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Analysis of the most common causes of viscera condemnation in pigs (liver, kidney, heart), in a slaughterhouse of Costa Rica, and its economical implication

Untersuchung der häufigsten Ursachen für Organverwurf bei Schweinen (Leber, Niere, Herz) in einem Schlachthof in Costa Rica und deren wirtschaftliche Bedeutung

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Abstract

This is an analysis of the causes and costs of rejection of viscera from the daily post-mortem meat inspection records from a slaughterhouse located in the Metropolitan area of the Central Valley. The records examined date from 2007 to the first semester of 2009. They were analyzed taking into consideration the following factors: month, year, affected organ and cause. The economical losses were calculated taking into account the quantity of organs rejected and averaging the weight in kilograms and the price by kilogram. During the recorded period, 562 843 animals were slaughtered. Kidney was the main viscera rejected. Cysts caused 48.9 % of the rejections, 22.2 % was because of contamination and 10 % due to nephritis. Some causes of liver rejection were milk spots (48.8 %), contamination (28.9 %) and congestion (9.3 %). Hearts rejection was due to pericarditis (35.6 %), contamination (32.2 %) and adhesions (24.5 %). There was no statistical difference in the lesion report rate or number of organs rejected during the different months and years. The direct financial loss from the viscera rejection during this period was $ 254 048.1. It is necessary to continue the studies looking for minimizing the factors contributing to viscera condemnation, with the aim of using this information as a diagnostic tool in preventive medicine.

Keywords: Swine, inspection, pathologic lesions

Zusammenfassung

Anhand von Aufzeichnungen der Fleischuntersuchung eines Schlachthofs in der Metropolregion „Central Valley“ in Costa Rica werden die Gründe ermittelt, die zur Verwerfung von Organen führen. Außerdem werden die daraus entstehenden Kosten kalkuliert. Es liegen Aufzeichnungen für einen Zeitraum von Anfang 2007 bis Mitte 2009 vor. Diese Aufzeichnungen werden unter folgenden Gesichtspunkten analysiert: Datum, betroffenes Organ, Grund für den Verwurf. Die ökonomischen Verluste werden anhand der Menge der verworfenen Organe, deren geschätztem Gewicht in Kilogramm und dem aktuellen Kilopreis berechnet. Im Aufzeichnungszeitraum wurden 562 843 Tiere geschlachtet. Das am häufigsten betroffene Organ ist die Niere. Von den beanstandeten Nieren wurden 48.9 % aufgrund von Zysten, 22.2 % wegen allgemeiner Verunreinigungen und 10 % aufgrund von Nephritiden verworfen. Bei der Leber führten in 48.8 % der Fälle sog. „Milk Spots“, in 28.9 % der Fälle allgemeine Verunreinigungen und in 9.3 % der Fälle eine Stauung des Organs zu einem Verwurf. Herzen wurden aufgrund von Perikarditiden (35.6 %), allgemeinen Verunreinigungen (32.2 %) und Verklebungen (24.5 %) beanstandet. Im untersuchten Zeitraum traten keine statistisch signifikanten Schwankungen der Menge der verworfenen Organe auf. Der unmittelbare wirtschaftliche Schaden für den Untersuchungszeitraum beläuft sich auf $254 048,1. Es ist notwendig weitere Untersuchungen vorzunehmen, um die daraus folgenden Erkenntnisse als diagnostisches Instrument innerhalb präventiver Maßnahmen nutzen zu können und die Einflussfaktoren, die zur Verunreinigung von Organen führen, zu minimieren.

Schlüsselwörter: Schwein, Fleischuntersuchung, Organveränderungen

Introduction

Pork is one of the most important sources of animal protein in the world with a perspective of increase in consumption between 2005 and 2030, of 20.5 %, after Roppa (2006). In fact, many of the Latin American countries have planned to increase the production in the next years (Maganhini et al., 2007; Rodriguez et al., 2007). Even in Costa Rica, it has been predicted a propitious behaviour for this industry, both competitiveness and profitability (SEPSA, 2006; Padilla-Pérez, 2008).

One of the main objectives in pork production is to increase the biological efficiency of animals in the growth and reproduction parameters (Pelliza et al., 2007). Among the factors that prevent to reach these objectives are the diseases, for this reason, the knowledge about the pathologies and its distribution is vital to make and set up measures to guide the producer and the domestic policies, making possible the development of swine production systems also the prevention of zoonoses (Torres-León and Ramírez-Porras, 1996; Pelliza et al., 2007; Fonseca et al., 2008).

The most widely used and regulated system for monitoring diseases in animals unfit for human consumption, is the inspection of the hygiene and quality characteristics in the animals both *ante-mortem* and *post-mortem* during slaughter process (Torres-León and Ramírez-Porras, 1996; Meynaud, 2004; Pelliza et al., 2007), all this to assure the safety of the animal-derived products (Meynaud, 2004; Fonseca et al., 2008). This inspection can be performed by qualified staff, endorsed by the Department authorized for this purpose, always with veterinary coordination and supervision (Meynaud, 2004; Fonseca et al., 2008; Reglamento Sanitario y de Inspección Veterinaria de Mataderos, Producción y Procesamiento de carnes, 2009). In this way, the main objectives of the inspection will be then locate and remove (confiscate) the potentially harmful or dangerous products besides those which, without being harmful, do not have the required organoleptic characteristics for human consumption (Meynaud, 2004; Fosse et al., 2007; Fonseca et al., 2008). In Costa Rica, the Department of Agriculture and Livestock (MAG, by its Spanish acronym) is the entity responsible for protecting the safety of the animal source food, which has as one its responsibilities to receive, list and file the amount of daily abattoir condemnations reported by the veterinarian service in each of the slaughter plants, assuring also that the costarican legislation is being applied under the article 147 of the law 29 588-MAG-S.

Nevertheless the benefits provided by this method of control, there is the possibility of many organs and carcasses being discarded, which leads to a decrease in the remuneration received by hog producers, increase in the abattoir production costs, etc., resulting in an increase of the prices of the final product. In economic terms, losses due to abattoir condemnation can be very substantial in developed countries and tend to be even bigger in underdeveloped countries (Althaus et al., 2005; Rodriguez et al., 2007; Bueno, 2008).

The aim of this study was to analyze the most frequent causes of viscera condemnation in pigs in a slaughterhouse located in the great metropolitan area of the Central Valley in Costa Rica, during the period from 2007 to first half of 2009 and its economical implication.

Material and methods

Material source

It was used the information coming from a slaughterhouse located in the great metropolitan area of Costa Rica, where pigs of different ages, weights, breeds and sexes are admitted for slaughter coming from several geographical zones of the country.

The data was obtained from the daily meat inspection reports taken by the veterinary service (assistant meat inspectors and veterinarian), endorsed by the MAG, after internal and external examination of carcasses and viscera of each animal slaughtered. The assessment of fitness for human consumption was made by meat inspectors in accordance with the department's handbook of meat inspection (Reglamento Sanitario y de Inspección Veterinaria de Mataderos, Producción y Procesamiento de carnes, 2009). Then, these data were processed taking into consideration the total amount of livers, kidneys and hearts condemned during the period from January 2007 to June 2009.

Statistical analysis

First, descriptive statistics on viscera condemnation prevalence was calculated. Then, variance analysis was performed based on the following factors: gross lesion prevalence, year, month, organ and cause of rejection. When significant differences in the data were found, the Duncan test was used to compare the means, with significant level $P < 0.05$. All these analyses were estimated using the program Statistica (StatSoft Inc. 2001).

Economical losses estimation

The economical losses were calculated using the price per kilogram (kg) given to each of the organs in the first semester of 2009, according to the data obtained from the official records of the MAG; in conjunction with the slaughterhouse own registers.

Because the condemned viscera is not weighted after its examination, the financial loss was established taking as a reference the weight values in kg for pig organs from birth to 154 days old reported by Casas et al. (2009), being this the average age at which pigs are sent to slaughter centers in Costa Rica (Padilla-Pérez, 2008). As a result, the formula used is as follows:

Price per kg x amount condemned x
average weight in kg for each of the organs

Results

During the studied period, 526 843 pigs were slaughtered in this abattoir; the condemnation of viscera and its proportion are specified in Table 1. The prevalence of kidney re-

TABLE 1: *Total amount of rejections for each organ and proportion.*

Organ	Condemned	
	N°	%
Kidney	218 555	*
Liver	132 961	25,2
Heart	44 546	8,4
Total pigs slaugthered	**562 843**	

*Proportion of kidneys condemnation was not calculated because lack of specifity in the reports.

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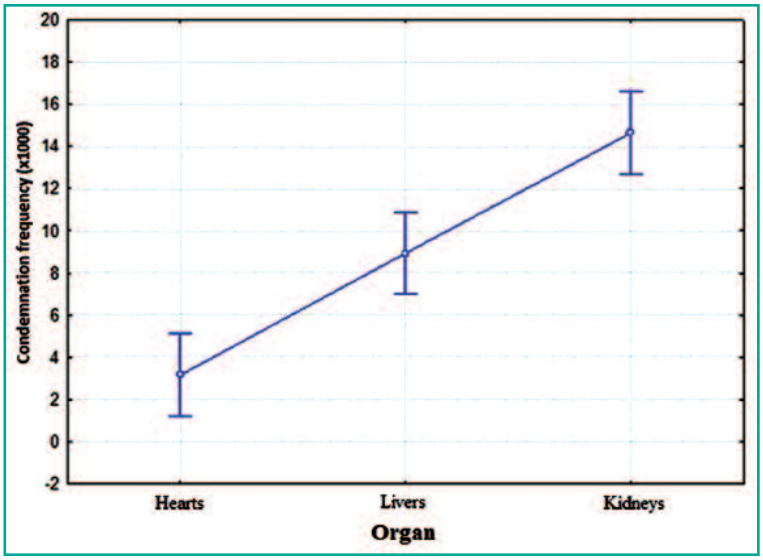

FIGURE 1: *Comparison of the condemnation frequency means per organ.*

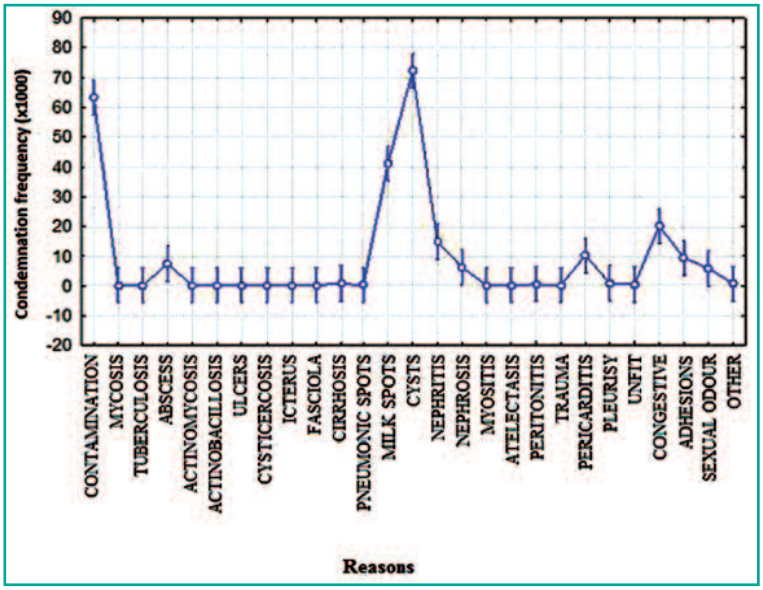

FIGURE 2: *Comparison of the condemnation frequency means per reason.*

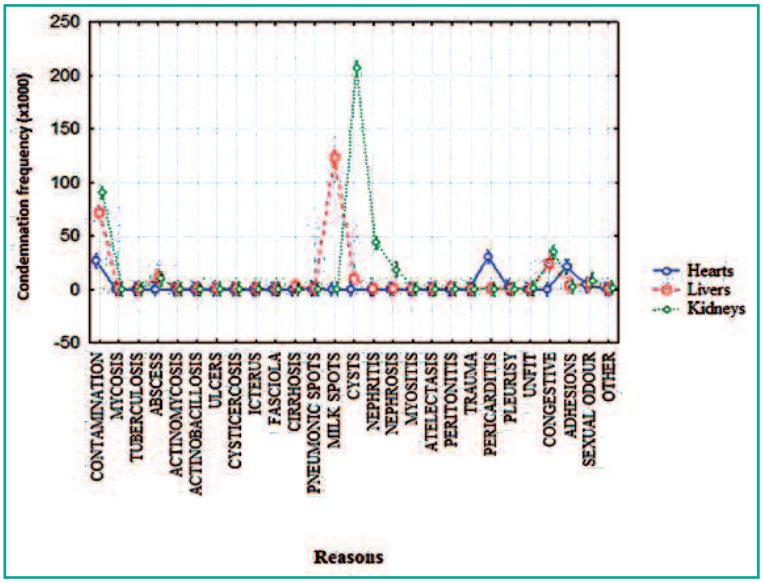

FIGURE 3: *Comparison of the condemnation frequency means per organ and reason.*

jection was not calculated, owing to the fact in the reports it is not specified if both or just one of the kidneys was condemned in each animal. It was found that the kidney was the main organ rejected, followed by the liver and the heart, considering $P < 0.05$ (Fig. 1).

For the kidney, cysts was significantly the main reason for rejection with 107 004 (48.96 %), contamination caused 48 617 (22.24 %) and nephritis 21 951 (10.04 %) (Tab. 2). Regarding the liver, the most prevalent reasons for rejection were "Milk Spots" 64 497 (48.85 %), contamination 38 513 (28.97 %) and congestion 12 333 (9.28 %) (Tab. 3). The principal reasons of condemnation for the heart were pericarditis, contamination and adhesions accounting 15 881 (35.65 %), 14 347 (32.21 %) and 10 912 (24.50 %) respectively (Tab. 4).

Taking into consideration all the reasons for condemnation, cysts was the most prevalent reported, influenced by the great amount of kidneys condemned when it is compared to the other organs, milk spots was the second reason, followed by congestion, nephritis, pericarditis, adhesions, abscess, nephrosis and sexual odour, the last ones without a significant difference between them (Fig. 2). However, contamination was the most commonly reported as a reason for the rejection of all studied viscera (Fig. 3).

There was found a no significant upward trend throughout the period when an analysis of the data was performed taking into consideration the prevalence of the reasons for condemnation. In addition, there was not established either a significant difference in the means when the prevalence of condemnations per month was studied (not published data).

The proportion of the causes for rejection was relatively constant for all viscera during each month of the studied period. However, it was observed months in which proportions changed abruptly in all the viscera according to the reports. For example, there were no kidneys rejected because cysts in June, 2008, but in March, 2009 the same reason was responsible for 97.4 % of the rejections. In October, 2008, milk spots was not recorded as a reason for rejection of livers, also the unique report during the 30 months period of telangiectasia (10.9 %) was observed in February, 2009. For the heart, it was noted a sudden report of pleurisy in September, 2007, and then as well in March and April, 2008 (not published data).

The economical losses accounted from rejections of whole viscera studied at this specific slaughterhouse were $254 048,1 (Tab. 5).

Discussion

As there is not a universal standard for the hygiene measurements, slaughter methods, also in the methods to take and record of the lesions found (Elbers et al., 1992), it is difficult to compare our results with those of other studies; this can also be a cause for the differences of the prevalence observed in this study with those reported in other countries. For this reason, we agree that it is important to have an international guide to describe, report and compare

TABLE 2: *Reasons for the rejection of kidneys.*

Specific reason	Nº	%
Abscess	5 351	2,45
Adhesions	1 340	0,62
Congestive	18 190	8,32
Contamination	48 617	22,24
Cysts	107 004	48,96
Nephritis	21 951	10,04
Nephrosis	10 222	4,68
Other	836	0,38
Peritonitis	195	0,09
Sexual Odour	4 367	2
Unfit	482	0,22
Total	**218 555**	**100**

TABLE 3: *Reasons for the rejection of livers.*

Specific reason	Nº	%
Abscess	6 022	4,53
Adhesions	2 054	1,54
Cirrhosis	1 198	0,9
Congestive	12 333	9,27
Contamination	38 513	28,97
Cysts	4 653	3,5
Milk Spots	64 947	48,85
Other	64	0,05
Peritonitis	435	0,33
Sexual Odour	2 305	1,73
Telangiectasia	377	0,28
Unfit	60	0,05
Total	**132 961**	**100**

the frequency of the different findings at abattoir (Tuovinen et al., 1994; Köfer et al., 2001). Even so, a comparison was made with other publications with similar pattern in recording procedures to establish an idea about the costarican situation, shown in one slaughterhouse, in respect of the global situation. It is important to emphasise that the present data were obtained from the records of others and not at first hand.

In agreement with Tiong & Bin (1989), kidneys were the most common organs condemned. However, the per cent of kidneys rejected in this study was bigger in a similar period of time. Regarding the rejection of hearts, Köfer et al. (2001) found a prevalence of 6.8 %, somewhat lower than the one reported by this slaughterhouse; but with a considerable difference with that reported by Rodríguez-Cariño, et al. (1999), who reported a condemnation prevalence of 47.6 % for this organ. On the other hand, the prevalence of liver condemnation was lower than the prevalence reported by Straw et al. (1994) in United States (49.2 %).

TABLE 4: *Reasons for the rejection of hearts.*

Specific reason	Nº	%
Abscess	14	0,03
Adhesions	10 912	24,5
Contamination	14 347	32,21
Other	38	0,09
Pericarditis	15 881	35,65
Pleurisy	1 044	2,34
Sexual Odour	2 304	5,17
Unfit	6	0,01
Total	**44 546**	**100**

Unlike our findings, Tiong & Bin (1989) described nephritis as the main reason for condemnation of kidneys (54.8 %). Nephritis lesions that show up at the abattoirs can be related to etiological agents as *Leptospira* spp., porcine parvovirus (PPV), porcine circovirus type 2 (PCV2), respiratory syndrome virus (PRRSV) and mycotoxins (Drolet et al., 2002; Boqvist et al., 2003; Gresham et al., 2006; Martínez et al., 2006). However, the results of this study were not sufficient to relate the low frequency of nephritis and its possible causes. On the other hand, renal cystic diseases are classified generally into inherited, developmental, and acquired (Bisceglia et al., 2006). The autosomal inheritance of this condition has been already reported in a study made in a landrace boar (Wells et al., 1980; Wijeratne and Wells, 1980), and has been also observed in canines (O'Leary et al., 1999), felines (Biller et al., 1996) and sheep (Jones et al., 1990). In addition, this inherited condition is the most common genetic renal disorder in humans (Izzi et al., 2010). Despite this, specific studies are necessary on this issue to clarify the cause of the lesions in Costa Rica.

The lesions caused by parasites ("Milk-spots") have been reported as the main reason for condemnation of livers by Tuovinen et al. (1992), Torres-León and Ramírez-Porras (1996), Köfer et al. (2001) and Zumbado (2008) in their study carried out in west and east Finland, Mexico, Austria, and Costa Rica, respectively; even when the prevalence reported for the first two were lower than those found in this study. These lesions are due to the damage left

TABLE 5: *Economic losses due to condemnation of kidneys, livers and hearts during the period.*

Period	Condemned organs			Total losses
	Kidney	Liver	Heart	
2007				
Semester I	34118	28045	10088	–
Semester II	36877	28244	12491	–
Anual	70995	56289	22579	–
2008				
Semeter I	40085	26331	8315	–
Semester II	56400	28762	7587	–
Anual	96485	55093	15902	–
2009				
Semester I	51075	21579	6065	–
Total	**218555**	**132961**	**44546**	**–**
Total in kg	**60758,29**	**195452,67**	**15145,64**	**–**
Total economical losses per viscera	**$35.744,0**	**$208.167,8**	**$10.136,3**	**$254.048,1**

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by the migration of larvae through the liver parenchyma as part of their life cycle in pigs. Histologically, it is observed eosinophilic hepatitis with abundant connective tissue as a result of the mechanical trauma produced (Torres-León and Ramírez-Porras, 1996; Rodríguez et al., 2007). Normally, *Ascaris suum* is the agent mostly related to these lesions in livers. However, The parasites: *Stephanurus dentatus, Taenia hydatigena, Ascaris lumbricoides, Metastrongylus apri, Toxocara cati, Toxocara canis* and *Fasciola hepatica* left behind a similar macroscopic pattern in this organ (Torres-León and Ramírez-Porras, 1996).

Zumbado (2008) found that endoparasites tended to have a greater influence on adult animals than on young, although it is known that usually the opposite behaviour is observed due acquired immunity through their life time. This could be owed to the intensive use of deworming products in the early stages of development and the gradual decline in subsequent periods until the time for slaughter comes. Furthermore, the low effect of the antihelmintics commonly used in the farms on the liver, could explain why it is still found milk spots on the liver during its inspection and lends support to the idea that the examination of the livers can be a good screening method for pig farms with ascariasis problems (Eriksen et al., 1992; Zumbado, 2008).

On the other hand, this is contrary to observation made by Tiong and Bin (1989) in Singapore (Cirrhosis 38.6 %, milk spots 20.4 %) and by Morales and Luengo (1995) in Chile (Cirrhosis 78.8 %, abscess 8.8 %, ascaris lesions 2.2 %), who reported cirrhosis as the main reason for condemnation, but any of the authors inferred from these results on possible explanations. Rodríguez et al. (2007) found that *F. hepatica* was the most common agent related to liver rejections, this is explained by the fact that many hog producers in Cuba supplement the diet being given to the animals with fresh forages harvested in lowlands, which increases the risk on consumption of the metacercaiae. This factor is not observed in Costa Rica, since animals in a large percentage are fed with feed derived primarily from corn.

Pericarditis has also been the most common cause of heart condemnation in the publications made by Tiong and Bin (1989), Morales and Luengo (1995), Köfer et al. (2001) and Meynaud (2004). However, it differs with the observation made by Rodríguez-Cariño, et al. (1999), who found in their study that the main reason for rejection was "Other lesions", in which they included haemorrhages and degenerations of cardiac muscle. Very few reports have been published concerning the possible causes for Pericarditis in slaughter pigs. In their reports Jensen et al. (1995) and Buttenschøn et al. (1997) came to the conclusion that *Mycomplasma hyopneumoniae* is the most likely cause of this lesion, although other species of mycomplasmas, *Actinomyces pyogene* and PPV were found also as possible causal agents for this particular lesion by these authors. More recently, Bollo (2004) reported in his survey that this lesion could be related to *Haemophilus parasuis, Pasteurela multocida* and *Streptococcus suis.*

It is interesting to note that contamination was one important cause of rejection for all organs. This is contrary to observation made by Hill and Jones (1984) and Meynaud (2004), who classified this reason as "miscellaneous reason" or a low prevalent reason for rejection of viscera and carcasses. From lairage to chilling, the slaughter process is full of opportunities for the contamination of the organs and carcasses with potential pathogenic agents for the humans (Borch et al., 1996). Among the contaminating agents being present during this process, are included: *Aeromonas hydrophila, Salmonella* spp., *Yersinia enterocolitica, Campylobacter coli/jejuni, Listeria Monocytogenes* y *Staphylococcus aureus,* which are characterized as high-risk bacteria to human health (Adesiyun and Krishnan, 1995; Borch et al., 1996; Fosse et al., 2007). It has been observed that those bacterial agents have different patterns of distribution during the process, consequently their control measures are directed at those specific points. For example, Morgan et al. (1987) noted that increases in the occurrence of *Salmonella* spp. isolations from pork carcasses ready to be placed in chiller storage was influenced by the time the animals spent in lairage, therefore proper coordination between producers and slaughterhouses in regard to arrival and sacrifice schedules could be an appropriate measure to prevent the contamination with these agents. Borch et al. (1996) also commented that because *Aeromonas* spp., *Listeria* spp. y *S. aureus* are endemic in the environment where the meat production process is carried, these could be easily controlled by a meticulous cleaning and disinfection of spaces. The most important source of *Salmonella* spp., *Campylobacter* spp. and *Yersinia enterocolitica* are the gastrointestinal contents which can contaminate the carcasses especially in the evisceration process. In addition, it has reported the risk of cross-contamination with *Campylobacter* spp. and *Yersinia enterocolitica* when the procedure for incision of the submaxilary lymph nodes is performed (Nesbakken et al., 2003). However, these agents may be present at any point in the process when good manufacturing practices and proper risk analysis for contamination are not present.

Although not observing fecal contamination on the carcasses or organs is not irrefutable evidence that there is no presence of any bacterial agent, the prevention of the visual contamination considerably reduces the risk of arrival of these pathogens to the bodies and viscera (Oosterom and Notermans, 1983; Gill, 2004; Fosse, 2007). For this reason, it is really important to identify the points where mistakes are made at this specific and controllable phase of the pork production process such as slaughter. Then based on this information, it is necessary to develop control systems such as Hazard Analysis Critical Control Points (HACCP) and in this way reduce the microbiological risks given by the contamination during the slaughter process (Nesbakken et al., 2003; Spescha et al., 2006). Thus it will be possible to assure the food inocuity, decrease the rejection of viscera and reduce the economical losses generated by this factor.

In our survey it was not observed a seasonal pattern in the condemnation prevalence of the different organs. Elbers et al. (1992) and Straw et al. (1994) reported a defined seasonal pattern for liver rejection explained by the seasonal development of *A. suis* eggs which finds a suitable ground conditions (humidity, temperature, etc.) during certain periods of the year. This could be not happening in Costa Rica because the variations of climatic conditions are more stable than those of the countries studied by the mentioned authors. Furthermore, the geographical area in which are located most of the hog farms in Costa Rica (Padilla-Pérez, 2008), is favourable for the development of the larvae almost during the whole year. It is important to mention that parasitic lesions observed in liver during the inspection in slaughtered animals are an indication of a worm infection in the last 4–6 weeks of the finishing period (Elbers et al., 1992; Torres-León and Ramírez-Porras, 1996) since the lesions left by larval migration through the

liver do not take more than two months to completely heal (Straw et al., 1986). However, to try to dismiss or accept the hypothesis of seasonality of the lesions further studies should be based on data taken from several years. In our survey it was analysed data from two and a half years which is a short period of time to determine more accurate seasonal patterns (Tuovinen et al., 1994).

The variations on the report of each lesion during the different months were not associated with the origin of the slaughter pigs. Hills and Jones (1984) y Elbers et al. (1992) commented that these differences can be attributed to the speed of the conveyor in combination with the level of perception and discrimination of lesions between meat inspectors during the inspection process. It was observed in this slaughterhouse a periodical shift rotation is made by the inspectors through the different inspection points. Moreover, often there are no substitute inspectors and therefore are no one to cover immediately the working place and accomplish all the tasks, overburdening the remaining team, in case one of them is absent. Despite this, it is necessary to carry out thorough surveys to clarify the real cause of these variations and if those are observed only in this specific slaughterhouse or is a widespread behaviour.

Morales and Luenjo (1996) calculated the approximate economical losses from every viscera in different species and also reported that the liver was the most important organ in such losses in pigs, followed by kidney. In agreement with Zumbado (2008), the parasitic lesions caused by larval migration in the liver had great economic importance because of its larger size and its higher value in comparison with the other viscera, although the number of livers rejected was significantly lower. Moreover, knowing that the diseases occur throughout the animal's life, there is an indirect economic implication due to the decrease on the average daily gain and the feed conversion ratio, which is commonly underestimated by farmers and difficult to give a real value (Heinonen, 2001; Rodríguez et al., 2007).

One of the main objectives of meat inspection is the protection of public health. In fact, meat inspection methods were instigated when meat and meat products were discovered to play a role in the transmission of disease attempting to ensure the inocuity of these products (Heinonen, 2001). Furthermore, even though the information obtained from the slaughter animals gives an idea about their health status during their final stage of production (Pelliza et al., 2007), routine slaughterchecks can be useful when they are taken into account to evaluate success of control measures on an individual herd basis, because it would be difficult to justify frequent evaluation of these findings for most commercial producers unless the checks are accompanied by implementation of new control measures. For example, the periodical evaluation of the slaughter findings is a basic tool to control the success of new deworming protocols in hog herds (Straw et al., 1994). It is for this reason that Heinonen (2001) commented that the concept of safety and quality of the meat products may begin when the animal is conceived and should cover every step on the production chain, requiring the producer and the local veterinarian to ascertain the inocuity of the products coming from the farm. In this way, it would be possible to extend the *ante-mortem* examination to the productive phase and to turn the meat inspection at slaughterhouses into one of many control points, in order to increase the guarantee of the final product and the effectiveness of *post-mortem* examination as a study and verification method.

In agreement with Hills and Jones (1984) and Elbers et al., (1992) opinion, we think meat inspection is physically demanding and requires considerable mental concentration. Consequently, ways must be found to improve the working conditions, working shifts, training and motivation of meat inspectors, also the interpretation capacity must be evaluated really closely by the veterinary stuff so the slaughterchecks could be taken as a source of animal health information.

In general, very few reports from Central America have been published concerning pig production, its stage in slaughterhouses and economic implications of viscera and carcass condemnation. The MAG in Costa Rica is still developing an effective system of identification and traceability of meat and meat products. Therefore, the exact information about the origin of the animals, when they arrive to the abattoir, is uncertain in many cases. In addition, the recording of rejected organs is made without specifying the animal or the farm, of which the viscera were taken from (FAO, 2009).

For these reasons, it is still difficult to estimate accurately the influence of the different factors in the rejections, reported in this slaughterhouse. Nevertheless, this investigation gives an overview about the situation in Costa Rica and can be used as a basis for further projects in the region.

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+++ Nachrichten aus Forschung und Industrie +++

(Die Verantwortlichkeit für die Texte liegt ausschließlich bei den Instituten und werbenden Unternehmen.)

SureFood Preis 2011

Lebensmittelmikrobiologie, Lebensmittelhygiene und Lebensmittelsicherheit sind gesellschaftliche Themen von zentraler Bedeutung. Die dynamisch fortschreitende Globalisierung der Lebensmittelprimärproduktion und das stetige Auftreten von sogenannten „new and emerging" Pathogenen, erzeugt fortwährend neue Herausforderungen denen man mit innovativen technologischen Verfahren begegnen muss.

Die rasante Entwicklung der Biotechnologie hat in den letzten Jahren zu einer hohen Verfügbarkeit von schnellen und modernen Methoden geführt, mit denen Qualitätsparameter in Lebensmitteln schnell und spezifisch überprüft werden können.

Die Entwicklung solcher Verfahren erfordert eine enge Verknüpfung von Forschung und Anwendung.

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Über die Vergabe entscheidet eine Jury, bestehend aus Wissenschaftlern/innen aus Forschung/Hochschule, Lebensmittelüberwachung und Qualitätssicherung (Lebensmittelindustrie).

Die Vergabe erfolgt auf dem Fachsymposium Lebensmittelmikrobiologie der VAAM/DGHM im Frühjahr 2012.

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