0.294$		$F = 2.907$ $p = 0.056$		$F = 1.992$ $p = 0.138$	

Note: M = mean, SD = standard deviation, ** p<0.01, * p<0.05, attention to animal welfare (F1), supporting local production and biodiversity (F2), origin and information (F3), price and intrinsic quality (F4)

Post hoc test revealed significant differences between all compared groups for attention to animal welfare factor (Table 34).

Table 34 Results of the least significant difference (LSD) values for usual paying price for fresh pork according to attention to animal welfare factor

Factor	Usual paying price for fresh pork Compared groups		*t*	*p*
Attention to animal welfare	≥ 76.00 (HRK/kg)	25.00 – 45.00 (HRK/kg)	0.475	0.006**
		46.00 – 75.00 (HRK/kg)	0.369	0.039*

Note: t = mean difference, ** p<0.01, * p<0.05

Table 35 shows differences between determined factor scores with respect to consumption frequency of the meat originating from Black Slavonian Pig. Significant differences were observed between factors F3 (origin and information; $F = 13.568$, $p < 0.01$) and F4 (price and intrinsic quality; $F = 4.432$, $p < 0.01$), according to the consumption frequency of fresh pork or cured meat products from the Black Slavonian Pig. Consumers who care for origin and information variables under factor origin and information consume fresh pork or cured meat products from the Black Slavonian Pig occasionally (M = 0.12, SD = 0.981) or frequently (M = 0.79, SD = 1.191), while consumers who care for variables explained under factor price and intrinsic quality never tried the Black Slavonian Pig meat (M = 0.17, SD = 0.862). Although no significant difference between other factor scores and consumption frequency of the Black Slavonian Pig meat was observed, it can be observed from Table 35 that consumers who care for variables explained under factors attention to animal welfare and supporting local production and biodiversity are those who also frequently or occasionally consume pork or cured products from the Black Slavonian Pig.

Table 35 Differences between investigated factors scores with regard to the consumption frequency of the Black Slavonian Pig meat

Consumption frequency of fresh meat or cured products from the Black Slavonian Pig	Factors							
	F1		F2		F3		F4	
	M	SD	M	SD	M	SD	M	SD
Never	-0.05	1.067	-0.07	1.046	-0.26	0.930	0.17	0.862
Yes, occasionally	0.02	0.950	0.03	0.971	0.12	0.981	-0.11	1.079
Yes, frequently	0.13	1.003	0.22	0.928	0.79	1.191	-0.25	0.961
ANOVA	$F = 0.385$		$F = 0.935$		$F = 13.568$		$F = 4.432$	
	$p = 0.680$		$p = 0.394$		$p = 0.000$*		$p = 0.012$**	

Note: M = mean, SD = standard deviation, ** p<0.01, * p<0.05, attention to animal welfare (F1), supporting local production and biodiversity (F2), origin and information (F3), price and intrinsic quality (F4)

Using the LSD test, significant differences were found between all compared consumption frequency groups except between a group of consumers who frequently consume fresh pork

and cured meat products of the Black Slavonian Pig and those who have never tried them for the price and intrinsic quality factor (Table 36).

Table 36 Results of the least significant difference (LSD) values for different consumption frequency of the Black Slavonian Pig meat

Factor	Consumption frequency Compared groups		*t*	*p*
Origin and information	Never	Yes, occasionally	-0.380	0.000**
		Yes, frequently	-1.045	0.000**
Price and intrinsic quality	Never	Yes, occasionally	0.280	0.006**
		Yes, frequently	0.426	0.084

Note: t = mean difference, ** p<0.01, * p<0.05

3.6. Discrete choice experiment: estimation of the main effect and interaction parameters

The parameter estimates for main effect variables and interaction terms between main effect variables and information treatment are presented in Table 37. The first column illustrates the results for the baseline MNL model, and the second and third columns represent the RPL and RPL-EC model to analyse the Croatian consumers' preference heterogeneity. Log-likelihood ratio test (LR test), Akaike information criteria (AIC), and the Bayesian information criteria (BIC) are calculated to compare chosen models through their statistical fit. These measures can be used to describe the relative appropriateness of the three presented models. The higher is the value of the log-likelihood criteria, and the lower is the information of the AIC and BIC criteria; the better a model fits the data. An LR test rejects the null hypothesis that all coefficients are zero ($p < 0.01$), and all coefficients of main effect variables except colour and geographical information (continental Croatia) are significantly different from zero. For all three models, the estimated parameters give the same sign, and they are similar. According to the data presented in Table 37, it may be primarily noticed that the RPL model provides an improvement to the baseline MNL model in the information criteria (AIC and BIC) (9865.369; 9975.887 in the RPL vs. 10214.84; 10286.35 in the MNL). The RPL and RPL-EC models allow for preference heterogeneity among consumers and better fit the data than the baseline MNL model. However, all criteria suggest that the RPL-EC model (6588.258; 6724.78) fits the data better than the MNL and RPL model, and the value of the RPL-EC model is closer to 0.

Table 37 Estimated parameters of the MNL, RPL, and RPL-EC models and interaction of information treatment with main effect variables

Mean estimates	Coefficients		
	MNL	RPL	RPL-EC
BS reared outdoors	0.4561***	0.4003***	1.0255**
BS reared semi-indoors	0.3709***	0.3195***	0.6570*
PRICE	-0.0109***	-0.0130***	-0.0203***
COLOUR (dark)	-0.0573.	-0.0877.	-0.0536
GEOGRAPHICAL INFORMATION			
Continental Croatia	-0.0121	-0.0183	-0.0346
Continental Croatia + PDO	0.2303***	0.2832***	0.3427***
Information treatment interaction with main effect variables			
BS reared outdoors * Information	0.2924***	0.3435 ***	1.2164*
BS reared semi-indoors * Information	0.2374***	0.2573***	1.1162*
COLOUR (dark) * Information	0.1042 **	0.1282.	0.0999
GEOGRAPHICAL INFORMATION			
Continental Croatia * Information	0.0564	0.0783	0.1310
Continental Croatia + PDO * Information	0.0112	0.0305	0.0109
St dev. of mean estimates (std. err.)			
COLOUR (dark)		0.5615***	0.4759***
GEOGRAPHICAL INFORMATION			
Continental Croatia		0.4679***	-0.5173***
Continental Croatia + PDO		0.4261***	0.4866***
Non status quo			5.1799***
Number of respondents	410	410	410
Number of observations	4920	4920	4920
Log-likelihood	-5096.4	-4915.7	-3273.1
AIC	10214.84	9865.369	6588.258
BIC	10286.35	9975.887	6724.78

Note: MNL – multinomial logit, RPL – random parameter logit, RPL-EC – error component random parameter logit, LR test – log likelihood ratio test, AIC – Akaike information criteria, BIC – Bayesian information criteria, BS – Black Slavonian Pig meat, PDO – protected designation of origin

. p<0.1, ** p<0.01, * p<0.05, *** p<0.001

Moreover, the standard deviations that reflect the variation among the surveyed participants of the RPL-EC model are statistically significant, indicating that the consumers' preferences for colour and geographical indicators (continental Croatia and continental Croatia + PDO) are heterogeneous and that the RPL-EC model is appropriate. Continental Croatia + PDO has the highest standard deviations among the presented attributes. This means that there is heterogeneity among the surveyed consumers concerning this attribute of the Black Slavonian Pig fresh meat. Non status quo is an additional error component that captures the correlation between the non-status quo alternatives assuming normal distribution. Researchers intuitively may think that hybrid meat obtained from pigs reared conventionally, which is a well known option to the respondents in this research, has less variance than the other two options, which is less familiar to the respondents. For this reason, an error component in the RPL-EC model is added to the function to allow the status quo alternative to have a separate error term. Standard deviation of the non-status quo alternative is positive and significant, meaning that unobserved heterogeneity associated with the designed alternatives confirms the assumption of a nonconstant status quo effect across respondents.

From Table 37 it can be observed that the fresh boneless ham produced from the meat of the Black Slavonian Pig reared outdoors and semi-indoors is preferred over hybrid pig meat obtained from conventional production system, which represents the status quo option. Consumers have generally obtained a lower utility from the status quo option than from the designed alternatives. The positive and significant alternative specific coefficients for fresh boneless ham produced of the meat of the Black Slavonian Pig reared outdoors and semi-indoors indicate that unobserved utility associated with the production system utility function is greater than utility received from fresh boneless ham produced in conventional production system (intensive – indoor) which supports the auxiliary hypothesis H2a. The highest utility increment occurs due to the fresh boneless ham produced of the meat of the Black Slavonian Pigs reared outdoors.

The price attribute is negative and highly significant, which is in accordance with econometric theory, signifying that the price has a negative impact on consumer utility. Each additional price unit would decrease the utility by 0.0203, i.e., given the same price, the consumers would prefer the option of the fresh meat obtained from the Black Slavonian Pigs reared outdoors over that of the meat of the Black Slavonian Pigs reared semi-indoors.

According to the results presented in Table 37, the negative sign of the dark red meat colour is barely significant ($p < 0.1$) and decreases consumer utility. In contrast, the light red meat colour increased it. The hypothesis H2b that the dark colour will significantly increase the probability of choice was not proven to be true with the main estimate variables, but in the interaction of information treatment with the main effect variables (Table 37), it can be observed that estimated coefficients for dark meat colour are positive and increases consumers' utility.

Regarding a geographical indicator, the presence of a label reared in continental Croatia + PDO has improved a selection probability when compared with the fresh ham of the pigs reared in other regions of Croatia and the fresh ham of the pigs bearing no such label (a status quo option). In general, the participants obtained the greatest utility from the label reared in continental Croatia + PDO, while the label reared in continental Croatia is not preferred by participants. Estimated results support the auxiliary hypothesis H2c that consumers will positively value the geographical label attribute continental Croatia + PDO while estimated coefficients for the label Continental Croatia are negative. The reason for that could be that Croatian consumers are not yet familiar with the mentioned label continental Croatia but they are familiar with PDO sign which adds extra utility to Croatia's continental provinces. Still, from the results in Table 37, it can be observed that the continental Croatia label has an information treatment positive sign, which means that this attribute adds extra utility to consumers after given information about the meaning of geographical labels.

Participants were divided in the survey into two treatments (control and information) in order to evaluate whether information about the product could positively affect consumer opinion. In information treatment, participants were informed about the impact of production systems of Black Slavonian Pig (outdoor and semi-indoor) on animal welfare and the environment, and they gained information about each attribute (colour of meat and geographical information) while in control treatment only choice experiment instructions were given to the respondents. Results of the RPL-EC model presented in Table 37 confirmed that providing details on production systems and the production of the Black Slavonian Pig meat has a positive effect on the participant's choices. These results support auxiliary hypotheses H2d that consumers in information treatment will value more Black Slavonian Pig meat reared outdoors and semi-indoors over hybrid meat obtained from a pig reared conventionally. Also, consumers slightly more prefer fresh meat obtained from the Black Slavonian Pig reared outdoors than semi-indoors. After being given information, they preferred darker over the light colour of the meat.

Although not statistically significant, geographical information reared in continental Croatia increases consumers' utility.

3.6.1. Impact of interaction terms on estimated models

The parameters estimated for main effect variables and interaction terms between main effect variables and sociodemographic clusters and consumers clusters for fresh pork are presented in Tables 38 and 39. Results of the RPL model in Tables 38 and 39 show that there is no difference between the main effect models presented in the previous section (3.6.). An LR test rejects the null hypothesis that all coefficients are zero, and all coefficients of main effect variables except colour and continental Croatia are significantly different from zero. By including an interaction term in the model, we were able to determine different habits and consumption preferences for Croatian consumers. The estimated parameters for MNL and RPL models are similar, and they gave the same signs. The estimated standard deviations for colour and geographical information are significantly different from zero, meaning that there is heterogeneity in the population in terms of consumers value for selected attributes (Tables 38 and 39). Comparing the modes with their statistical fit, according to the LR test, AIC and BIC measure the RPL model outperforming and fits data better than the MNL model (Table 38 and 39).

K-mean cluster analysis was used to cluster sociodemographic characteristics of Croatian consumers into three different clusters. Cluster one (n = 159) represents young urban families with children since respondents in this group are 35 to 44 years of age with 2 to 4 family members in the household, with at least one child younger than 15 years. This group does not have any connection with agriculture, and its monthly household income is between HRK 11,501.00 and 16,500.00. The second cluster (n = 146) consists of older urban families (55 and more years), with 2 to 4 family members; without younger children; they have no connection with agriculture, and their monthly household income is between HRK 7,501.00 and 9,500.00. The third group (n = 105) represents young rural families. This group consists of respondents between 25 and 35 years with 2 to 4 family members, without children younger than 15 years of age, they are connected with agriculture, and their monthly household income is between HRK 5,501.00 and 7,500.00 (Table 38).

Table 38 Estimated parameters of the MNL and RPL models and interaction of sociodemographic clusters with main effect variables

Mean estimates	Coefficients	
	MNL	RPL
BS reared outdoors	1.0490***	1.0372***
BS reared semi-indoors	0.8755***	0.8442***
PRICE	-0.0110***	-0.0130***
COLOUR (dark)	0.0151	-0.0046
Continental Croatia	0.0147	0.0084
Continental Croatia + PDO	0.2754***	0.3318***
Sociodemographic cluster interaction with main effect variables		
BS reared outdoors * older urban families	-0.7634***	-0.7813***
BS reared semi-indoors * older urban families	-0.7048***	-0.7117***
BS reared outdoors * young rural families	-0.6274***	-0.6469***
BS reared semi-indoors * young rural families	-0.4663***	-0.4793***
COLOUR (dark) * older urban families	-0.0750	-0.0677
COLOUR (dark) * young rural families	0.0270	0.0245
Continental Croatia * older urban families	0.0701	0.0970
Continental Croatia + PDO * older urban families	-0.1516*	-0.1538.
Continental Croatia * young rural families	-0.0740	-0.0553
Continental Croatia + PDO * young rural families	0.0377	0.0599
St. dev. of mean estimates (std. err.)		
COLOUR (dark)		0.5476***
GEOGRAPHICAL INFORMATION		
Continental Croatia		0.4128**
Continental Croatia + PDO		0.4061***
Number of respondents	410	410
Number of observations	4920	4920
Log-likelihood	-5043.2	-4868
AIC	10118.49	9780.051
BIC	10222.51	9923.074

Note: MNL – multinomial logit, RPL – random parameter logit, LR test – log likelihood ratio test, AIC – Akaike information criteria, BIC – Bayesian information criteria, BS – Black Slavonian Pig meat, PDO – protected designation of origin,

. p<0.1, ** p<0.01, * p<0.05, *** p<0.001

Table 39 Estimated parameters of the MNL and RPL models and interaction between consumers clusters for fresh meat with main effect variables

Mean estimates	Coefficients	
	MNL	RPL
BS reared outdoors	1.2185***	1.2338***
BS reared semi-indoors	0.9819***	0.9633***
PRICE	-0.0112***	-0.0133***
COLOUR (dark)	0.0259	0.0163
Continental Croatia	0.0916*	0.0989
Continental Croatia + PDO	0.2267***	0.2774***
Sociodemographic cluster interaction with main effect variables		
BS reared outdoors * traditional meat consumers	-1.3029***	-1.3968***
BS reared semi-indoors * traditional meat consumers	-0.9578***	-0.9973***
BS reared outdoors * inattentive meat consumers	-0.5185***	-0.5141**
BS reared semi-indoors * inattentive meat consumers	-0.5554***	-0.5624***
COLOUR (dark) * traditional meat consumers	-0.0734.	-0.0949
COLOUR (dark) * inattentive meat consumers	-0.0445	-0.0418
Continental Croatia * traditional meat consumers	-0.1876**	-0.1862.
Continental Croatia + PDO * traditional meat consumers	0.0450	0.0710
Continental Croatia * inattentive meat consumers	-0.0070	-0.0061
Continental Croatia + PDO * inattentive meat consumers	-0.0826	-0.0699
St. dev. of mean estimates (std. err.)		
COLOUR (dark)		0.5668***
GEOGRAPHICAL INFORMATION		
Continental Croatia		0.4596***
Continental Croatia + PDO		0.4243***
Number of respondents	410	410
Number of observations	4920	4920
Log-likelihood	-4946.2	-4764.4
AIC	9924.472	9572.896
BIC	10028.49	9715.919

Note: MNL – multinomial logit, RPL – random parameter logit, RPL-EC – error component random parameter logit, LR test – log likelihood ratio test, AIC – Akaike information criteria, BIC – Bayesian information criteria, BS – Black Slavonian Pig meat, PDO – protected designation of origin

. p<0.1, ** p<0.01, * p<0.05, *** p<0.001

In Tables 38 and 39, interaction terms (sociodemographic clusters and consumers clusters for fresh meat) with main effect variables are presented. Regarding the interaction terms presented in Table 38, all values regarding intercept (Black Slavonian Pig meat produced outdoors and semi-indoors) are significant but negative, meaning that clusters 2 (older urban families) and cluster 3 (young rural families) compared to cluster 1 (young urban families) are less likely to buy Black Slavonian Pig meat produced outdoors and semi-indoors. Young urban families give a more favourable valuation for Black Slavonian Pig fresh meat produced both outdoors and semi-indoors. No significant difference between clusters regarding the darker colour of the Black Slavonian Pig meat was observed, although results in Table 38 show that consumers in cluster 2 are less likely to prefer the darker red colour of the fresh meat than consumers in clusters 1 and 3. Consumers grouped in cluster 1 (young urban families) value more Black Slavonian Pig meat labelled with continental Croatia + PDO than consumers in cluster 2.

Clusters presented in Table 39 refer to clusters presented in chapter 3.3. Fresh meat consumer's segmentation analysis, meaning that cluster 1 refers to altruistic meat consumers, cluster 2 to traditional meat consumers, and cluster 3 are inattentive meat consumers. Regarding the interaction terms, all intercept values were significant but negative, meaning that differences between clusters exist. Altruistic meat consumers give a more positive valuation for Black Slavonian fresh meat produced outdoors and semi-indoors. In contrast, consumers in cluster 2 (traditional) and cluster 3 (inattentive) prefer the status quo option (hybrid meat obtained from a pig reared conventionally) over alternative specific option. Coefficients in the MNL model for cluster 2 (traditional meat consumers) are negative but significant, suggesting that consumers in cluster 2 are less likely to buy darker red meat from Black Slavonian Pig labelled continental Croatia than consumers in cluster 1 (altruistic meat consumers).

3.7. Willingness to pay estimation and market simulation for the MNL model

The average WTP estimations using MNL, RPL and RPL-EC models are presented in Table 40. WTP presented in Table 40 are the maximum premium prices for the attributes compared to the reference product (meat obtained from hybrid pigs reared in conventional production system). Consumers are willing to pay a premium for fresh ham of the pigs reared outdoors and semi-indoors as well as for geographical information labels. These results support auxiliary hypothesis H2e and H2f. Surveyed consumers are willing to pay 50.51 HRK/kg more for fresh boneless ham produced from the meat of the Black Slavonian Pig reared outdoors and 32.36

HRK/kg for fresh boneless ham produced from the same breed reared semi-indoors over the price for regular pork. Consumers are willing to pay 32.06 HRK/kg more for fresh meat from the Black Slavonian Pig with the continental Croatia + PDO label compared to other regions (regions of the Republic of Croatia in which Black Slavonian pigs are not traditionally reared). Consumers are willing to pay a large premium for fresh ham of the Black Slavonian Pig reared outdoors and with reared in continental Croatia + PDO label. This means that producers of the Black Slavonian Pigs can gain a premium price for fresh meat reared outdoors and labelled reared in continental Croatia + PDO in comparison to the fresh meat from the Black Slavonian Pig reared semi-indoors and labelled only as reared in continental Croatia. However, this also commands a premium price, but it is smaller than the first two options. Apparently, the "protected designation of origin" (PDO) label adds utility to Croatia's continental provinces.

Table 40 Willingness to pay (HRK/kg) for alternative specific constant and geographical information attribute compared to reference point

Attributes	WTP_{MNL}	WTP_{RPL}	WTP_{RPL-EC}
BS reared outdoors cf. regular pork	55.17	31.15	50.51
BS reared semi-indoors cf. regular pork	44.77	25.09	32.36
Continental Croatia cf. other regions	24.74	36.41	13.47
Continental Croatia + PDO cf. other regions	44.80	47.80	32.06

Note: BS – Black Slavonian Pig meat, PDO – protected designation of origin, cf. – compared to, regular pork (hybrid meat obtained from pigs reared conventionally) and other regions (regions of the Republic of Croatia in which Black Slavonian Pigs are not traditionally bred) present a reference point.

The probability that surveyed consumers will buy fresh ham meat obtained from the Black Slavonian Pigs over regular pork priced 45.00 HRK/kg was calculated from the MNL model using the estimated parameters. The probability that consumers will purchase fresh ham with different production methods and labels is presented in Figure 7. The red line in Figure 7 represents a darker red fresh ham meat obtained from the Black Slavonian Pig reared outdoors labelled as continental Croatia + PDO. The results show that the Croatian consumers would select a darker meat obtained from the Black Slavonian Pigs reared outdoors and labelled with a PDO sign until its price is up to 140.00 HRK/kg (Figure 7). At this price level, the probability

of choosing the fresh Black Slavonian Pig meat over the regular porcine meat (i.e., meat from hybrid pigs from conventional production system) is the same.

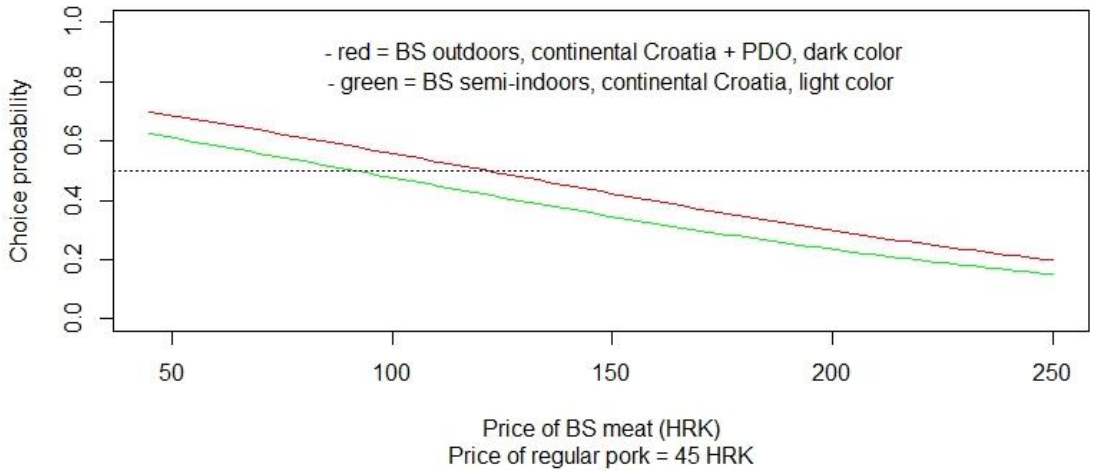

Figure 7 Probability of choosing an option among two alternatives

The green line (Figure 7) represents the light red fresh ham meat obtained from the Black Slavonian Pigs reared semi-indoor, labelled as continental Croatia. Compared to regular pork for 45.00 HRK/kg, consumers have a higher probability of preferring lighter red fresh ham meat obtained from the Black Slavonian Pigs reared semi-indoor up to the price of 100.00 HRK/kg while beyond this price, the purchase of regular pork for 45.00 HRK/kg becomes more likely.

4. DISCUSSION

This research has been conducted to investigate Croatian consumer preference for fresh meat of the Black Slavonian Pig for social concerns when purchasing pork and for other relevant attributes by using a discrete choice experiment. The present study adds to the current literature by including the effect of information on consumers using information treatment to evaluate whether information about the product could positively affect consumers' preference and willingness to pay (WTP). The results also reflect consumers' knowledge about social concerns (sustainability, biodiversity and rural development and animal welfare), which can be helpful for producers, national agricultural food policy makers and marketers.

The research was conducted on 410 Croatian consumers who are either responsible or co-responsible for food shopping in their household and consume pork. The sample is representative in terms of gender, age and geographical region for the overall population. But the overall sample is however biased in favour of respondents with higher education and living in the urban areas, which can present the limitations of the study related to the form of data collection and to the instruments used. Bowers (1998) and Evans and Mathur (2005) recommend it as the best way to minimise this disadvantage usage of panels because quotas and screening can help target the proper respondents in a demographically balanced manner. According to Sharma (2017), although it is a subset, it is representative of the population and suitable for research in terms of cost, convenience and time.

Consumers in the survey declared that they mostly buy fresh meat at butcher shops and in the supermarket, but they mostly (82.2 %) do not know from which pig breed the meat originates. More than half of respondents tried and occasionally consumed fresh meat or the cured meat products from the Black Slavonian Pig. However, 40.5 % of the respondents never tried meat or meat products from indigenous pig breeds. The main reasons for that are that they perceive that type of meat as expensive and not easy to find. Also, the majority of them stated that taste is different, but overall, they agree that lack of information and label on the product regarding the breed of pigs from which meat originates is the problem. Consumers in Spain share the opinion of Croatian consumers about the taste of the meat from the indigenous pig breeds and they consider Iberian meat products too expensive, too. According to García-Gudiño et al. (2021), this is clearly affected by the degree of knowledge about Iberian meat production and characteristics showing the necessity to increase the knowledge to give higher value to the

product and understand the price. However, Spanish producers have taken advantage of the EU legislation on geographical indications and by introducing Quality Standard for Iberian meat in an attempt to clarify and provide transparency to the industry, as well as providing information for the consumers through different labels regarding breed, production system and the minimum age at slaughter (Ortiz et al., 2020).

When buying fresh meat, Croatian consumers consider its freshness the most (M = 4.54), then quality and safety (M = 4.47), appearance (M = 4.21), price (M = 3.99), and origin (M = 3.98). Among altruistic motives, consumers evaluate with the highest rating animal welfare (M = 3.72) and fairness in the supply chain (M = 3.65), while environmental impact (M = 3.48) is evaluated as less important than other attributes. These results are in agreement with previous research on the importance of certain attributes when buying fresh meat. The study on German, Norway and UK consumers showed that price of the meat was the most important attribute and that country of origin takes second place, while the organic attribute appears to be relatively important (Yeh et al.; 2021). Grunert et al. (2004), in their research, concluded that fresh meat has a considerably lower degree of differentiation than other food products, and consumers are mostly relying on visual characteristics and branding.

Using factor analysis, ten opinions on the importance of certain attributes when buying fresh meat were grouped into three independent factors explaining 66.9 % of the total variance. Three obtained factors were named following: sustainability performance, intrinsic quality and origin and economy and convenience according to the variables that mostly participated in its creation. Cluster analysis was carried out based on the results of factor analysis and obtained three clusters, i.e. consumers segments named altruistic, traditional and inattentive meat consumers. Differences between clusters were validated by canonical discriminant functions. The discriminant analysis showed that three obtained factors significantly influenced ($p < 0.01$) to cluster differentiation. Wilks' Lambda measures were small (Wilks' Lambda function 1 = 0.184; function 2 = 0.451), and all values associated with the chi-square test (χ^2) were significant at $p < 0.01$. Discriminant function classification results regarding the importance of certain factors when buying fresh meat showed that 98.8 % of original grouped cases were correctly classified. According to Barbosa Carvalho et al. (2015), discriminant function in research is a good tool to validate the results obtained by cluster analysis in which researchers from the market field can take advantage of this technique to confirm the results of segmentation analysis in order to target consumers concerning different product or service to

develop new strategies of price, display, advertising, and promotion.

In the interpretation of the consumer segment, sociodemographic characteristics of consumers, as well as purchasing, consumption behaviour and knowledge about the pig breed, were determined using the chi-square test (χ^2). According to the results, a significant association between the variables gender ($p < 0.05$), consumers connection with agriculture ($p < 0.01$), number of elders more than 60 years old in the household ($p < 0.01$), place of purchase ($p < 0.05$), consumption frequency of fresh pork ($p < 0.05$), consumption frequency of fresh or cured products from the Black Slavonian Pig ($p < 0.01$), and awareness about the pig breed ($p < 0.01$) exists. Three segments of consumers with different sociodemographic and consumption trends with respect to fresh meat products have been obtained. The first of these has been defined as altruistic meat consumers. Regarding sociodemographic characteristics, purchasing and consumption habits this segment consist predominantly of women from urban areas who are not connected with agriculture; they prepare pork once or twice a week; they consume fresh meat or cured meat products from the Black Slavonian Pig occasionally and they purchase meat from the butcher, but they do not know from which breed meat originates. The second segment covers traditional meat consumers in which men and women are equally represented, similarly as the first segment, this segment is characterised by consumers from urban areas who are not connected with agriculture. Consumers in this segment buy fresh meat in the supermarket so as expected they do not have knowledge about the pig breed from which the meat originates; they consume pork once or twice a week and they never tried fresh or cured meat products from the Black Slavonian Pig. The third segment or inattentive meat consumers are men from urban areas with a connection with agriculture and are predominantly from Central and Eastern Croatia. They consume fresh pork four times a week, purchase fresh meat from the butcher, and they are aware of the breed origin of the meat they buy. They occasionally consume fresh or cured meat products from the Black Slavonian Pig. Performed market segmentation analysis provides information that can be used in developing marketing strategies for both producers and retailers. The methodology used in this study is in line with previous research (Kallas et al., 2019; Eldesouky et al., 2020; Mesić et al., 202; Ortiz et al., 2021). From the results of segmentation analysis, it is evident that consumers don't have enough information when purchasing fresh meat; therefore, there is opportunity for producers and retailers to target consumer segments. Also, it is important to educate and inform consumers about economic and social concerns when buying fresh meat, and that could be done through labels and declarations, which can be used to communicate important information to consumers,

especially those who buy meat in supermarkets.

Croatian consumers were also asked to declare their opinion on twenty-one statements regarding fresh boneless ham from the Black Slavonian Pig. Statements referred to general purchasing behaviour and to social concerns (local production, preservation of biodiversity, environment protection and animal welfare). Consumers most support the claims regarding the freshness of the fresh boneless ham (colour, marbling, water excaudate) as they mention that is the most important factor when they buy all types of fresh meat (M = 4.28). Second, the highest-rated statements were "Breeding indigenous pig breeds (such as Black Slavonian Pig) promotes sustainability and supports local farmers" (M = 4.26), "Locally produced food helps preserve traditional breeds and production methods" (M = 4.22) and "Breeding a Black Slavonian Pig outdoors is a more environmentally friendly production" (M = 4.12). Croatian consumers gave a high rating to statements regarding labelling. They think that it should be clearly declared on the product that meat originates from indigenous pig breeds or hybrid pigs and whether the pigs were raised to higher standards of welfare. From the results of the study it can be observed that consumers opinions differ and they gave higher ratings to social concerns when they were asked to declare their opinion about the statements about fresh pork and pork from the indigenous pigs, although at the beginning of the survey they gave the highest scores to traditional attributes when buying fresh meat (such as price, appearance, freshness, safety, origin and quantity). From other characteristics of fresh pork, consumers also found taste important (M = 4.07) and price (M = 4.02), but it is evident that their opinions are shifted towards more sustainable production, preservation of biodiversity and local tradition. Although they, on average, expressed the lowest agreement (M = 3.51) with the statement, "I do not mind paying a higher price for pork produced to higher animal welfare standards". However, they agree with the statement that indoor pig breeding is cruel and they are concerned about animal welfare and that pigs should be able to express their natural behaviour on farms which is in accordance with tested social concerns.

From the results, it is evident that consumers in Croatia are concerned and interested about animal welfare of pigs, but they still do not have enough information about conditions under which animals are raised and impact of animal welfare on product quality. Which is in accordance with Font i Furnols et al. (2019), in Europe most consumers know little about the conditions under which animals are raised, but they are interested in aspects of housing, climate, ability to engage in natural behaviour, animal health, transport, slaughter and suffering

from stress because they associated better animal welfare with better meat quality. Tomasevic et al. (2020) surveyed 13 Eastern European countries (Bosnia and Herzegovina, Bulgaria, Czech Republic, Croatia, North Macedonia, Hungary, Moldova, Poland, Romania, Serbia, Slovakia, Slovenia, and Ukraine) consumers' attitudes and beliefs about animal welfare, and they generally agree that animals we use for food should be treated with dignity. This is also in accordance with results by Mayfield et al. (2007) research conducted in Great Britain, Italy and Sweden where the consumers are especially concerned about where animals are kept, with what they are fed and how they are treated in transport and at slaughter.

The results showed a strong interrelationship among twenty-one statements regarding purchasing behaviour, local production, preservation of biodiversity, and animal welfare. The factor analysis produced four factors that explained 64.0 % of the total variance. The four factors were named attention to animal welfare, supporting local production and biodiversity, origin and information and price and intrinsic quality. Independent samples t-test and ANOVA were performed to identify the significant differences between obtained factor scores according to consumers sociodemographic characteristics, consumption habits, purchasing behaviour and knowledge about fresh meat and pig breeds. Obtained results support the first hypothesis and auxiliary hypotheses H1b, H1c and H1d that consumers are aware of the concept of social welfare when purchasing fresh pork and that there is a significant difference between sociodemographic characteristics, purchasing and consumption habits, as well as the respondent's knowledge of the pig breed and obtained factor scores. From the results, it is evident that there is a statistically significant difference between the gender of the respondents and obtained factor scores. Results of the t-test showed that there is a statistically significant difference between factors attention to animal welfare ($p < 0.01$) and origin and information ($p < 0.05$). Female respondents pay more attention to pigs' animal welfare when buying fresh meat, they also support more local production and preservation of biodiversity, and intrinsic and extrinsic attributes are important to them, although these factor scores were not statistically significant. Male consumers are more ethnocentric than females; they care more for variables under factor origin and information. Results show that respondents aged 45 to 55 years are more supportive than younger consumers. They are more oriented to variables expressed under the factor supporting local production and biodiversity. They agree with the statement that locally produced food is healthier and more natural ($p < 0.01$). At the same time, younger consumers care more for animal welfare and traditional attributes such as freshness and taste. Regarding the origin and information factor score, the research shows that statements

associated with this factor score mean equal to the younger and older respondents. From the study, it is evident that younger (age 18 – 35) and older (55+) meat consumers care for origin and information on the product. They associated the quality of the meat with the breed's geographical origin. It is important to them to know the location and how pork is produced, and they are willing to pay more for locally produced food. However, these differences didn't prove to be statistically significant. These results are in accordance with a comparison of the labour of the respondents and factor scores where it is evident that employed and retired consumers ($p < 0.05$) are more ethnocentric (care for variables under factor origin and information) and more supportive regarding local production and biodiversity than other consumers groups and unemployed consumers care more for traditional food attributes (described by factor price and intrinsic quality), which are in accordance with their economic status because meat and meat product from the autochthonous breed is more expensive as well as locally and organically produced meat.

These results of the present study follow McKendree (2014) study where gender has a significant impact on consumers' concerns regarding animal welfare. Younger females were more concerned about animal welfare than male respondents. They thought that information about animal welfare should be clearly stated on a product, and better communicated through marketing activities.

Martelli (2009) showed that except for gender, the consumer's perception of animal welfare mainly is affected by economic and educational level. This is in line with results of the study by Tomasevic et al. (2020), where animal welfare perception depended on the respondents' income, education, gender, and age. In their study women, younger consumers (less than 36 years of age), with higher education and with better economic status of the family from the urban areas agreed more with the statements that it is important how animals are treated and were willing to pay more for meat from animals treated with dignity. In the study by Zanoli et al. (2012) animal welfare was an important extrinsic cue in organic meat. Women had a higher WTP for higher animal welfare than men. Additionally, local breeds, domestic origin and organic production were the most important attributes of beef meat. Authors agreed that it is important to have an animal-friendly label identifying the level of welfare because consumers have a good perception of the link between food quality, food safety, and animal welfare in the same chain. In their research, Mesić et al. (2021) did not find the connection between the sociodemographic characteristics of respondents and embedded food consumers, however they

found that the main reasons consumers buy local food are to motivate farmers to stay in rural areas and support the local economy.

In this research, a verified connection between factors scores and the number of children below 15 years and elders in the household was found. Furthermore, a significant difference between origin and information and price and intrinsic quality factors was found. Consumers with one child (younger than 15 years of age) pay more attention to variables expressed under factor origin and information, while meat consumers who care for price and intrinsic quality attributes described in price and intrinsic quality had no children below 15 years of age. Although no significant differences were determined, households without children are more animal friendly and supportive towards locally produced food and biodiversity. On the other hand, households with one elder person (older than 60 years of age) are more oriented to average meat attributes (price, freshness, marbling, fat content, colour etc.) defined by factor origin and intrinsic quality than respondents without or with two or more elders. Similar to the results of the present study, Merlino et al. (2017) concluded that households with children value more organic labelling while families without children value more taste and flavour of the beef meat. Also, to both investigated groups (with and without children), brand, animal breed, price and animal welfare have great importance, while traceability, nutritional information and colour are least important.

Looking at region separation of consumers and obtained factor scores, a significant difference between animal welfare ($p < 0.01$) and supporting ($p < 0.05$) factor scores was determined. Consumers from central Croatia, Northern Adriatic, Lika and Middle and South Adriatic are more oriented to variables defined under factor attention animal welfare, while to the consumers from Eastern Croatia, preservation of biodiversity and local production defined by factor supporting local production and biodiversity is very important, and animal welfare is not at all important. This could be due that it is an extremely livestock area, where consumers are more familiar with zootechnical rules of the profession, as well as procedures in the production. Consumers from the Middle and South Adriatic region care for origin and information of the fresh meat variables expressed in the factor origin and information, while consumers from the Northern Adriatic and Lika region are more oriented to traditional meat attributes described by factor price and intrinsic quality.

Sabolek et al. (2021) conducted the survey among veterinary students (domestic and foreign)

regarding animal welfare of farm animals (cattle, pigs and poultry) and companion animals (cats and dogs), and came to similar conclusions that differences between regions are results of cultural differences among Croatian regions. For example, students from certain regions like Eastern Croatia and Dalmatia have lower attitudes regarding animal welfare than students from Central Croatia. In contrast, international students expressed the highest concern about the animal welfare of laying hens, and students from Lika and Gorski Kotar expressed the highest concern about companion animal suggesting that these students may be increasingly facing welfare issues in these species in their region due to the weak demographic and economic development in the Lika region.

In this study, significant differences in average values for factor scores and knowledge about the origin of the fresh meat, purchasing and consumption habits of Croatian consumers were found. Significant differences between factors origin and information and price and intrinsic quality are found regarding respondents' knowledge about the breed of pig from which the meat originates, place of purchase and consumption frequency of the Black Slavonian Pig fresh meat or cured products. Consumers who care more for origin together with information and support local production and biodiversity are familiar with the origin of fresh meat, and they buy fresh meat directly from the producers or in the butcher shop, while the group of consumers who care for price and intrinsic quality together with animal welfare do not have knowledge about the breed of pig from which the meat originates, and they mostly buy the meat in the supermarket. Consumers who purchase meat directly from the producer can obtain more information about the rearing system, feed for pigs, breed, and animal welfare, while consumers who buy meat in the supermarket lack that information and can rely only on declaration on the product and the labels, which are usually insufficient. Consumers in the group origin and information are those who consume fresh pork or cured meat products from the Black Slavonian Pig occasionally or frequently, while consumers in the group price and intrinsic quality never tried the Black Slavonian Pig meat. Regarding the paying frequency for the fresh pork, significant differences were found between factor score attention to animal welfare. It is observed that consumers who are paying the highest price for one kilogram of fresh pork (HRK 76.00 or more) are under factor score named attention to animal welfare. In the study of Renko (2014) about distribution channels of meat in Croatia, it was shown that Croatian consumers prefer one-stop shopping at large-scale retailers due to the variety of merchandise offered, but also that consumers preference for place of purchasing is influenced by sociodemographic and health concerns. Results of this study showed that as age decreases and work status rises,

respondents prefer more hypermarkets, and as age increases and work status decreases, consumers prefer more traditional butcher shops. Also, consumers from Mediterranean and mountain regions prefer to buy fresh meat in the butcher shop because they trust their local butcher that the meat they buy is fresher, nicer and possibly better quality.

Using a discrete choice experiment, Croatian consumers declare their preferences and WTP for the boneless fresh ham from the Black Slavonian Pig. According to the results of the choice experiment, Croatian consumers preferred the meat of the Black Slavonian Pig reared outdoors and semi-indoors over meat from hybrid pigs reared conventionally (indoor), for which respondents obtained lower utility. This has also been confirmed by previous research. A pilot study conducted on the smaller sample (100 Croatian consumers) has positively valued the outdoor and semi-indoor production systems compared to a conventional pig rearing system (Jelić Milković et al., 2021). The consumers also preferred a darker red colour of the fresh Black Slavonian Pig meat labelled with a geographical information, such as that of continental Croatia or continental Croatia + PDO (Jelić Milković et al., 2021). Krystallis et al. (2009) conducted conjoint analysis in order to determine attitudes of European citizens (Belgium, Denmark, Germany and Poland) towards the pig production system. They concluded that factors like housing and flooring type, effort to protect the soil, air and water strongly influenced evaluation of the pig production system while farm size, fat and quality had negative utility for respondents. Pugliese and Sirtori (2011) investigated indigenous pig breeds from southern Europe which are in high demand due to better quality of meat and concluded that a free-range system increases the value of animal products.

The geographical indicators (continental Croatia and continental Croatia + PDO) had more value to the consumers than the fresh ham of the pigs reared in other regions of Croatia and the fresh ham of the pigs bearing no such label (a status quo option). Expected quality can result from a perceived intrinsic perspective derived from the assessment of the taste, texture and smell, as well as extrinsic perspective based on the features of the product such as packaging and price (Díaz-Caro et al., 2019). In the choice experiment study conducted to examine Spanish consumers' preferences for Iberian dry-cured ham production system, region of the production has been valuated as of the most important, where the consumers preferred ham produced in areas in which Iberian dry-cured ham is traditionally produced over other regions of Spain. Also they preferred the ham to be produced from animals reared in traditional montanera production system (Díaz-Caro et al., 2019).

Regarding the information treatment, consumers significantly preferred the fresh meat options obtained from the Black Slavonian Pig reared outdoors and semi-indoors over meat originating from hybrid pigs. Additionally, the option Black Slavonian Pig reared outdoors gave them more value than the Black Slavonian Pigs reared semi-indoors. Consumers who had more information about the production system preferred the darker red colour of the meat than consumers who did not have that additional information, although the established difference was not significant in RPL-EC model but was in MNL ($p < 0.01$) and in RPL ($p < 0.1$). It can be concluded from the results of this study that information treatment improves the validity of the choice experiment. This is in accordance with results of Khachatryan et al. (2021) who used different consequentiality treatments and control treatment in order to investigate the role of the trust and consequentiality perceptions on consumers preferences for products with eco-labels. The authors concluded that consequentiality treatments serve as a means to improve internal validity in the choice experiment and that presence of consequentiality treatments increased WTP when compared to the control group. In general, according to García-Gudiño et al. (2021) consumers do not have much knowledge about indigenous pig breeds production system, animal welfare and environmental impact of the production. In the present study, the information about the rearing system, meat colour and geographical information allowed consumers to make a more informed choice. In this study, almost half of the respondents never tried meat from the Black Slavonian Pig, but chose the darker colour of the meat after the given information. Vitale et al. (2020) and Cerjak et al. (2011) determined that sensory properties and information about indigenous pig breeds influenced consumers preferences and moved their expectation towards the informed test. Dransfield et al. (2004) investigated consumers' reactions to the appearance and taste of pork with and without information concerning outdoor production of pigs in France, Denmark, Sweden and the UK. In all four investigated countries, consumers were mostly oriented on colour and fatness of the meat, then marbling and drip. Colour significantly differed between investigated countries. French consumers preferred darker colour, while British and Danish consumers preferred the lighter colour of the meat; all consumers prefered leaner meat over fatty one. García-Gudiño et al. (2021) studied the perception of Spanish consumers for different aspects of pig production and animal welfare throughout the conjoint analysis and segmented consumers according to their knowledge about Iberian pig production. The authors concluded that consumers have poor knowledge about Iberian pig production, however they prefered Iberian products mainly when the animals are reared freely and in natural conditions, thus giving great importance to animal welfare. Consumers considered Iberian products of higher quality, tastier, healthier and produced with

higher standards of animal welfare than pork produced from white cosmopolitan pig breeds (García-Gudiño et al., 2021). On the other hand, they thought that Iberian products are more expensive, although this depended on the level of knowledge they had about the Iberian production system and products from this breed. Results of this study indicate the need to increase the knowledge of consumers about the meat from indigenous pig breeds (Black Slavonian Pig), which is in accordance with the results of García-Gudiño et al. (2021). According to the authors, if consumers have knowledge about Iberian pork products and their premium price, it will give them higher value, however the knowledge about the breed and labelling of products is essential. The authors emphasised that it is necessary to clearly state information about breed and rearing conditions on the label, which were very important to the researched consumers in both studies.

In regard to sociodemographic clusters and fresh meat consumers segmentation analysis, altruistic meat consumers and younger urban families give a more positive valuation for fresh meat from the Black Slavonian Pig produced outdoors and semi-indoors over status quo option. Altruistic meat consumers preferred darker red meat from Black Slavonian Pig labelled to be produced in continental Croatia. On the other hand, young urban families in the sociodemographic cluster value the darker red colour of the fresh meat from the Black Slavonian Pig labelled with continental Croatia + PDO labels.

The results suggest that surveyed consumers are willing to pay a premium for the fresh meat from the Black Slavonian Pig reared outdoors and semi-indoors and geographical label over the meat of hybrid pigs reared in conventional production system. When purchasing pork, consumers are confronted with different alternatives, and their choice will be characterised by the information they have and available alternatives. In their study, Verbeke et al. (2005) investigated the role of drip, colour, marbling and fat cover as intrinsic cues that determine consumers' purchasing decisions. Results of the study showed that consumers preferred pork without fat cover; preference for colour was equally consistent between respondents, however 35 + age consumers preferred darker meat, while preference for marbling and drip were not determined by socio-demographic characteristics of respondents. Also, the authors concluded that taste was the most important benefit when buying pork, convenience was second, while price, availability, and nutritional values were of lower importance.

Consumers are willing to pay the large premium for fresh ham from the Black Slavonian Pig

reared outdoors and labelled as reared in continental Croatia + PDO in comparison to the fresh meat from the Black Slavonian Pig reared semi-indoors and labelled only as reared in continental Croatia. The results of the study showed that the protected designation of origin (PDO) label adds utility to Croatia's continental provinces. This is in accordance with the study of Lusk et al. (2007) who found that, on average, consumers from the United States are willing to pay a premium price for pork products with public good attributes such as products with certifications related to the environment, animal welfare, and antibiotics. In the research of Sahelices et al. (2017), a high percentage of researched consumers in choice experiment valuated PDO label positively (93.6 %) and were willing to pay a premium of more than 10.0 % price for dry-cured Iberian ham. Many European consumers place greater trust in domestic food and assume it to be of better quality. Preference for domestic food is especially higher in Germany and Norway compared to the UK (Yeh et al., 2021). Dransfield et al. (2004) came to the same conclusion by investigating consumers from four European countries (France, Denmark, Sweden and UK) who preferred pork labelled as originating from their own country as opposed to imported, and labelled as pork from pigs reared outside as opposed to inside. Consumers in this study were also willing to pay 5 % more for their home country and reared outside label.

Assessing the Croatian consumers' preferences for the rearing system, meat colour and geographical information through choice experiment it can be observed that consumers preferences are heterogeneous. In Croatia, the certification of fresh meat from indigenous pigs is not regulated, and consumers gained a higher level of utility for a product labelled with PDO label when compared with labelled only as continental Croatia probably because the consumers know more about PDO label.

The results presented show that there is label potential in the Croatian market, which is in accordance with the results of Marescotti et al. (2020). The authors noticed a similar situation in Italy, where consumers preferred to choose meat labelled with PGI label (protected geographical indication) rather than the new label probably because they are more informed about it, but their preferences for the new label were heterogeneous, as also shown by this study. Therefore, it is important to inform Croatian consumers about the meanings of the labels continental Croatia and continental Croatia + PDO and why fresh meat labelled with these labels has a higher price than regular fresh pork or meat from the Black Slavonian Pigs produced in different regions. The mentioned labels add extra value to the product because they

represent fresh meat from the Black Slavonian Pig produced in traditional rearing regions, in controlled conditions and guarantees to the consumers that it is a high-quality authentic product. The results of Kallas et al. (2019) showed the existence of the market niche for traditional pork products. Consumers value these original and pure high-quality products where no add-ons are required to enhance their liking by the consumers. Furthermore, this is very important for the preservation of local breeds and rural development, thus being is in accordance with the Santos Silva and Tirapicos Nunes (2013) research on the sustainability of the Mediterranean traditional pig industry. The traditional pig industry depends on the preservation of endogenous resources, the quality of management at the farm level, as well as the marketing transparency, maintenance of the final product characteristics, together with the defence of its genuineness (PDO and PGI) (Santos Silva and Tirapicos Nunes, 2013). Preservation of the natural ecosystem should be ensured in symbiosis with farmers (taking into account their production objectives and resources) and global and regional public policies (Halimani et al., 2012; Santos Silva and Tirapicos Nunes, 2013).

The results of this study show that it is necessary to create the brand for fresh meat of the Black Slavonian Pig and increase the Croatian consumers' level of knowledge about indigenous pig meat production systems and organoleptic characteristics of the meat. The results of the conducted choice experiment confirm the second hypothesis, providing information for producers and retailers about production attributes that have greater value for consumers and giving them information on how to make the product competitive in the market. The positive aspect is that producers and retailers could use mentioned geographical identification labels to signal consumers that fresh meat and meat products from the Black Slavonian Pigs are of higher quality and produced according to the product specification. Trusted labels and brands could be a tool to differentiate products on the market and to increase their marketing value. Grunert et al. (2004) emphasised in their research the importance of fresh meat branding. Branding can play a major role in marketing of differentiated meat and meat products. Consumers are receptive to the brand signal, and they use the brand as a major cue for forming expectations about health quality (Grunert et al., 2004). Branding the product means making it physically different from other products. It should be placed on a different cooling counter, should have distinctive packaging and labels with extended product information in which sellers can signal superior quality, reduce consumers uncertainty, and encourage them to pay a premium for better quality (Grunert et al., 2004). Escribano et al. (2020) additionally stated that in order to make the brand more attractive and recognizable to consumers, especially younger, additional

concepts such as sustainability, sociality and responsibility need to be incorporated in the branding together with urban design in order to contribute to the enrichment of the value of dehesa agroforestry system products and to increase their market niche. Advertising of the meat products from the indigenous pig breeds should be done by emphasising their originality and healthy properties and promotion should involve improving the knowledge of the traditional system through networks, web pages, food and gastronomic events in HORECA sector (hotels, restaurants and catering), in stores by selling the top quality products which with their premium price can indirectly help the primary sector (Rivera-Toapanta et al., 2021).

Maybe the most important result of this research is that Croatian consumers are aware of social concerns when buying fresh meat and fresh pork. Preservation of biodiversity, sustainability, animal welfare, and rural development are highly rated as important by the consumers. The same is proven by choice experiment in which Croatian consumers have positively valued the outdoor and semi-indoor production systems, which represent more sustainable production and production with higher animal welfare standards than a conventional pig production system. The consumers are willing to pay a premium price for the fresh meat of the Black Slavonian Pig produced outdoors and labelled with the label reared in continental Croatia + PDO. Consumers expect traceability and information to make informed purchasing decisions and gain a higher utility when buying and consuming the meat produced from the Black Slavonian Pig.

5. CONCLUSION

In this study, we segmented the Croatian consumers based on the most important attributes they take into consideration when buying fresh meat. The study provides insight into the existence of different consumers segments based on attributes that affect consumers' decisions when buying fresh meat regarding general shopping habits, safety and quality perceptions and social concerns (fairness in food supply chain, environmental impact and animal welfare). Based on the mentioned attributes in this study, three consumers segment were determined: altruistic, traditional and inattentive meat consumers. The determined segments differ regarding to their sociodemographic characteristics (gender, consumers connection with agriculture, number of elders older than 60 years of age in the household), place of purchase, pork consumption frequency, information about pig breed when buying meat and consumption frequency of fresh meat or meat products from the Black Slavonian Pig. Based on the results specific marketing strategies can be developed for each consumer segment.

In the second part of the dissertation, the consumers were presented with twenty-one statements and asked to declare their opinions regarding purchasing and social concerns (local production, preservation of environment and biodiversity, and animal welfare) of fresh boneless pork ham from the Black Slavonian Pig. The average score for the statements was 3.92 (somewhat agree). According to the results, consumers most support the claim that the freshness and appearance of fresh pork are important. Secondly, the highest ratings they gave to the statements regarding social concerns. In their opinion, rearing of the Black Slavonian Pig is more environmentally friendly compared to conventional hybrid pig production. Respondents gave lower ratings to the taste, price and visual appearance. After determining the importance of certain statements, factor analysis was performed in order to reduce the number of variables. The results showed strong interdependence among twenty-one statements. The factor analysis produced four factors named attention to animal welfare, supporting local production and biodiversity, origin and information and price and intrinsic quality. Results showed that there are significant differences between obtained factor scores and sociodemographic characteristics of consumers, consumption habits, purchasing behaviour and knowledge about fresh meat and pig breeds. Results showed that economic status of the family and education did not have a significant impact on consumers opinion regarding statements about animal welfare, rural development and preservation of biodiversity, however gender, age, region, labour status, number of children younger than 15 years of age

and number of elders in the household did.

In order to investigate in-depth consumers preferences and willingness to pay (WTP) for fresh boneless ham from the Black Slavonian Pig reared outdoors and semi-indoors, the methodology of the discrete choice experiment was applied. To make the hypothetical choice as much as possible accurate to the real choice situation, the labelled design was chosen. The discrete choice experiment revealed that consumers preferred fresh boneless ham from the Black Slavonian Pig produced in outdoor and semi-indoor production systems over fresh boneless ham produced in conventional rearing systems (intensive – indoor). Consumers also gained the highest utility from fresh boneless ham produced from the meat of the Black Slavonian Pig reared outdoors over semi-indoors. Regarding the geographical indicator, surveyed consumers obtained the greatest utility from the label reared in continental Croatia + PDO. Information treatment has also proven to be significant since results show that information given to the consumers regarding the production system which is in accordance with social concerns regarding animal welfare and preservation of environment, meat colour, and geographical information positively affected consumers' decisions. Consumers who were distributed to the information treatment group and who had more information about the production system and social concerns related to it, preferred the darker red colour of the meat and had a better understanding of the importance of geographical information labels than consumers who did not have that additional information. The results of the study showed that young urban consumers and altruistic meat consumers prefer fresh boneless ham from the Black Slavonian Pig produced in outdoor and semi-indoor production systems. They also prefer the darker red colour of the meat and both geographical indicators gave them extra value. The result from the RPL-EC model suggested that there is heterogeneity among consumers' preference for the fresh boneless ham from the Black Slavonian Pig and surveyed consumers, in general, are willing to pay price premium for the meat produced in the outdoor system and labelled with reared in continental Croatia + PDO label. Although such a label does not exist on the Croatian market, a potential for its creation and introduction into the market exists. Results presented indicated that consumers' previous experience or getting the right information about the product is significant, since only 59.5 % of the surveyed respondents consumed (frequently or occasionally) fresh meat or cured meat products from the Black Slavonian Pig. Appropriate labelling and information on the product could positively affect consumers' preferences, representing a market strength of the mentioned product. Therefore, the Black Slavonian Pig production can help preserve biodiversity and make indigenous breeds competitive and

effective in modern market conditions.

The results of the study confirmed the set objectives and both main hypotheses that meat quality, sustainable rearing systems, good animal welfare, preservation of the environment and local tradition which all represent social concerns are important to the consumers. Black Slavonian Pig meat is recognised and appreciated by consumers. They associate it with traditional and premium products which have high economic, environmental, and social value.

The market information provided in the study identified potential market segments that producers or retailers can target. These results are important for the producers, retailers, and policy makers because they can utilise our findings to design and develop successful tools for the promotion of fresh meat and meat products from the Black Slavonian Pig, and position themselves before different consumer segments emphasising environmental, ethical and sustainable aspects of the product. It is important to create policy measures and tools for the improvement of standards in meat production, as well as for transfer of information through labels and declarations. Information provision is significant for fresh meat, so producers, retailers and policy makers must cooperate and play an important role in providing the right information to the consumers regarding production system, labelling and meat characteristics from the indigenous pig breeds to protect the integrity of the products and also ease the risk of consumer deception by incorrect or self-claimed labelling. The Croatian market should introduce labels reared in continental Croatia or reared in continental Croatia + PDO and these labels can be obtained only by producers who produce the Black Slavonian Pig meat according to the specification. Creation of marketing opportunities in rural areas through the development of a brand and a label that conveys biodiversity, sustainability, and environmental values is also important for the producer because they can achieve premium price and extra profit.

The expected scientific contribution of the paper is expressed by proving main and auxiliary hypotheses, but at the same time, it is a fundamental contribution of this research to the current literature about consumers' preferences regarding the impact of social concerns on the consumer’s choice for the fresh meat and fresh meat of the Black Slavonian Pig. Theoretically, the scientific contribution is manifested through both quantitative and qualitative presentation of the results of consumers' attitudes about social concerns and by including the effect of information in the choice experiment to evaluate how information about the production system that is indirectly related to animal welfare, environmental protection and conservation of

biodiversity positively affect consumers' preference and willingness to pay a premium price for the fresh meat from the Black Slavonian Pig.

From the methodological point of view, the presented methodology can be applied to other food products in order to investigate consumer heterogeneity and predict consumer behaviour, which is one of the greatest challenges in marketing. Future investigations should focus on the larger sample of the respondents using different modelling approaches, including the psychological and lifestyle traits of the respondents, in order to create key market segments for the product. Furthermore, a comparison between hypothetical and non-hypothetical choice experiments with actual purchases can be made to confirm and enhance our results.

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7. SUMMARY

The main objective of the dissertation was to obtain an overview of consumers attitudes and beliefs towards some aspects related to social concerns (sustainability, biodiversity and rural development, and animal welfare) and examine influence of information (about production system, colour, geographical information) on consumer choice in favour of local pig breeds, in this case, the Black Slavonian Pig breed, but also to provide knowledge support to producers, national agricultural food policy makers and retailers. Croatian consumers were randomly assigned to one of two treatment options (control or information) in an online survey. Consumers (n = 410) answered questions about their purchase intentions, perceptions and beliefs. A hypothetical choice experiment was used to examine participants' preferences and willingness to pay (WTP) for fresh meat of the Black Slavonian Pig breed reared outdoors and semi-indoors. The results show that the consumers have a notable preference for fresh boneless ham from the Black Slavonian Pig produced in both production systems and labelled as reared in continental Croatia + PDO (Protection of Designation Origin) compared to fresh boneless ham produced from pigs reared in conventional rearing system (intensive – indoor) without a label. Information treatment also proved to be important, as the results show that the information given to the consumers about the production system (that is in line with animal welfare, environmental protection and preservation of biodiversity) meat colour and geographical information positively influenced the consumers' decisions giving great importance to investigated social concerns regarding sustainability, preservation of biodiversity and animal welfare. It is evident that appropriate labelling and information on the product could positively influence consumer preferences, indicating the importance of highlighting the traditional characteristics (production system, darker colour of the meat and production area) of fresh meat from the Black Slavonian Pig on the label in promotional activities.

Key words: consumer preferences, fresh meat, Black Slavonian Pig, choice experiment

8. SAŽETAK

UTJECAJ DRUŠTVENIH ZAHTJEVA NA POTROŠAČKI ODABIR MESA CRNE SLAVONSKE SVINJE

Cilj disertacije bio je dobiti pregled stavova i uvjerenja potrošača prema nekim od aspekata društvenih zahtjeva (održivost, biološka raznolikost i ruralni razvoj te dobrobit životinja) te ispitati utjecaj informacija (o proizvodnom sustavu, boji mesa i zemljopisnim oznakama) na izbor i ponašanje potrošača u korist lokalne pasmine svinja, u ovom slučaju pasmine crne slavonske svinje, ali također pružiti potporu u znanju proizvođačima, kreatorima nacionalne poljoprivredno prehrambene politike i trgovcima. Hrvatski potrošači su nasumično raspoređeni u jedan od tretmana (kontrolni ili informacijski) u online anketi. Potrošači (n = 410) su odgovarali na pitanja vezana o kupovnim namjerama, percepcijama i uvjerenjima. Hipotetski eksperiment odabira korišten je za ispitivanje preferencija potrošača i njihove spremnosti za plaćanje (WTP) premium cijene za svježe meso crne slavonske svinje uzgojene u otvorenom i poluotvorenom sustavu držanja. Dobiveni rezultati pokazuju da hrvatski potrošači preferiraju svježi but bez kosti od crne slavonske svinje uzgajane u oba sustava i označen s oznakom kontinentalna Hrvatska + ZOI (zaštićena oznaka izvornosti) u odnosu na svježi but bez kosti proizveden od svinja uzgajanih na konvencionalni način (intenzivni – zatvoreni sustav proizvodnje) bez oznake. Tretman s informacijom također se pokazao važnim, jer rezultati pokazuju da su informacije dane potrošačima o proizvodnom sustavu (koji je u skladu s dobrobiti životinja, zaštitom okoliša i očuvanjem bioraznolikosti), boji mesa i zemljopisnim oznakama pozitivno utjecale na odluke potrošača dajući veliku važnost istraživanim društvenim zahtjevima u vezi s održivošću, očuvanjem biološke raznolikosti i dobrobiti životinja. Evidentno je da bi odgovarajuće označavanje i informacije na proizvodu mogle pozitivno utjecati na preferencije potrošača, što ukazuje na važnost isticanja tradicionalnih karakteristika (sustav proizvodnje, tamnija boja mesa i područje proizvodnje) svježeg mesa crne slavonske svinje na ambalaži u promotivnim aktivnostima.

Ključne riječi: preferencije potrošača, svježe meso, crna slavonska svinja, eksperiment odabira

9. APPENDIX

9.1. List of Tables

9.2. List of Figures

9.3. Quantitative survey for the empirical study

Questionnaire

<table>
<tr><td colspan="2">This questionnaire is subject to research entitled "Impact of social concerns on consumer choice of Black Slavonian pig meat" studied by a doctoral student at doctoral study program Agricultural Sciences subprogram Agroeconomics at the Josip Juraj Strossmayer University of Osijek, Faculty of Agrobiotechnical Sciences Osijek. The research is entirely anonymous, and the information collected by respondents will be used for academic research only.

The questionnaire lasts about 15 minutes.

We, therefore, ask you for your consent to the processing of personal data, reminding you that your participation is voluntary. Therefore, you have the right to withdraw from the investigation at any time and for any reason. Thank you very much for your cooperation.

☐ I give my consent and declare that I am 18 years old.

☐ I do not give consent and gave up participating in the survey.</td></tr>
<tr><td colspan="2">The following two questions are used to evaluate whether you are part of our target group.</td></tr>
<tr><td>Do you consume pork?</td><td>☐ Yes
☐ No</td></tr>
<tr><td>In your household, you are responsible (at least partially) for purchasing food products.</td><td>☐ Yes
☐ No</td></tr>
<tr><td colspan="2">Habits regarding meat consumption</td></tr>
<tr><td colspan="2">Please complete all questions by filling in the blank by putting the mark “X” in the box of your choice.</td></tr>
<tr><td colspan="2">Approximately how many times a week do you consume meat or cured meat products? Check the option that is closest to your usual behaviour.</td></tr>
<tr><td colspan="2">Once a week — Seven times a week

Meat

Pork

Cured meat (bacon, ham, sausages, kulen, švargl etc.)</td></tr>
<tr><td>Where do you usually buy pork?</td><td>☐ Direct from producer
☐ Butchery
☐ Hyper/supermarket</td></tr>
<tr><td>How much (kg) pork (e.g., fresh pork ham without bones) do you usually buy when preparing a meal for your family's everyday needs?</td><td>Click or tap here to enter text.</td></tr>
<tr><td>Please enter in the blank field how much do you usually pay (HRK/kg) for a fresh pork ham without bones?</td><td>Click or tap here to enter text.</td></tr>
</table>

How often do you prepare fresh pork ham without bones?	☐ Once per month or less ☐ Once per week ☐ Twice per week ☐ Three times per week ☐ Four or more times per week
Which of the following pig breeds have you heard of? (Multiple answers can be selected).	☐ Yorkshire ☐ Landrace ☐ Duroc ☐ Pietrain ☐ Mangalitsa ☐ Black Slavonian pig ☐ Turopolje pig ☐ Banija spotted pig
Do you know from which breed of pig the meat you usually buy comes?	☐ Yes ☐ No
Have you ever consumed and how often do you eat fresh meat or cured products from the Black Slavonian pig?	☐ Never ☐ Yes, occasionally ☐ Yes, frequently
What are the reasons you do not consume or occasionally consume the meat of the black Slavonian pig? (Multiple answers can be selected).	☐ I do not like it ☐ Too much fat content ☐ Not easy to find ☐ Not having the opportunity to try it ☐ Too expensive meat ☐ Other Click or tap here to enter text.
Factors that influence purchasing decision for fresh meat	
Please express your opinion on the importance of certain attributes when buying fresh meat. (1 = not at all important, 2 = slightly important, 3 = moderately important, 4 = very important, 5 = extremely important)	
PRICE (price you pay for fresh meat)	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
APPEARANCE OF THE MEAT (e.g., colour, fat content, marbling, drip loss etc.)	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
QUANTITY OF THE MEAT (amount of packaged fresh meat)	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
COUNTRY OF ORIGIN (the meat is produced in the Republic of Croatia, or it is imported)	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
SAFETY AND QUALITY OF THE MEAT (high meat quality and safe for consumption)	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
FRESHNESS (date of packaging and expiration date)	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
CONVENIENCE (how fast and easy the meat can be prepared)	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
FAIRNESS (farmers, processors, retails, and consumers equally benefit)	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
ENVIRONMENTAL IMPACT (effects of meat production on the environment)	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
ANIMAL WELFARE (well-being of animals used in food production)	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

Attitudes of buying behaviour, biodiversity, rural development and animal welfare	
Please score your opinion for these statements. (1 = Strongly disagree, 2 = Somewhat disagree, 3 = Neither agree nor disagree, 4 = Somewhat agree, 5 = Strongly agree)	
I always check the price when buying fresh boneless pork ham.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
When buying fresh pork, freshness and the appearance of meat (colour, marbling, drip loss) are important to me.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
I think that the taste of the meat is the most important.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
I find it important to know the location and how pork is produced.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
I associate the quality of the meat with the geographical origin of the breed.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
The labels and information on the product are very important because they represent quality and safe meat.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
It should be indicated on the product whether the meat originates from an indigenous breed (such as Black Slavonian Pig) or other modern pig breeds.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
Locally produced food is healthier and more natural (following the original production process).	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
Meat from indigenous pig breeds (such as Black Slavonian Pig) is tastier, juicier, softer and of better quality.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
Locally produced food helps preserve traditional breeds and production methods.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
Breeding indigenous pig breeds (such as Black Slavonian Pig) promotes sustainability and supports local farmers.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
The farm (indoor) breeding causes environmental problems (e.g., massive water consumption, energy consumption, greenhouse gas emission).	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
Rearing a Black Slavonian Pig outdoor is a more environmentally friendly production.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
I prefer to buy locally produced food even though it is sometimes more expensive.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
I am concerned about farm animal welfare.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
Respect for animal welfare results in better meat quality.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
I think intensive (indoor) pig rearing is cruel.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
It does not matter how the pigs are reared because they do not know better.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
Pigs should be able to express natural behavior on-farm (trenching, rolling in the mud, etc.).	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
I do not mind paying a higher price for pork produced to higher animal welfare standards.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
It should be indicated on the product whether the pigs are reared to higher standards of welfare.	1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
Socio-demographic characteristics	
What is your gender?	☐ Male ☐ Female
How old are you?	Click or tap here to enter text.

Place of residence	☐ Urban ☐ Rural
Are you or someone in your family connected with agriculture?	☐ No ☐ Yes, parents ☐ Yes, close relatives ☐ I'm farmer ☐ OtherClick or tap here to enter text.
From which region do you come?	☐ Central Croatia ☐ North-western Croatia ☐ Eastern Croatia ☐ Northern Adriatic and Lika ☐ Middle and South Adriatic
What is your occupation?	☐ Student ☐ Unemployed ☐ Employed part-time ☐ Employed ☐ Retired
What is the highest level of education you have completed?	☐ High school or lower education ☐ Higher education (university or professional studies e.q. bachelor) ☐ University degree (master's and/or PhD)
How many persons, including you, live in your household?	Click or tap here to enter text.
How many children less than 15 years old are there in your household?	Click or tap here to enter text.
How many people older than 60 years of age are there in your household?	Click or tap here to enter text.
Your household income group.	☐ Significantly below average ☐ Below average ☐ Average ☐ Above average ☐ Significantly above average
How much is your household income per month (HRK)?	☐ 0.00 - 3,500.00 ☐ 3,501.00 – 5,500.00 ☐ 5,501.00 - 7,500.00 ☐ 7,501.00 – 9,500.00 ☐ 9,501.00 – 11, 500.00 ☐ 11,501.00 - 16,500.00 ☐ 16,5001.00 – 20,500.00 ☐ > 20,500.00

9.4. Example of a choice set used in the choice experiment

Information given to the respondents in the information treatment

Production system

The outdoors comply with animal welfare criteria and environmental protection. This system of rearing allows pigs to express natural behaviour. Animals can move freely and dig the ground, have access to fresh air and natural light and enough space to explore the environment, free movement and social contact, thus reducing aggression and anxiety. The semi-indoor production system is also considered a system that respects animal welfare, and it is in line with environmental protection as the outdoors but in this system, animals are indoors, usually on litter, with outlets where they can go out.

Meat colour

The meat of the Black Slavonian Pig is darker in colour due to higher number of oxidative types of muscles than in modern breeds.

Geographical indication

Continental Croatia is a traditional breeding region of the Black Slavonian Pig. Black Slavonian Pig meat is produced exclusively within the administrative borders of Pannonian and Northern Croatia.

Continental Croatia + PDO marks Black Slavonian Pig's traditional meat production area and protected designation of origin of Black Slavonian Pig meat, which guarantees that it is a high-quality authentic product, manufactured in traditional regions and controlled conditions.

Other regions represent other regions of the Republic of Croatia in which the Black Slavonian Pig breed is not traditionally bred.

Price of the meat: Variable from 70.00 HRK/kg to 170.00 HRK/kg.

Information given to the respondents in the control treatment

Meat colour

- The dark red colour of the meat
- The light red colour of the meat

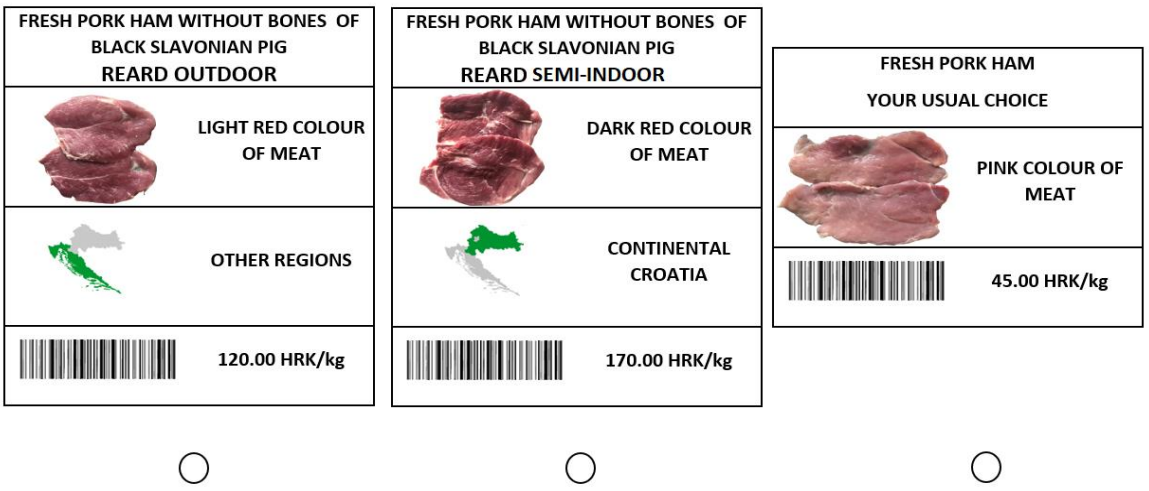
Geographical indication

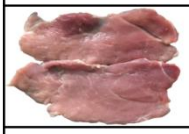
- Continental Croatia
- Continental Croatia + PDO
- Other regions

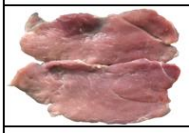
Price of the meat

Variable from 70.00 HRK/kg to 170.00 HRK/kg.

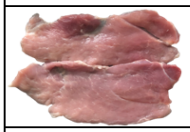
Choice sets used in the discrete choice experiment



FRESH PORK HAM WITHOUT BONES OF BLACK SLAVONIAN PIG REARD OUTDOOR	FRESH PORK HAM WITHOUT BONES OF BLACK SLAVONIAN PIG REARD SEMI-INDOOR	FRESH PORK HAM YOUR USUAL CHOICE
 LIGHT RED COLOUR OF MEAT	 DARK RED COLOUR OF MEAT	 PINK COLOUR OF MEAT
 CONTINENTAL CROATIA	 CONTINENTAL CROATIA + PDO	
170.00 HRK/kg	120.00 HRK/kg	45.00 HRK/kg
○	○	○

FRESH PORK HAM WITHOUT BONES OF BLACK SLAVONIAN PIG REARD OUTDOOR	FRESH PORK HAM WITHOUT BONES OF BLACK SLAVONIAN PIG REARD SEMI-INDOOR	FRESH PORK HAM YOUR USUAL CHOICE
 LIGHT RED COLOUR OF MEAT	 DARK RED COLOUR OF MEAT	 PINK COLOUR OF MEAT
 CONTINENTAL CROATIA	 CONTINENTAL CROATIA + PDO	
170.00 HRK/kg	70.00 HRK/kg	45.00 HRK/kg
○	○	○

FRESH PORK HAM WITHOUT BONES OF BLACK SLAVONIAN PIG REARD OUTDOOR	FRESH PORK HAM WITHOUT BONES OF BLACK SLAVONIAN PIG REARD SEMI-INDOOR	FRESH PORK HAM YOUR USUAL CHOICE
 DARK RED COLOUR OF MEAT	 LIGHT RED COLOUR OF MEAT	 PINK COLOUR OF MEAT
 CONTINENTAL CROATIA + PDO	 OTHER REGIONS	
170.00 HRK/kg	70.00 HRK/kg	45.00 HRK/kg
○	○	○

FRESH PORK HAM WITHOUT BONES OF BLACK SLAVONIAN PIG REARD OUTDOOR	FRESH PORK HAM WITHOUT BONES OF BLACK SLAVONIAN PIG REARD SEMI-INDOOR	FRESH PORK HAM YOUR USUAL CHOICE
 DARK RED COLOUR OF MEAT	 LIGHT RED COLOUR OF MEAT	 PINK COLOUR OF MEAT
 CONTINENTAL CROATIA + PDO	 OTHER REGIONS	
170.00 HRK/kg	70.00 HRK/kg	45.00 HRK/kg

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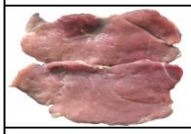
 LIGHT RED COLOUR OF MEAT	 DARK RED COLOUR OF MEAT	 PINK COLOUR OF MEAT
 OTHER REGIONS	 CONTINENTAL CROATIA	
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○	○	○

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170.00 HRK/kg	120.00 HRK/kg	
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 OTHER REGIONS	 CONTINENTAL CROATIA	
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 OTHER REGIONS	 CONTINENTAL CROATIA + PDO	
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FRESH PORK HAM WITHOUT BONES OF BLACK SLAVONIAN PIG REARD OUTDOOR	FRESH PORK HAM WITHOUT BONES OF BLACK SLAVONIAN PIG REARD SEMI-INDOOR	FRESH PORK HAM YOUR USUAL CHOICE
 LIGHT RED COLOUR OF MEAT	 LIGHT RED COLOUR OF MEAT	 PINK COLOUR OF MEAT
 CONTINENTAL CROATIA + PDO	 OTHER REGIONS	
170.00 HRK/kg	70.00 HRK/kg	45.00 HRK/kg

FRESH PORK HAM WITHOUT BONES OF BLACK SLAVONIAN PIG REARD OUTDOOR	FRESH PORK HAM WITHOUT BONES OF BLACK SLAVONIAN PIG REARD SEMI-INDOOR	FRESH PORK HAM YOUR USUAL CHOICE
 LIGHT RED COLOUR OF MEAT	 DARK RED COLOUR OF MEAT	 PINK COLOUR OF MEAT
 CONTINENTAL CROATIA + PDO	 OTHER REGIONS	
170.00 HRK/kg	70.00 HRK/kg	45.00 HRK/kg

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 OTHER REGIONS	 CONTINENTAL CROATIA	
70.00 HRK/kg	170.00 HRK/kg	45.00 HRK/kg

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FRESH PORK HAM WITHOUT BONES OF BLACK SLAVONIAN PIG REARD OUTDOOR
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120.00 HRK/kg

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 LIGHT RED COLOUR OF MEAT
 CONTINENTAL CROATIA + PDO
70.00 HRK/kg

FRESH PORK HAM YOUR USUAL CHOICE
 PINK COLOUR OF MEAT
45.00 HRK/kg

FRESH PORK HAM WITHOUT BONES OF BLACK SLAVONIAN PIG REARD OUTDOOR
 DARK RED COLOUR OF MEAT
 OTHER REGIONS
170.00 HRK/kg

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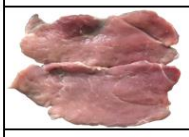
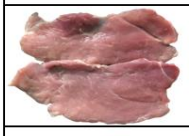
 LIGHT RED COLOUR OF MEAT
 OTHER REGIONS
120.00 HRK/kg

FRESH PORK HAM YOUR USUAL CHOICE
 PINK COLOUR OF MEAT
45.00 HRK/kg

FRESH PORK HAM WITHOUT BONES OF BLACK SLAVONIAN PIG REARD OUTDOOR
 DARK RED COLOUR OF MEAT
 CONTINENTAL CROATIA + PDO
170.00 HRK/kg

FRESH PORK HAM WITHOUT BONES OF BLACK SLAVONIAN PIG REARD SEMI-INDOOR
 LIGHT RED COLOUR OF MEAT
 CONTINENTAL CROATIA
170.00 HRK/kg

FRESH PORK HAM YOUR USUAL CHOICE
 PINK COLOUR OF MEAT
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 OTHER REGIONS	 CONTINENTAL CROATIA + PDO	 45.00 HRK/kg
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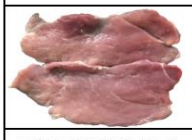
 DARK RED COLOUR OF MEAT	 LIGHT RED COLOUR OF MEAT	 PINK COLOUR OF MEAT
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 OTHER REGIONS	 CONTINENTAL CROATIA	
70.00 HRK/kg	170.00 HRK/kg	45.00 HRK/kg
○	○	○

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 CONTINENTAL CROATIA	 CONTINENTAL CROATIA + PDO	
120.00 HRK/kg	70.00 HRK/kg	45.00 HRK/kg
○	○	○

CURRICULUM VITAE

Sanja Jelić Milković was born 11 January 1989 in Osijek, where she completed primary and secondary education. In 2011 she gained the academic title of Bachelor of Engineering Sciences in Agriculture. She graduated from the Faculty of Agriculture in Osijek, Agroeconomics programme in 2013 on topic “Management production of beef cattle Simmental and Hereford” and Crop Production programme in 2015 on topic “Effect of sowing density on sugar beet growth and root yield and quality in 2014”. She is currently attending the Agroeconomics postgraduate doctoral programme at the Faculty of Agrobiotechnical Sciences Osijek.

From 2014 to 2015 she worked in the Ministry of Finance - Customs Administration, Osijek Regional Customs Office - Service for Excise Duties and Special Taxes as an expert associate, and in 2016 she was employed in Hana-Koška Ltd in the position of technologist in crop production. As of 2017, she has been employed at the Faculty of Agriculture in Osijek (now Faculty of Agrobiotechnical Sciences Osijek) as an assistant in the Department of Bio-economics and Rural Development with the Chair of Marketing and Market Research. Where she participates in teaching at the undergraduate and graduate university level.

Sanja Jelić Milković is the author or co-author of 34 scientific papers, of which 11 in the A1 category, 6 in the A2 category and 17 in the A3 category. As an associate she participated in the project KK.01.1.1.04.0052 "Innovative production of organic fertilizers and substrates for growing seedlings" led by Professor Zdenko Lončarić. She has been a member of the Croatian Agro-Economic Society since 2017, and the Osijek Society of Agronomists since 2019.