Long distance transport of pigs

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Abstract

European Union policies, related to intra-Community trade, transporting live animals and food safety, aim to protect public health and the internal market by ensuring high levels of animal health, animal welfare, and food quality.
Council Regulation 1/2005/EC, which came into force in 2004, established new fundamental rules on the European Union's protection of animals during transport. It has changed the minimum standards for transporting live animals between EU countries, to protect welfare of animals and to prevent the occurrence and spread of infectious animal diseases.

At the beginning of 2019 the Dutch public's opinion on long distance transport of pigs and related operations was ascertained by a survey research. This survey was carried out to identify current views and knowledge on this subject. Between February 25th and March 7th, 2019, a total of 439 people participated in this research.

The key objectives of this survey are:

- How citizens specify what constitutes animal welfare in general and what importance they attach to welfare of transported pigs.
- Determining peoples' views on the relationship between transport and meat quality and the availability of products originating from animals not being transported: How do citizens specify the definition ''quality'' of meat, can transport influence this quality and would they be prepared to pay more for non-transport meat?
- Assessing respondent's awareness/ knowledge and perceived importance on elements of transporting live pigs, with a particular focus on information and education about this subject: What do citizens know about the transportation of live pigs and do they want to have more information on this subject?

The key findings of this survey are:
The majority of the Dutch respondents refers to animal welfare as proposed and defined by the Brambell Committee. Most respondents have negative thoughts on the information of welfare of farm animals and consider it not objective.

More than half of the Dutch respondents think chicken is the meat most consumed by people living in the EU and indicate to know about long distance transport of live animals in general, although, thoughts on the maximum transport time of live pigs differ. The possibility of pigs dying during transport is to most respondents a negative circumstance that must be prevented. The sample populations' opinion differs on whether animal welfare of transported animals should be protected by private businesses or by public authorities.

Most respondents refer to the quality of pork, as it being safe to eat, or the taste being good. They think that this quality is negatively influenced by long distance transportation of the animals.
Most respondents would not buy pork from over long distance transported pigs and they would even pay a premium for pork to prevent pigs from being transported over long distances.

The majority of the Dutch respondents wish to have more information on transportation of animals. Animal Welfare Organizations is the opinion of the respondents, are the preferable institutions to provide more education on transported animals, according to the survey.

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Table of contents

LITERARY REVIEW

SURVEY RESEARCH

SURVEY REPORT

1 Introduction

The Netherlands is the second largest agricultural exporter in the world. Meat is the third most important agricultural product of the total export (Centraal Bureau voor Statistiek, 2016; Dolman et al., 2019). Figure 1 shows an overview of the agricultural export value of the Netherlands over 2016 and 2017 (Ramaekers, Dolman, & Jukema, n.d.).

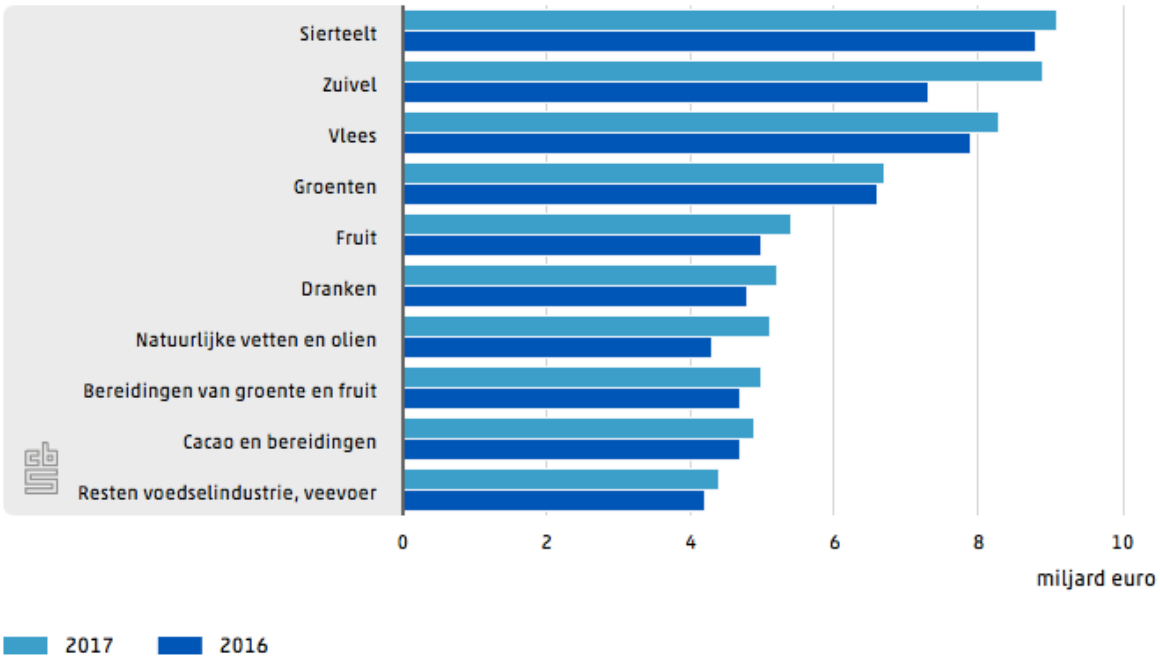

Figure 1. Agricultural exports of the Netherlands, reprinted from *De Nederlandse landbouwexport 2017* by Ramaekers et al., (2017)

Meat is not only exported, but a significant quantity is also imported into the country (Centraal Bureau voor Statistiek, 2018). Figure 2 shows the import and export of products from porcine origin. Remarkable is the import and export of the same products.

The Netherlands has more than enough pigs to provide its population with pork. Within the context of supply and demand, the Dutch consumer market could be provided by its own livestock. In 2017, 15.2 million pigs were slaughtered in the Netherlands (Data.overheid, 2017). If imported pigs are excluded, this would amount 14.5 million pigs. The average weight of these pigs was 96 kilograms with a meat percentage of 59.2% (Data.overheid, 2015). This means that 14.5 million pigs would produce 825 million kilograms of meat. A report, from Wageningen Agricultural University, commissioned by the Animal Welfare Organization Wakker Dier, calculated that an average Dutchman consumed approximately 36 kilograms of pork in 2016 (Terluin et al., 2017). Assuming that the quantity of pork consumption in 2017 was equal, this means that 17 million people consumed 612 million kilograms of pork in that year. Hence, 825 million kilograms of pork, produced by the Dutch pigs, is sufficient to provide the Dutch population in their need for pork.

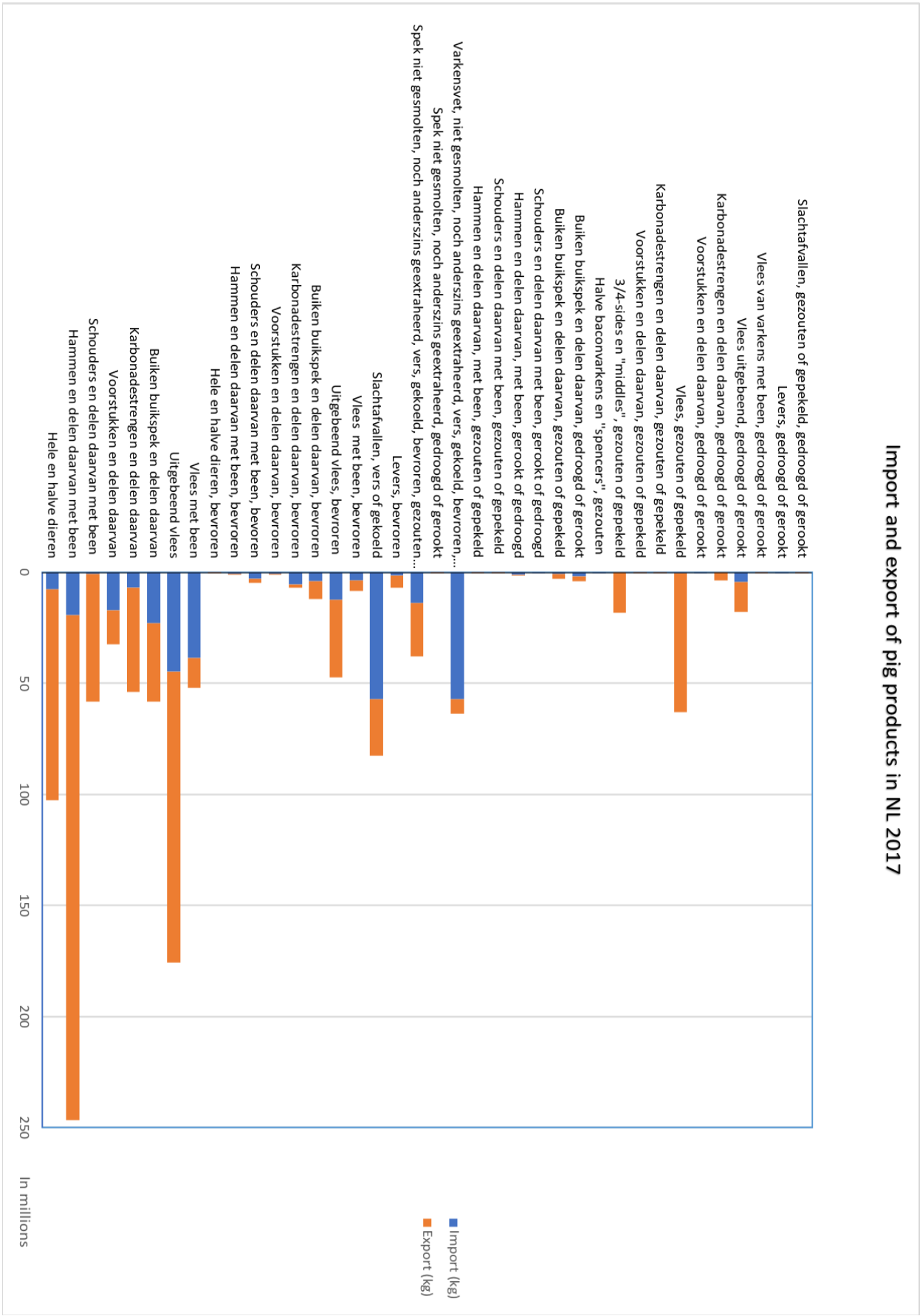

Figure 2. Import and export of meat and slaughter by-products of pigs NL 2017, adapted from ‘’*Goederensoorten naar EU, niet-EU, natuur, voeding en tabak*’’, *by Centraal Bureau voor Statistiek, 2018*

But not only meat is an agricultural commodity. Also, live animals cross Dutch borders daily. Every year millions of live pigs, (slaughter pigs, piglets and sows; breeding pigs not included) are exported from the Netherlands to other Member States of the European Union (EU) and third countries. In the year 2017, 17.3 million pigs were exported of which 99.9% to other Member States. Again, animals were not only exported; live pigs were also imported into the Netherlands. In 2017 this were approximately 640.000 pigs. Most pigs came from the Benelux, with a very few from Germany, France and Austria (Data. overheid, 2017).

In 2017, Belgium, Luxembourg and Germany purchased the majority amount of pigs from the Netherlands: 99% of the total number of slaughter pigs, 81.4% of the piglets and 59% of the sows were exported to these counties. Southern countries like Spain and Italy also imported Dutch pigs. These counties come in third and fourth place with Spain purchasing 0.4% slaughter pigs, 4.8% piglets and 10.8% sows and Italy 1.5%, 2.4% and 8.7% (Data. overheid, 2017).

Exporting live pigs is an important commodity for the Dutch economy. Most kilograms of exported live animals are derived from transporting pigs (International Trade Centre, 2018). Some export journeys last long (long distance transport: ≥ 8 hours). Certain problems come along with these export journeys such as a negative impact on welfare of pigs and the creation of hazards for animal- and public health.
This study examines the impact of long distance transport on these topics. In addition, the veterinary and social aspects of transporting live animals will be outlined. The effects of transports on the environment have not been analyzed but would be necessary to complete the One Health view on this research.

First the development of the European and Dutch trade market will be described. Second, the economic value of exporting live pigs is analyzed. Furthermore, an overview of animal welfare will be given, including the complexity of this subject and animal welfare issues associated with long distance transport. Next, a review on livestock diseases that are important when pigs are transported or when pork carcasses are transported will be given.
In chapter 5 the different roles of veterinary medicine and veterinarians regarding animal transport will be examined. The relevant question of how people in today's modern society consider animal welfare - as described in literature - will also be discussed.
Finally, this report will present the outcome of a survey held among 439 Dutchmen. This investigation was done to obtain an impression of the public's opinion and perception regarding transportation of pigs over long distances.

2 Livestock industry of the European Union and the Netherlands

2.1 Short history of production and consumption of meat and the origin of livestock trade

The Netherlands has been a trading country for centuries. And still it plays a prominent role on the world stage. The Dutch market has always been strongly internationally oriented and the economy owes its success substantially to its trade with different countries. (Centraal Bureau voor Satistiek, 2018a)
Export of meat already started in the nineteenth century, when the need of the Dutch population was less than the total production. As worlds need for meat grew, so did the technology, which favored the world trade in meat and livestock after 1850. The industrialization of European countries caused important changes in the history of the food industry. It brought structural change in production, distribution, conservation, composition and preparation of food. This allowed large-scale food production which resulted in lower prices and an increased consumption. Before the Second World War the annual Dutch meat consumption was about 50 kg per capita. After the second World War meat consumption was not as high until the 1960s. From then on pork became the most important meat product in the Netherlands. (Koolmees, 2009) The high food production recovered, as did the Dutch trade market of goods.

A unified European trade market was stimulated because the trade between European Economic Community (EEC) countries became duty free (europa.eu, 2017). The EEC decided to control the food production chain together. In 1977, Directive 64/432/EEC became effective (europa.eu, Main achievements).This Directive, concerning trade in live animals, also facilitated trade between Member States. In the 1970s the annual meat consumption in the Netherlands increased to about 70 kg per capita (Koolmees, 2005). Thus, not only was meat production encouraged by the national consumption, the EEC also supported it. This led to an export of about 60 percent of the total Dutch meat productions in the 1980s (Koolmees, 2009). The EEC was growing. In 1986 the Single European Act was established, the basis for the implementation of an internal market. In 1993 the Internal Market/ European Single Market/ Common Market was completed by the four freedoms (freedom of movement of persons, goods, services and capital) included in the Maastricht Treaty, officially the Treaty on the European Union. The treaty founded the European Union (EU) and expanded the competence of the EU. (europa.eu, 2017)

From the 1960s onwards, the market for animal products grew. These products were no longer exclusively for wealthy people since personal incomes increased, enhanced by the innovation of mechanical slaughtering. The introduction of the conveyor belt, which stimulated the division of labor, increased the efficiency of the slaughter process. (Koolmees, 2005) Along with this mass production and consumption, the growing demand for meat and the Trans-European-Networks (TEN) being added to the Maastricht Treaty, the international meat trade increased, including long-distance transport of live animals within Europe (Centraal Bureau voor Satistiek, 2018a; Corson & Anderson, 2008; International Trade Centre, 2018). Meat accounts for a significant commodity in the EU economy. Pork is the most popular meat product (50%) of the meat consumption in the EU (*Agriculture and Rural Development*, 2018). Most meat is traded within the EU and transported as prepared products. In many cases transport of carcasses is easier and cheaper than live animal

transport since Council Regulation 1/2005/EC, concerning transport of live animals, became effective. Still millions live animals are being transported over long distances. (Corson & Anderson, 2008)

2.2 An economical point of view

The Netherlands is the second largest agricultural exporter in the world. At least 78 percent of the Dutch agricultural export in 2017, were destined to one of the 28 EU Member States (Ramaekers et al., 2017). The most important Dutch agricultural export products in 2017 were potatoes, fruit and vegetables with 12.1 billion euros, prepared products for human consumption (such as processed meat, fish and vegetables), live animals and meat (both 10.5 billion euros), floricultural products (9.1 billion euros) and dairy products and eggs (8.9 billion euros). In 2017, potatoes, fruit and vegetables contributed over 13 percent to the total agricultural export value. Prepared products and animals and meat were both good for nearly 12 percent. Floriculture and dairy products and eggs both had a share of almost 10 percent. The value of all these export products showed an increase in 2017 (Figure 3). Five EU countries import the largest quantities of live animals and meat. These are Germany (26%), the United Kingdom (12,3%), Belgium (8%), France and Italy (both 7%).

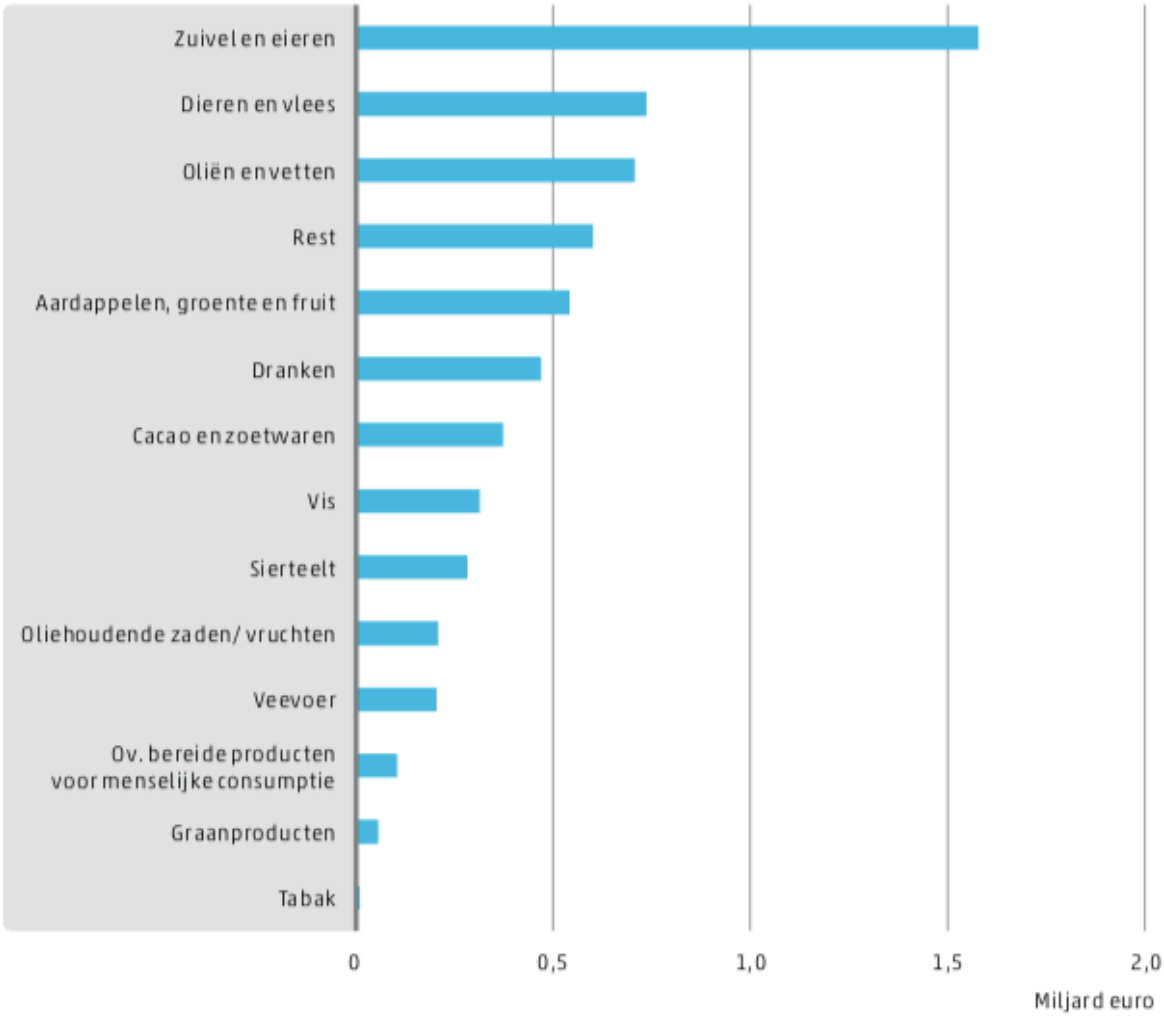

Figure 3. Development of product groups in agricultural exports 2016-2017 reprinted from *''De Nederlandse landbouwexport 2017'', by Ramaekers et al., 2017*

The introduction described the two-way traffic in meat products and live animals to and from the Netherlands. This indicates that the Dutch population may not be satisfied by its indigenous products. The way of livestock production differs between certain areas of Europe. Most pig farms are situated in the region of Belgium, France, Germany, the Netherlands and Spain (Corson & Anderson, 2008). As the regional rearing of animals differ over countries, so does the meat production and consumer preferences within Europe (e.g. by different tastes and traditions). Still, one of the main reasons for the trade is to exploit price differences between Member States (Garciru, 2011). So, consumer preferences and shortages and surpluses resulting in price differences, are the economic key factors to stimulate transactions of meat and live animals. But also logistical circumstances , such as access ease to slaughterhouses and the high efficiency of some slaughterhouses, play a role (Corson & Anderson, 2008).

From the 10.5 billion euros earned by export of animals and meat, 8.2 billion was earned by meat and 2.3 billion was earned by selling live animals. In 2017 the Netherlands accounted for the largest part of export of live pigs within Europe, accounting for more than one million euros (*Agriculture and Rural Development*, 2018). The fact that transporting live pigs is a minor proportion of the overall trade, is a strong argument for replacing it. Still it would be a great challenge to overcome the economic interests of transporting live pigs. Many companies claim that the high costs of refrigerated vehicles prohibit the conversion of live slaughter transport into an entirely carcass trade. The main factor affecting profitability is not the refrigerated transport costs, but the fact that live animals fetch a better price. Live animals slaughtered within the importing country can be sold as domestic meat. With customers preferring domestic meat, transporting live animals eventually yields more money (Corson & Anderson, 2008). In order to achieve only carcass trade or transportation of embryos and semen, prices of meat will be higher which have to be paid by the consumer

Within the EU yearly around 150 thousand horses, 4 million cattle, 4 million sheep, 28 million pigs and 243 million poultry are transported over long distances (europa.eu, Main achievements). As live animals are considered to be an important economic commodity, whereby they are generally viewed as ''commodity'', animals are often subjected to a constant drive for reducing costs. Both parties, sellers and buyers involved in the trade, seek to purchase the best price. Under these circumstances, animal welfare and the hazards for animal- and public health are often not taken into consideration. EU legislation demands minimum standards for animals on transport, to limit the impact on animal welfare on transport. Other EU legislation is adopted to provide a safe and free circulation of live animals within the EU (europa.eu, Main achievements). In the next paragraph, legislation regarding animal welfare and animal- and public health during transport will be discussed.

2.3 European and Dutch legislation on animal transport

The trade of live animals within EU is regulated by a number of European laws. These are meant to provide harmonization between Member States with a consistent enforcement. Different aspects have to be taken into account with transporting live animals: the overall quality of animal transport considering animal welfare, but also animal and public health. European legislation is designed to cover all stages within the European meat sector. Concerning live animals, European legislation covers animals on farm, animals on transport and at the time of killing. EU countries are responsible for daily enforcement by

implementation of EU directives into national legislation. Also they have to perform control activities of this legislation (europe.eu, Legislative aspects of farm animal welfare). Next, European and Dutch legislation, concerning intra- Community trade in certain live animals and products, will be discussed.

On the website of The Netherlands Food and Consumer Product Safety Authority (NVWA), national laws, directives and regulations are categorized within different subjects. Within the subject 'Vervoer levende dieren' [transport of live animals] an overview is given of the European legislation and the Dutch legislation concerning this subject.
European council directives and regulations related to transport of live pigs or trade of products derived from pigs within the EU are: Council Directive 90/425/EEC, 64/432/EEC and 96/93/EEC and Council Regulation 1/2005/EC and 1255/97/EC (NVWA, Vervoer levende dieren).

Council Directive 90/425/EEC ''concerning veterinary and zootechnical checks applicable in intra-Community trade in certain live animals and products in light of the completion of the internal market'' was adopted in 1990 (eur-lex.europa.eu, 1990). This directive describes measures designed to establish a safe internal market in animals and products of animal origin. It implies to dismantle zootechnical and veterinary barriers that apply to intra-Community trade.
In order to transport animals safely, transmission of diseases, to either other animals or humans, should be avoided. To accomplish a safe and free trade in of live animals, the EU has laid down a wide range of animal health requirements in Council Directive 64/432/EEC. This Council Directive ''on animal health problems affecting intra- Community trade in bovine animals and swine'' was adopted in 1964 (eur-lex.europa.eu, 1964). It establishes same requirements for trade between all Member States to ensure animal health guarantees that are needed for safe and free trade of bovine and swine within the EU.
Council Directive 96/93/EEC ''on the certification of animals and animal products'' was adopted in 1996 (eur-lex.europa.eu, 1996). The responsibility to ensure that veterinary checks and certification are carried out in an appropriate manner, lies with the Member State of production or dispatch. Therefore, Member States can rely completely on the integrity of the product.
Council Regulation 1/2005/EC ''on the protection of animals during transport and related operations and amending Directives 64/432/EEC and 93/119/EC and Regulation (EC) No 1255/97'' was adopted in 2004 (eur-lex.europa.eu, 2005). Directive 93/119/EC concerned the protection of animals at the time of slaughter or killing but was replaced by 1099/2009/EC. Council Regulation 1/2005/EC has changed the minimum standards for transporting live animals between EU countries and provides checks on animals entering or leaving the EU (Corson & Anderson, 2008; eur-lex.europa.eu, 2005). The rules vary for different animal species and for different travel distances. This regulation includes: the way animals should be treated, if animals are suitable for transport, how transport vehicles should be equipped, which travel plans should be used, etc. This regulation aims to prevent unnecessary suffering of the animals.
Council Regulation 1255/97/EC ''concerning Community criteria for staging points and amending the route plan referred to in the Annex to Directive 91/628/EEC'' was adopted in 1997. Directive 91/628/EEC concerned the protection of animals during transport but is no longer in force since it is replaced by Council Regulation 1/2005/EC. Regulation 1255/97/EC

applies to the staging points that need to accommodate domestic solipeds and domestic animals of the bovine, ovine, caprine and porcine species for at least 24 hours. These staging points needs to comply with the Community criteria laid down in this Regulation in order to improve welfare of the animals involved .Inspections and controls undertaken by the Food and Veterinary Office confirm if authorities in the EU Member States apply EU legislation in an effective and uniform way (europe.eu, Legislative aspects of farm animal welfare).

Dutch legislation and directives regarding the transport of live pigs or trade of products derived from pigs within the EU are: Wet dieren, Gezondheids- en welzijnswet voor dieren, Regeling Handel levende dieren en levende producten, Regeling Houders van dieren, Regeling Identificatie en registratie van dieren, Regeling Preventie, bestrijding en monitoring van besmettelijke dierziekten en zoönosen en TSE's, Regeling diergeneeskundigen and Beleidsregels dierenwelzijn 2009 (NVWA, Vervoer levende dieren).The Dutch regulations refer to the European regulations. Though, certain Dutch legislation and directives are stricter than the European ones.

Despite optimal conditions and compliance to legislation, still some animals will be injured, get sick or die (Stevenson & Formosinho, 2008). Sometimes through unavoidable situations as traffic jams or excessive heat or cold, which is not uncommon, due to regional differences in infrastructure and climate throughout Europe. In addition, minimum standards demanded by EU legislation, are often not achieved (Dohrmann, 2018). The report on the state of implementation of Regulation (EC) No 1/2005, has documented insufficient and great differences of implementation between Member States. Due to this insufficient enforcement and a lack of inspections and effective penalties, serious breaches of welfare were observed (Corson & Anderson, 2008; Dohrmann, 2018).

2.4 The Brexit

On 29 May 2019, the United Kingdom (UK) will become a third country as it leaves the EU (Moran, 2019). An orderly withdrawal would reduce the impact on the agricultural sector of the EU. Though, disruption will definitely be caused since a substantial amount of agricultural goods are exchanged between the UK and the EU (Agriculture and Rural Development, 2018b). Some Member States will be more affected than others. Products of animal origin are most sensitive, given the European regulations and controls in the unified trading market (Agriculture and Rural Development, 2018b). Not only will trade be disrupted, it will also affect animal welfare. Animal suffering may be caused since animals in the UK could face feed shortages (Moran, 2019). Particularly longer journeys will additionally cause animal suffering given that stops at the boarder will take longer for checking documents, vehicles and animals (Dohrmann, 2018). Eurogroup for Animals' Brexit & Animals taskforce is determined to reduce the threats for animal welfare (Moran, 2019). But whatever happens probably has a significant impact on animals and the European trading marked.

3 The impact of long-distance transport on welfare of pigs

Trade in live animals is a complex and multifactorial process and is driven by many different factors such as food habits, economy, religion and customer preferences. The transportation process can be very stressful for pigs as it exposes them to different challenges: high stocking densities; deprivation of food and water; (unknown) environmental factors; injuries and even death (Corson & Anderson, 2008). There are many reports on violation of animal welfare during long distance transport. Because of this, a great controversy exists about the action of shipping live animals to other countries for slaughter (Stevenson & Formosinho, 2008).

This chapter outlines the aspects that influence the welfare of pigs on transport. The first paragraph will discuss the concept of animal welfare in general and animal welfare related to farm animals. Next, welfare indicators to evaluate welfare on transport will be reviewed. Then an overview will be given on the behavior principles of pigs, linked to the proper way to handle pigs on transport. Furthermore, the multiple key factors affecting welfare on transport and what is needed to improve these factors are examined. Finally, alternatives for transporting live animals will be discussed.

3.1 How is animal welfare defined?

Animal welfare can be interpreted in different ways: animal welfare may concern mental feelings, in which animal welfare and the quality of life are presented from the perception of the animal; it may concern fitness and physical health, where injury and illness must be prevented; or the ability of animals to express their natural behavior, by living in natural conditions (Aarts & Woerkum, 2005). Fraser divided the concept in three major approaches: the feeling approach; the biological function approach; and the natural living approach Knowledge on animal welfare is gathered by research in different disciplines: physiology, animal health and animal behavior. Scientific communication between different disciplines can be difficult and is often hampered by cultural and paradigmatic differences (De Jonge & Spruijt, 2005). Therefore, an unequivocal answer to social questions about animal welfare is not always possible.

As described, animal welfare is a concept that exists of different aspects. The Brambell Committee was the first who proposed a definition of animal welfare in 1965 (Brambell, 1965; De Jonge & Spruijt, 2005). In this concept physical health and mental well-being are included. More definitions appeared in the scientific literature, after the first concept was proposed by the Brambell Committee. One concept defines animal welfare being obtained when harmony between physiology and psychology is accomplished. Another definition describes that animal welfare is affected when an animal cannot cope with its environment, resulting in an animal being unable to express its natural behavior The fundamental difference between the possible approaches of animal welfare is based on feelings and emotions on one side, and on the other side on a more technical measurable approach based on physical health (De Jonge et al., 2000).

Many scientists proposed restricted conceptions relating to only one approach: feeling; biological function; or natural living. In practice, studies also seem to be sectioned in these approaches. Most studies can be divided into retrospective studies, where welfare is measured by parameters that determine behavior or physiology of individual animals (scoring behavior, cortisol concentrations, cardiac activity, respiration activity etc.); or welfare

assessments based on necessary stipulations which are expected to be related to certain levels of welfare (housing conditions, management, stockman ship etc.) None of these conceptions fully represents the definition of animal welfare (De Jonge & Spruijt, 2005). This makes issues on animal welfare of farm animals, with its major ethical concerns over the quality of life, in particular complex to handle. Difficulty is again created by the involvement of different disciplines, but also because scientific controversies exist over the exact nature of animal welfare For this reason, fundamental lines of enquiry and debate are raised from social, political and moral questions about animal rights related to human behavior (Aarts & Van Woerkum, 2005). This debate was even made more difficult by the fact that the results must not only answer the questions on how to improve animal welfare, but it also has to fit in the current intensive farming systems. It must be economically viable; morally acceptable; and practically feasible (De Jonge, Goewie, Blokhuis, & Hague, 2000). Not mentioned is the difficulty in translation of objective acquired observations on different animal species, into subjective experiences of animals. All these factors have made it impossible to form one distinct and consistent answer about the level of welfare of animals in livestock production systems.

One single parameter or method that instantly reflects animal welfare levels, is still missing. Although this one parameter is missing, a combination of multiple welfare indicators can be used to fully represent the state of animal welfare. Most scientist have adopted a combination of the three welfare concepts in order to make valid judgements.

3.2 Welfare indicators for assessing welfare on transport

Animals on transport are exposed to multifactorial stressors. The intention and duration of the stressors determine the reaction of the animals. Mainly short-term effects (e.g. certain behavior) can be measured when animals are transported to be culled. When animals are transported to be fattened or bred somewhere else, long-term effects can be measured (e.g. meat quality).

Different measurements that may be used in welfare research are: behavior measurements; physiological measurements; morbidity measurements; meat/ carcass measurements; and mortality measurements (Broom, 2008, 2014). Changes of behavior can indicate that an animal is experiencing an unpleasant situation and is not able to cope with it. Behaviors vary between species and individual animals. Also, within species reactions can differ in responses to certain stressors. For instance, reactions of pigs differ to one another, to stressors within transport procedures (e.g. loading, transporting, unloading and lairage). Some observed behaviors like vocalization, freezing, and fleeing help to find out which situations provokes aversiveness (Hemsworth, 2014). Another valuable behavior administration is fighting (Broom, 2008).

Many physiological measurements, some more useful than others, are often used in welfare research. Important is that basic levels need to be determined, before results can be analyzed. Indicators that can be used within short-term physiological effects are: plasma cortisol and lactate, heart rate, breathing rate, muscle tremor, foaming at the mouth and body temperature. Again, care is needed in interpreting these measurements. Long-term physiological effects can be measured by: the red blood cell count, osmolality of the blood when animals are unable to drink for a long (transport) period, immunosuppression with a

possibility to an increased disease incidence and by suppression of normal development (Broom, 2008, 2014).

Injuries, skin damage, bruises, morbidity and mortality rate are aspects that can be noted when pigs are unloaded (Garcia, 2014). Not only does this reveal welfare problems present during transport circumstances, but it also has economic consequences.

Injury or skin damage due to poor transportation circumstances will downgrade the quality of meat. It can lead to dark, firm and dry or pale, soft and exudative meat. Meat/carcass quality can expose major welfare problems during transport since strong stressors are needed to have an effect on meat quality (Maria, 2008). On the other hand, when meat quality is not affected, absence of suffering is not guaranteed. To gain a reputation as reliable supplier and to meet market and customer requirements, transport of animals should avoid damaged carcasses and provide meat of good quality. Important parameters that are used to measure meat quality are pH, rigor mortis, temperature, water binding capacity and color (Lambooij, 2014). As bad quality meat cannot be used anymore this has again economic consequences.

As mentioned, transport can also influence the morbidity rate because stress (caused by transport) affects the immune system. This may result in an increased susceptibility to infections which could increase the number of infected animals, arising on transport. Also, infectivity of (sick or subclinical infected) animals may increase since stress can enhance the level of duration of pathogen shedding (Manteca, 2008). More about this subject will be discussed in the paragraph on animal diseases.
The mortality rate is an absolute parameter that presents the impact on welfare during transport and is often the only indicator used for information about the welfare on transport (Broom, 2008; Nielsen, Dybkjr, & Herskin, 2010). Several studies found a positive correlation between the length of transport and mortality rate (Nielsen et al., 2010).
During transport in the EU, an average mortality rate of 0,25% has been estimated. This represents more than 500.000 pigs per year. More than 70% die on transport and about 30% die after unloading at the abattoir. There are several reasons that cause death of pigs on transport, but the main reason why pigs die is because of hyperthermia. According to EU regulations, carcasses of dead animals should be seen as a total loss and yearly accounts for approximately €60 million (Maria, 2008).
It is clear that welfare on transport can be measured by many different methods. In order to get a good indication on the state of animal welfare on transport, a combination of these measures is needed.

3.3 Behavior principles of pigs and human-animal interaction

Understanding the behavior of certain species is important to handle animals correctly and to ensure their welfare. Efficient handling of pigs (but also other farm animals) can be encouraged when reacted properly to different behaviors as exploratory behavior, social behavior and fear. Exploratory behavior is an expression that serves to gather information about the environment. With unknown situations and objects, pigs are initially fearful and will refuse to move forward. If people would allow them a few seconds to explore these situations, instead of trying to force them, this would prevent stressing them and other animals (Hemsworth, 2014). Pigs also show social behaviors as walking, fighting, feeding, lying and running together when living in groups. When pigs are moved from the stable to the

vehicle, these behaviors can be used. Facilitating wide alleys so pigs can walk next to each other and can have a clear view ahead to see other animals, will ease their movement. The optimum group number for moving pigs onto a vehicle is five or six (Hemsworth, 2014). Mixing animals from different social groups before or during transport and in lairage, provokes aggressive and fighting behavior and results in damaged carcasses and minor quality meat. This can be prevented by keeping animals in familiar groups (Broom, 2014). For communication pigs use olfactory and auditory signals. They have a wide variety of vocal signals which are used when in fear or stress. This may have an impact on other pigs and should be prevented by handling them with care. Humans should avoid negative impulses as slaps, kicks, and shocks with electric prodders. Positive interactions as strokes and a resting hand on backs of the animal, should be stimulated (Hemsworth, 2014).

Influencing pigs' welfare during transport already starts on the farm; if farmers handle piglets gently at an age of two or three days, it will be easier to handle them during development and when handled for transport (Broom, 2008).When working with animals, one should always take in into account their unpredictability. Sometimes, through unavoidable situations, expression of certain behavior characteristics can affect the handing of animals. In most cases, it will influence their movement in (unfamiliar) environments (Nielsen et al., 2010). These findings show that knowledge on behavior expressions of pigs are important to ensure their welfare.

Research has shown that paying methods of staff is of great influence on how animals are treated. It has been proven to be a good strategy to stimulate and demand proper attitudes towards animals. If stock people are payed an amount based on the number of live animals, incidences of injurie reduce and the meat quality and welfare improve (Broom, 2014). ''Animal welfare payments'' supports high standards of animal welfare and going beyond the applicable mandatory standards (Dohrmann, 2018). Not only animal welfare payment has proven to be effective, but also codes of retailers can have significant effects on the way animals are handled. Companies need to protect their reputation in favor of sales. Often this is managed by including customer demands in their management. Since animal welfare is a rising topic of public concern, companies will have to reconsider their management (Broom, 2014). The change in the human-animal relationship can therefore lead to significant improvement in welfare. Also, it is recommended to compulsory re-educate all of those involved in transporting pigs in some of the basic principles of handling, to ensure and improve animal welfare on transport (Dohrmann, 2018).

3.4 Key factors affecting welfare of pigs on transport

Welfare is not only depending on behavior related to the interaction with humans and other pigs. There are many more factors that may stress animals on transport: the design of handling facilities and equipment; the skills of the driver; the quality of roads; and environmental factors are of great importance on the welfare status of pigs (Hemsworth, 2014). Different studies pointed out that these factors can affect welfare on both short and long journeys (Lambooij, 2014). Logically duration of transport becomes a risk when the factors are neglected; the longer the pigs are exposed to it, the greater the effect on welfare (Lambooij, 2014; Nielsen et al., 2011). This may cause increased morbidity and mortality rates and a higher percentages of pathological findings (Lambooij, 2014). To minimize the negative effects of these factors, they should be adapted as good as possible to pigs' needs.

It is important to recognize that in most studies research is done with slaughter pigs, while newly weaned and breeding pigs are also transported and young piglets being especially sensitive since they already experiencing weaning stress (Garcia, 2014).

A potential stressor to the pigs, that is linked to the quality of the road and the skills of the driver, is not maintaining balance. Not maintaining balance can result in injuries, bruises and skin damages. It can also cause motion sickness. Different studies discovered that pigs are likely to suffer motion sickness in the form of vomiting (Broom, 2008; Garcia, 2014; Nielsen et al., 2010). The driver must drive calm and should avoid many lateral movements, high speed, sudden braking or swerving and emergency stops to prevent bruises, skin damage or motion sickness (Broom, 2014). Many stressors depend on the design of the handling facilities and thus the design of the vehicle. Since pigs have a wide angle of vision, they are capable to detect stimuli on either side of them. To prevent excitation during lairage or transport, pen fronts should be up to pigs' height (Hemsworth, 2014). Another factor important for pigs, is the availability of enough floor area on the vehicle. Space is needed to ensure an adequate freedom of movement to stand and lie down. The requirements for space are greater on long distance transportations as in some cases the vehicle provides the resting, feeding and drinking area when stationed. Space allowance is influenced by not only the design but also by the skills of the driver, road surface, journey length and stocking density (Broom, 2008). Stocking density is expressed in kilograms per square meter and may not exceed 235kg/m^2 when transporting pigs (of the vehicle). Stocking density and space both influence the ability of the pigs to thermoregulate effectively.
Thermoregulation is needed when the temperature is below or above the thermoneutral zone. The thermoneutral zone of pigs again depends on intrinsic factors as breed, age, weight, gender etc. Not to forget, the contribution of the feeding level, physical activity and stress on heat production of pigs (Lambooij, 2014). In fact, the main reason why pigs die on transport is because of hyperthermia (Maria, 2008). Environmental conditions and equipment to regulate environmental temperatures, humidity and ventilation properly, are necessary to prevent hyperthermia (Lambooij, 2014). It is of great concern that reports published the use of inappropriate vehicles to transport live animals. To reduce the infringements on transport, stronger and harmonized enforcement is needed in the EU. Repeated infringements should lead to prosecution and penalties including the confiscation of vehicles, to achieve the use of appropriate vehicles with adequate equipment and proper roads as well as a good quality driving to ensure the welfare of pigs on transport (Dohrmann, 2018).

It has to be clear, that welfare on transport is a multifactorial concept. So, to guarantee good animal welfare on transport a multifactorial approach is needed. Since various hazards interact with the duration of transport, journey time is the main variable to control to reduce transport stress. The main conclusion of this chapter is that not journey duration per se compromises animal welfare, but the quality of the associated effects (Lambooij, 2014; Nielsen et al., 2010). The current EU Regulation (EC) 1/2005 aims to protect animals' welfare on transport, partly by limiting transport duration of animals to 8 hours. But a report on the overall degree of progress in implementation of Regulation (EC) 1/2005, showed that the Member States have been insufficient to meet the Regulation's main objective: protecting animal welfare on transport. Therefore, several alternatives have been suggested to reduce or replace live animal transport. Alternative strategies are: economically viable local slaughter facilities; on farm slaughter; replacing the transport of breeding animals by semen or/and

embryos; and transportation of carcasses and meat which will be discussed later on (Dohrmann, 2018; The Brussels Times, 2019). The next paragraph describes communication resources that could help improving animal welfare on transport.

3.5 Labelling & TRACES – resources of communication

More and more consumers are interested in information on the livestock production sector. Awareness is growing on animal welfare, but also other issues became of public concern as food safety and the sustainability of the whole chain (Appleby, 2005). Since consumers are increasingly interested in livestock and farming circumstances, welfare labelling schemes exist. But these systems are not harmonized within the EU, which makes it difficult to understand and differentiate between welfare standards (europa.eu, Labelling related to animal welfare). Labelling is an important factor in informing consumers clear and correctly. Also, for the fact that imported animals being slaughtered in the imported country and can be sold as domestic meat, labelling is a crucial factor. This could be prevented though when codes of retailers would be more stricter or by improving legislation for detailed labelling, as was introduced by Regulation 1169/2011/EC concerning provision of food information to consumers (Corson & Anderson, 2008). During the conference "Animal Welfare – Improving by Labelling?" in 2007, the European Economic and Social Committee (EESC) concluded that labelling could improve animal welfare under certain conditions (europa.eu, Labelling related to animal welfare). And by forming a crucial communication resource between the meat production chain and the general public, labelling should be done more extensive and correctly. This would enable consumers to make more informed purchasing decisions on origin, quality and animal welfare (Corson & Anderson, 2008; europa.eu, Labelling related to animal welfare).

In 2004 a new system was introduced by the EU; The Trade Control and Expert System (TRACES). With this program the entire certification process was digitized. It has made possible to track down the movement of animals and certain type of products within and from outside the EU (europa.eu, TRACES). Veterinarians are responsible for monitoring and generating TRACES forms. Veterinary checks must ensure controlling and monitoring of documentation and the identity, welfare and physical health of animals. TRACES is a marketing system which aims to provide greater accountability for traded products and facilitates quick exchange of relevant information between involved trading parties and control authorities. It can motivate all individuals involved in the chain, to improve practices (Grandin, 2000). It is therefore an efficient tool to improve not only animal welfare but also food-safety. With the possibility to trace back all movements, the impact of disease outbreaks will reduce and therefor provides a better protection of animal and public health (europa.eu, TRACES). It is a network that promotes better cooperation between traders and is again crucial communication resource.

4 Food safety

After the second World War the pattern of meat consumption changed. The consumption of foods of animal origin increased which had a great effect on the food supply chain and international trade. Not only the food industry changed, but also a transformation of public's concern about animal and public health care and a demand for quality control occurred. In this paragraph highly contagious animal diseases, which may have dramatic consequences on the free movement of people and goods within the EU, on animal welfare and on animal and public health, are reviewed. Next, the safety of pork carcasses and the microbiological hazards of transporting pork carcasses will be discussed.

4.1 Controlling animal diseases

From the 1960s onwards farm sizes have increased rapidly due to the intensification of livestock rearing. Removal of internal borders in the EU and the increased livestock production, have led to a new nature of (farm) animal diseases. Diseases have changed towards multifactorial (e.g. housing strategies, production level related problems, management factors etc.) endemic diseases with an increased risk of disease transmission (Noordhuizen-Stassen & Noordhuizen, 2005). Good examples are the outbreaks of classical swine fever in the Netherlands in 1997 and foot-and-mouth disease in the UK and the Netherlands in 2001 (Belk & Grandin, 2014).

Key factors that influence welfare on transport have been described above. Many of these key factors are related to stress because animals can be stressed by any change in their environment: change within the availability of food and water; mixing social groups; strange sounds or light; handling by humans etc. Stress can affect the immune system and a combination of different stressors has an even greater effect on the immune system. The hypothalamic-pituitary- adrenal (HPA) axis responds to these stimuli by the release of glucocorticoids and/or catecholamines, which can reduce immunity. The reduction of immunity ensures a descending defense mechanism against infection with an increased susceptibility to infection. Not only does stress make animals more susceptible to infections, it can also enhance the infectiousness of (sub)clinical infected animals. It can in fact heighten the level and duration of pathogen shedding. In addition, the intensity and frequency of contact between animals is increased during transport. This can contribute to spreading diseases. So, three main factors are important in terms of contagious diseases with live animals on transport: increased susceptibility; increased infectivity; and increased contact rate. (Manteca, 2008)

The prevention and control of highly contagious animal diseases has become a social and political issue since diseases cause major economic losses, can have a high mortality and morbidity rate and sometimes cause severe public health hazards (Noordhuizen-Stassen & Noordhuizen, 2005). Transmissible diseases have a potential to spread rapidly which would have great socio-economic and public health consequences, this has led to enforcement of stringent regulations for a number of Office International des Epizooties (OIE) listed diseases (Belk & Grandin, 2014). Most of these diseases are not zoonotic but could have a major impact on the free movement of people and goods within the EU and on animal welfare (OIE, 2019). Diseases on this list that have to be taken into account when pigs are transported are: African swine fever virus; classical swine fever virus; porcine reproductive and respiratory syndrome virus (PRRS); Taenia solium (Porcine cysticercosis); Nipah virus encephalitis;

Transmissible gastroenteritis; Anthrax; Crimean Congo hemorrhagic fever; Aujeszky's disease virus; Brucella abortus, Brucella melitensis and Brucella suis, Echinococcus granulosus, Echinococcus multilocularis, foot and mouth disease virus; Mycobacterium tuberculosis complex; rabies virus; rinderpest virus; Trichinella spp.; Japanese encephalitis; new world screwworm (Cochliomyia hominivorax); old world screwworm (Chrysomya bezziana); Paratuberculosis; Q fever and Surra (Trypanosoma evansi) (OIE, 2019).

Infected hosts can infect other animals that are loaded on the vehicle. Pathogenic agents are shed by oronasal fluids, respiratory aerosols, faces and other secretions or excretions. It is important that animals are carefully inspected before transport, to prevent the loading of unhealthy animals. Since subclinical infected animals will not be detected by veterinary checks, improving welfare on transport may be a solution to reduce the spread of diseases. With reducing the negative effects that transport has on welfare, stress decreases, whereby the immune system is less affected (Manteca, 2008).

The conversion of live animal transport into an entirely carcass trade, could be another solution to minimize the transmission of the OIE listed diseases from country to country. But before transporting carcasses, clean/ safe carcasses should be assured to reduce the risk of food-borne-(zoonotic)diseases and to prevent cross-contamination from carcass to carcass.

4.2 Food-borne zoonotic diseases

Zoonotic diseases are described as micro-organisms that can infect both animals and humans. Humans can be infected by direct or indirect contact with infected animals, by drinking contaminated water or by eating contaminated food, which refers to food-borne pathogens (RIVM, 2019). Food-borne zoonotic diseases are a threat to global public health. They cause over more than 320.000 human cases in the EU each year and are the main cause of zoonotic infections in humans in the Netherlands (EFSA, n.d.; Uiterwijk et al., 2018).
Food-borne pathogens can contaminate food at different moments in the food chain (EFSA, n.d.). The food chain consists of four main operations; production (e.g. farm); processing (e.g. slaughterhouse); distribution (e.g. transport); and preparation (e.g. kitchen) (Centers for Disease Control and Prevention, 2017). Every operation within this chain may have a different influence on the microbial level of pathogens within food (Andreoletti et al., 2011). Therefore, the EU has adopted an integrated approach to prevent food being contaminated in these different stages. This approach consists of risk assessment and risk management on each operator within the food chain and is supported by timely and effective risk communication activities (EFSA, n.d.). Such a coordinated approach already resulted in a reduction of human Salmonella cases by almost one-half over a five-year period (2004-2009).

Despite the integrated approach on food safety, the possibility exists of meat containing different microbiological hazards that can cause illness in humans (Andreoletti et al., 2011). Meat can contain micro-organisms and chemical contaminants that can be harmful to public health (RIVM, 2013). Micro-organisms include viruses, bacteria, fungi and parasites (RIVM, 2013). Dioxins are an example for chemical contaminants. A qualitative risk assessment of the EFSA on food-borne hazards in swine in the EU presented that *Salmonella* spp. is of high relevance to form health risks for consumers, followed by *Yersinia enterocolitica*, *Toxoplasma gondii* and *Trichinella* spp. (Andreoletti et al., 2011). Hereby was presented that chemical substances are unlikely to pose health risk for consumers.

To assure pork carcass safety and to control these micro-organisms, a range of longitudinal preventive measures and controls were integrated on both farm and at abattoir level. Targets were set to be achieved for chilled carcasses. At farm level herd health programs, closed breeding pyramids and Good Manufacturing Practices (GMP)/Good Hygiene Practices (GHP) were introduced (Andreoletti et al., 2011). Risk reduction measures at abattoir level are controlled by programs based also on GMP/GHP, Hazard Analysis and Critical Control Point (HACCP) and quality management (QM) systems. With these systems, the whole process is managed. Each operation within the slaughter line carries a different microbial risk. By managing the whole process, the effect of every step within the process is known. Resulting in the achievement of quality and safety, without testing every end product. Council Directive 852/2004 obligates food business operators to work with food safety systems. Still pork-carcass safety varies because it is strongly influenced by hygiene performance of the operators.

4.3 Pork-carcass trade and it's microbiological hazards on transport

Source attribution and data used on the prevalence in and on chilled carcasses, pointed out that a significant part of contamination happens during the slaughter process, whereby the vast majority of contamination occurs on the surface of carcasses. Since chemical contaminants, viruses and parasites do not grow on the surface of carcass meat, these microbiological hazards are irrelevant in the discussion on cross-contamination between carcass surfaces. More relevant pathogens on chilled pork carcasses are bacteria. Again *Salmonella* spp., *Y. enterocolitica,* but also *Listeria monocytogenes,* are the most important bacteria on the potential risk of public health within chilled pork carcasses (BIOHAZ, 2014).

The primary factor to control the growth of bacterial pathogens on carcass surfaces is temperature management. *Salmonella* spp*., Y. enterocolitica and L. monocytogenes* are agents on pork carcasses that form potential risks for public health when it comes to chilling regimes. Since chilling carcasses has a great influence on the reduction of microbial growth of these pathogens, it is of great importance that carcasses are chilled continuously, also when distributed, which includes chilling on transport. The continuum of chilling is even proved to be the most essential factor to prevent bacterial growth from slaughter to consumption (BIOHAZ, 2014). Therefore, carcasses are immediately chilled after post-mortem inspections. Slaughterhouse chill rooms ensure a carcass core temperature of not more than 7 ºC, as required by Regulation 853/2004/EC (eur-lex.europa.eu, 2004). After a core temperature of 7 ºC is achieved, carcasses can be transported. But only when carcasses remain at this temperature during transport, according to the regulation.

Though, it is not essential that the chilling occurs in the slaughter plants as mandated in the regulation, since it has been proven that the continuum of chilling is the most essential factor to prevent bacterial growth. For this reason, chilling could also happen on transport. In order to achieve a continuous chilling process on transport, a proper chilling capacity of vehicles is needed. There seem to be a major difference in the quality of transport vehicles for carcass transport. However, most vehicles that are used for long distance transport, do have a good chilling capacity. Refrigerators on these vehicles can even achieve a decrease of 1 ºC/hour of the core of pork carcasses. Most efficient should be to begin with chilling of carcasses already on transport, instead of at abattoirs. In this situation, it must be taken into account that the

chilling capacity is less when vehicles are stationed. The decrease of the core temperature by 1 ºC will then not be achieved. This requires the core temperature already to be 7 ºC before stationed, so only the continuum of the chilling process is sufficient (BIOHAZ, 2014).

So, time and money could be spared by chilling on transport. It is an opportunity since refrigerated vehicles are available that can decrease carcass temperatures and have the capacity to continuously chill. Thereby could this happen without increasing the risk of *Salmonella* spp*., Y. enterocolitica and L. monocytogenes* for public health.

Chilling carcasses is one of the key steps to minimize the microbial level of pork carcasses. Another key step to improve the microbial status of pork carcasses, is to minimize transport of live animals. Other transport related factors that can improve pork safety are minimizing lairage duration and physical separation of batches of pigs during lairage and transport. The above mentioned factors are key steps because they are important in reducing the risk of cross-contamination between animals. An implementation of measures concerning these key steps, results in positive effects on reducing the microbial level of pork carcasses (Andreoletti et al., 2011).

5 The role of veterinary medicine in transport of animals and meat

From 1850 onwards, worlds need for meat grew and so did the agricultural technology. This favored the world trade in meat and livestock. Increased animal production and improved animal husbandry were achieved by industrialization of the food industry. A large-scale international meat industry developed and brought structural change to every involved segment within the meat chain. The European meat sector consists of farmers, farmer cooperatives, slaughterhouses and retailers. Each element of this chain is involved with veterinary medicine. Veterinarians have specific and important roles in the food industry. This paragraph outlines the different functions of veterinary medicine within this chain. In particular the role of veterinary medicine and veterinarians, concerning live animals on transport and the transport of carcasses, will be described.

5.1 Animal health

High animal densities associated with intensification of livestock rearing, facilitated the spread of transmissible infectious diseases, resulting in great socio-economic and public health consequences. This led to the urgent need of measures to effectively control animal diseases. Veterinarians are involved in developing eradication and prevention programs and reduction of disease prevalence (Noordhuizen-Stassen & Noordhuizen, 2005). Also, they are responsible for the enforcement of necessary measures during outbreaks of infectious diseases (Koolmees, 2005). The ultimate goal of these measures is to limit the outbreak to minimize the obstruction of the EU trade market and to limit economic losses (Noordhuizen-Stassen & Noordhuizen, 2005). To achieve health of large groups of production animals, herd health management is necessary. This made veterinary practitioners advisors of herd health which supports safe transports of live animals (Koolmees, 2005). Live animals are traded everyday within the EU. To ensure safe transports and to avoid the transmission of diseases, to either animals or humans, all live animals must travel with a health certificate. This certificate is validated by an official veterinarian specifying that the animals meet the animal health requirements set out in relevant Council Directives (europa.eu, n.d.-b).

5.2 Food quality control

Public demand for food quality and safety is growing (Appleby, 2005). Veterinarians play an important role in managing animal health, which contributes to meat quality and safety. They can detect clinical observable zoonotic diseases, identify animals, which enables traceability, and make evaluations of cleanliness of individual animals at the abattoir (Andreoletti et al., 2011). Also, new production control systems were adopted to realize products of higher health and quality (Koolmees, 2005). With control systems as HACCP and QM, the whole process of meat production is managed. Veterinarians fulfill inspections of end products with the post-mortem inspections at the end of the slaughter line. This makes veterinarians accountable for the quality and safety of meat when distributed (Andreoletti et al., 2011).

5.3 Animal welfare

The growth of production and consumption of meat created public concern on the safety and quality of it. Also, welfare of production animals drew public's attention. Three major approaches, as before mentioned designed by Frasier and often used, are the feeling approach, the biological function approach, and the natural living approach. Many producers tend to emphasize the biological function aspects of welfare. The same is true for

veterinarians since they help to increase the agricultural efficiency (Appleby, 2005). The poor image of livestock farming has therefore reflected on veterinarians. To improve this image, the veterinary profession paid more attention to sustainable and more extensive livestock production (Koolmees, 2005). Though, on transport it is difficult to guarantee animal welfare given that it is depending on many key factors.

Still veterinarians can have a significant effect on animal welfare on transport since they supervise if animals are fit enough to travel. Using fitness as a selection criterion when animals are loaded, is a major factor in assuring animal welfare during transport. An incorrect preselection is even responsible for the largest percentage of infringements during transport (Dohrmann, 2018). The risk of comprising animal welfare is greater when animals are injured or sick. If they are not fit to travel, veterinarians should prohibit these animals being loaded on the vehicle (Lambooij, 2014). The main reason for these infringements of fitness is due to the lack of compliance with fitness guidelines across Member States Therefore, one working definition of what constitutes fitness is needed. Also, training courses for farmers, drivers and veterinarians could help to reduce the high levels of fitness infringement (Dohrmann, 2018). Other important welfare aspects that have to be controlled by the vet are: the prober handling of animals by the driver and stocking people; the use of suitable vehicles for transporting certain species; which travel schedules must be used; if the transport companies and drivers are on the list of approved and registered transporters; and if the drivers are permitted to drive short or long distances (NVWA, n.d.).

It can be concluded that veterinarians bear great responsibilities regarding animal health and welfare, as well as food safety. They are expected to act professionally and contribute expert knowledge on these multifarious and important aspects within society. This can sometimes be difficult as they have to deal with colliding opinions and ethical issues (concerning farm animals) on a daily base. Also, they have to work with opposing points of view on every stage within the food production chain combined with a set framework of the professional field by national and EU-legislation.

6 The perception on transporting livestock of today's society

Welfare of farm animals is a recurring point of discussion in today's society. The difficulty with this discussion is that the attitudes towards farm animals widely vary (Aarts & Van Woerkum, 2005). In earlier times, consumers were mainly interested in low priced animal derived products (Koolmees, 2005). Nowadays, a gradual shift in attitudes towards animals has taken place whereby animal welfare has been accepted to be of relevance (Noordhuizen-Stassen & Noordhuizen, 2005). Not only the general public, but also livestock producers have shown an increasing interest in assuring animal welfare in the production chain (Geers & Madec, 2006). Besides changes within the perception of animal welfare, significant development is found in knowledge of the effects of livestock farming on the environment (Steinfeld et al., 2006). Consequently, public concerns on food safety grows (Appleby, 2005). Authorities were forced to take public action (Koolmees, 2005). As a reaction, increased efforts have been made by research and educational institutions, government agencies, enterprises, health care organizations and others, in developing and accessing information that contributes to the creation of sustainable housing environments, management procedures and humane conditions for producing foods of animal origin (Geers & Madec, 2006).
Most of the developed countries have laws and regulations on the care and use of farm animals. The European regulation on animal welfare during transport aims to prevent injury or unnecessary suffering of the animals (eur-lex.europa.eu, 2005). But in some cases, where European legislation is complied, the welfare of animals during transport has been compromised for a variety of reasons (Corson & Anderson, 2008). In 2008, an international campaign was started to stop long distance transport of farm animals (Broom, 2008). This campaign was led by the World Society for the Protection of Animals (WSPA), an Animal Welfare Organization. Results of an opinion poll, made during the campaign, showed that the Dutch population criticizes the long-distance transportations. Though, specification on the objections is not further described.

To understand the perception of Dutch citizens on long distance transports of animals, a survey has been held among 439 Dutchmen. The results of the survey will be analyzed in the next chapters. First an introduction will be given on the subject of the survey, followed by a summary of the key finding. Then the research methodology and development of the survey will be explained, as will be the methods used to successfully gather enough respondents. Thereafter, the research findings and specific outcomes are displayed in the survey report. Finally, this thesis ends with a conclusion where the results of the literary review and survey research are combined.

Survey research

1 Introduction

European Union policies related to intra-Community trade, transporting live animals and food safety, aim to protect public health and the internal market by ensuring high levels of animal health, high levels of animal welfare and high levels of food quality.
Council Regulation 1/2005/EC, which came into force in 2004, established new fundamental rules on the European Union's protection of animals during transport and related aspects. It has changed the minimum standards for transporting live animals between EU countries to protect welfare of animals and to prevent the occurrence and spread of infectious animal diseases.

At the beginning of 2019 the Dutch public opinion on long distance transport of pigs and related operations was consulted by a survey research. This survey was carried out by research facilitator Bureau Fris to establish current views, opinions and knowledge on this subject. It is a study commissioned by veterinary master student Romy Röring, of the master's program Farm Animal and Veterinary Public Health. It is for the purpose of a master thesis within the Institute for Risk Assessment Sciences (IRAS), an interfaculty research institute of the faculty of Veterinary Medicine of Utrecht University. Between February 25th and 7 March, a total of 439 people participated in this research.

The key objectives of this survey are:

- How citizens specify what constitutes animal welfare in general and what importance they attach to welfare of transported pigs.
- Determining peoples' views on the relationship between transport and meat quality and the availability of products originating from animals not being transported: How do citizens specify the definition ''quality'' of meat, can transport influence this quality and would they be prepared to pay more for non-transport meat?
- Assessing respondent's awareness/ knowledge and perceived importance on elements of transporting live pigs, with a particular focus on information and education about this subject: What do citizens know about the transportation of live pigs and do they want to have more information on this subject?

2 Key findings

The majority of the Dutch respondents refer to animal welfare as proposed and defined by the Brambell Committee.

The majority of the Dutch respondents have a negative impression on the information of welfare of farm animals.

More than half of the Dutch respondents assume information on animal welfare is not objective.

More than half of the Dutch respondents are under the impression that chicken-meat is the most consumed meat by people living in the EU.

The majority of the Dutch respondents claim to have knowledge about long distance transport of live pigs.

Respondents are divided on the statements whether the maximum transport time of live pigs should be eight hours or shorter and that live pigs should not be transported at all.

The large majority of the Dutch respondents indicate that not a single pig should die during transport.

Overall, the sample population is divided on whether animal welfare of transported animals should be protected by private businesses or by public authorities. The EU and the government are most frequently ranked as the best to do so.

Most respondents refer to quality of pork as it being safe to eat or the taste being good.

The majority of the Dutch respondents indicate that the quality of pork is negatively influenced by long distance transport of the animals.

The large majority of the Dutch respondents indicate not to buy pork from over long distance transported pigs.

The large majority of the Dutch respondents would pay a premium to prevent pigs being transported over long distances.

A majority of the Dutch respondents wish to have more information on transported animals.

Most people think Animal Welfare Organizations are the best institutions to provide more education on transported animals.

3 Research methodology

What is the opinion of the Dutch population on long distance transport of pigs and related operations? A quantitative and nonexperimental or descriptive research design is needed to generate a substantiated and detailed answer on this question. Within this research design, a nonexperimental survey research is a systematic method for collecting data from a representative sample for a specific population. In fact, it is one of the most widely used nonexperimental research designs to collect large amounts of data to create detailed and quantitative descriptions of certain phenomena (Kalaian, 2008). Different equipment can be used to collect data from individuals, such as face-to-face interviews, telephone, email or other computerized resources. Data can eventually be used to empirically and scientifically study behaviors, thoughts, preferences and attitudes of people at a given point in time and place (Ballou, 2008). Afterwards it can again be used in correlational research studies, experimental studies, and quasi-experimental studies (Kalaian, 2008).

Different steps were taken to construct the survey, to collect data and to analyze the results (Ballou, 2008):

a. Research question
b. Hypothesis development based on literary review
c. Sample design and selection of respondents
d. Questionnaire design
e. Data collection
f. Data analysis
g. Research findings and specific outcomes.

First the steps a, b, c and d will be discussed, which were necessary to develop the survey.

3.1 Research question

Every year millions of live pigs, (slaughter pigs, piglets and sows; breeding pigs not included) are exported from the Netherlands to other Member States of the European Union (EU) and third countries. Trade in live animals is a complex process and is driven by different factors. Many reports mention violation of animal welfare during long distance transport (Dohrmann, 2018; Stevenson & Formosinho, 2008). It has been claimed that the Dutch society has great objections on shipping live animals, based on an opinion poll, but descriptions of this poll are missing ("Vroege Vogels - Natuur en Milieu in Nederland," 2008). To investigate the opinion of the Dutch population on long distance transport of pigs and related operations, the following research question has been stated: ''What is the opinion of the Dutch population on long distance transport of pigs and related operations?''.

3.2 Hypothesis development

In a survey type of research, it is unnecessary to state research hypotheses (Kalaian & Kasim, 2008). It is impossible to anticipate or predict possible outcomes of a questionnaire, because it is designed to explore and describe opinions, preferences, behaviors, attitudes etc. Special research was done before designing the questionnaire, this will be further analyzed in the paragraph on the questionnaire design.

3.3 Sample design and selection of respondents

The goal of this research is to investigate and describe the Dutch opinion on long distance transported pigs and related operations. To achieve this goal, two major elements of the survey have to be implemented properly: the sample design and the selection of respondents. Sample design is a framework of selection criteria applied when respondents are selected. It forms the basis of the selected population sample and is called the sampling frame (Shapiro, 2008). The sampling frame influences other elements of the survey and may affect the external validity of the study (Davern, 2008). To ensure an adequate research for collecting, decisions on the sample frame are among the most important ones (Shapiro, 2008). The sample frame should contain the information that is needed to select a representative sample (Hall, 2008). The population sample has to be representative for the population the research is meant to present.

Almost no sampling frame is perfect (Hall, 2008). Problems that occur include both overcoverage and undercoverage. Overcoverage is an error in which some suitable respondents are selected twice, or respondents being selected that are not suitable for the study Undercoverage is an error in which suitable respondents will not or cannot be selected. This can be reduced by including as many elements as possible of the target population (Pearson, 2008). Therefore, accurate information of respondents is necessary. Undercoverage is difficult to prevent because certain elements of the target population can easily be forgotten. It is even impossible to prevent when selection of suitable respondents is limited, which refers to self-selection bias (Shapiro, 2008). This in fact is the case since representative respondents that are not a member of Bureau Fris, will be excluded from the study.

To ensure a representative sample:

1. the sampling frame must be as complete as possible, with the knowledge that each point listed below has a nonzero chance of being selected for the sample,
2. representative individuals must be selected randomly within the sampling frame,
3. gathered respondents must meet the sampling frame (Davern, 2008).

The sampling frame that represents the population of interest of this research is:

- male and female respondents of Bureau Fris
- invitation through email
- 18 years or older
- non-educated - high-educated
- living in the Netherlands
- distributed over all Dutch provinces.

3.4 Questionnaire design

Constructing a questionnaire is the process in which the format and questions are designed. Primary requirements that must be met to design a questionnaire are: theoretical knowledge on the topic of research; setting up the research goal which has to be operationalizable; experience in writing questionnaires; and knowledge of the target population
A questionnaire generally consists of four main parts: a) an introduction, which introduces the research, b) instructions, containing the rules that must be followed by the respondents to answer questions correctly, c) the main body of a questionnaire, the actual questions and d) a word of thanks to the respondents for their collaboration (Trobia, 2008). A good quality of

questionnaire design is important since it is the major element of the survey that collects the required data. Data needs to be reliable and extern validity must be high to be representative for the population the research is meant to represent. This can be achieved by reducing the total amount of measurement errors in a questionnaire. Errors in questionnaires are a result of variance and bias. The way of question wording, structuring and formatting is important in minimizing these errors Also, the interviewer, the respondent and the mode of data collection influence variance and bias As a final point, questionnaires must be tested before they are emailed to the respondents. Several question testing methods are available and increase the quality of the questionnaire (Holyk, 2008).

3.5 Question structure and format

The format of the questionnaire should contain an intuitive and logical flow and has to be easy to understand, with a corresponding lay-out of questions and response categories. Space between questions must be clear and equal to provide visual distinction from one to another. To distinguee the questions, questions could have their own progressive number or identification code. The structure of the questionnaire must be chronologically and logical, for instance, questions on related topics should be grouped together. Big bodied questions should appear early. This can reduce the influence of respondent fatigue on motivation and prevents early withdrawal The design of a questionnaire has the following order: first general and neutral questions should be asked, then questions that require greater effort, next sensitive questions (concerning money or religion) follow, finishing with demographic questions (Trobia, 2008). Nevertheless, questionnaire designs may have multiple shapes. The researcher decides which form fits best to reach the goal. Another important element is the questionnaire length. This element again influences the respondent fatigue on motivation which leads to early withdrawal as refusal rates increase with the length of questionnaire (Holyk, 2008).

3.6 Question wording

Each question included in the questionnaire, should provide useful information related to the research question and the goal of the research. Useful information can be collected by items or questions, that guarantee reliability and validity. Reliability reflects the consistency of a question and is high when similarity is seen in interpretations and responses over repeated trials. Validity of questions can be supported by clearly reflecting the underlying construct of interest (. These aspects can be achieved by a good quality of question wording. The terminology of constructed questions should be clear, and structure should be simple. Open-ended and closed-ended questions can both be used in a survey. Open-ended questions leave the respondents free to answer in their own words and results often in more detailed and informative responses (Holyk, 2008). Though, analyzing the answers may be difficult and expensive since it takes a lot of time. On the other hand, closed-ended questions can be analyzed immediately (Trobia, 2008). Extra attention must then be given to providing relevant response alternatives.

3.7 Response alternatives

Closed-ended questions can best be used within self-administered questionnaires because response alternatives avoid the greater subjectivity and volatility as seen with open-ended questions However, the construction of alternatives must be done properly to prevent bias by framing, which refers to manufacturing a particular response, or by predetermining what

answer is considered to be desirable Therefore, response alternatives must be exhaustive and mutually exclusive (Holyk, 2008; Trobia, 2008). Mutually exclusive means that no response alternative will overlap in conceptual meaning (Lavrakas, 2008). Being exhaustive states that every response should be a logical and possible answers to the question (Lavrakas, 2008). In some situations, it is good to present a ''don't know'' alternative. This occurs when questionnaires contain unfamiliar topics in which the possibility exists that respondents have no knowledge on, and thus truly may have no opinion about the topic (Holyk, 2008).

3.8 Question testing methods

Verification of the survey being well understood and that it doesn't yield to obvious bias effects, will increase the quality of the survey (Holyk, 2008; Trobia, 2008). Different question testing methods can be used to detect problems, these are: expert panels, traditional interviewer debriefing, behavior coding, cognitive interviewing, focus groups, and split-half experiments (Holyk, 2008).

As previous stated, many elements can influence the quality of a questionnaire. Designing the questionnaire carefully, will reduce the chance of error of each element.

The applied questionnaire was composed by a collaboration between Bureau Fris, IRAS and Romy Röring. The firm 'Bureau Fris', is a recognized research company. It conducts professional research by different modes commissioned by other companies.
Bureau Fris has given advise on the structure, format and wording of the questionnaire. They provided the lay-out and program in which the questionnaire was made. Also, they delivered an expert panel to pretest the questionnaire. This was combined with a focus group which were asked to test and criticize the survey. IRAS-VPH staff has given advise on the content of the questions. The actual questionnaire can be found in the annex of this report.

3.9 Data collection

When the survey has been tested it is administered to the respondents. Surveys can be administrated in many ways. The modes of administration are: face-to-face, telephone, or via computers (using the internet) (Trobia, 2008). In this research the survey has been administrated through internet. This made it is possible to reach a big population at relatively low costs. Computerized self-administered questionnaires (CSAQ) allow respondents to complete the survey without human assistance (Horner, 2008). Also, it provides a way to gather sensitive information (spending more money on higher quality meat yes or no), which in other modes might not have been given. Thereby, data entry errors are minimized and time is spared since the data is directly entered in a database. Limitation of CSAQ are, as mentioned before, overcoverage and undercoverage which decreases the ability to represent the general population. Another limitation that cannot be controlled is the nonresponse error, as email requests for survey participation it can easily be rejected or ignored (Horner, 2008). Internet surveys are also more often rejected because they may pose confidentiality issues to people (Horner, 2008).

To increase the reliability of collected data, these five steps are important:

1. define the total population you want to investigate: 17.080.000 (Centraal Bureau voor Satistiek, 2018b)
2. decide the level of accuracy (margin of error and confidence interval)

3. calculate the sample size you will need, to achieve the research goal
4. calculate the response rate or nonresponse rate (only 10%-15% will complete the survey)
5. send out the total number of surveys that are necessary to achieve the sample size/goal ("Bereken de steekproefgrootte | SurveyMonkey," n.d.)

The sample size has been calculated by the sample size calculator of SurveyMonkey ("Bereken de steekproefgrootte | SurveyMonkey," n.d.). With a confidence interval of 95%, a margin of error of 5% and a population size of 17.080.000 people, the sample size has come to 385 respondents.

By conducting the questionnaire through the professional research company 'Bureau Fris', an attempt was made to keep the non-responsive error to a minimum. Though many members did not respond or dropped the survey. It must be noted that Bureau Fris normally does not provide quantitative research, but only qualitative studies. This could have caused distrust among members. In total 458 Dutch citizens, from different social and demographic categories, as desired by the sampling frame, were approached to conduct the survey. 50 of the 458 invitations were not received because of outdated email addresses (undercoverage error). To increase the number of respondents, extra attention was asked for this research, by publishing the survey on Facebook. By this action the sample frame and random selection was lost, which resulted in a sample not being representative for the population. In total 439 representative respondents participated with 78 respondents on behalf of Bureau Fris and 361 respondents on behalf of Romy Röring. Table 1 shows the differences between the sample population and the Dutch population, from what can be concluded that the sample population is not representative for the whole population.

Table 1. Comparison of sample population and Dutch population *(Centraal Bureau voor Satistiek, 2018b; Voedingscentrum, n.d.)*

	SAMPLE POPULATION N = 429	SAMPLE POPULATION (%)	REPRESENTATIVE POPULATION (N = 17.181.000)
GENDER			
FEMALE	300	70%	52,1%
MALE	129	30%	47,9%
LEVEL OF EDUCATION			
NO EDUCATION	16	3,7%	10%
LOW LEVEL OF EDUCATION (MBO)	69	16,1%	60%
HIGH LEVEL OF EDUCATION (HBO OR WO)	344	80,2%	30%
EATING MEAT			
YES	266	62%	-
NO	54	12,7%	-
SOMETIMES	109	25,3%	55%
PLACE OF RESIDENCE			
CONURBATION OF WESTERN HOLLAND	290	67,6%	47,8%
RURAL AREA	139	32,4%	52,3%

4 Research findings and specific outcomes

4.1 Data analysis

For each question the results were analyzed in terms of numbers or percentage of the sample population to get a first impression of the distribution of the answers. Thereupon the results were individually analyzed to see if there was a significant difference of choices made by the difference of sex, level of education, the frequency of eating meat or residence (rural or conurbation). These classified variables were systematically cross-analyzed with the responses of all the question to find significant differences. SPSS Statistics software was used to analyze answers. To facilitate the statistical tests, people with no education and low educated people were merged together as one variable, named ''low educated people''. This was also applied, in most tests but not all, with people that do not eat meat or eat meat sometimes, named ''sometimes/no''.

This report tackles the following themes in subsequent order:

1. Animal welfare and farm animals: knowledge and perceived importance
2. Knowledge on transports of live animals, perceived importance on their welfare and the regulation of welfare of pigs on transport
3. Transport and quality of meat
4. Pork of transported pigs
5. Information and education on transporting live animals

The report is displayed in the following order:

1. *Key finding(s*) of the distribution of a question.
2. Analysis of the results
3. Sociodemographic analysis with significant differences

The significant differences within the socio-demographic analyzes are displayed in histograms comparing the means of the classified independent variables. These histograms can be found in the annex of the report to facilitate the ease of reading.

1 Animal welfare and farm animals: knowledge and perceived importance

The purpose of the first part of the survey is to better understand the relationship between citizens and farm animals and they specify what constitutes animal welfare.

1.1 General understanding of animal welfare.

The majority of the Dutch respondents refers to animal welfare as proposed and defined by the Brambell Committee.

The first question aims to determine the general understanding of animal welfare. The charter bars are virtually distributed nearly equal. Though, the leading answers are ''It refers to animals having enough water and feed and an adequate housing condition'' and ''It refers to animals being able to express their natural behavior'' both referring to the five freedoms proposed by the Brambell Committee. These propositions score the highest within good and excellent (both sum 86%). The other statements score lower in the sum of good and excellent. ''It can be achieved by animal protection'' and ''It refers to the duty to respect all animals'' score a sum of 71%. Followed by ''It contributes to better quality of animal products'' with 63%. ''It concerns the way animals are treated'' scores 60% of what Dutch people find a good or excellent description of animal welfare (Figure 4).

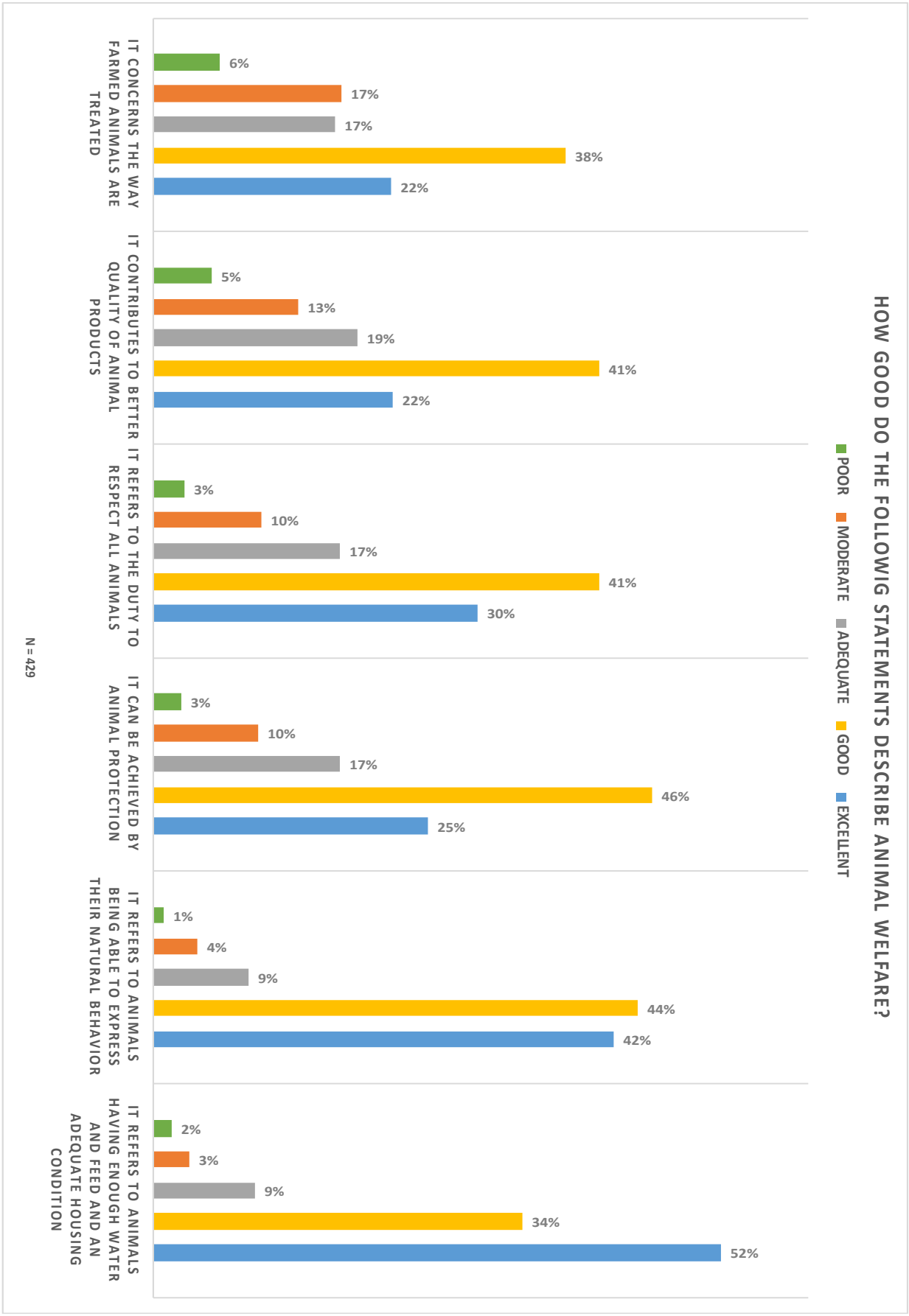

Figure 4. Value proposition of six statements (poor – excellent) that describe animal welfare

A socio demographic analysis shows a statistical difference between men and women in describing animal welfare as "It refers to animals as being able to express their natural behavior". Women score significantly higher on this answer than men (Figure 19).
Also, a significant difference exists between the level of education: people with no education and low educated people (merged together as low education, as earlier explained) appear to find this proposition more correct compared to high educated people (Figure 20).

1.2 General opinion on provided information about farm animals and their welfare.

The majority of the Dutch respondents have negative thoughts on the information of welfare of farm animals.

Respondents were asked for their opinion on the value of information that is given, describing welfare of farm animals. Only a very small proportion (2%) consider the information on welfare as excellent. Followed by a percentage of 11% that find the provided information good. 23% score adequate on the given information. An absolute majority of the sample population (48%) are of the view that the provided information is moderate and 17% score the provided information as poor (fFigure 5).

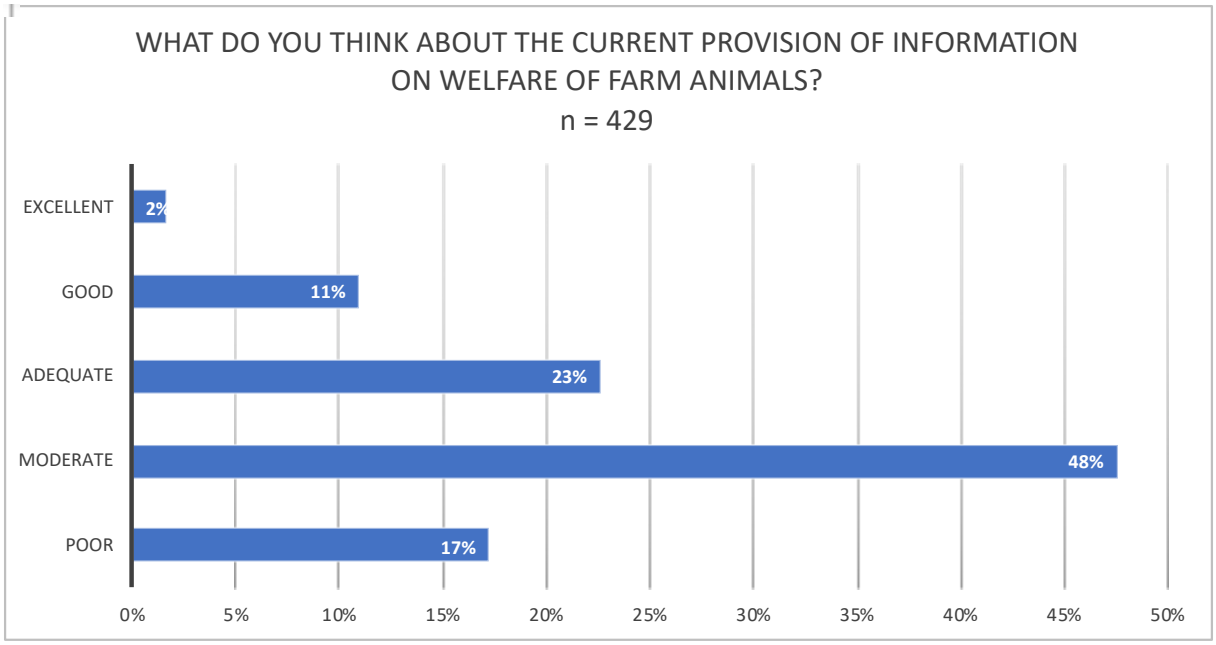

Figure 5. Value proposition (poor – excellent) of the current provision of information about welfare of farm animals

On socio demographic level it appears that people who eat meat (fFigure 21) or are living in rural areas (Figure 22) find the provided information on animal welfare of farm animals significant better than people that do not or sometimes eat meat or that are living in the conurbation of the Western of Holland.

1.3 General opinion on the objectivity of information describing welfare of farm animals.

More than half of the Dutch respondents think information on animal welfare is not objective.

Respondents were asked to consider whether they think information on animal welfare of farm animals is objective. More than half of the respondents (52%) indicate that the current information is not objective. 34% indicate they do not know whether the information is objective or not and 14% do find the information objective (Figure 6).

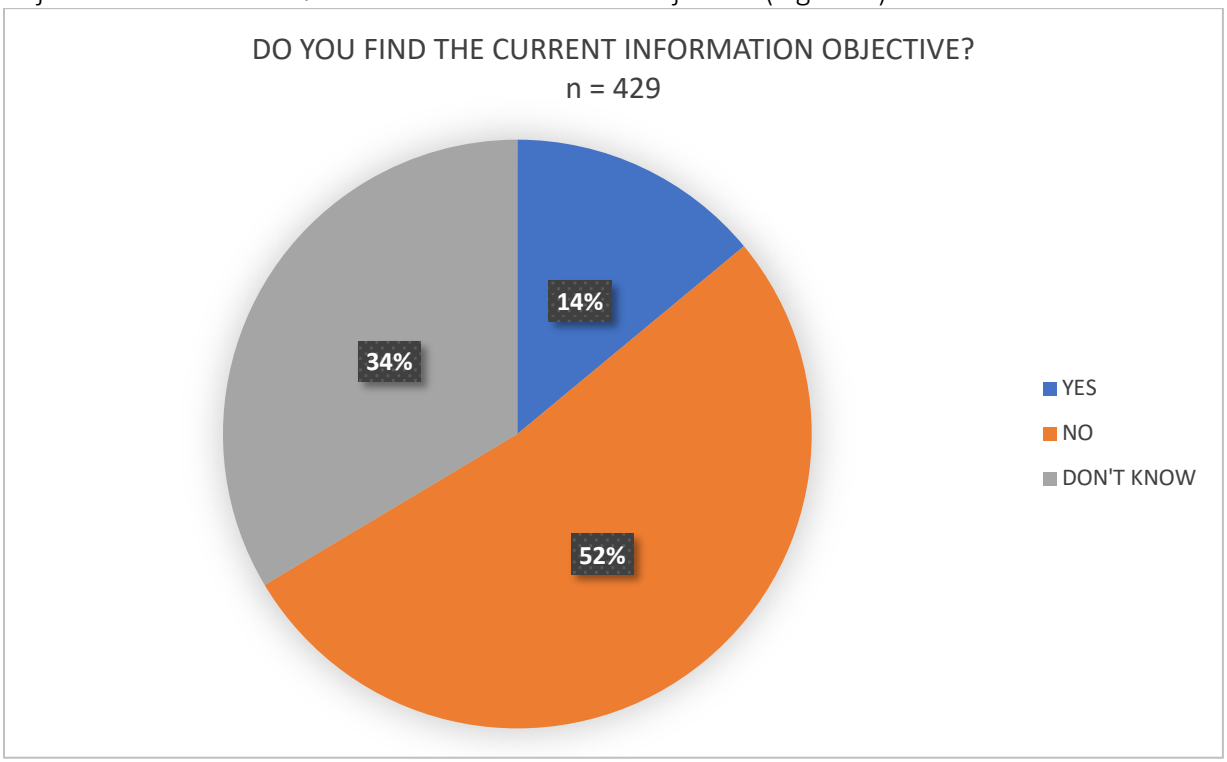

Figure 6. Pie chart of the sample population displayed in percentages on the question whether they find the current information about animal welfare of farm animals objective

Several differences can be observed on socio demographic level. It appears that women are more likely to find the information not objective (56% compared to 45%, see Table 3) and score significantly higher on this answer.
Respondents that do find the information objective are more likely to eat meat (Figure 23) or being low educated (Figure 24).

1.4 General knowledge of Dutch citizens about the meat consumption in the European Union.

More than half of the Dutch respondents think chicken is the most consumed meat by people living in the EU.

Five options were presented to the respondents from which they had to choose of what they think is the most consumed meat by people living in the EU. This question aims to determine their general knowledge on the meat consumption. More than half (51%) of the sample population think that chicken is the most consumed meat, whilst 30% consider pork to be the most frequent eaten meat. A proportion of 19% indicate beef as most consumed. Mutton and horse meat score both zero (Figure 7).

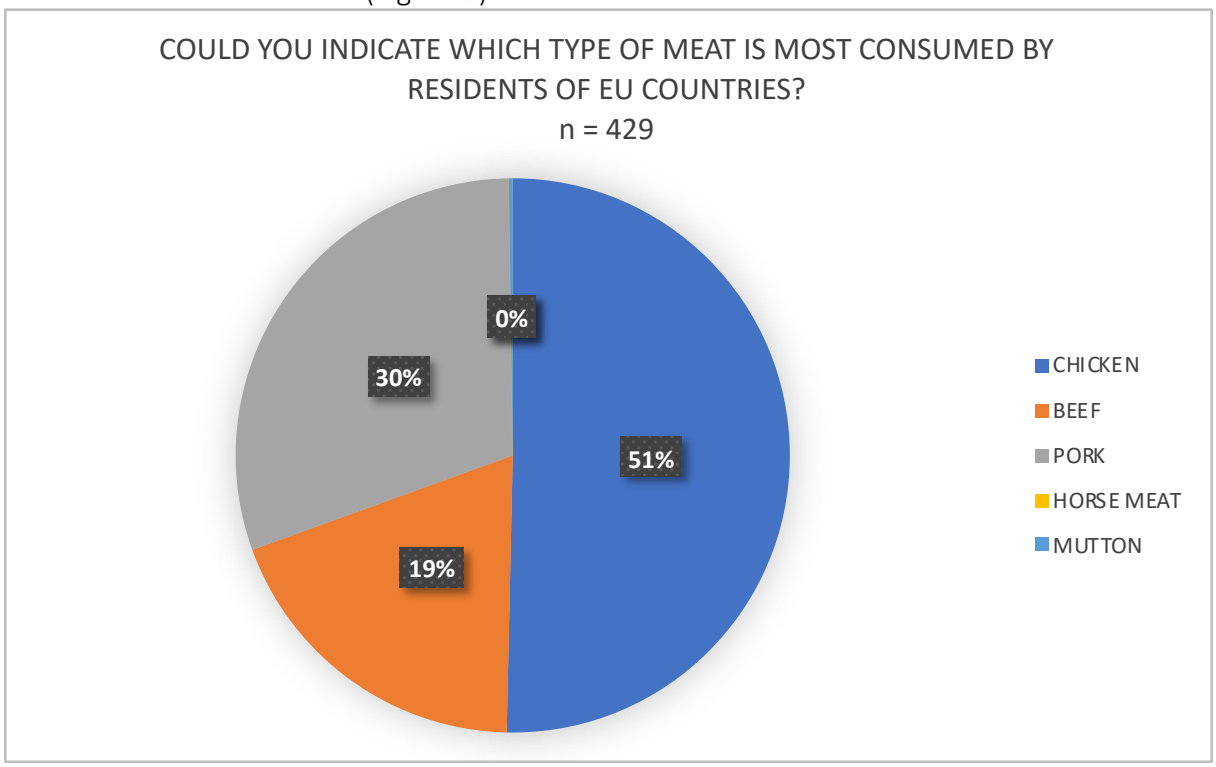

Figure 7. Pie chart of the sample population displayed in percentages on the question which type of meat is most consumed by residents of EU countries

A socio demographic analysis of the results reveals that there is a significant difference between people who eat meat and people who do it sometimes or not at all, that chose chicken to be the most consumed meat in the Netherlands (Figure 25).

2 Knowledge on transports of live animals, perceived importance on their welfare and the regulation of welfare of pigs on transport

The purpose of the second part of the survey is to gain information about the knowledge of the sample population on long distance transports of live animals. Also, the opinion is asked about maximum transport times, how important respondents find the welfare of transported pigs and what operation should be the best to regulate this welfare.

2.1 General knowledge on long distance transport of animals.

The majority of the Dutch respondents indicate to know about long distance transport of live pigs.

Respondents were asked about pigs on long distance transport, to investigate their knowledge on this phenomenon. The majority (65%) of the sample population denote to know about long distance transport. A quarter indicate to not know about transport of live pigs and 10% has heard of it but does not know exactly what it means Figure 8).

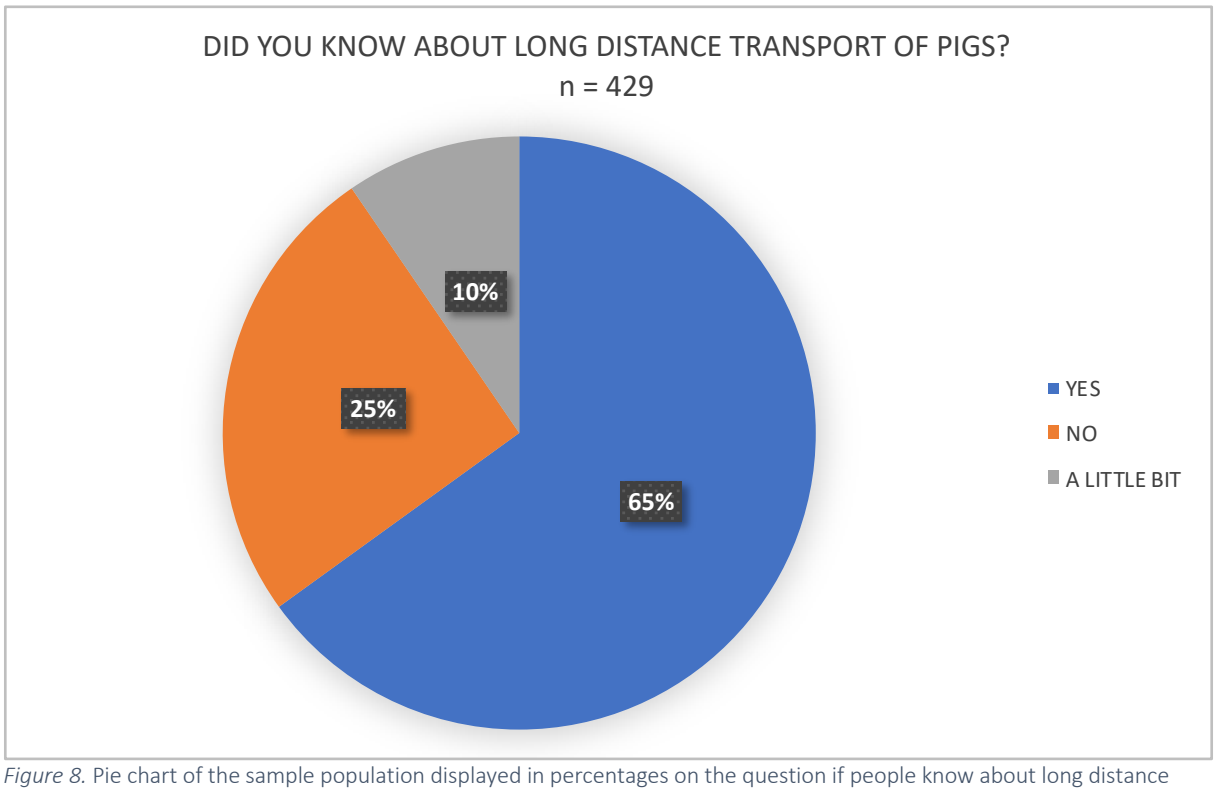

Figure 8. Pie chart of the sample population displayed in percentages on the question if people know about long distance transport of live pigs

A socio demographic analysis shows significant differences between the classified variables of eating meat, sex and residence:

- people who are eating meat score significantly higher on ''YES'' than people that eat do not or sometimes eat meat (Figure 26);
- men score significantly higher on ''YES'' than women and (Figure 27);
- people that live in rural areas score significantly higher on ''YES'' than people living the conurbation in Western Holland (Figure 28).

2.2 General opinion on the maximum transport time of live pigs.

Overall, respondents are divided on the statements whether the maximum transport time of live pigs should be eight hours or shorter and that live pigs should not be transported at all.

People were asked for their opinion on the maximum transport time for live pig. Almost half of the sample population thinks pigs should not be transported longer than eight hours (=<8). Slightly less citizens think live pigs should not be transported at all. And 11% believe that pigs can be transported for eight hours or longer (=>8)Figure 9.

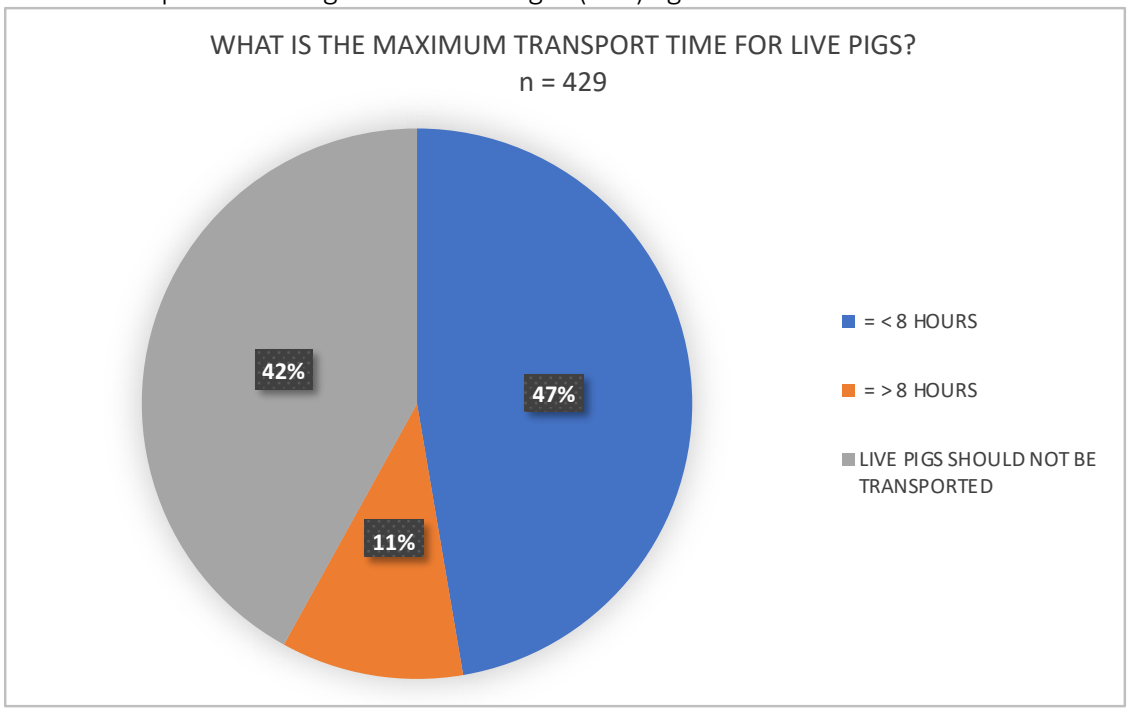

Figure 9. Pie chart of the sample population displayed in percentages viewing of what people think is the maximum transport time for live pigs

At socio demographic level many differences were revealed:

- people eating meat score significantly higher on the proposition of transporting pigs eight hours or longer, than people that eat meat sometimes or not at all (Figure 29);
- also, man score significant higher on this answer than women (Figure 30);
- as well do people living in rural areas compared to the people living in the conurbation of Western Holland (Figure 31).
- On the other hand, women score significant higher on the statement where no pig should be transported, compared to men (Figure 32);
- but also the people that sometimes eat meat or not at all score higher on this statement compared to people eating meat (Figure 33).

2.3 General opinion about the death rate of transported pigs.

The large majority of the Dutch respondents indicate that not a single pig should die during transport.

Respondents were explained that some pigs may die due to transporting the animals. The population was asked of what they think that should be the maximum number of pigs to die on transport. Overall the respondents (72%) think no pig should die on transport. Secondly with 19%, people choose for the answer whereof 1 in 3000 pigs may die. Only 6% believes that 1 in 400 pigs may die and 3% that 1 in 200 pigs may die (Figure 10).

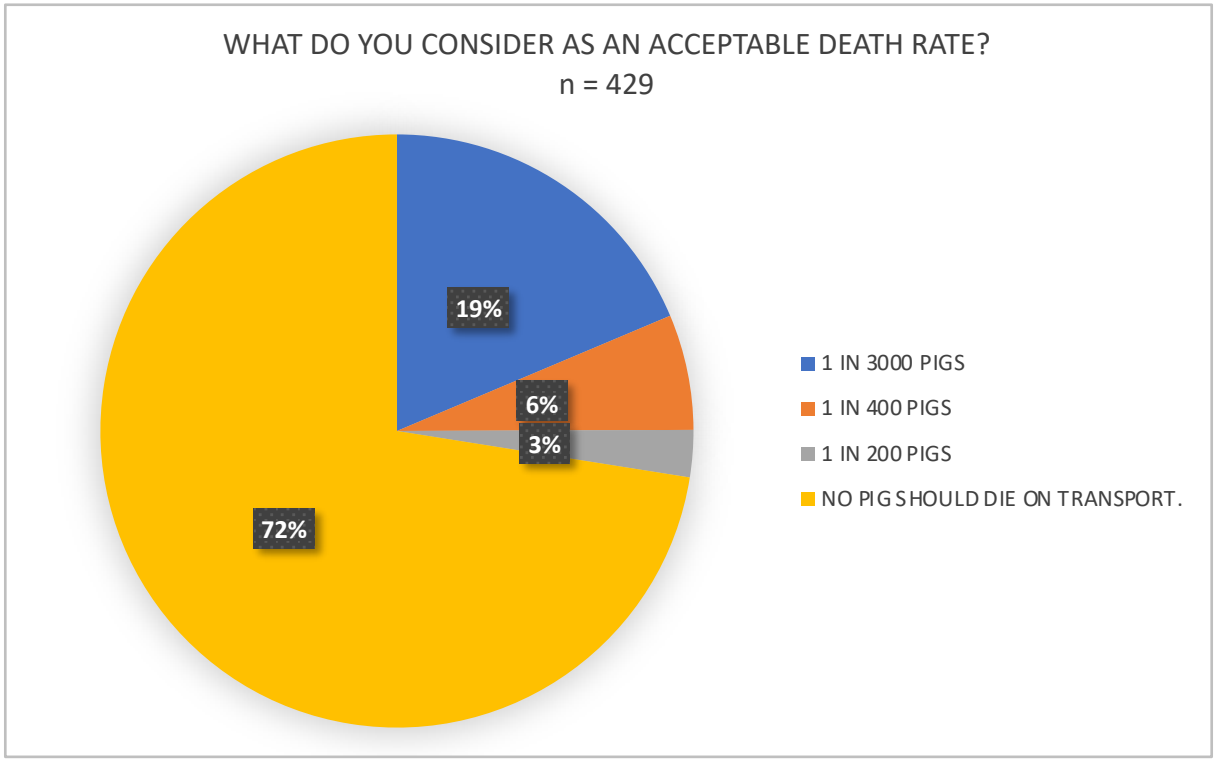

Figure 10. Pie chart of the sample population displayed in percentages viewing of what people think is an acceptable death rate due to transport

A socio-demographic analysis reveals that:

- ''No pig should die on transport'' is chosen significantly more by women than by men (Figure 34);
- and people who eat meat sometimes or not at all, pick this answer significantly more often than people eating meat (Figure 35).
- The option that states that ''1 in 3000 pigs'' may die is picked more frequently by people who eat meat compared to people that eat meat sometimes or not at all (Figure 36);
- besides, men select this proposition more than women (Figure 37).
- ''1 in 200 pigs'' that may die on transport scores statistically higher by meat eating people than people who eat meat sometimes or not at all (see Figure 38);
- also, it has been selected more by low educated people than high educated people (see Figure 39);
- and by people living in rural areas compared to people living in the conurbation of Western Holland (see Figure 40).

2.4 General opinion on the best operation to guarantee animal welfare on transport.

Overall, the sample population is divided on whether animal welfare of transported animals should be protected by private businesses or by public authorities. The EU and the government are most frequently ranked as the best to do so.

Respondents were asked to consider what operation should be the best one to guarantee animal welfare on transport. Due to an error in the questionnaire, the respondents were not obligated to rank all options by order. Only the first position on the ranking list has been selected 429 times. In the first part of the bar chart you can see that the EU has picked the most (35%) as an answer to this question, followed by the government with 23%. Next people think that the transporter is important to guarantee welfare with (16%). Animal Welfare Organizations and vets follow with 12% and 10%. Retailers come in last with 4%.
On the second place the government ends highest with 41%. The other options are divided almost equally. On the sixth place the transporters score highest (25%) followed by retailers (22%), Animal Welfare Organizations (18%) and vets (17%). The EU and the government are picked least on sixth place with 8% and 0%. In Figure 11 the ranking results are shown.

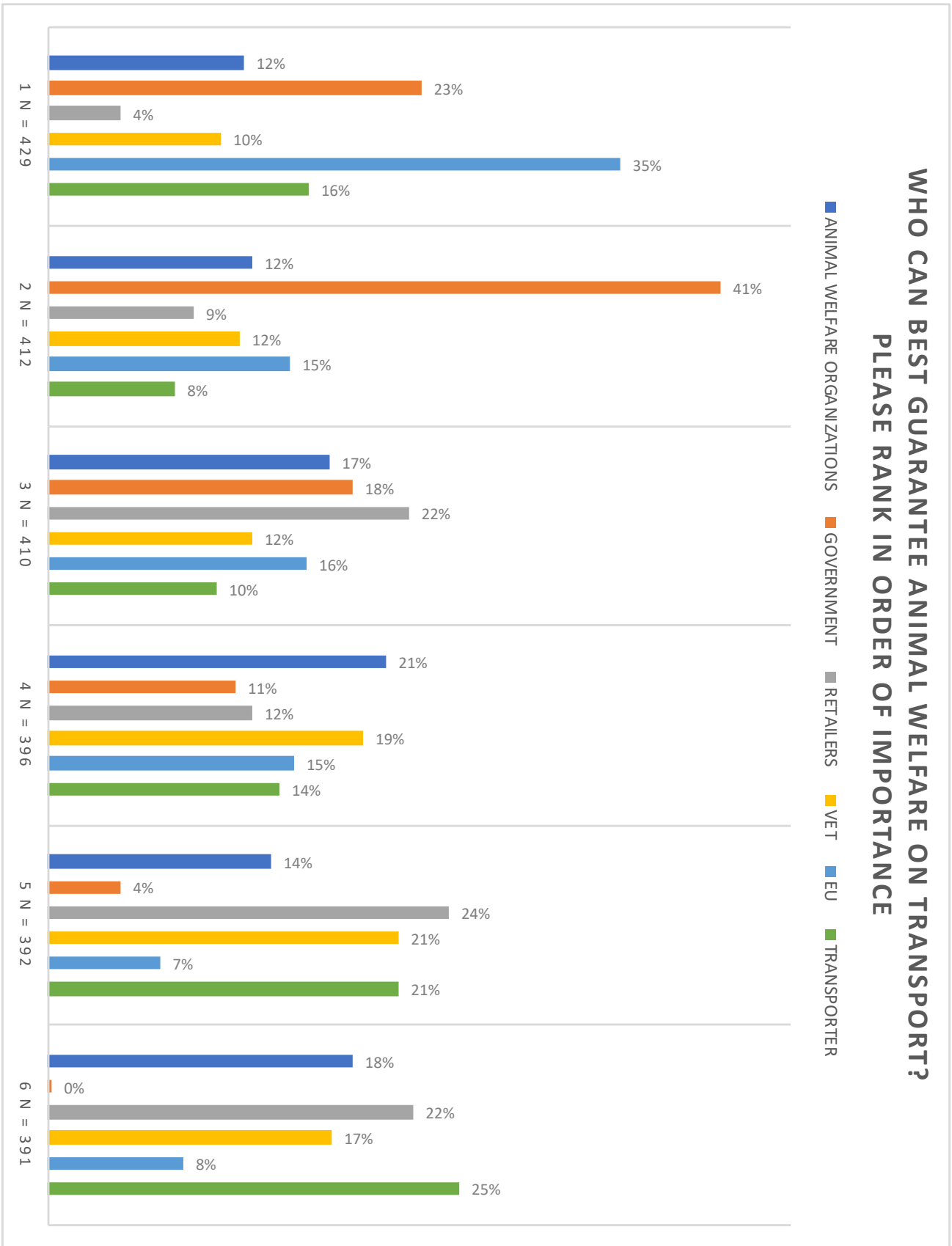

Figure 11. Ranking proposition of six operations that should guarantee animal welfare on transport (1 = best – 6 = worst)

Because of the error in the questionnaire, the respondents that did not rank all the answers, were removed (n = 391). The socio demographic analysis shows some significant difference per category. Visual displays of the means are left out to prevent confusion on the value since in this ranking question 1 is the highest value and 6 is the lowest value to an answer.

Animal Welfare Organizations:

- Low educated people rank Animal Welfare Organizations higher than high educated people.
- Respondents that eat meat, rank Animal Welfare Organization lower than people that eat meat sometimes or not at all.

Government:

- The government is more often chosen by women than by men.

Retailers:

- Retailer are more chosen by men than by women.

Vet:

- Vets are higher ranked by women than by men.
- Also, high educated people choose vets more often compared to low educated people.

EU: within the EU no significant differences were found.

Transporter:

- Transporters are more favorite by people living in rural areas than people that live in the conurbation of Western Holland.
- Thereby, transporters are more often chosen by people eating meat.

3 Transport and quality of meat

A further objective of this survey is to determine people's view on the quality of pork and to investigate if people think transport can influence this quality.

3.1 General opinion on the quality of pork.

Most respondents refer to quality of pork as it being safe to eat or the taste being good.

Respondents were asked which terms refer to the meaning of ''quality'' of pork, more answers were possible. Most people (n=339) selected that quality of meat means it is safe to eat. Meat tasting good comes second as the most selected answer (n = 308). Tenderness is less linked to quality (n = 156) and meat being appealing comes last as being a good description for quality (n = 120), see Figure 12.

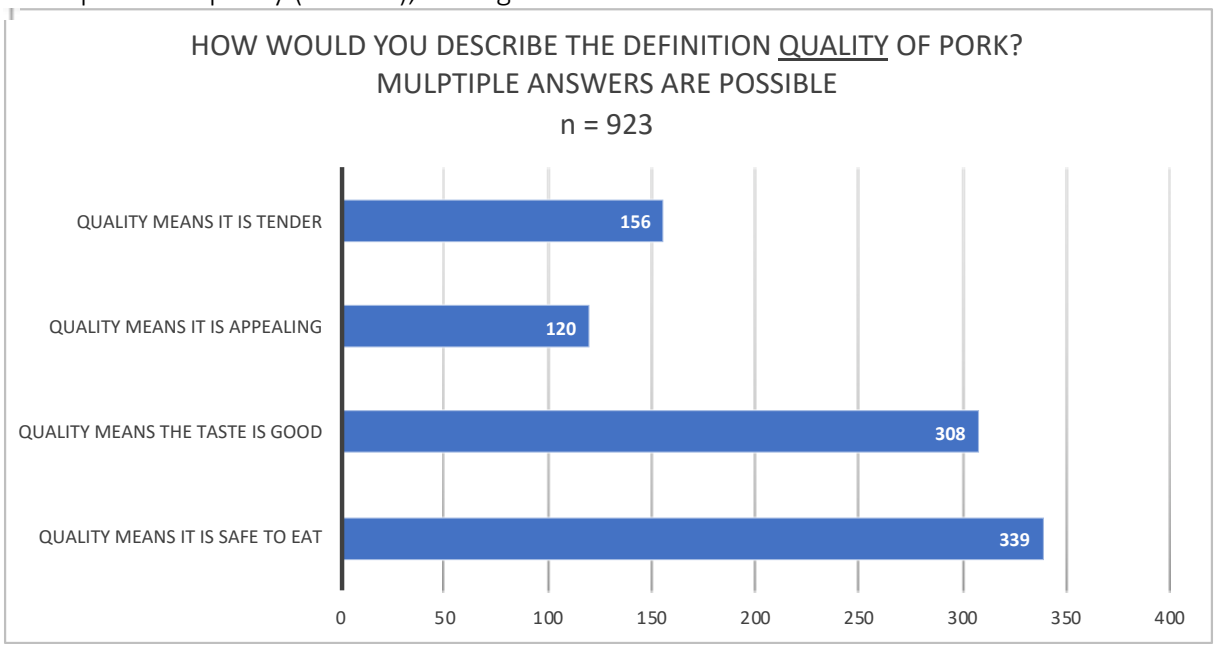

Figure 12. Terms that may refer to the definition of quality of meat

A socio demographic analysis shows no significant differences across eating meat, sex, level of education or residence for this question.

3.2 General knowledge about the influence of transport on the quality of meat.

The majority of the Dutch respondents indicate that the quality of pork is negatively influenced by long distance transport of the animals.

This question aims to determine people's ideas on the influence of different transport related aspects, on the quality of meat. The sample size population was asked if they think transport could negatively influence the quality of meat. A large part (64%) of the population indicates ''YES'' to this question. More than a quarter (27%) does not know what to answer to this question and only 9% thinks long distance transport does not have a negative influence on the quality of pork (fFigure 13).

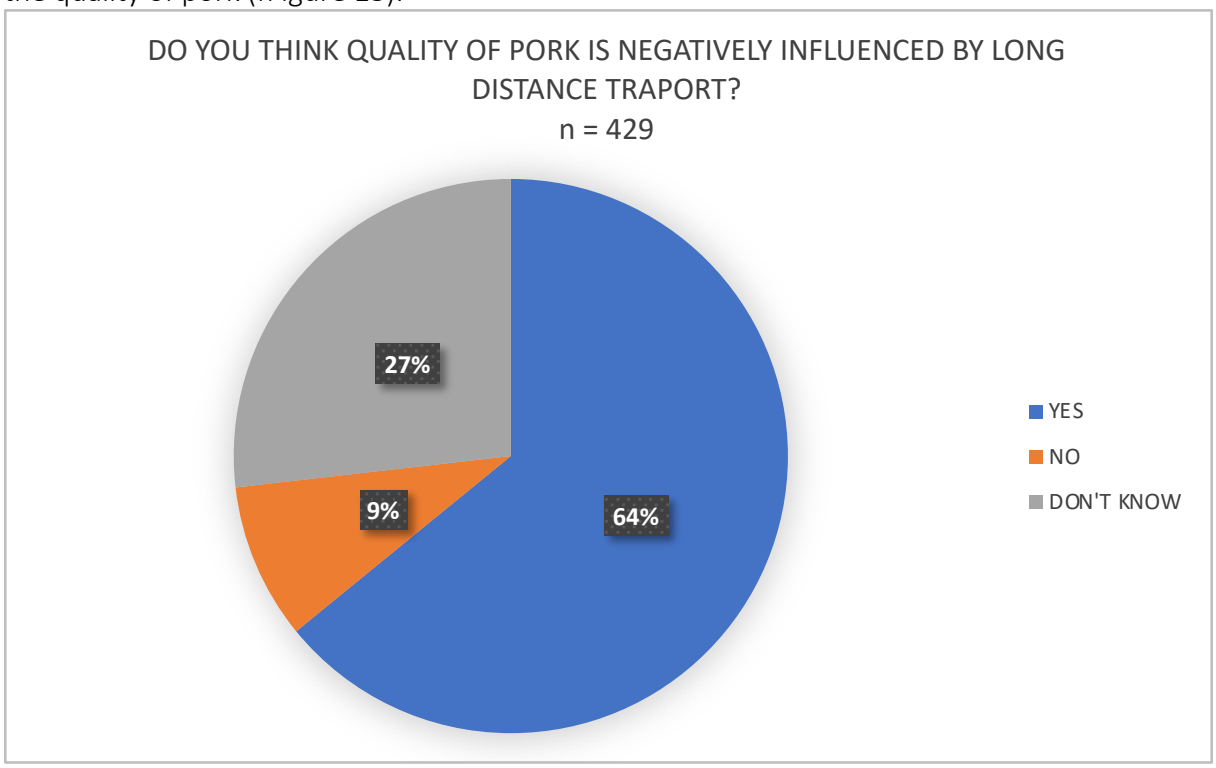

Figure 13. Pie chart of the sample population displayed in percentages viewing people's opinion on the influence of long distance transport on the quality of pork

At a socio demographic level, women score significantly higher thinking that transport can negatively influence the quality of pork (Figure 41). People living in the conurbation score significantly higher on the ''DON'T KNOW'' option then people living in rural areas (Figure 42). People living in rural areas think more often that transport does not negatively influence the quality of pork (Figure 43).

4 Pork of transported pigs

This part of the survey aims to understand whether people want to eat meat from pigs that are transported over long distances and their willingness to pay a premium for meat from pigs that were not transported over long distances. Also, it describes what people find the most important effect of reducing long distance transport of pigs.

4.1 General opinion on buying pork from long distance transported pigs.

The large majority of the Dutch respondents indicate not to buy pork from over long distance transported pigs.

This question aims to determine people's thoughts on purchasing meat from transported pigs. Respondents were asked if they would buy pork from over long distance transported pigs. Almost three quarters (74%) indicate that they would not buy this meat. 26% says they would buy pork from transported pigs (Figure 14).

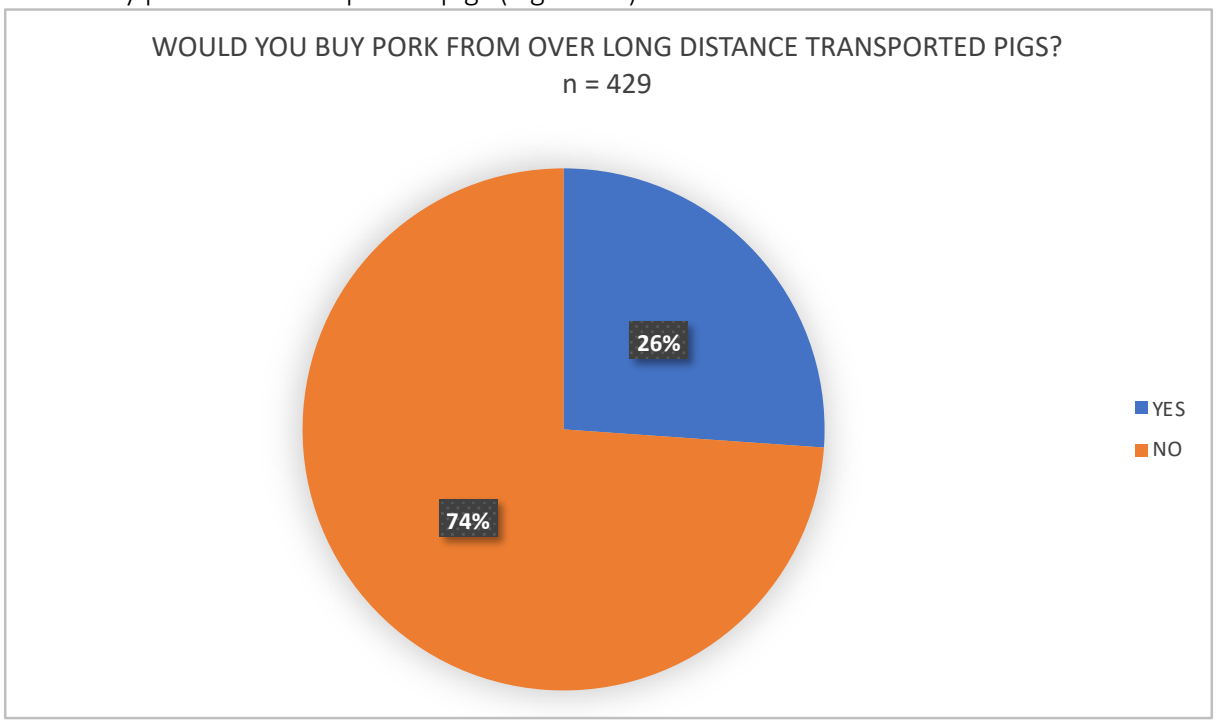

Figure 14. Pie chart of the sample population displayed in percentages viewing if people would by pork from over long distance transported pigs

Socio demographic analysis show that especially women would not buy pork from transported pigs (Figure 44). People eating meat sometimes or not at all score also significant higher on not buying this pork (Figure 45).

4.2 General opinion on paying more to stop long distance transport of pigs.

The large majority of the Dutch respondents would pay a premium to prevent pigs being transported over long distances.

Respondents were asked whether they would be willing to pay a premium for products to stop long distance transport of pigs. The absolute majority (83%) indicates that they would pay more to stop transport. Only 17% answers ''NO'', Figure 15).

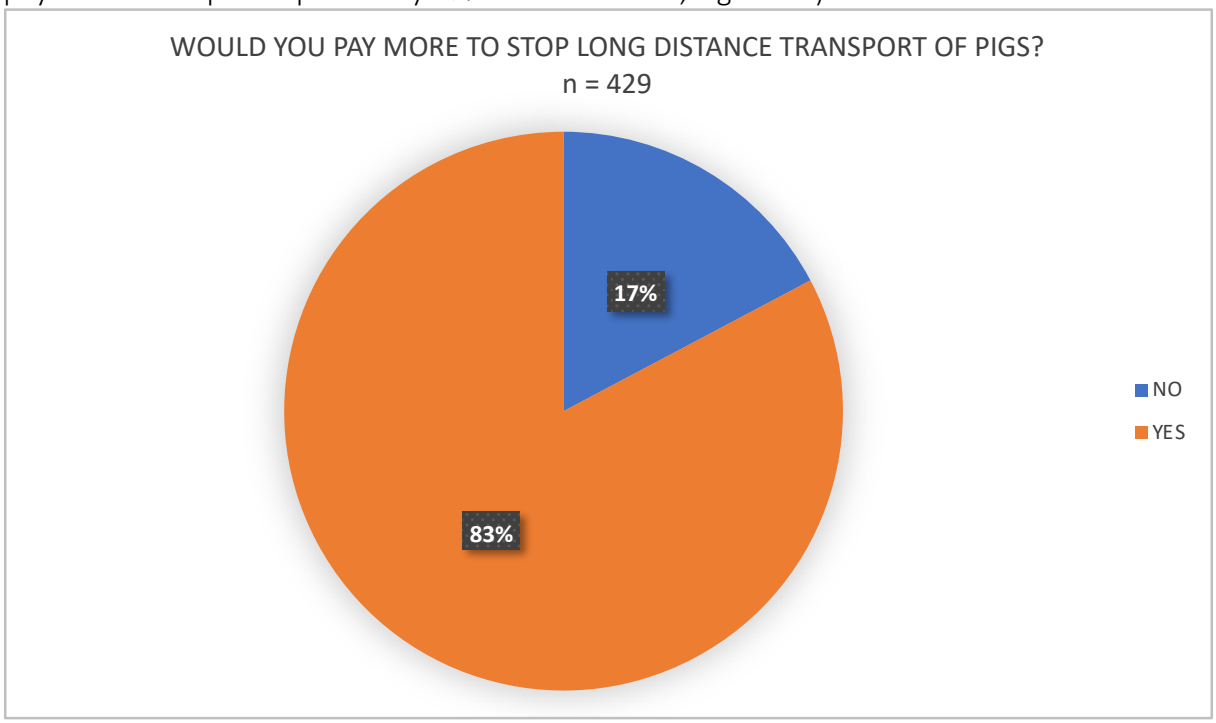

Figure 15. Pie chart of the sample population displayed in percentages viewing if people would pay more to stop long distance transport of pigs

Social demographic analysis reveals that:

- more women are willing to pay more to stop long distance transport compared to men (Figure 46);
- as well do higher educated people, that say significantly more ''YES'' to this question (Figure 47);
- likewise, people living in the conurbation (Figure 48).
- People eating meat are less willing to pay more (Figure 49).

4.3 General opinion on different results when reducing transports.

A big part of the Dutch respondents thinks that animal welfare being improved is an important result of the reduction of long distance transports of live animals.

This question aims to find out what people think that is the most important result of reducing transporting live animals. They had to rank four options. That animal welfare will improve when animal transport declines, is the most important effect according to 61% of the respondents. 17% find the outcome for climate the most important. Slightly less (14%)

selected the reduction of transmission of animal diseases. Only 7% find the consequences for the prices of pork the most important result. Unfortunately, this ranking question had the same error as question eight, which caused some respondents did not rank all options. In Figure 16, the ranking results are displayed.

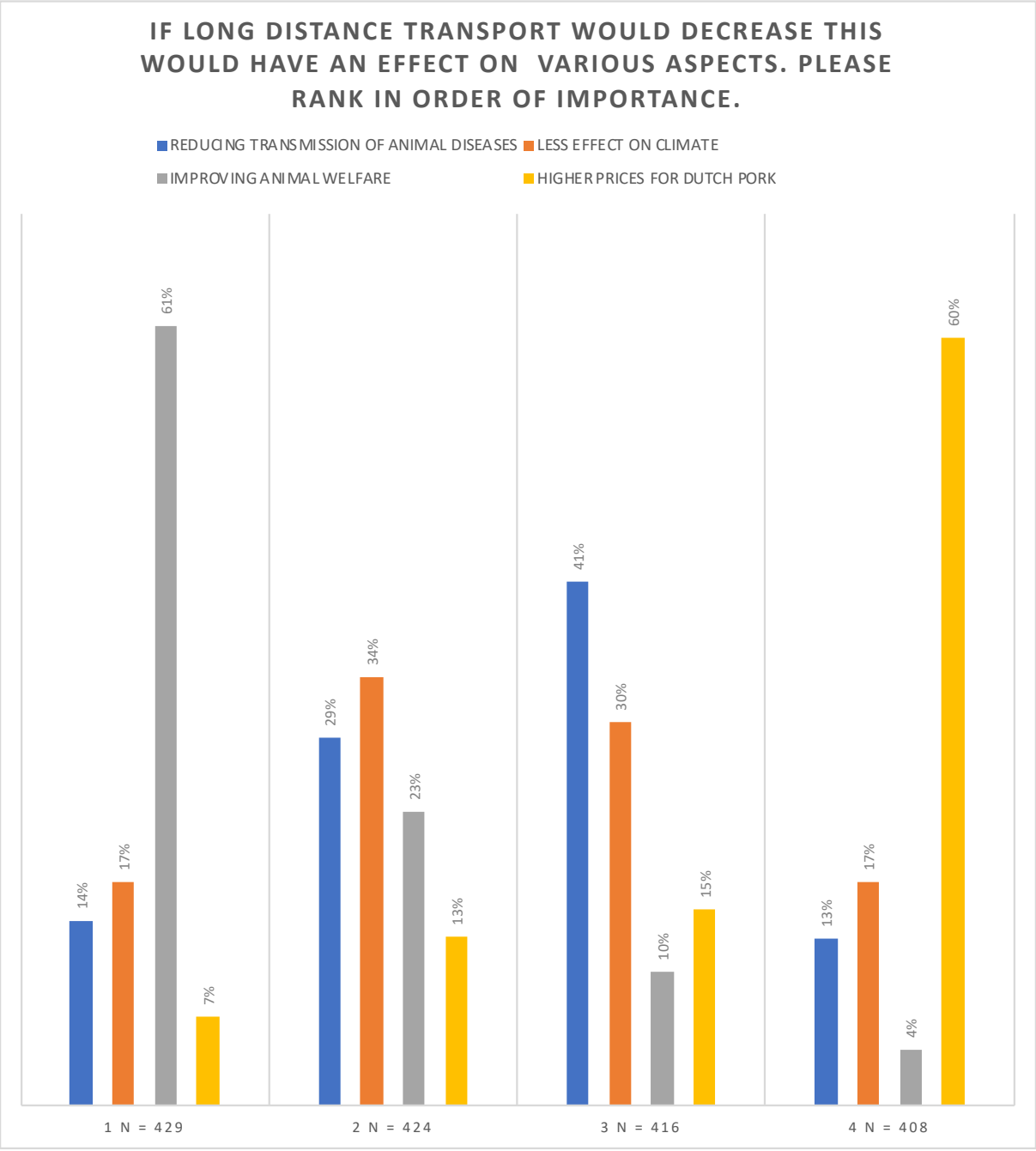

Figure 16. Ranking proposition of four results from decreasing animal transports (1 = most important – 4 = least important)

Because of the error in the questionnaire, the respondents that did not rank all the answers, were removed (n = 408). The socio demographic analysis shows some significant difference per category. Visual displays of the means are left out to prevent confusion on the value since in this ranking question 1 is the highest value and 4 is the lowest value to each answer.

Improving animal welfare:

- is higher ranked by people living in the conurbation of Western Holland.
- People who are eating meat, believe this statement to be less important than people who do not or sometimes eat meat.

Less effect on climate:

- is of more importance for people in the conurbation than people living in rural areas.

Reducing transmission of animal diseases:

- is more selected by people eating meat;
- and by people living in rural areas.

Higher prices for Dutch pork:

- is logically find more important by people that eat meat.

5 Information and education on transporting live animals

Finally, the last section of the survey is to assess the perceived importance on information and education about long distance transport of live animals.

5.1 General opinion on information about transported animals.

A majority of the Dutch respondents wishes to have more information on transported animals.

Respondents were asked if they think it is important to have more information about transported animals. More than half of the sample population answers this question with ''YES''. 41% does not need more information on this subject (Figure 17).

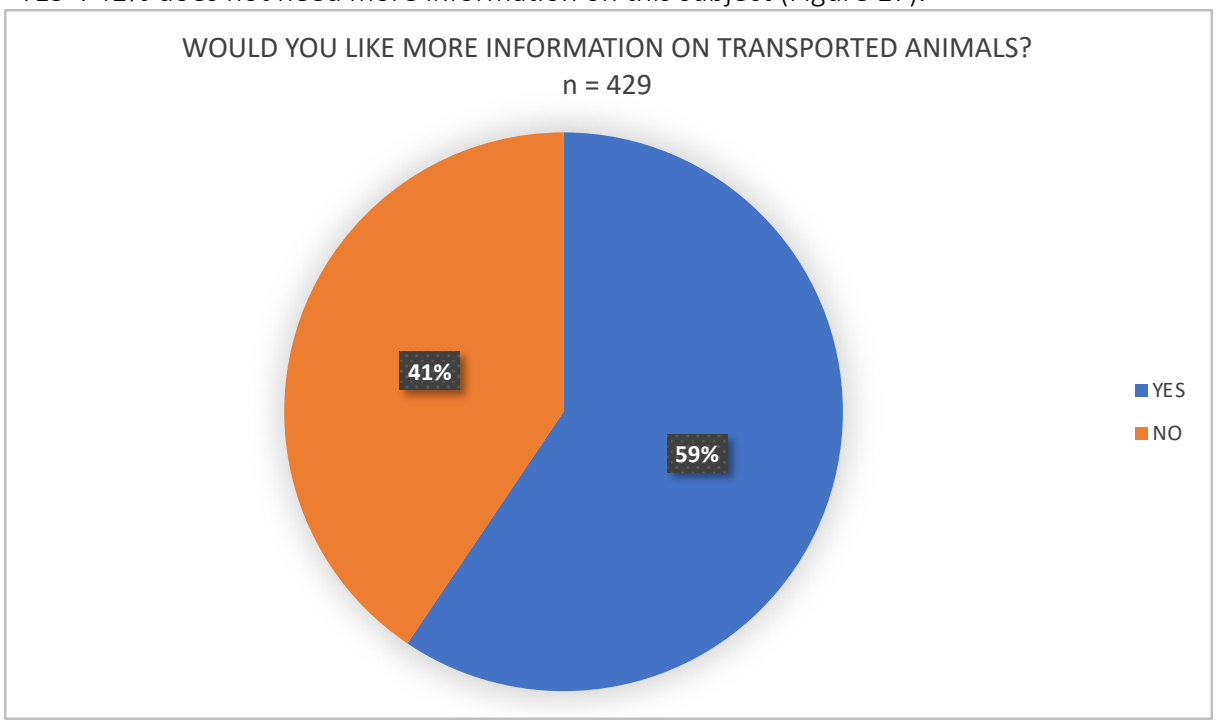

Figure 17. Pie chart of the sample population displayed in percentages viewing if people want to know more on transportation of live animals

Social demographic analysis reveals that:

- women score significantly higher on wanting to have more information about this subject, compared to men (Figure 50).
- People eating meat score lower in their demand for more information (Figure 51);
- just as people living in rural areas (Figure 52).

5.2 General opinion on the most suitable operation to provide this information (referring to question 14).

Most people think Animal Welfare Organizations are the best operation to provide more education on transported animals.

This question aims to find out which operation should be best to educate people about circumstances of transported animals, according to the sample population. More answers

were possible, but the most selected answer is Animal Welfare Organizations with n = 259. National Stations has been chosen as the second-best operation to provide information. The Animal Protection Service has scored the third place, followed by retailers. The vets score the lowest position in this question (Figure 18).

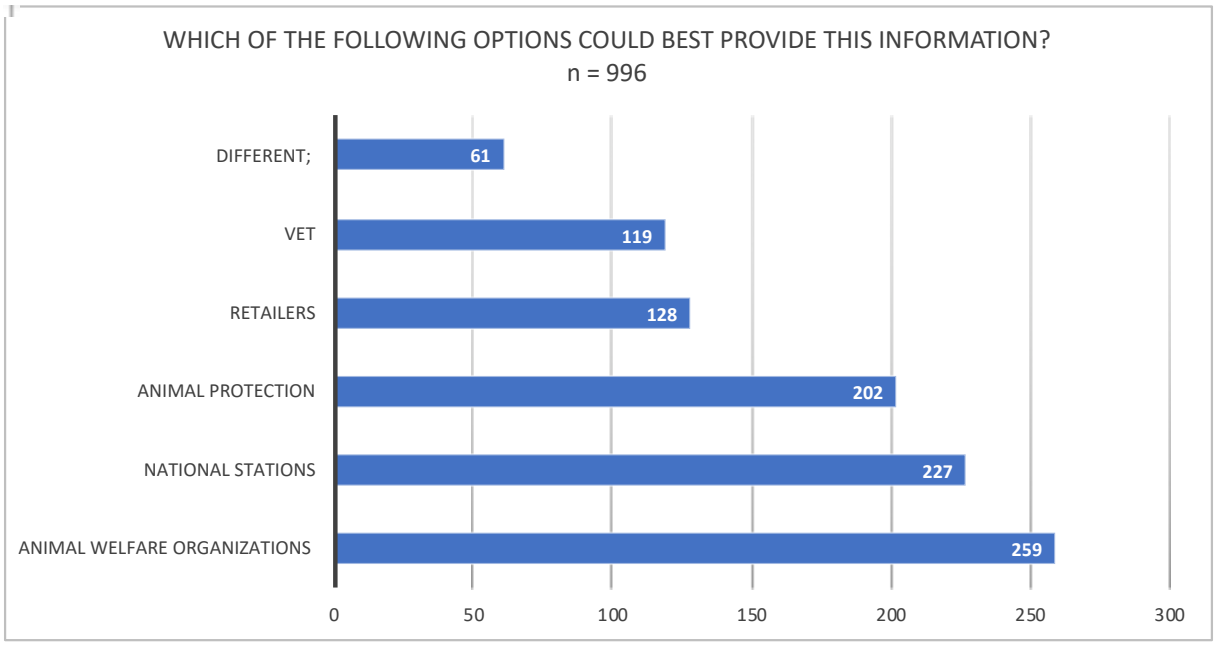

Figure 18. Most suitable operation to educate people on transporting live animals

61 people filled in ''DIFFERENT'' from what 57 people gave other options (Table 2).

Table 2. Alternatives administered by respondents that did not find a suitable answer between the offered options to provide information on transporting live animals.

DIFFERENT:	
GOVERNMENT	34
INDEPENDANT PARTY	6
EU	4
MEDIA	3
CONSUMER	2
FARMER	2
RETAILERS	2
VET	2
ANIMAL WELFARE ORGANIZATION	1
IT IS NOT POSSIBLE	1
TOTAL	**57**

The socio demographic analysis shows some significant difference per category.
Animal Welfare Organization has been picked the most. Low educated people choose this option significant more than high educated people. Also, women selected this answer more than men. People that eat meat sometimes or not at all did too pick this option more often compared with people eating meat (Figure 53).

The second option for the most suitable operation, National Stations, also contains significant differences between the independent variables. Again, a significant difference exists between women and men. The people in the conurbation selected National Stations more than people living in rural areas. Thereby, high educated people think of national stations as a good operation to provide information on transported animals, just as people that eat meat sometimes or not at all (Figure 54).

The Animal protection Service option showed a significant difference between low educated a high educated people (Figure 55).

Retailers score higher within people living in the conurbation compared to people living in rural areas (Figure 56).

Finally, vets are more selected by women than by men (Figure 57).

6 Conclusion

Within the EU yearly millions of animals are transported over long distances. The Netherlands is the second largest agricultural exporter in the world whereof live animals and meat are the second most important commodities. As live animals are defined as commodity, they are often subjected to a constant drive for reducing costs. Under these circumstances, animal welfare is often not taken into consideration.

Since pork is the most popular meat product within the EU (respondents thought chicken to be the most consumed within the EU), almost all Dutch pigs exports are destined to one of the 28 EU Member States. These transportation processes are stressful and expose pigs to different challenges. Research demonstrated that a multifactorial approach is needed in order to guarantee animal welfare on transport. It appeared that many factors interact with the duration of transport. This causes journey time to be the main and easiest variable to control and reduce transport stress. It can be concluded that it is not journey duration per se affecting animal welfare, but the quality of the associated effects.

The current EU Regulation (EC) 1/2005 aims to protect animals' welfare on transport. Partly by limiting transport duration of animals to eight hours, this is believed to be an acceptable journey time among the majority (47%) of the sample population. The regulation also demands minimum standards for animals on transport. Unfortunately, some Member States have been insufficient in meeting this legislation and failed in the protection of animals on transport. This may harm the trust of the population towards the EU and governmental institutions, since these public authorities are perceived as capable to protect animal welfare. It is not only in conflict with the transport regulation but also with the five freedoms and therefore an infringement on animal welfare according to 86% of the sample population. Due to the insufficient enforcement and a lack of inspections and effective penalties, serious breaches of welfare were recorded. This has caused great controversy about the action of shipping live animals to other countries, supported by the observation that 42% of the sample population disagree with transporting pigs at all, and that 61% indicated to find it important that a reduction of transports will benefit the welfare of animals. The fact that transporting live pigs is a minor proportion of the overall trade, is also a strong argument for replacing it.

Several alternatives have been suggested to reduce or replace live animal transport which is encouraged by 64% of the sample population that believe transporting animals affects the quality of pork. Alternative strategies are: economical viable and local slaughter facilities; on farm slaughter; replacing the transport of breeding animals by semen and embryos; and transportation of carcasses and meat. In many cases transport of carcasses is easier and cheaper than transporting live animals. Not only would carcass trade benefit the welfare of pigs, but it would also reduce the transmission rate of highly contagious animal diseases. Moreover, the quality of pork safety would increase which is of great importance among a subpopulation of the Dutch citizens as they point out high value to meat being safe to eat.

Trade in live pigs remains a complex process to be replaced because it is driven by many different factors. Consumer preferences, shortages and surpluses resulting in price differences, are the economic key factors that stimulate transactions of live animals. But also food habits, religion, customer preferences and logistical circumstances, such as access ease

to slaughterhouses, play an important role. Though, the greatest challenge is to overcome the economic interests of transporting live pigs. In order to achieve only carcass trade or transportation of embryos and semen, prices of meat will be higher which have to be paid by the consumer. This challenge loses a bit of its insuperability since a significant majority (83%) of the sample population indicate to pay a premium to stop long distance transport of pigs.

Welfare of farm animals is a recurring point of discussion in today's society. The difficulty with this discussion is that the attitudes towards farm animals vary widely, reinforced by different opinions on the objectivity about the information on welfare of farm animals. Nevertheless, a gradual shift in attitudes towards animals has taken place whereby animal welfare has been accepted to be of relevance, proved by the results showing that many respondents do not want pigs to die on transport (72%) and rather not eat the meat of transported pigs (74%). Surprisingly enough the survey showed that more than half of the sample population (65%) already knew about long distance transport of animals. Still, it seems necessary to pay more attention to this phenomenon stated by 59% of the respondents. Especially Animal Welfare Organizations seem the right institutions to do so.

7 Annex

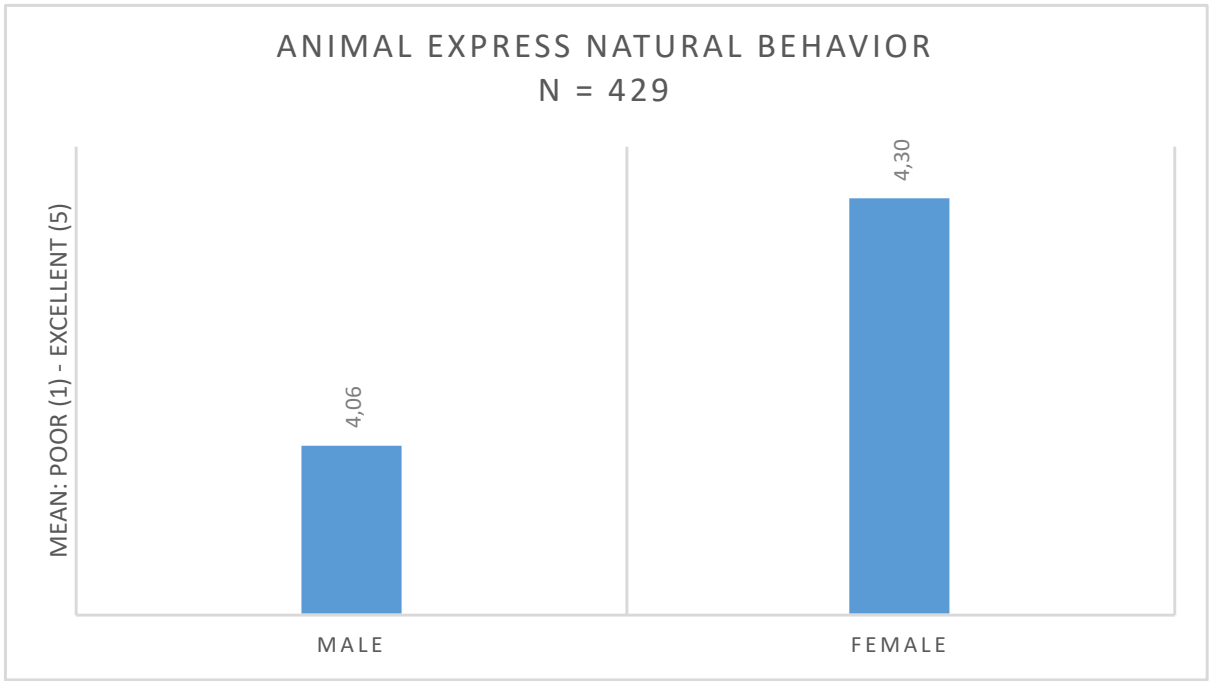

Figure 19. Female score significantly higher on the statement *"It refers to animals as being able to express their natural behavior"* compared to male

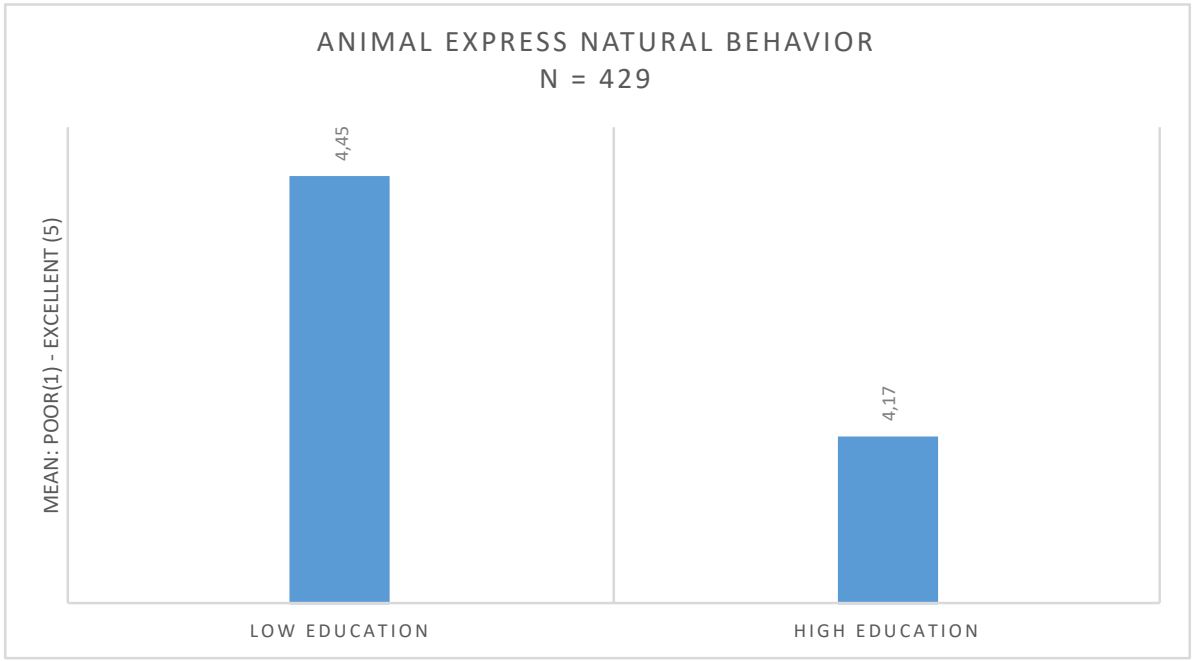

Figure 20. Low educated people score significantly higher on the statement *"It refers to animals as being able to express their natural behavior"* compared to high educated people

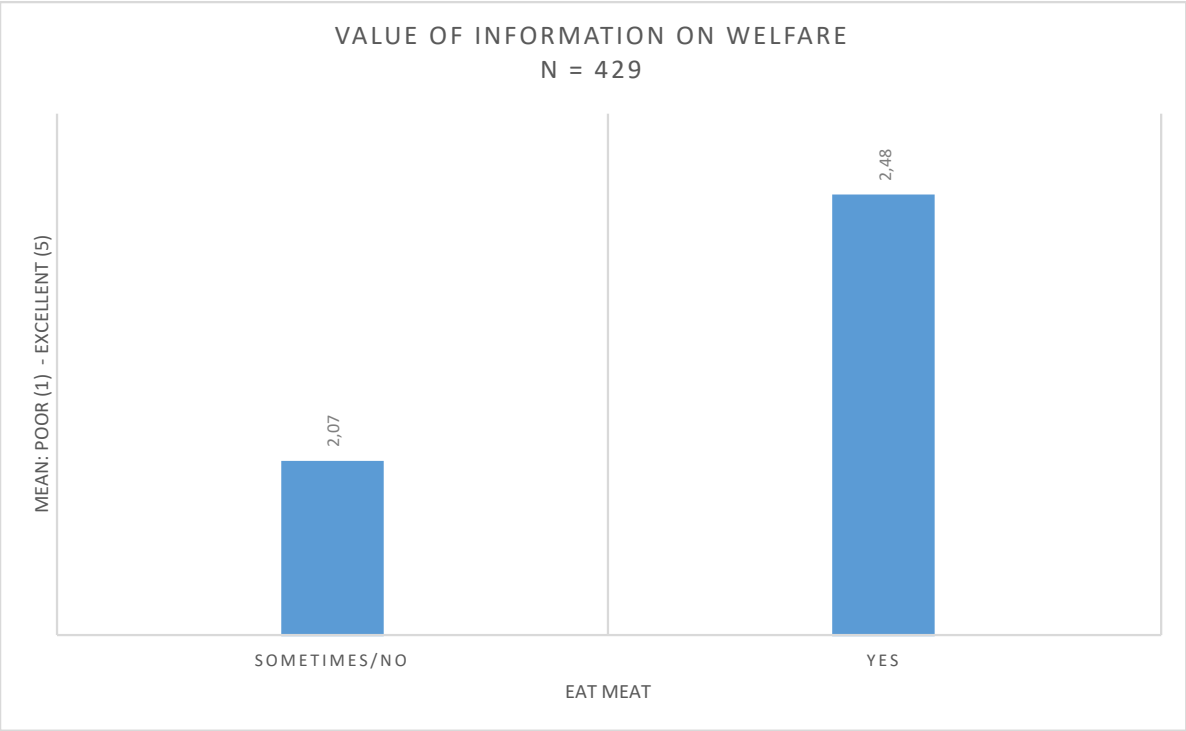

Figure 21. Meat eating people indicate higher values to the current provision of information about welfare of farm animals compared to people that do not or sometimes eat meat

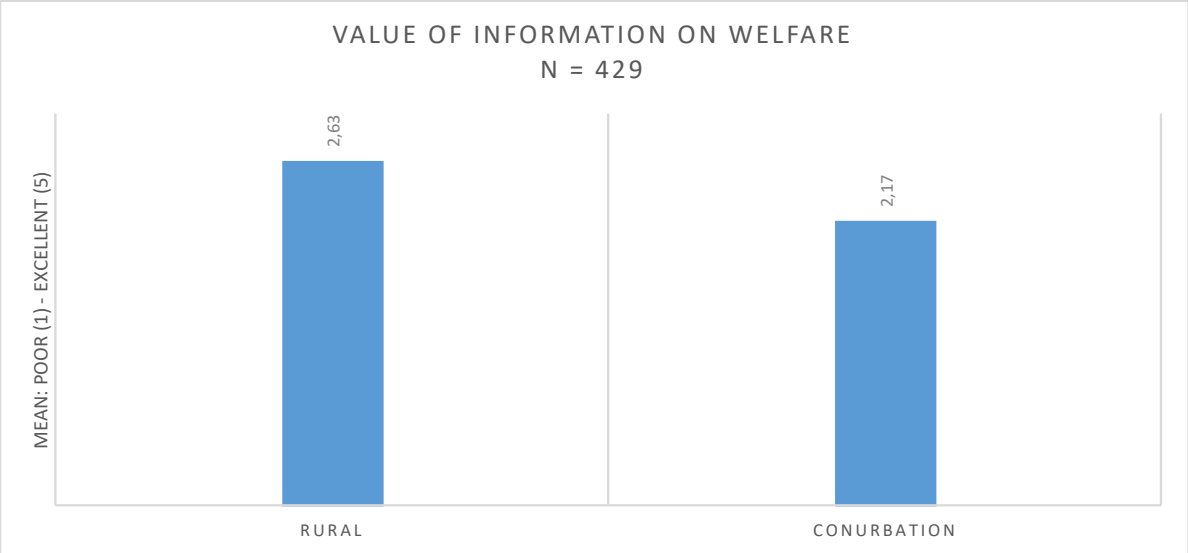

Figure 22. People living in rural areas indicate higher values to the current provision of information about welfare of farm animals compared to people living in the conurbation

Table 3. Female score significant higher in finding the information not objective compared to male (n = 225)

GENDER	FEMALE		MALE	
OBJECTIVE?	NUMBER	%	NUMBER	%
YES	36	12%	24	18%
NO	**167**	**56%**	**58**	**45%**
DON'T KNOW	96	32%	48	37%
TOTAL	**299**	**100%**	**130**	**100%**

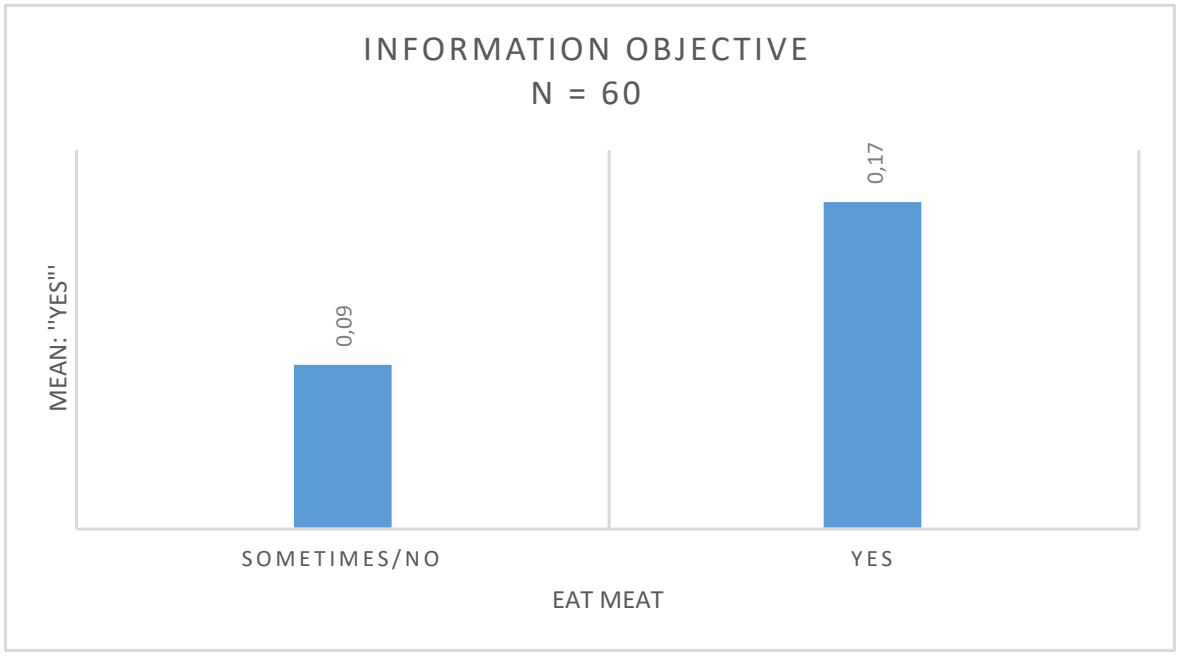

Figure 23. Meat eating people score significantly higher to find the current information about welfare of farm animals objective compared to people that do not or sometimes eat meat

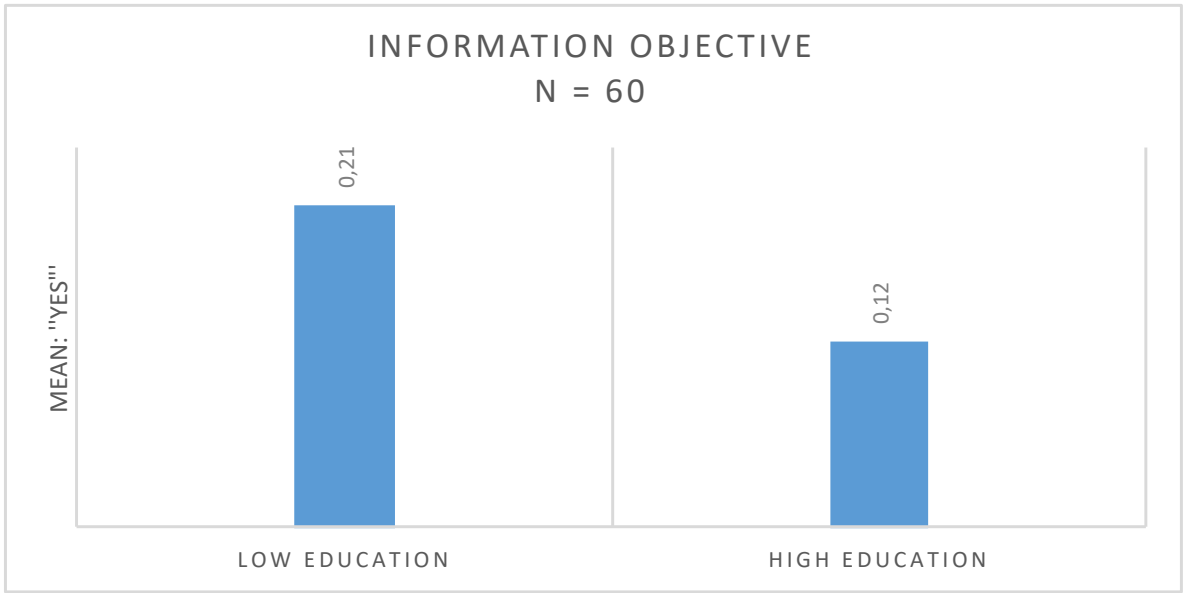

Figure 24. Low educated people score significantly higher to find the current information about welfare of farm animals objective compared to high educated people

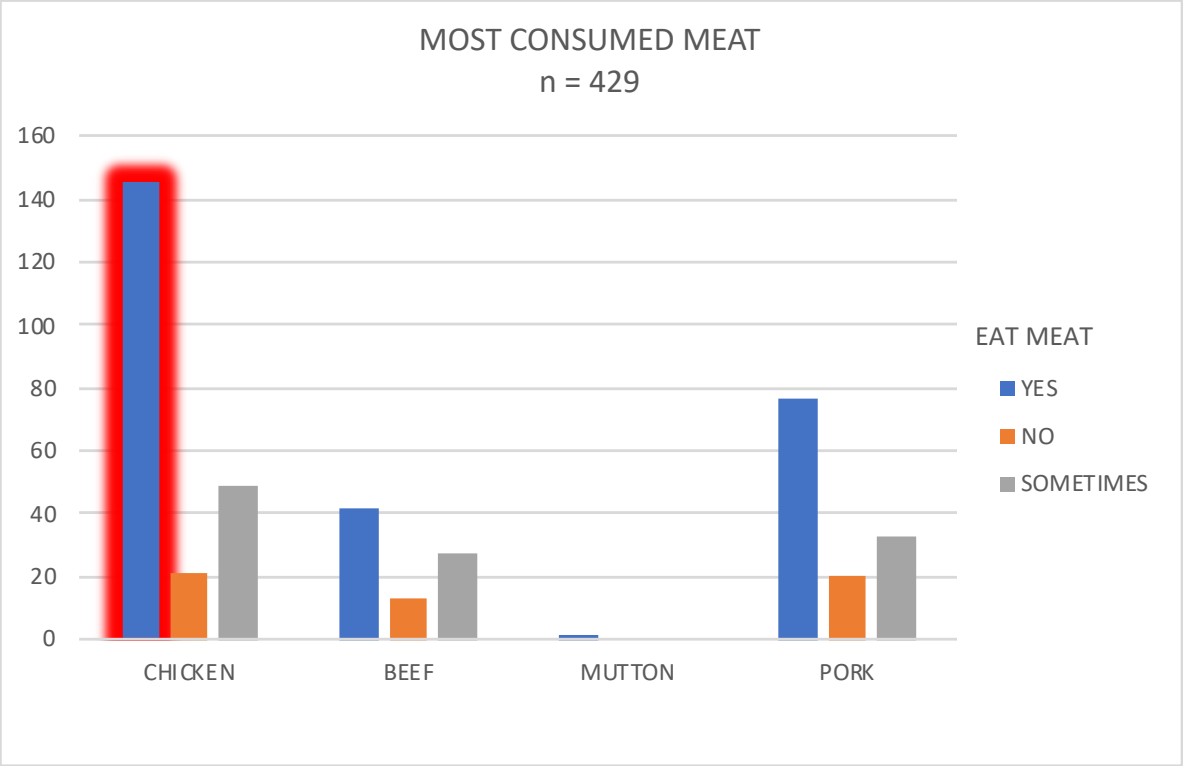

Figure 25. Meat eating people score significantly higher to think chicken is the most consumed meat compared to people that do not or sometimes eat meat

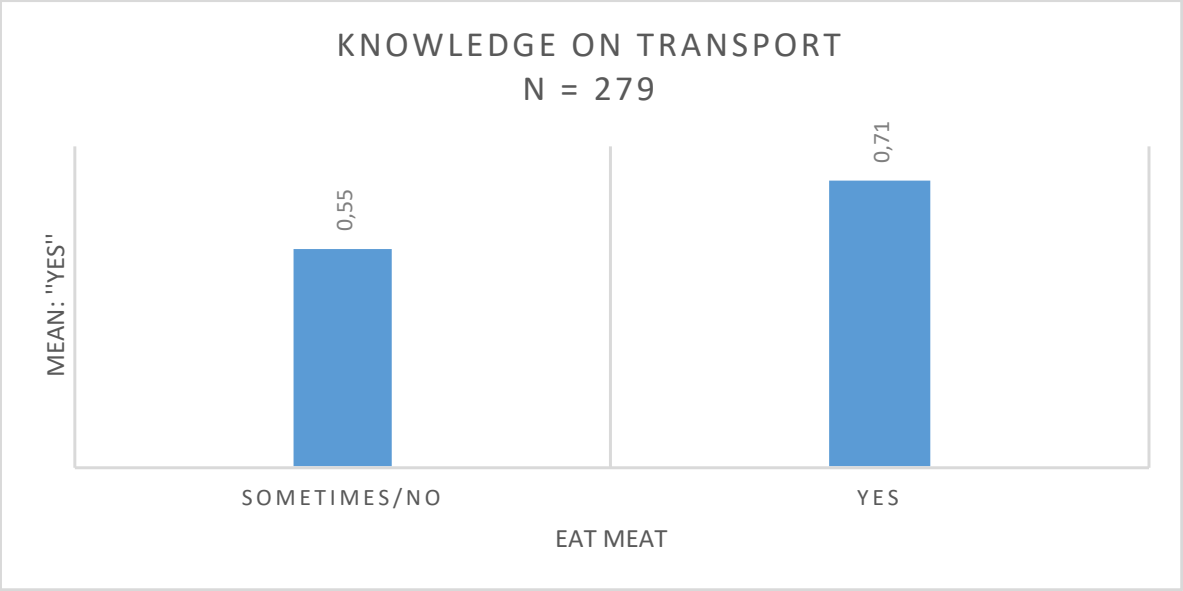

Figure 26. Meat eating people score significantly higher to know about live pigs being transported compared to people that do not or sometimes eat meat

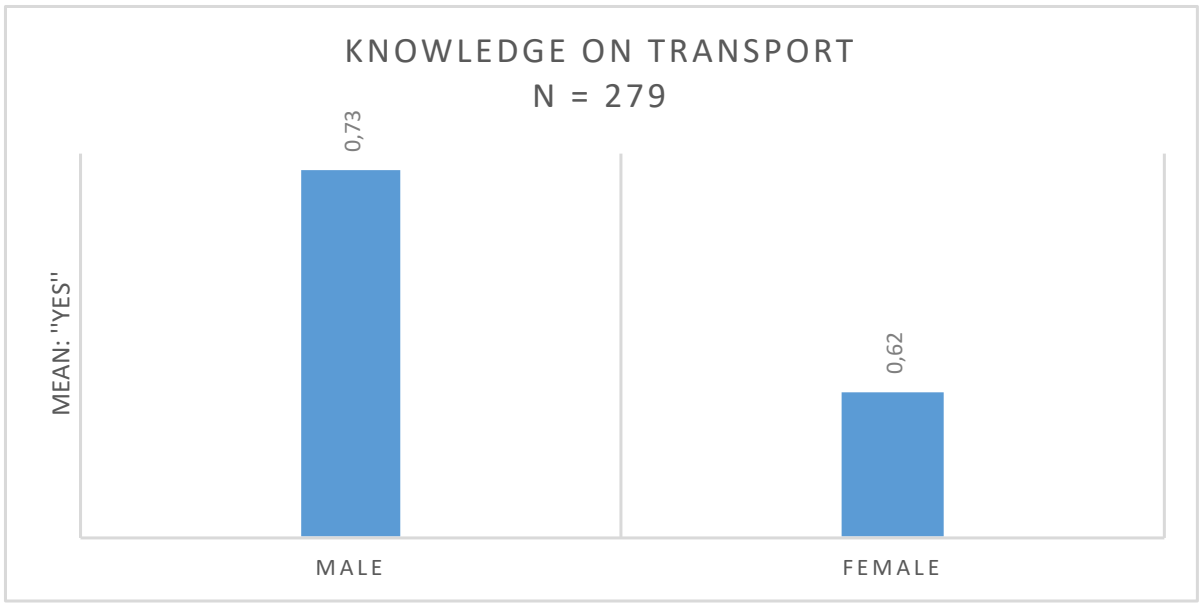

Figure 27. Male score significantly higher to know about live pigs being transported compared to female

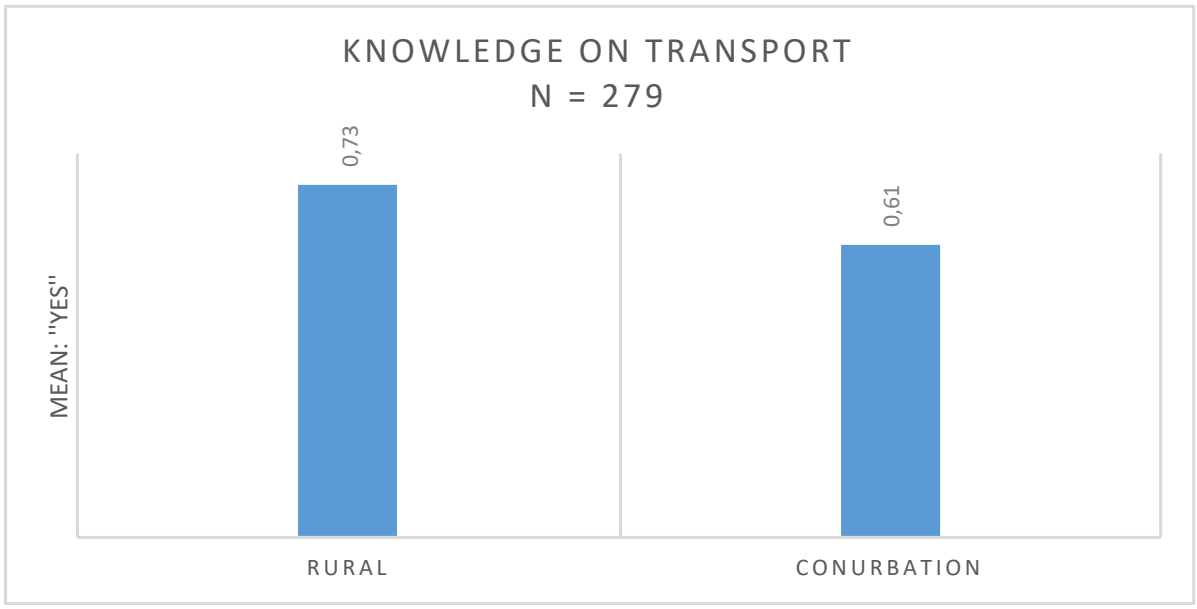

Figure 28. People living in rural areas score significantly higher to know about live pigs being transported compared to people living in the conurbation

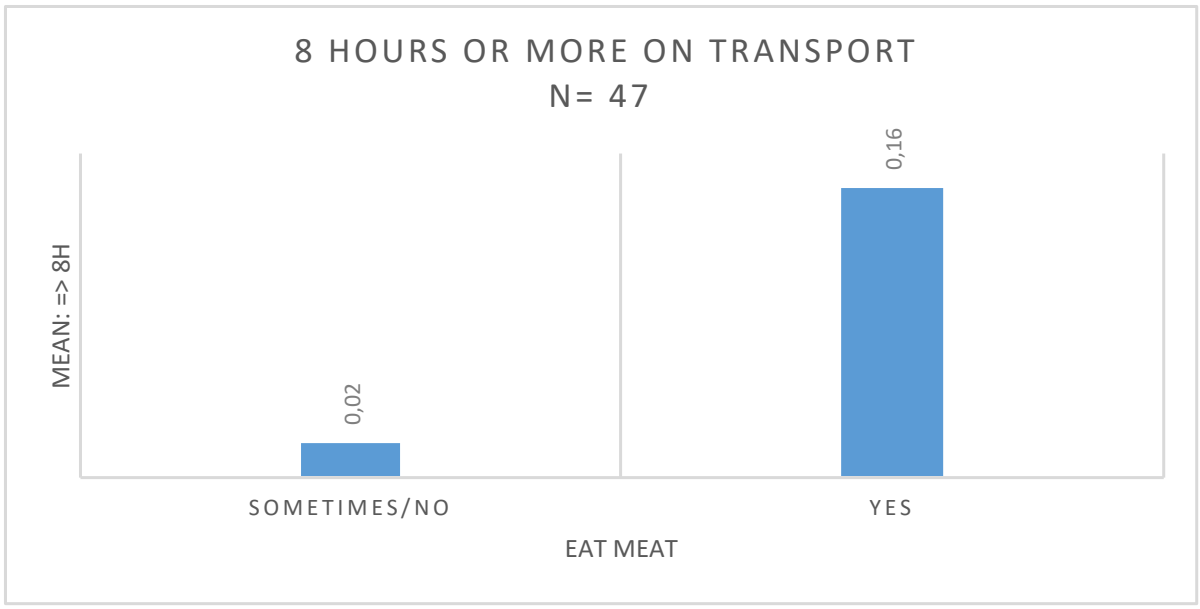

Figure 29. Meat eating people score significantly higher on the statement were pigs can be transported eight hours or longer compared to people that do not or sometimes eat meat

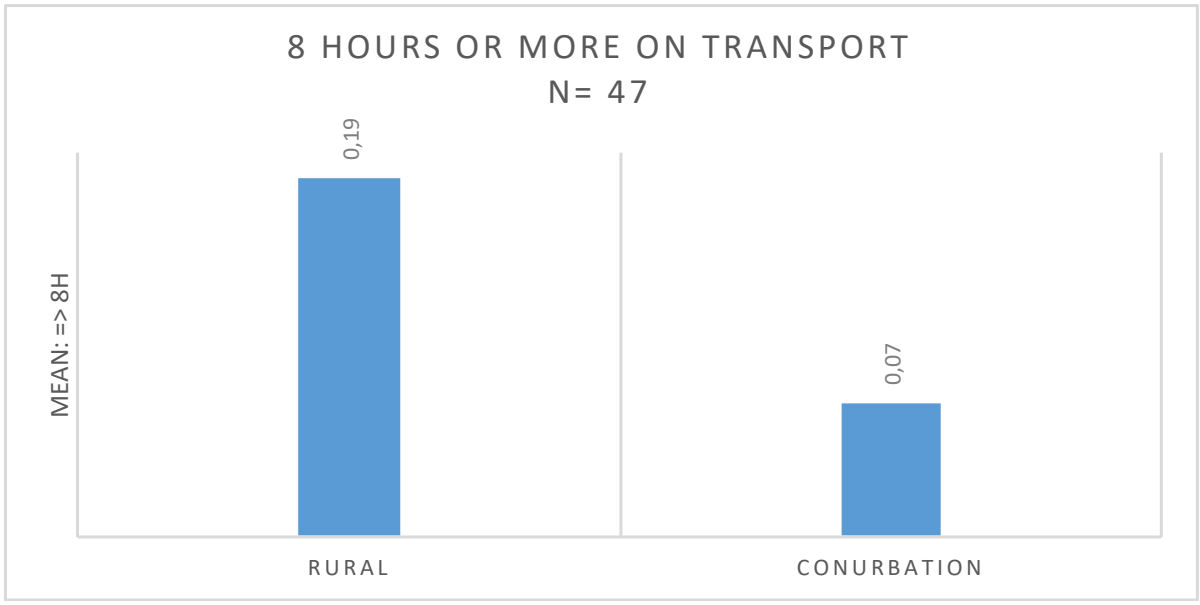

Figure 30. Male score significantly higher on the statement were pigs can be transported eight hours or longer compared to female

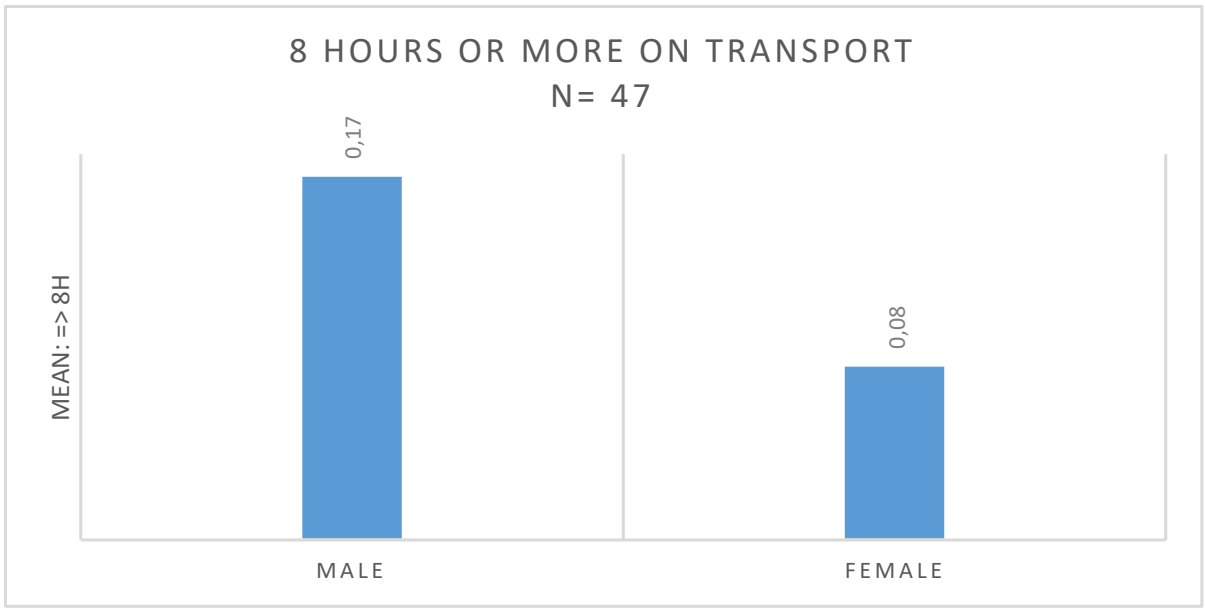

Figure 31. People living in rural areas score significantly higher on the statement were pigs can be transported eight hours or longer compared to people living in the conurbation

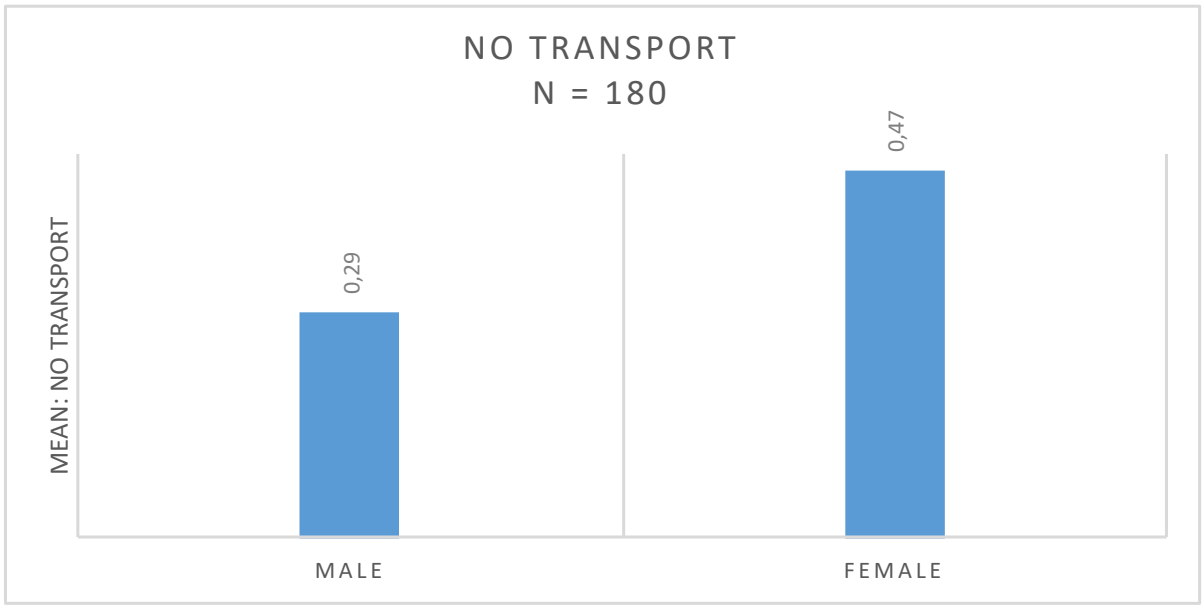

Figure 32. Female score significantly higher on the statement were pigs should not be transported compared to male

Figure 33. People that eat meat sometimes or not at all score significantly higher on the statement were pigs should not be transported compared to people that eat meat

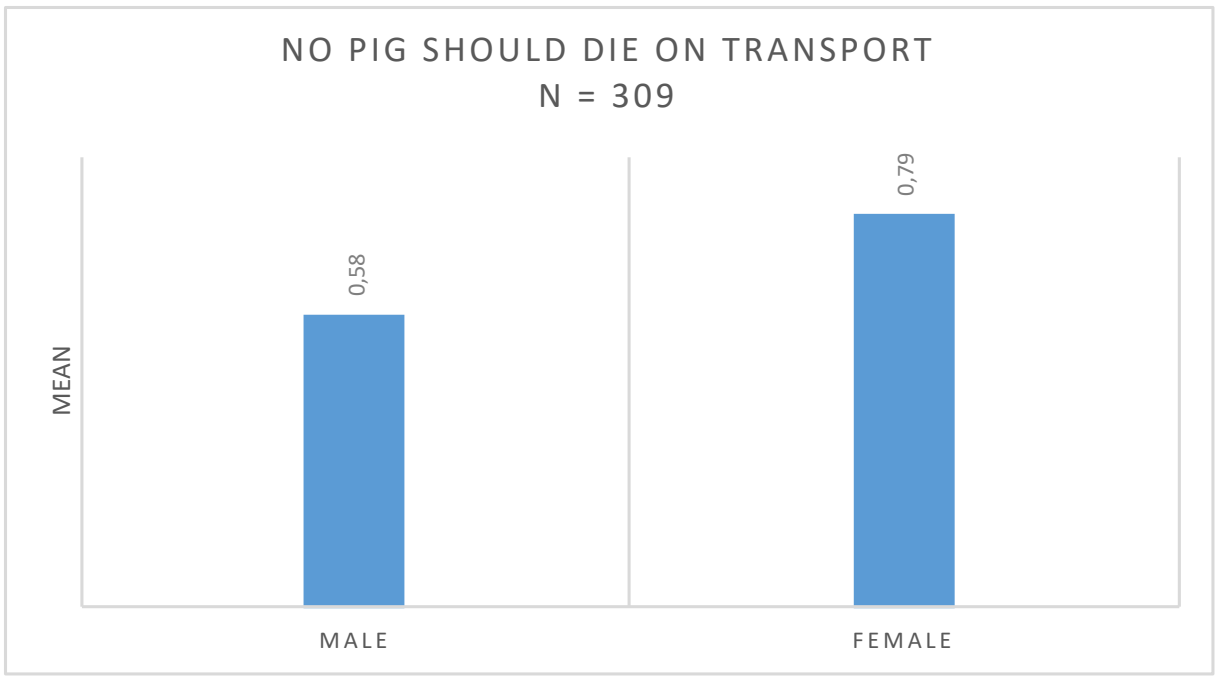

Figure 34. Female score significantly higher on the statement were pigs should not die on transport compared to male

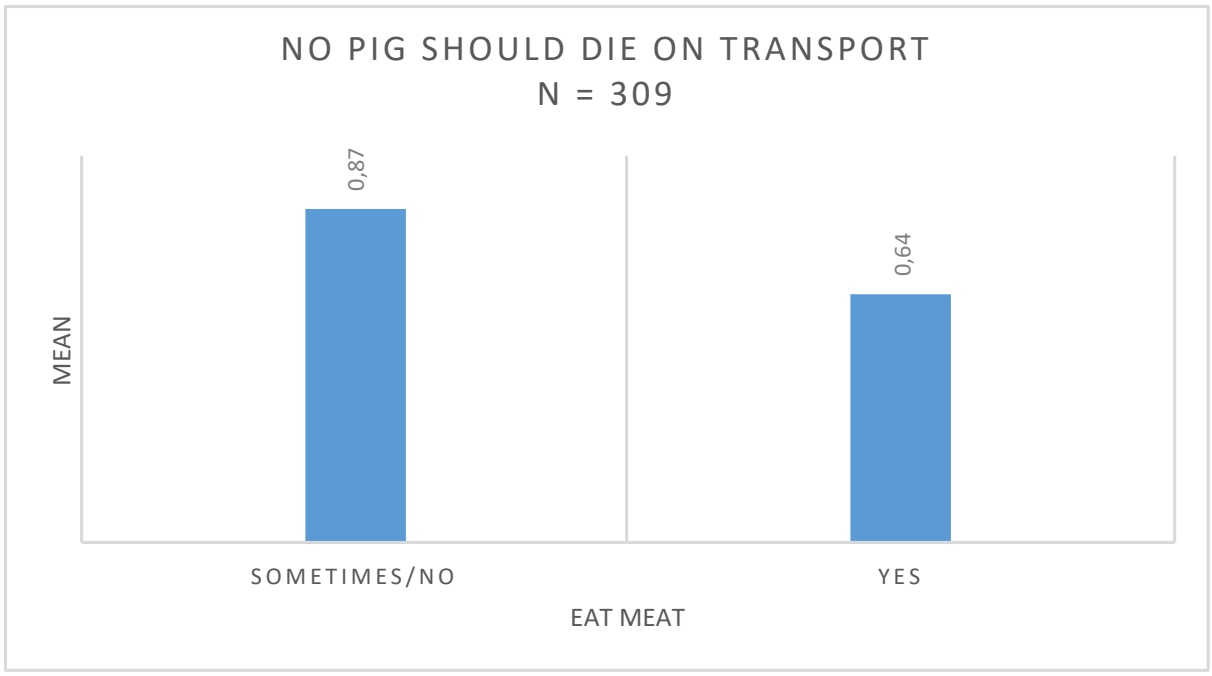

Figure 35. People that eat meat sometimes or not at all score significantly higher on the statement were pigs should not die on transport compared to people that eat meat

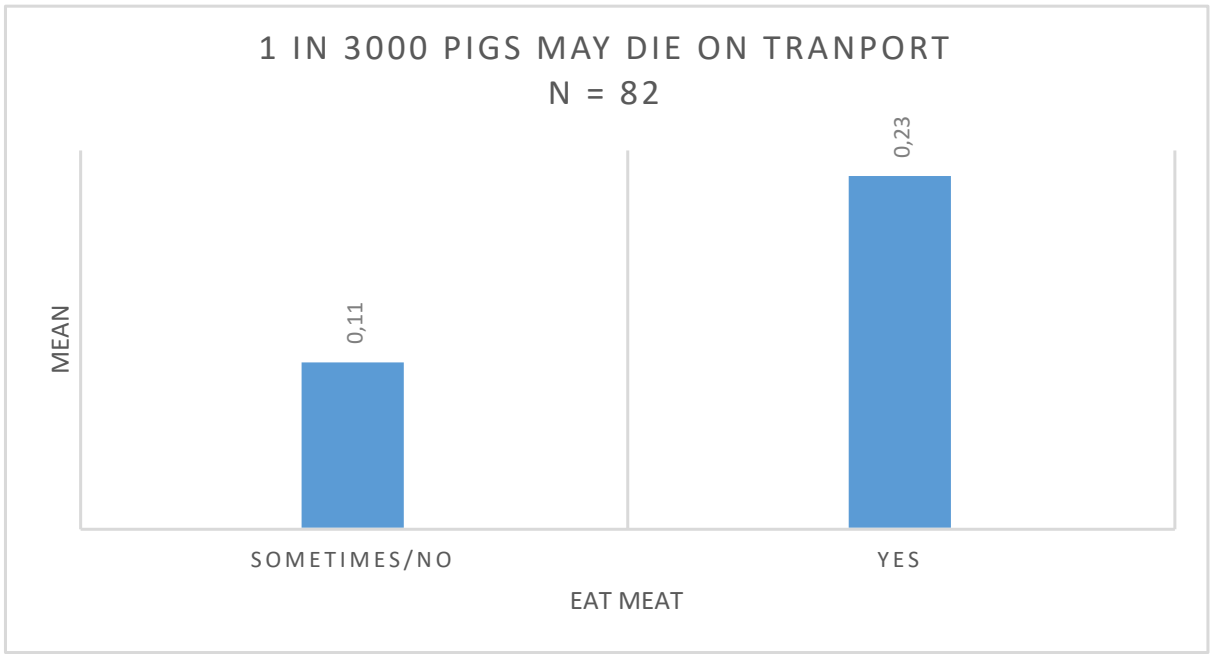

Figure 36. Meat eating people score significantly higher on the statement were 1 in 3000 pigs may die on transport compared to people that do not or sometimes eat meat

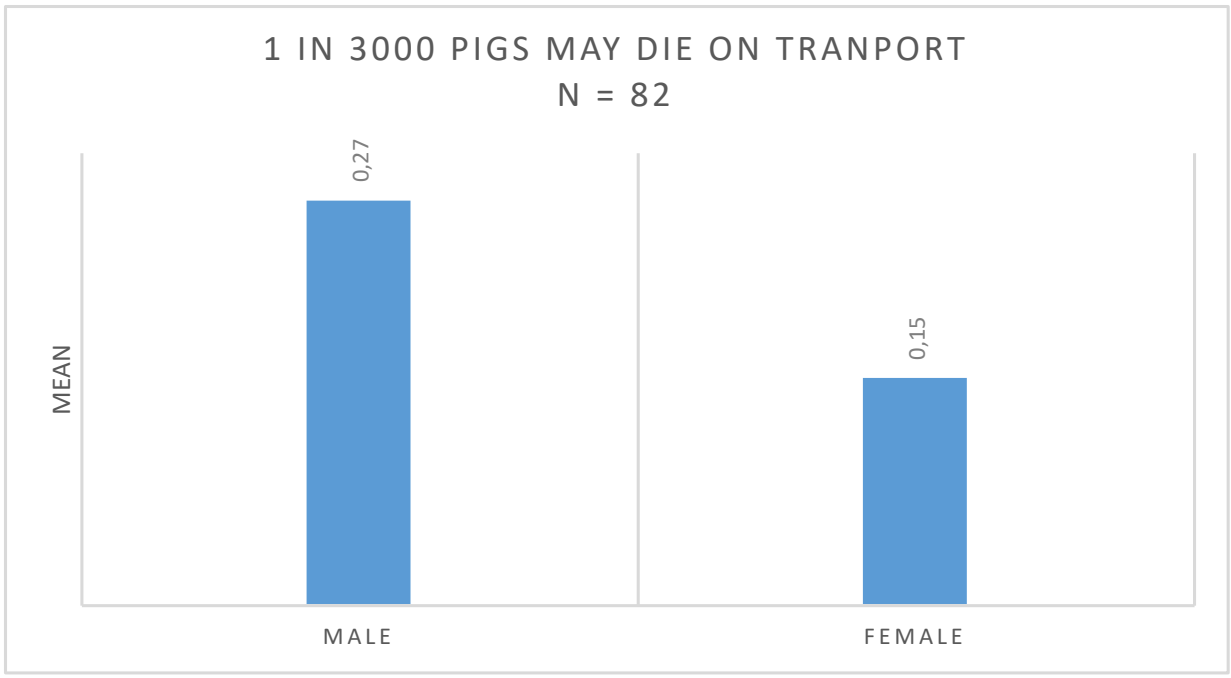

Figure 37. Male score significantly higher on the statement were 1 in 3000 pigs may die on transport compared to female

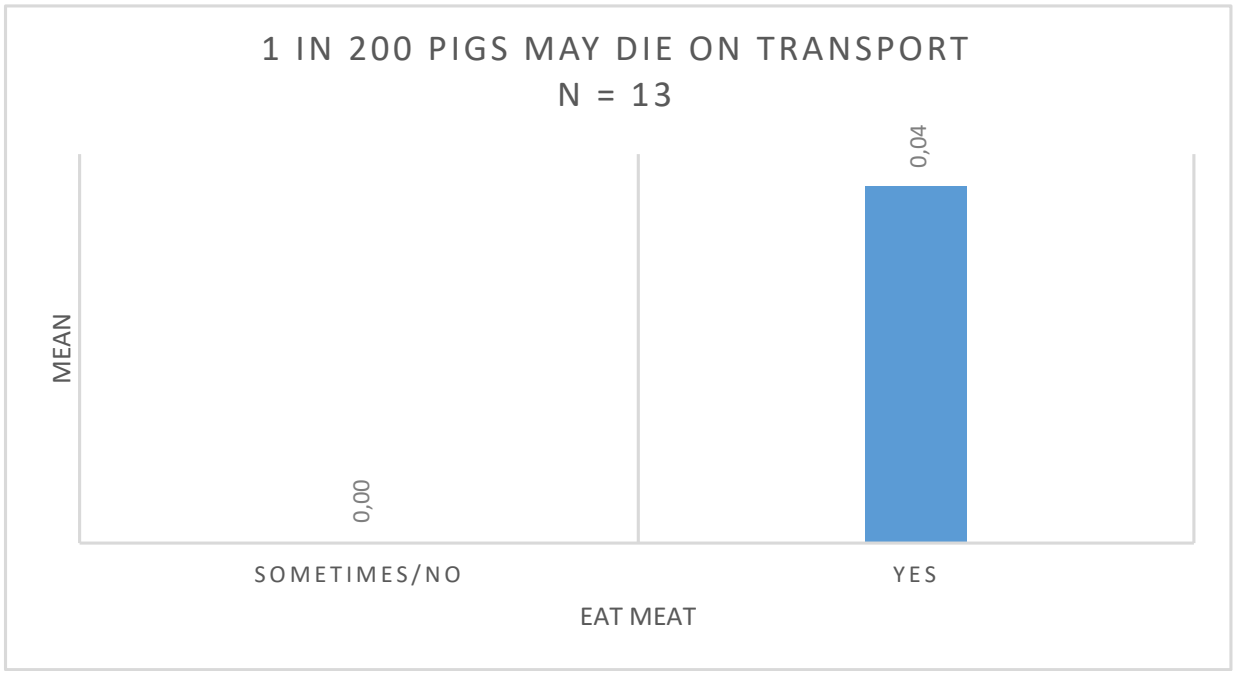

Figure 38. Meat eating people score significantly higher on the statement were 1 in 200 pigs may die on transport compared to people that do not or sometimes eat meat

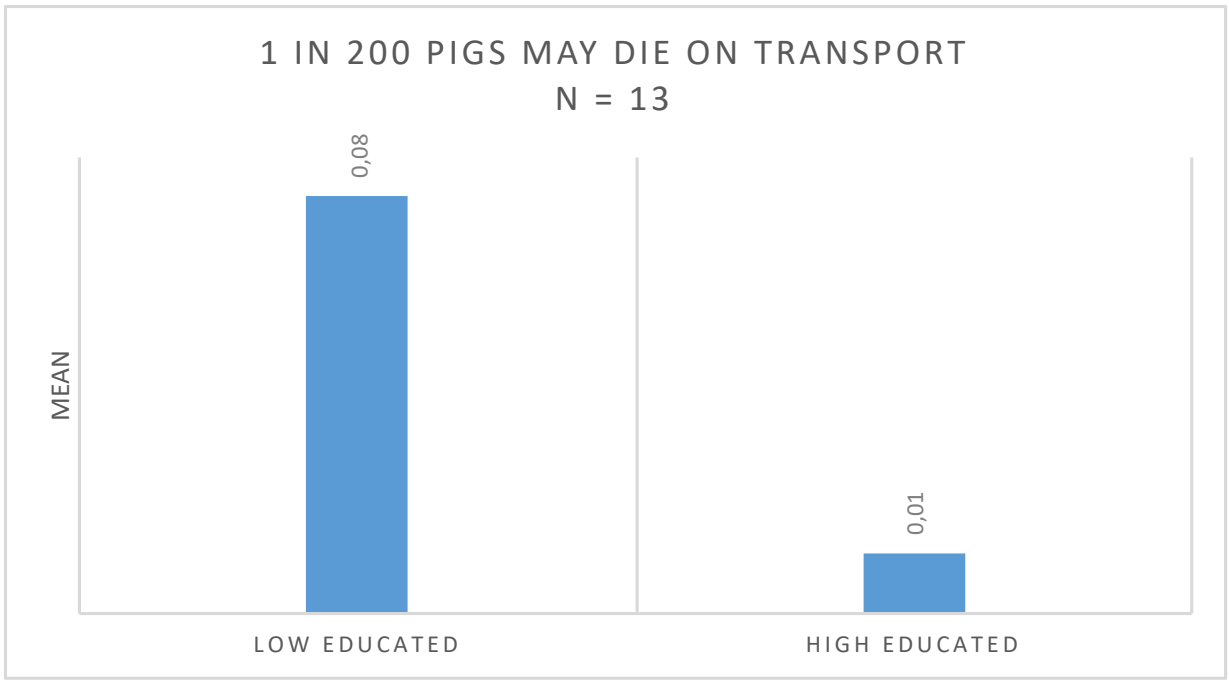

Figure 39. Low educated people score significantly higher on the statement were 1 in 200 pigs may die on transport compared to high educated people

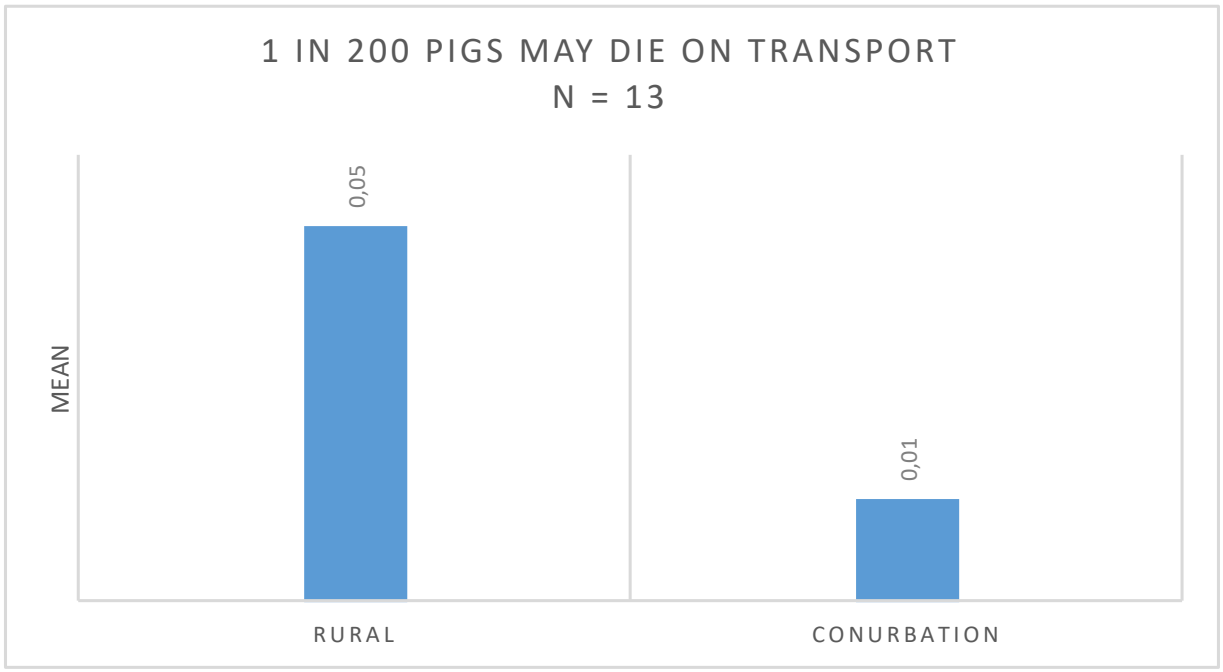

Figure 40. People living in rural areas score significantly higher on the statement were 1 in 200 pigs may die on transport compared to people living in the conurbation

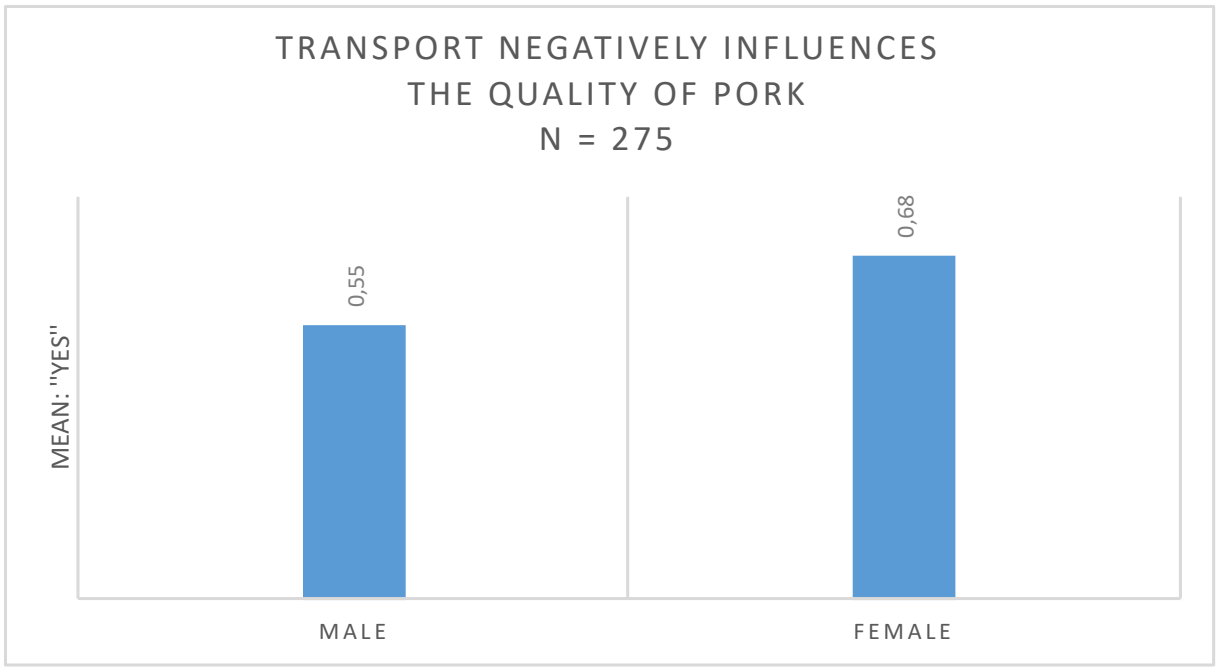

Figure 41. Female score significantly higher on the statement were pork is negatively influenced by long distance transport of pigs compared to male

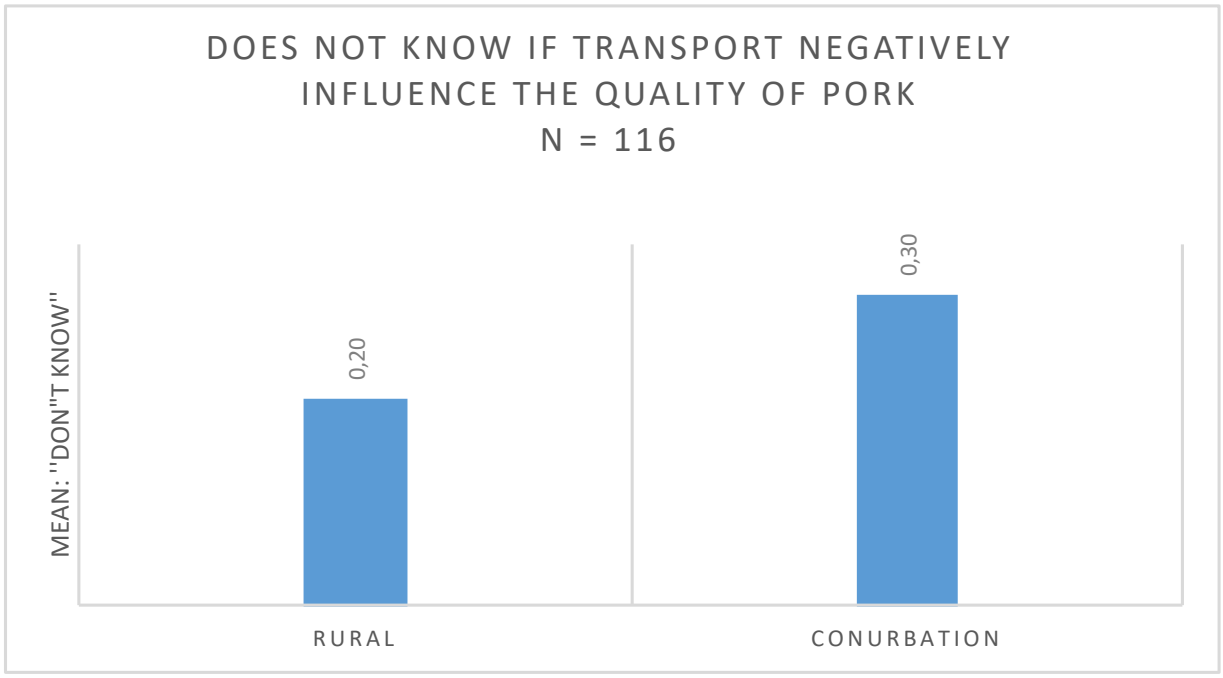

Figure 42. People living in the conurbation score significantly higher on the ''don't know'' answer compared to people living in rural area

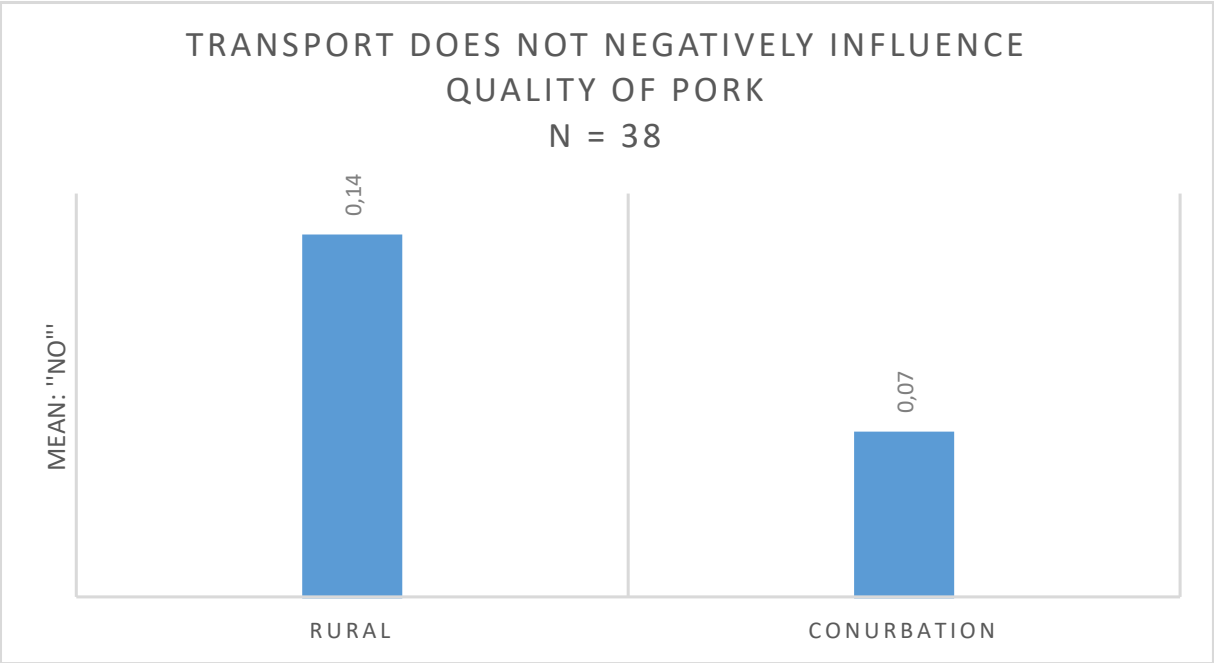

Figure 43. People living in rural areas score significantly higher to think transport does not negatively influences the quality of pork compared to people living in the conurbation

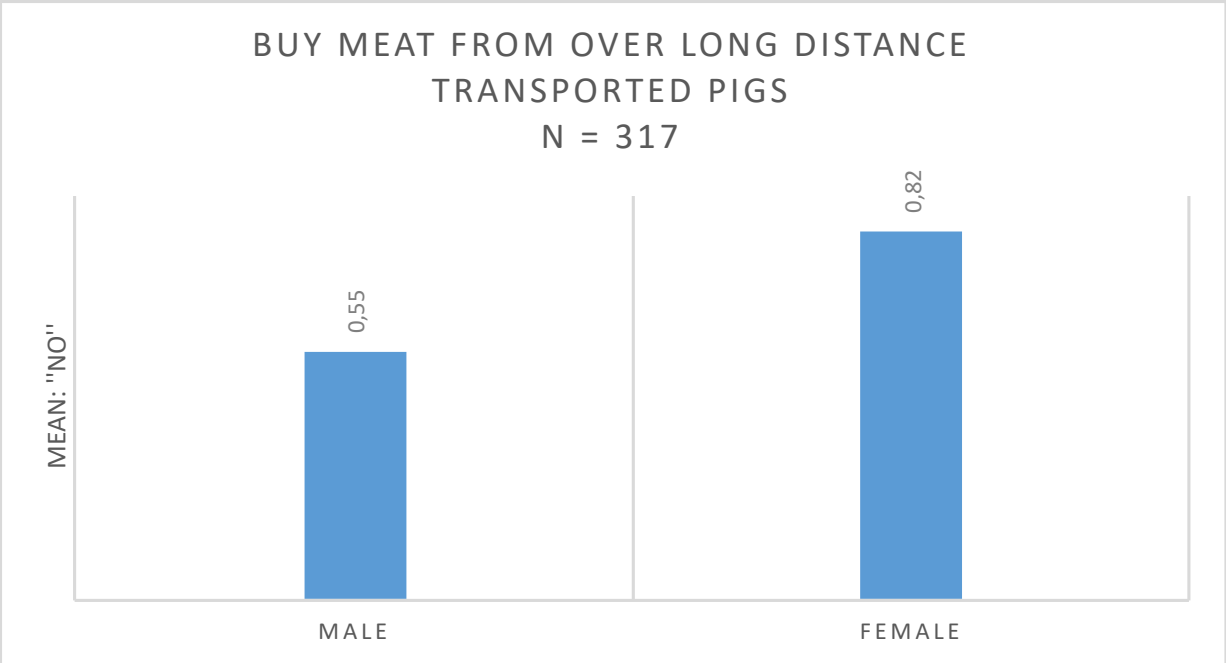

Figure 44. Female score significantly higher on not buying pork from over long distance transported pigs compared to male

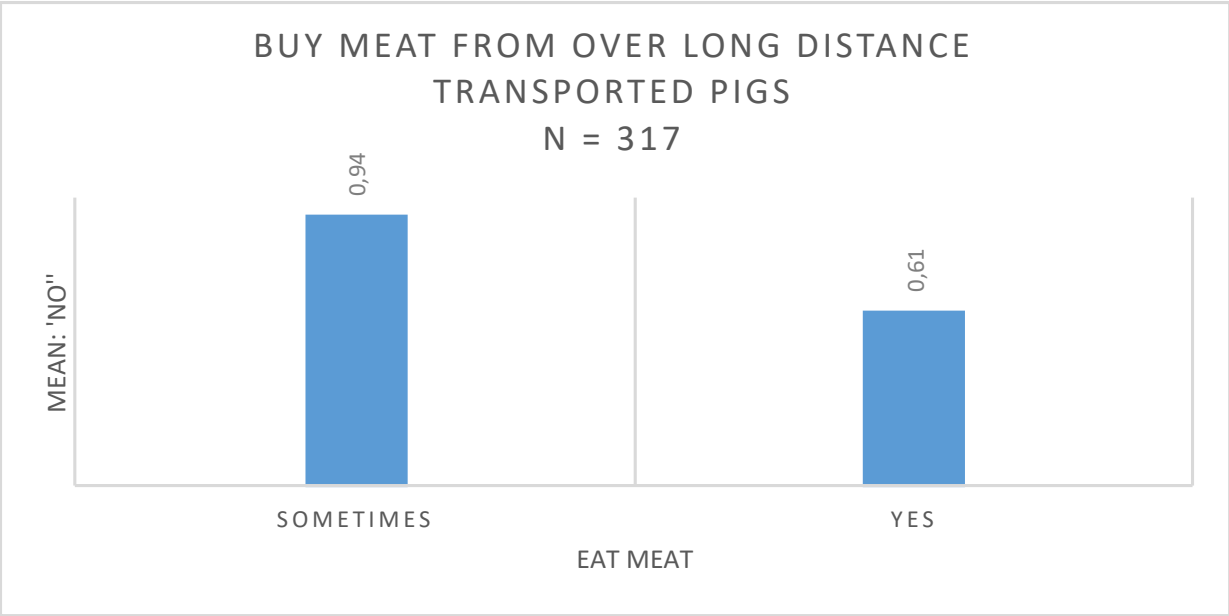

Figure 45. People that eat meat sometimes score significantly higher on not buying pork from over long distance transported pigs compared to people that eat meat

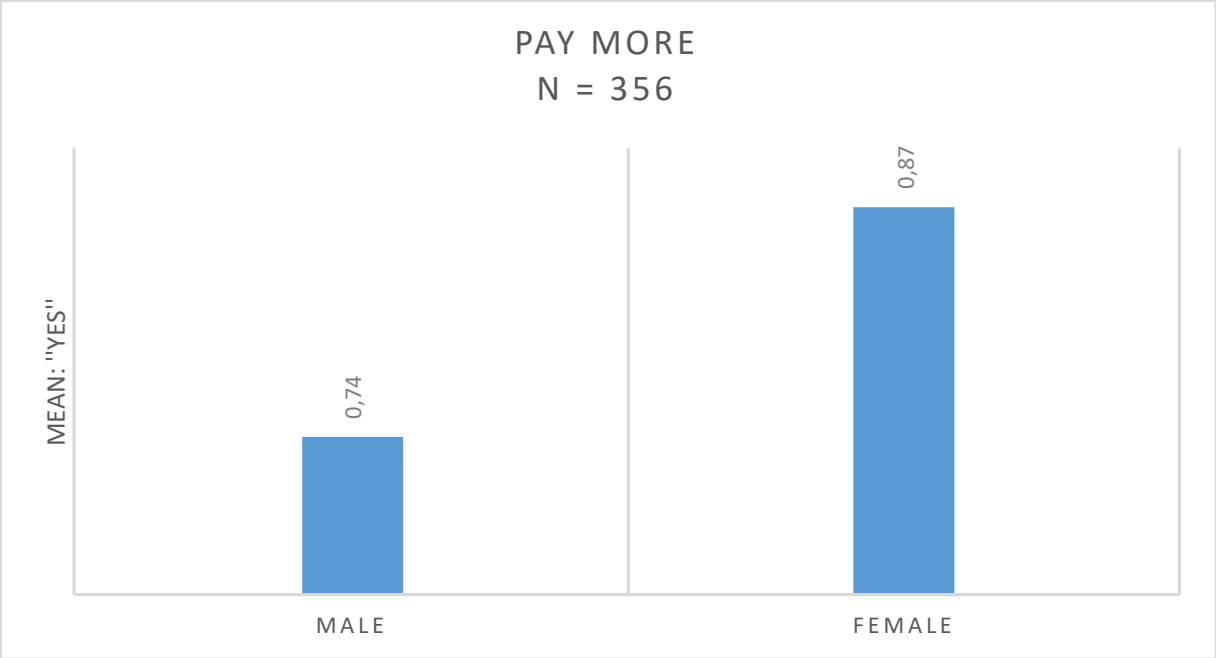

Figure 46. Female score significantly higher on willing to pay more for meat to stop long distance transport of pigs compared to male

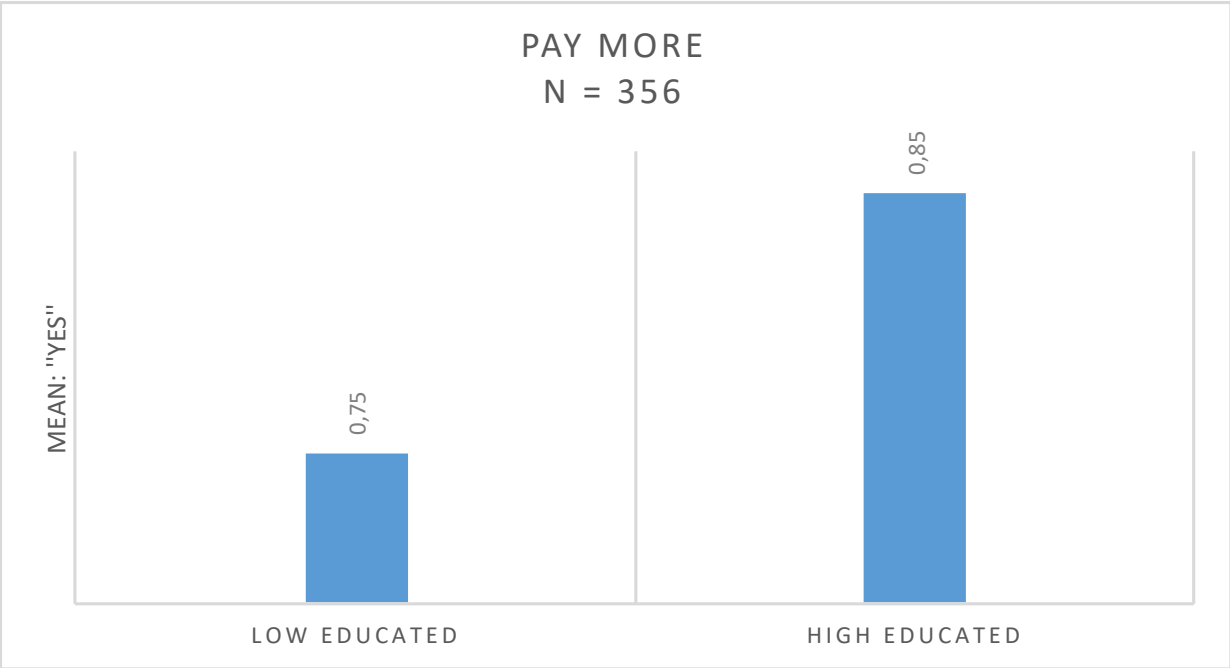

Figure 47. High educated people score significantly higher on willing to pay more for meat to stop long distance transport of pigs compared to low educated people

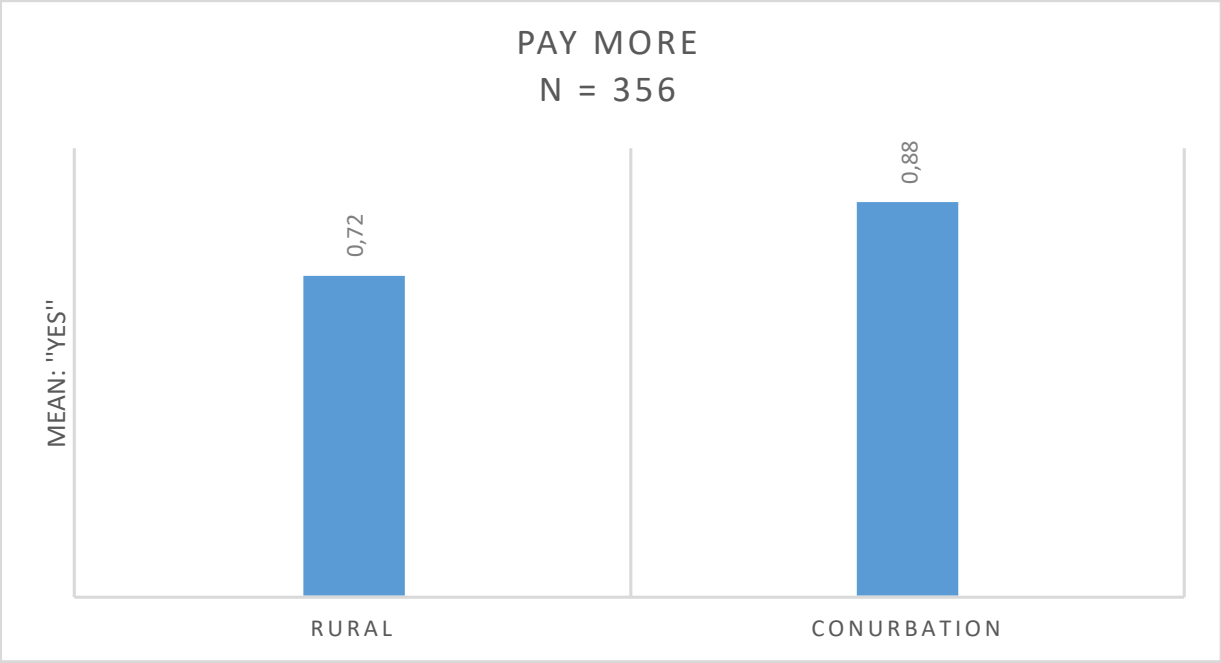

Figure 48. People living in conurbation score significantly higher on willing to pay more for meat to stop long distance transport of pigs compared to people living in rural areas

Figure 49. People that eat meat are less willing to pay more for meat to stop long distance transport of pigs compared to people that eat meat sometimes

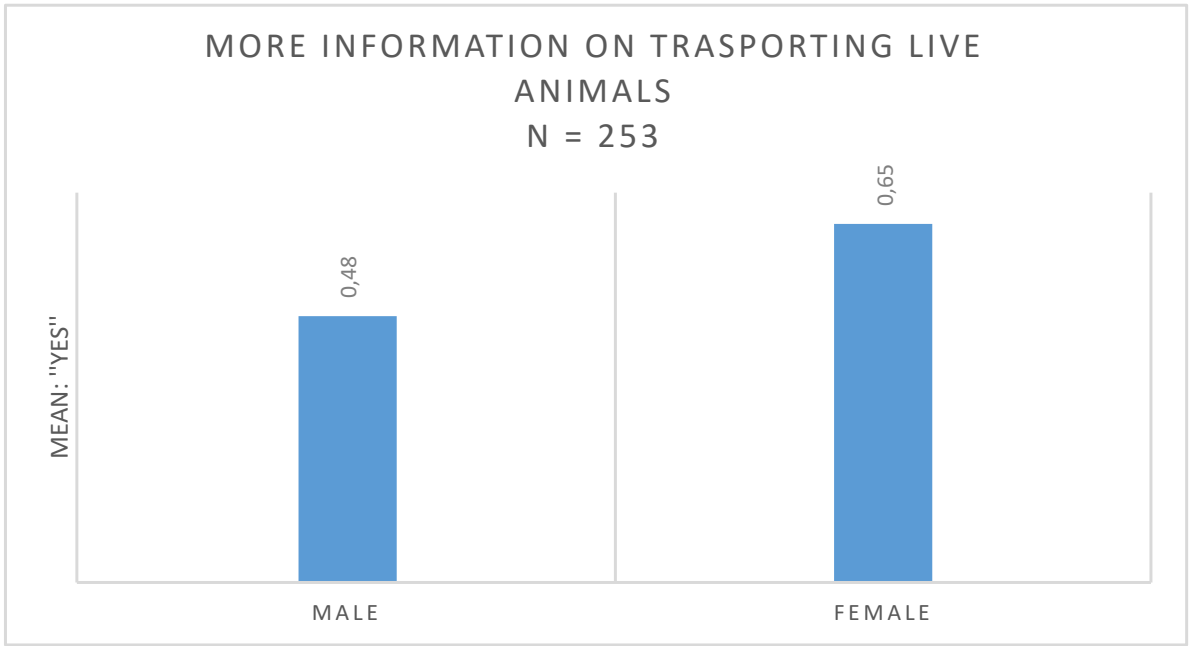

Figure 50. Female score significantly higher to want more information on transporting live animals compared to male

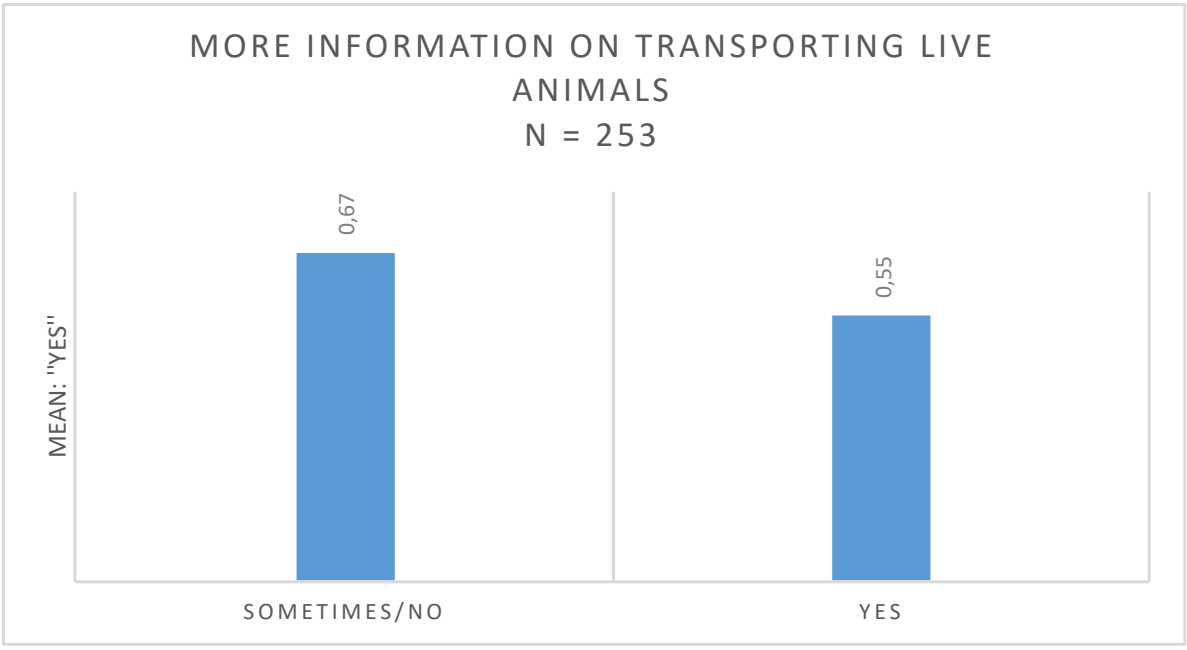

Figure 51. People that sometimes eat meat or not at all score significantly higher to want more information on transporting live animals compared to people eating meat

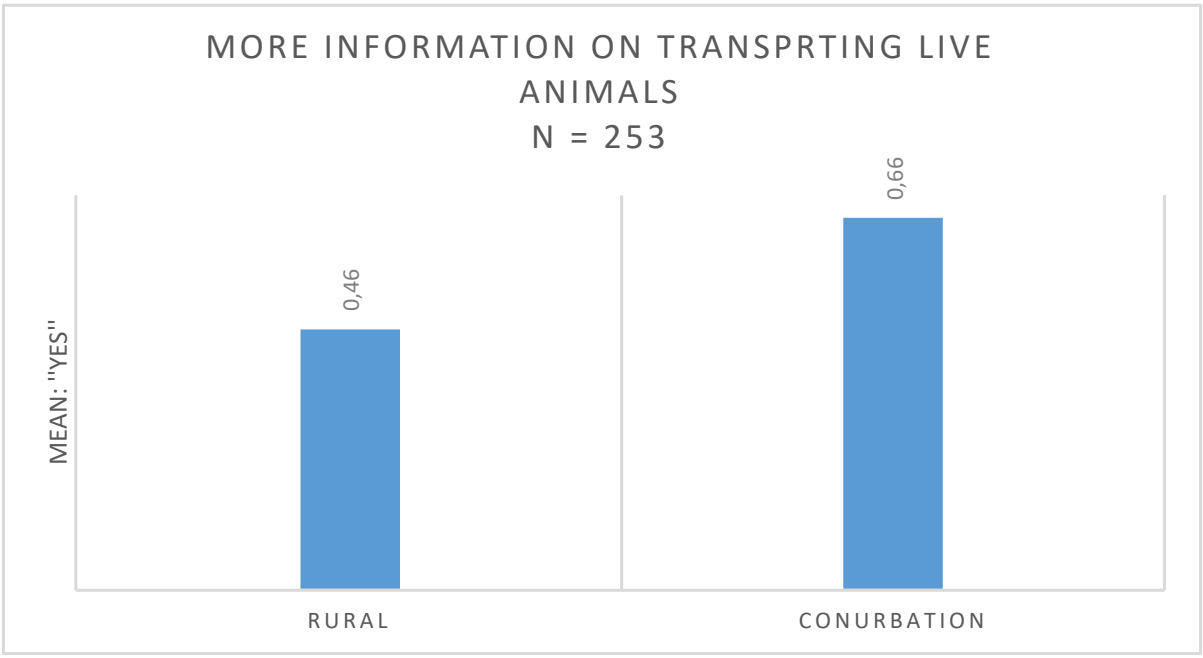

Figure 52. People in the conurbation score significantly higher to want more information on transporting live animals compared to people living in rural areas

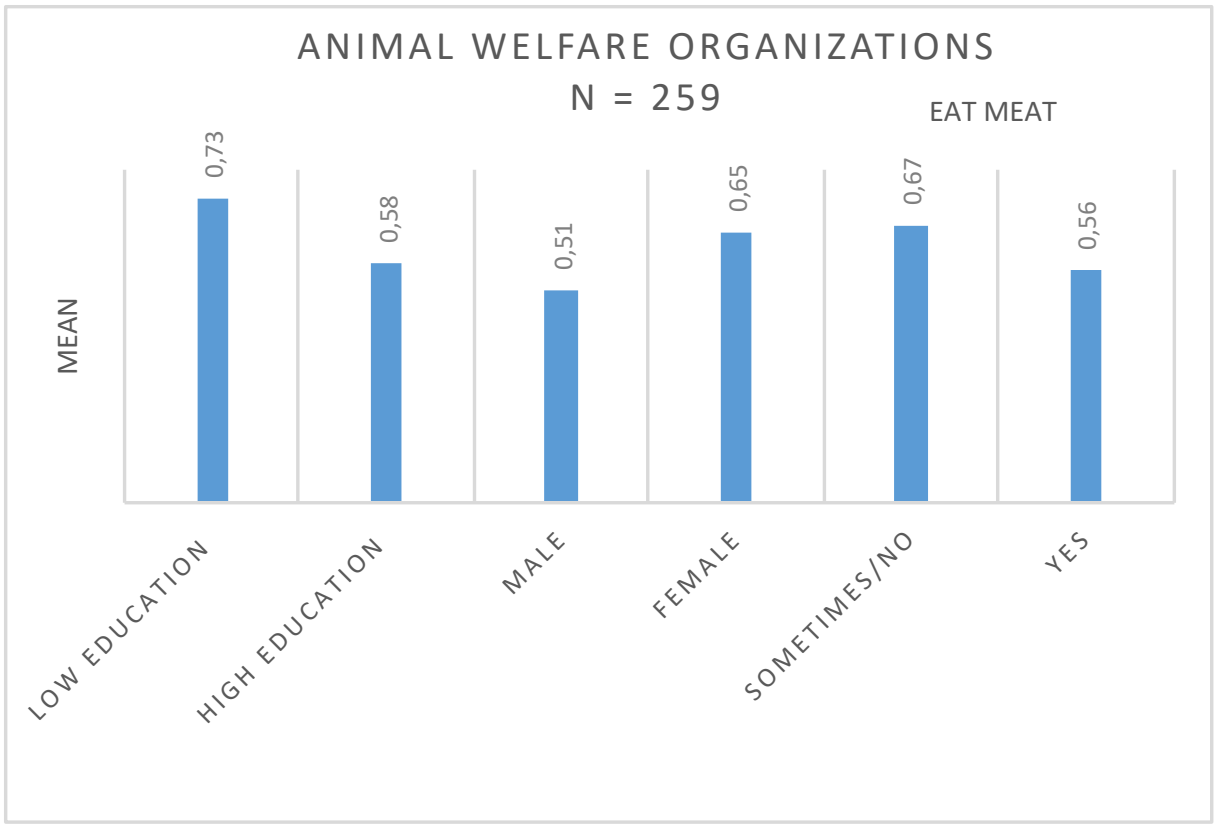

Figure 53. Significant differences were found in the selections of Animal Welfare Organizations as the best option within the level of education, gender and eating meat

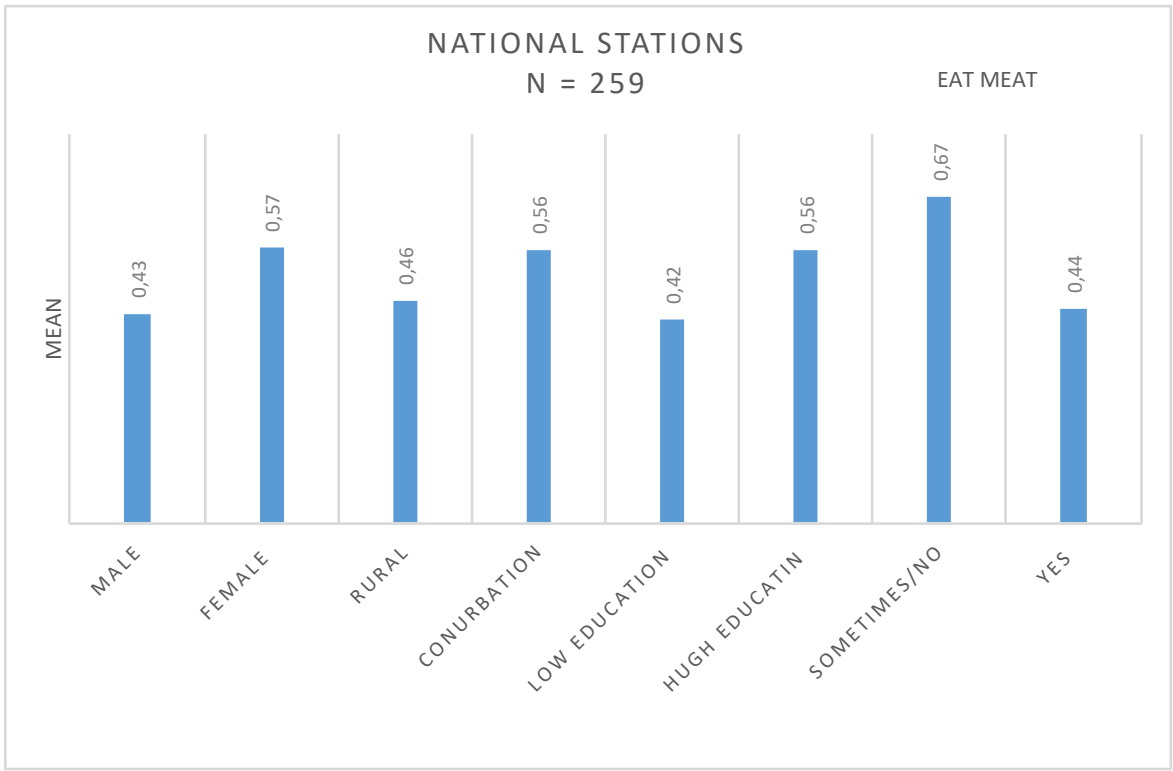

Figure 54. Significant differences were found in the selections of National Stations as the best option within gender, residence, level of education and eating meat

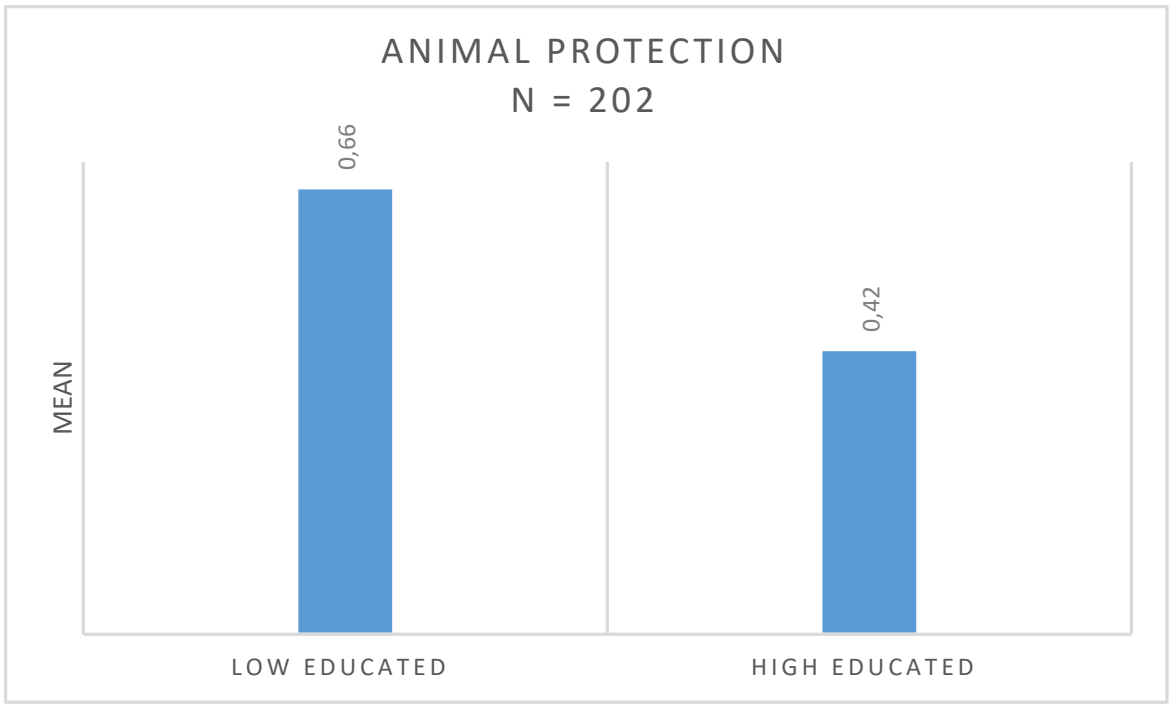

Figure 55. Low educated people score significantly higher on the option Animal Protection Service compared to high educated people

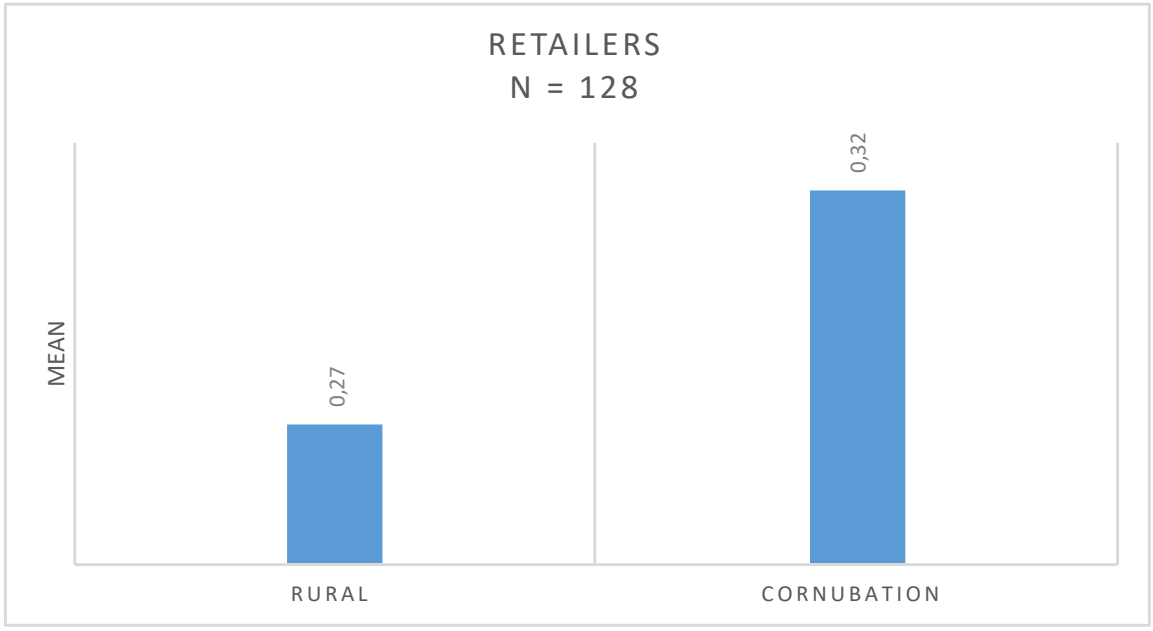

Figure 56. People in the conurbation score significantly higher on the option retailers compared to people living in rural areas

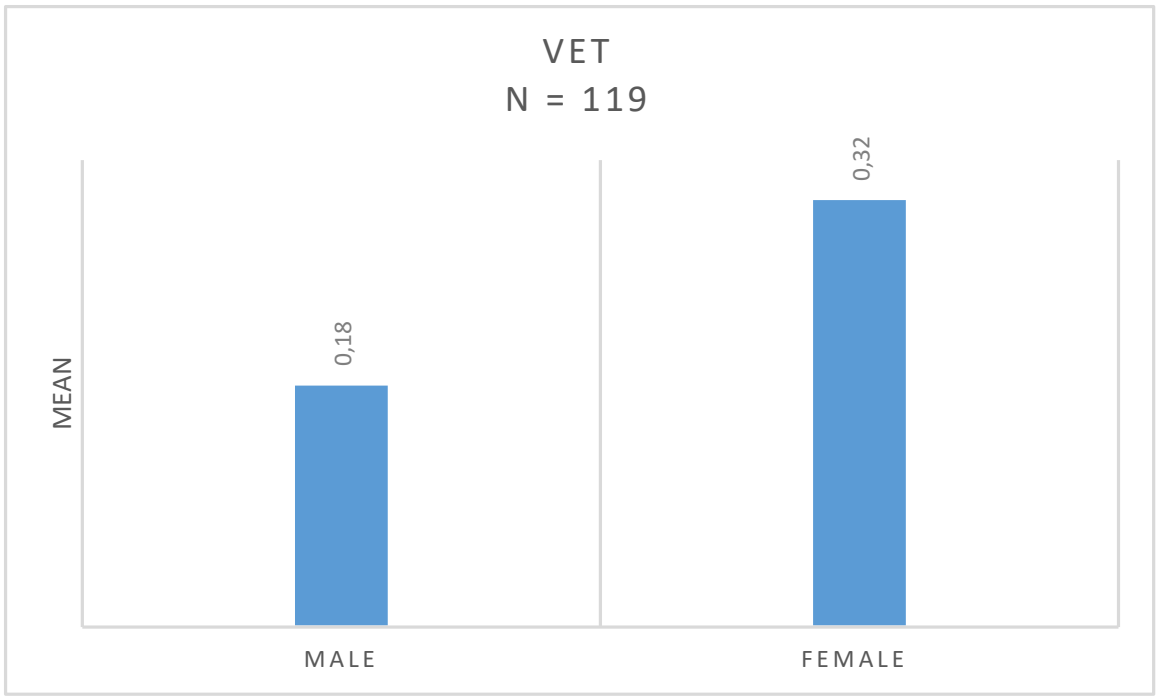

Figure 57. Female score significantly higher on the option Vet compared male

A Beste deelnemer,

Ontzettend leuk dat u deze vragenlijst wilt invullen. Dit onderzoek gaat over het welzijn van dieren en bestaat uit 14 vragen.
Het invullen duurt maar 5 minuten!

U maakt ook direct kans op een vergoeding van €25,-.

Alvast hartelijk dank.

Met vriendelijke groet,

Romy, student diergeneeskunde

Q3 **Geef aan wat op u van toepassing is;**

	Man	Vrouw
Geslacht	○	○

Q4 **Geef aan wat op u van toepassing is;**

	Geen	MBO	HBO	WO
Opleiding	○	○	○	○

Q5 **Geef aan wat op u van toepassing is;**

	Ja	Nee	Soms
Eet u vlees?	○	○	○

Q6 **Leeftijd**

Q7 **Woonplaats**

Q8 **Om de vergoeding te verloten wil ik u vragen hier uw mailadres in te vullen. Indien u anoniem wilt blijven vult u "x" in. Alvast bedankt!**

B Geef bij ieder van de onderstaande stellingen aan hoe correct ze het begrip dierenwelzijn omschrijven, volgens u.

Q9 **Het verwijst naar de plicht om alle dieren te respecteren.**
Slecht 1 - 2 - 3 - 4 - 5 Uitstekend

Q10 **Het betreft de manier waarop landbouwdieren worden behandeld (met landbouwdieren worden dieren bedoeld die zorgen voor dierlijke producten zoals melk/vlees/eieren).**
Slecht 1 - 2 - 3 - 4 - 5 Uitstekend

Q11 **Dierenwelzijn kan worden behaald door dieren te beschermen.**
Slecht 1 - 2 - 3 - 4 - 5 Uitstekend

Q12 **Dierenwelzijn draagt bij aan het verbeteren van de kwaliteit van dierlijke producten.**
Slecht 1 - 2 - 3 - 4 - 5 Uitstekend

Q13 **Dierenwelzijn houdt in dat dieren hun natuurlijke gedrag kunnen vertonen.**
Slecht 1 - 2 - 3 - 4 - 5 Uitstekend

Q14 **Dierenwelzijn houdt in dat dieren beschikken over voldoende water en voer en een goede huisvesting.**
Slecht 1 - 2 - 3 - 4 - 5 Uitstekend

Q15 **Wat vindt u van de huidige verstrekking van informatie omtrent dierenwelzijn van landbouwdieren?**
Slecht 1 - 2 - 3 - 4 - 5 Uitstekend

Q16 **Vindt u de huidige informatie objectief?**
- Ja
- Nee
- Weet ik niet.

Q17 **Kunt u aangeven welk vlees volgens u het meest wordt geconsumeerd door inwoners van landen die behoren tot de Europese Unie (EU)?**
- Rundvlees
- Kippenvlees
- Varkensvlees
- Schapenvlees
- Paardenvlees

Q18 **Levende dieren en vleesproducten staan in de top 3 van Nederlands belangrijkste exportproducten. Sommige export-transporten, bijvoorbeeld die van Nederlandse (levende) varkens naar Italië, duren langer dan 8 uur. Dit worden lange afstand transporten genoemd.**
Wist u van het bestaan van lange afstand transporten van levende varkens?

- Ja
- Nee
- Wel eens van gehoord, maar geen idee wat het inhoudt.

Q19 **Wat is voor u de maximale transporttijd voor levende varkens?**

- Korter dan 8 uur.
- Langer dan 8 uur.
- Levende varkens zouden niet getransporteerd moeten worden.

Q20 **Niet alleen Nederland handelt in levende varkens, dat gebeurt in de hele EU. In totaal worden jaarlijks 28 miljoen varkens vervoerd, waarvan sommige langer dan 8 uur. Varkens kunnen sterven als gevolg van dit lange transport, meestal aan oververhitting. Wat vindt u een acceptabel sterftepercentage?**

- 1 op de 3000 varkens
- 1 op de 400 varkens
- 1 op de 200 varkens
- Geen een varken zou mogen sterven ten koste van transport.

Q21 **Wie kan volgens u dierenwelzijn van landbouwdieren op transport het beste garanderen?**
Zou u deze in orde van belang kunnen rangschikken?
(Indien u een keuze ongedaan wilt maken, dient u opnieuw op dit antwoord te klikken.)

1. Dierenwelzijnsorganisaties
2. De overheid
3. Retailers, winkels die vlees verkopen
4. Dierenartsen
5. De Europese Unie
6. De transporteur of chauffeur

Q22 **Hoe zou u de definitie van "kwaliteit" van varkensvlees omschrijven? Let op, er zijn meerdere antwoorden mogelijk.**

- [x] De kwaliteit van vlees houdt in dat het veilig is om het te eten.
- [x] De kwaliteit van vlees houdt in dat de smaak ervan goed is.
- [x] De kwaliteit van vlees houdt in dat de het er goed uit ziet.
- [x] De kwaliteit van vlees houdt in dat het mals is.

Q23 **Denkt u dat lange afstand transporten een negatieve invloed hebben op de kwaliteit van het varkensvlees?**

- Ja
- Nee
- Weet ik niet

Q24 **Als u op het punt van aankopen zou weten dat het vlees afkomstig is van een over lange afstand getransporteerd dier, zou u het dan kopen?**

- Ja
- Nee

Q25 **Zou u meer betalen voor varkensvlees om ervoor te zorgen dat de lange afstand transporten van deze dieren stopt?**

- Ja
- Nee

Q26 **Indien het lange afstand transport van levende varkens zou verminderen heeft dat effect op verschillende aspecten. Zou u de stellingen in orde van uw belang kunnen rangschikken?**

1. De kans op het overbrengen van dierziekten (zoals mond en klauwzeer of Afrikaanse varkenspest) wordt kleiner.
2. Minder transporten reduceert de negatieve effecten ervan op het klimaat.
3. Dierwelzijn zou verbeteren bij afname van lange afstand transporten.
4. De prijs van het Nederlandse varkensvlees zou op de lange termijn stijgen indien er minder levende varkens worden geëxporteerd omdat veel varkenshouders hun varkens niet meer tegen redelijke prijs kunnen afzetten en hun bedrijf zullen moeten stoppen.

Q27 **Zou u meer informatie willen over de omstandigheden waarin landbouwdieren verkeren tijdens transport?**

- Ja
- Nee

Q28 **Wie zou het beste deze informatie kunnen geven? Let op, er zijn meerdere antwoorden mogelijk.**

- ☑ Dierenwelzijnsorganisaties →E5
- ☑ Publieke omroepen →E5
- ☑ Dierenbescherming →E5
- ☑ Retailers →E5
- ☑ Dierenartsenpraktijken →E5
- ☑ *[Anders, namelijk;]* →E5

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