



Ciência Rural

ISSN: 0103-8478

cienciarural@mail.ufsm.br

Universidade Federal de Santa Maria
Brasil

Oliveira Souza, Ana Paula; Forte Maiolino Molento, Carla
Good agricultural practices in broiler chicken production in the state of Paraná: focus on
animal welfare

Ciência Rural, vol. 45, núm. 12, diciembre, 2015, pp. 2239-2244

Universidade Federal de Santa Maria
Santa Maria, Brasil

Available in: <http://www.redalyc.org/articulo.oa?id=33142570026>

- How to cite
- Complete issue
- More information about this article
- Journal's homepage in redalyc.org

redalyc.org

Scientific Information System

Network of Scientific Journals from Latin America, the Caribbean, Spain and Portugal

Non-profit academic project, developed under the open access initiative

Good agricultural practices in broiler chicken production in the state of Paraná: focus on animal welfare

Boas práticas agropecuárias na avicultura de corte do estado do Paraná: foco no bem-estar animal

Ana Paula Oliveira Souza¹ Carla Forte Maiolino Molento^{1*}

ABSTRACT

Broiler chicken welfare regulation at farm level is scarce in Brazil. This research aimed to study good agricultural practices at farm level adopted by broiler chicken companies in the state of Paraná, analyzing them in relation to the promotion of animal welfare. Twenty exporting companies were contacted, 15 answered the questionnaire. The participating companies were responsible for 76.3% of the State broiler production. Indicators related to the availability and the quality of food and water are being adapted by the companies, but still need to be improved. Regarding environmental indicators, companies had concerns about air and litter quality and about the implementation of emergency systems on totally enclosed broiler houses. Natural light has been replaced by low intensity artificial lighting. Footpad dermatitis was the most cited disease used as a sanitary indicator (93.3%), but little information was given about the maximum percentages allowed. Environmental enrichment is not used in poultry houses. This study identified agricultural programs with positive and negative impacts on animal welfare. Investments on research seem to be the only way to conduct changes on broiler chicken chain without reducing the quality of animals' life.

Key words: five freedoms, indicators, regulation, poultry.

RESUMO

A regulamentação em bem-estar animal (BEA) no Brasil não tem especificidade para a cadeia de frangos de corte nas etapas anteriores ao abate. Este trabalho teve como objetivo estudar os programas de boas práticas agropecuárias (BPA) de empresas de avicultura de corte do Paraná, analisando-os em relação à promoção do BEA no âmbito das granjas. Vinte empresas exportadoras do Paraná foram contatadas, 15 aceitaram participar, sendo estas responsáveis por 76,3% da produção do Paraná. Observou-se que os indicadores relacionados à disponibilidade e qualidade de alimento têm sido objeto de adequação nas granjas, ainda sujeito a melhorias. Nos indicadores ambientais, observaram-se cuidados com a qualidade

do ar e da cama, implementação de sistemas de emergência em granjas climatizadas e a substituição da iluminação natural por artificial de baixa intensidade. A pododermatite foi a doença mais citada como indicador sanitário (93,3%), mas pouca informação foi dada a respeito dos valores máximos para este e outros indicadores sanitários. O enriquecimento ambiental não é usado pelas empresas respondentes. Foram identificados programas de BPA que podem ter consequências positivas e negativas para o BEA. Os resultados deste trabalho sugerem que o investimento em pesquisa parece ser a única via para balizar mudanças no setor de avicultura, sem que estas incorram em redução na qualidade de vida das aves.

Palavras-chave: cinco liberdades, frangos de corte, indicadores, legislação.

INTRODUCTION

Brazil is the third producer and the leading broiler chicken meat exporter in the world, and the state of Paraná is the leading producer and exporter within the country (ABPA, 2014). Despite the economic relevance of broiler chicken production in Brazil, animal welfare regulation is scarce at farm level. Thus, facilities design and animal handling follow the rules of each company.

International publications have shown the actions of some countries to improve farm animal welfare, such as in the United States (MENCH, 2008) and European Union countries (VEISSIER et al., 2008). In contrast, international publications have suggested deficiency of animal welfare policies in developing countries, including Brazil (VAN

¹Departamento de Zootecnia, Universidade Federal do Paraná (UFPR), Rua dos Funcionários, 1540, 80035-050, Curitiba, PR, Brasil.
E-mail: carlamolento@ufpr.br. *Corresponding author.

HORNE & ACHTERBOSCH, 2008). The weakness of animal welfare regulations has been understood as poor animal welfare in comparison to European Union (EU) countries. However, recent evidence-based comparisons of broiler chicken welfare began to clarify broiler chicken welfare in Brazilian industrial system (TUYTTENS et al., 2014; SOUZA et al., 2015).

Information about animal welfare has reached companies in Brazil through governmental, commercial and civil channels, being the last two the most influential (MACIEL & BOCK, 2013). However, the level of implementation of this information in the Brazilian broiler chicken chain is not known. Therefore, this research aimed to study good agricultural practices at farm level adopted by broiler chicken companies in the state of Paraná, analyzing them in relation to the promotion of animal welfare.

MATERIAL AND METHODS

Twenty nine units approved by the Ministry of Agriculture to export to general list and/or European Union were identified in the state of Paraná. Companies with more than one unit but with centralized management were considered as one company. Companies that were part of a business group, but had independent management in each unit, were considered as individual companies. Therefore, the initial sample counted 20 companies, covering all export companies of Paraná, of which 15 accepted to participate in this study.

Nine general questions and 45 questions about good agricultural practices in broiler chickens were applied to the veterinarians of the participating companies. In order not to limit information provided by the respondents, an open question was available to encourage them to mention any practice relevant to animal welfare (AW) that was not considered within the questionnaire. Questions were built based on international regulation (ENGLAND, 2007; EC, 2007), animal welfare assessment and certification protocols (WELFARE QUALITY®, 2009; RSPCA, 2011; GLOBALG.A.P.®, 2013a), code of practice (GRANDIN, 2013) and technical report (EFSA, 2012); and included requirements about bird handling, poultry house facilities, equipment and quality programs. Interviews were performed in person, by phone or videoconference between August 2013 and February 2014. Results were analyzed by descriptive statistics.

RESULTS AND DISCUSSION

Participating companies accounted for 76.3% of broiler chicken slaughtered in the state of

Paraná, 53.3% (8/15) of them approved to export to general list and 46.7% (7/15) to general list and EU. The EU, which presents high concerns about AW (VEISSIER et al., 2008), was considered one of the main export markets by only one third of companies. About 60.0% (9/15) of companies did not have clients with AW requirements at farm level, and the others (40.0%, 6/15) mentioned clients of EU as being concerned with AW at farm level. Even though the EU is not the main international market of Brazilian chicken meat, approval to export to this economic bloc may facilitate market opening worldwide. Clients in other countries are aware of the high sanitary requirements to export to EU, and some may consider this approval as a quality attribute during the development of broiler chicken meat supplier in Brazil. Based on this, the increasing number of companies aiming to be approved to export to the EU due to economic reasons may contribute to improve animal welfare at farm level.

Nutritional indicators

All companies (15/15) had their own feed mill, and 73.4% (11/15) informed that any level of good manufacturing practices was implemented on feed mills, according to the Ministry of Agriculture regulation IN 4/2007 (MAPA, 2007). In other companies (26.6%, 4/15), feed mills were certified in one or more of the following protocols, in addition to the IN 4/2007: GLOBALG.A.P.® Compound Feed Manufacturing, ISO 9001, Hazard Analysis and Critical Control Point and Sindrões. Feed quality seems to be an important item to participating companies, since 66.7% (10/15) of them spontaneously declared raw material or final product characteristics at feed mill as a nutritional indicator.

Feeder and drinker distribution in poultry house plays an important role on AW because it is determinant in avoiding or promoting animal dispute to reach food and water. All companies initially informed the bird to nipple and bird to feeder ratios. Considering the feeders, recommendations are based on space per bird, which may range between 1.0 to 1.6cm bird⁻¹ (RSPCA, 2011; GLOBALG.A.P.®, 2013a). Companies had to check feeder diameter in use, and only ten companies calculated the space per bird during or after the interview. The values were 0.7 to 0.9cm bird⁻¹ in 60.0% of companies and higher or equal to 1.0cm/bird in 40.0% of companies. As feeder diameter vary among manufacturers, the adoption of a space to bird ratio may be more effective to guarantee birds access to feed. Considering the nipple drinkers, all companies (15/15) mentioned to work with the

maximum 10:1 or 12:1 ratio, which is in accordance with the 10:1 and 20:1 ratios described in certification and animal welfare assessment protocols (CERTIFIED HUMANE®, 2009; WELFARE QUALITY®, 2009; RSPCA, 2011; GLOBALG.A.P.®, 2013a).

About 73.3% (11/15) of companies informed that poultry houses are equipped with individual hydrometer within all farms, 20.0% (3/15) have implemented individual hydrometers only on new poultry houses and 6.7% (1/15) do not have hydrometers. Measuring bird water consumption is a recommended practice since any increase or decrease may suggest health problems (OIE, 2013). Attention must also be paid to water quality and source (OIE, 2013). Eleven companies (73.3%) performed microbiological water analysis in poultry houses every year, three companies (20.0%) did it only at new farms and one company informed that there was no frequency established for analysis. According to the Ministry of Agriculture regulation IN 36 (MAPA, 2012), companies must perform microbiological water analysis in poultry houses when the farm is first registered at the regulation body, and thereafter annually. Results suggested that participating companies have worked on indicators related to food and water availability and quality.

Environmental indicators

Poultry house environment directly affects animal welfare. The European Food Safety Authority report on broiler chicken welfare (EFSA, 2012) pointed critical items in poultry house environment, such as air and litter quality, stocking density, temperature and lighting. All companies (15/15) declared to assess aerial ammonia by sensorial analysis. It is an easy method for daily control, since human beings are able to detect aerial ammonia in concentrations below ten ppm (parts per million) (EFSA, 2012). About 46.7% (7/15) of companies had equipment to measure aerial ammonia, in addition to sensorial analysis. The maximum values reported were between 10 and 20ppm, which are in accordance to scientific recommendations (EC, 2007; GRANDIN, 2013) and certification protocols (CERTIFIED HUMANE®, 2009; RSPCA, 2011; GLOBALG.A.P.®, 2013a). The frequency of ammonia analysis differed among companies: 14.3% (1/7) measured it during the winter, 14.3% (1/7) during chicks arrival at the poultry house, 28.6% (2/7) during chicks arrival and just before slaughter, and 42.8% (3/7) without a specific frequency. All companies (15/15) assessed litter quality during technical visits at poultry farms, and the respondents mentioned the terms dry and

friable to describe a good litter. These words are equivalent to the terms of good litter described in European Directive 43/2007 and in Welfare Quality protocol (2009).

Most companies (12/15, 80.0%) adopted 33.0 to 39.0kg m⁻² stocking density level. Stocking density recommendations may range between 30.0kg m⁻² (CERTIFIED HUMANE®, 2009; RSPCA, 2011) up to 42.0kg m⁻² (EC, 2007). Higher densities have been observed on fully enclosed poultry house of EU, such as 42.6 (38.6-45.5) kg m⁻² and 45.5 (39.9-48.8) kg m⁻² (WELFARE QUALITY®, 2010) and 40.0±0.9kg m⁻² (FEDERICI, 2012). This may be a consequence of the thinning procedure, practiced in EU. Participating companies did not perform thinning, which is in accordance with EFSA (2012) recommendation to reduce both animal stress and biological risks in poultry houses.

About 93.3% (14/15) of companies informed that they were implementing a life support backup procedure in poultry houses when the electricity fails, such as an emergency power supply source available at farm or by rental contract. A total of 28.6% (4/14) of these companies had the emergency power supply at farm on dark houses and on fully enclosed poultry houses, and 35.7% (5/14) affirmed it is mandatory only on new poultry houses or new farms with more than two units. Ninety-three percent (14/15) of companies informed that poultry houses with automatic ventilation system are equipped with an alarm to protect birds against ventilation failure, and 6.7% (1/15) of companies implemented an alarm system only in new poultry houses. According to GRANDIN (2013), life support backup procedures are critical control points in poultry houses, and the results presented in this study suggest that companies are concerned about it on fully enclosed poultry houses.

A total of 93.3% (14/15) of companies declared to use four hours of darkness in 24 hours in poultry houses to promote bird resting, which is in accordance with the minimum determined by international regulation and recommendations (EC, 2007; NEW ZEALAND, 2012; EFSA, 2012; GLOBALG.A.P.®, 2013). Some stricter certification schemes require a daily minimum of six hours of uninterrupted darkness (CERTIFIED HUMANE®, 2009; RSPCA, 2011). In Brazil, broiler chicken companies are replacing natural lit poultry houses with those working exclusively with artificial lighting. In this study, 93.3% (14/15) of companies affirmed they have implemented dark houses systems in some farms. Lighting intensity within these farms have ranged according to figure 1, and more than

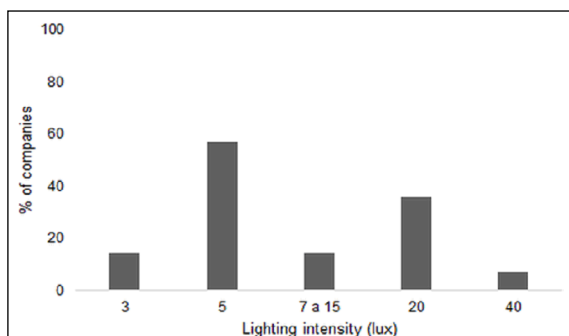


Figure 1 - Poultry house lighting intensity of 14 companies in the State of Paraná, Brazil. Total percentage is higher than 100% because some companies adopted more than one lighting program.

half of companies mentioned five lux as one of the lighting program in place. Low lighting intensity decreases locomotory activity and may lead to contact dermatitis and leg disorders (EFSA, 2012). Even though it complies with breeder companies recommendations (COBB®, 2008; ROSS®, 2009; HUBBARD®, 2014), five lux is lower than the minimum of 10 and 20 lux recommended for broiler chickens (EC, 2007; EFSA, 2012). Natural lighting in poultry houses has been studied (BAILIE et al., 2013) and has been mandatory by some retailers on United Kingdom (MORRISONS, 2013). It has also been requested on certification protocols, where they might be considered mandatory (RSPCA, 2011) or voluntary (GLOBALG.A.P.®, 2013b). Replacing natural light with artificial light of low intensity in Brazil may lead to future consequences to farmers once United Kingdom and EU, which are the world leading countries on animal welfare regulation, tend to work in the opposite direction.

Sanitary indicators

Most companies (13/15, 86.7%) informed maximum acceptable daily mortality rates that ranged from 0.07% to 0.5%, and are in accordance to international recommendation (CERTIFIED HUMANE®, 2009; GLOBALG.A.P.®, 2013a). Eighty percent (12/15) of companies registered dead and culled animals separately. This practice is important since mortality itself does not directly reflect animal welfare as accurately as the relationship between mortality and culls on farm, where high mortality associated to low levels of culling may indicate poor welfare (EFSA, 2010). Sixty percent informed that farmers registered the main causes of mortality and culling, which is essential to address welfare problems on current and future flocks and is an important item to be improved on participating companies.

Diseases and injuries mentioned by companies as sanitary indicators are presented on figure 2, being all of them critical points on broiler chicken production (GRANDIN, 2013). Leg problems are a major cause of poor welfare in broilers (EFSA, 2010), but few companies mentioned lameness as a sanitary indicator. Companies provided little information about maximum rates for each item. Three companies informed maximum footpad dermatitis levels between 3.0% and 25.0%, which differed from the values observed in other studies that ranged between 55.0% and 82.0% (ALLAIN et al., 2009; GOUVEIA et al., 2009; FEDERICI, 2012; MARTINS et al., 2014; SOUZA et al., 2015). Lack of information about the maximum rates suggests a difficulty faced by companies to develop those indicators. Since these diseases and injuries indicate poor welfare situation, it is important to prioritize studies that establish and improve sanitary indicators. Some World Animal Health Organization (OIE, 2013) recommendations for broiler chicken welfare were observed by all participating companies, such as: written animal health plan including handling, cleaning and pest control; farmer training, daily poultry house inspection and regular technical visits on flocks. Thus, results suggested that companies have adopted an organizational structure that provides regular technical support in poultry houses.

Behavioral and psychological indicators

Compassionate handling may directly affect human-animal relationship (HAR), and according to RUTHERFORD et al. (2012), the assessment of affective states in animals is a critical component of animal welfare. None of the respondents informed to use a validated method to assess HAR or emotional

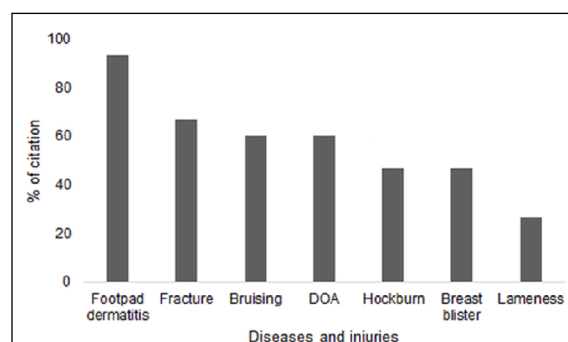


Figure 2 - Disease and injuries cited as sanitary indicators by 15 companies in the state of Paraná, Brazil. Total percentage is higher than 100% because some companies adopted more than one indicator. DOA means dead on arrival.

state, but 40.0% (6/15) of companies performed an informal assessment based on general animal behavior, such as the presence of scared or agitated birds on farm; and 13.3% (2/15) of companies observed condemnations by scratches at the slaughterhouse. These condemnations are compatible with stress situations on broiler chicken production, once fear reactions and escape attempts usually lead to animal injuries (WAIBLINGER et al., 2006). These results suggested that companies performed informal behavioral visual assessment to evaluate animal health, birds-farmers relationship and animal comfort, relating them to animal emotional state. However, validated assessment methods are not used by companies, probably due to lack of knowledge.

Broiler chickens are usually reared in low complexity environments (EFSA, 2012). About 13.3% (2/15) of companies performed attempts using straw and perches as environmental enrichment (EE) in poultry houses, but without conclusive results. A total of 53.3% (8/15) of companies informed that some farmers used to play music inside the poultry house to keep birds calm, although this procedure was not part of company recommendations. Companies may not understand the benefits of EE when only economic results are expected. EE is not common practice by participating companies, and it is an important item to be developed in broiler chicken commercial production in the state of Paraná.

CONCLUSION

This study identified agricultural practices with positive and negative impacts on animal welfare. Attitudes towards decreasing sanitary and environmental problems on broiler chicken production have been essential to improve animal welfare. On the other hand, replacing natural lighting in poultry houses seems to be incompatible to AW and incoherent, as it has been related to better animal welfare. Companies must know the welfare of broiler chickens in each type of poultry house to evaluate the impact of each facility on AW and to define strategies for the future of commercial production. Investments on research seem to be the only way to conduct changes on broiler chicken chain without reducing the quality of animals' life.

BIOETHICS AND BIOSSECURITY COMMITTEE APPROVAL

This project was approved by the Human Research Ethics Committee of the Universidade Federal do Paraná (SCS/UFPR), protocol 288.274.

ACKNOWLEDGEMENTS

This research was funded by Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) and Fundação Araucária. The authors wish to thank the Brazilian Association of Animal Protein, SINDIAVIPAR, the participating companies, Bruno Roberto Müller and the editorial commission that offered valuable comments.

REFERENCES

- ABPA (BRAZILIAN ASSOCIATION OF ANIMAL PROTEIN). **Annual report 2014**. São Paulo: 2014. 55p.
- ALLAIN, V. et al. Skin lesions in broiler chickens measured at the slaughterhouse: relationships between lesions and between their prevalence and rearing factors. **British Poultry Science**, v.50, n.4, p.407-417, 2009. Available from: <<http://www.tandfonline.com/doi/full/10.1080/00071660903110901#tabModule>>. Accessed: Dec. 19, 2014. doi: 10.1080/00071660903110901.
- BAILIE, C.L. et al. Influence of the provision of natural light and straw bales on activity levels and leg health in commercial broiler chickens. **Animal**, v.7, n.4, p.618-26, 2013. Available from: <<http://dx.doi.org/10.1017/S1751731112002108>>. Accessed: Dec. 16, 2014. doi: 10.1017/S1751731112002108.
- CERTIFIED HUMANE®. **Human farm animal care - Animal care standards (chickens)**. 2.ed. Herndon: Humane Farm Animal Care, 2009. 40p.
- COBB-VANTRESS®. **Broiler management guide**. [S.l.], 2013. 73p.
- EC (EUROPEAN COMMISSION). **Directive 43/2007/EC Laying down minimum rules for the protection of chickens kept for meat production**. Brussels, 2007. 10p.
- EFSA (EUROPEAN FOOD SAFETY AUTHORITY). Scientific opinion on the influence of genetic parameters on the welfare and the resistance to stress of commercial broilers. **EFSA Journal**, v.8, n.7, p.1-82, 2010.
- EFSA (EUROPEAN FOOD SAFETY AUTHORITY). **Scientific report updating the EFSA opinions on the welfare of broilers and broiler breeders**. Brussels: 2012. 116p.
- ENGLAND. **The welfare of farmed Animals**. United Kingdom, 2007. 20p.
- FEDERICI, J.F. **Bem-estar de frangos de corte no Brasil e na Bélgica: avaliação e impacto nas relações de comércio internacional**. 2012. 116f. Dissertation (Masters on Veterinary Science) - Universidade Federal do Paraná.
- GLOBAL G.A.P.®. **Control points and compliance criteria: integrated farm assurance – poultry**. 4.0. 2.ed. Cologne: GLOBALGAP, 2013a. 70p.
- GLOBAL G.A.P.®. **Animal welfare add-on module for poultry/broiler chicken**. Cologne, 2013b. 11p.
- GOUVEIA, K.G. et al. Welfare assessment of broilers through examination of haematomas, FPD, scratches and breast blisters at processing. **Animal Welfare**, v.18, p.43-48, 2009.

- GRANDIN, T. **Animal welfare audits for cattle, pigs, and chickens that use the HACCP principles of critical control points with animal based outcome measures**. [S.l.]: 2013. Accessed: Dec. 19, 2014. Online. Available from: <<http://www.grandin.com/welfare.audit.using.haccp.html>>. Accessed: Mar. 23, 2015.
- HUBBARD®. **Broiler management guide**. Quintin: Hubbard, 2014. 64p.
- MACIEL, C.; BOCK, B. Ethical concerns beyond the border: how European animal welfare policies reach Brazil. In: RÖCKLINSBERG, H.; SANDIN, P. (Eds.). **The ethics of consumption SE - 57**. Upsala: Wageningen Academic Publishers, 2013. p.361-365.
- MARTINS, R.S. et al. Influence of in-house composting of reused litter on litter quality, ammonia volatilisation and incidence of broiler foot pad dermatitis. **British Poultry Science**, v.54, n.6, p.669-676, 2013. Available on: <<http://www.tandfonline.com/doi/abs/10.1080/00071668.2013.838747#.VRC3HvnF9UU>>. Accessed: Mar. 23, 2015. doi: 10.1080/00071668.2013.838747.
- MAPA (Ministério da Agricultura, Pecuária e Abastecimento). **Instrução Normativa 4/2007**. Regulamento técnico sobre as condições higienico-sanitarias e de BPF para estabelecimentos fabricantes de produtos destinados à alimentação animal. Brasília, 2007.
- MAPA (Ministério da Agricultura, Pecuária e Abastecimento). **Instrução Normativa n.36 de 6/12/12**, referente aos procedimentos para registro, fiscalização e controle de estabelecimentos avícolas de reprodução e comerciais. Brasília, 2012.
- MENCH, J.A. Farm animal welfare in the USA. Farming practices, research, education, regulation and assurance programs. **Applied Animal Behavior Science**, v.113, n.4, p.298-312, 2008. Available from: <<http://www.sciencedirect.com/science/article/pii/S0168159108000105>>. Accessed: Dec. 18, 2014. doi: 10.1016/j.applanim.2008.01.009.
- MORRISONS. **Corporate responsibility review**. Bradford: 2013. 80p.
- NEW ZEALAND. **Code of welfare 2012 (meat chickens) under section 75 of the Animal Welfare Act 1999**. New Zealand, 2012. 39p.
- OIE (WORLD ANIMAL HEALTH ORGANIZATION). Animal welfare and broiler chicken production systems. In: OIE. **Terrestrial animal health code**. 22.ed. Paris, 2013. 8p.
- ROSS®. **Broiler management manual**, 2009. Scotland: Aviagen, 2009. 114p.
- RSPCA. **RSPCA welfare standards for chickens**. Horsham, Reino Unido: Royal Society for the Prevention of Cruelty to Animals, 2011. 84p.
- RUTHERFORD, K.M.D. et al. Qualitative behavioural Assessment of emotionality in pigs. **Applied animal behaviour science**, v.139, n.3-4, p.218-224, 2012. Available from: <<http://www.sciencedirect.com/science/article/pii/S0168159112001207>>. Accessed: Dec. 10, 2014.
- SOUZA, A.P.O. et al. Broiler chicken welfare assessment in GLOBALGAP certified and non-certified farms in Brazil. **Animal Welfare**, v.24, n.1, p.45-54, 2015. Available from: <<http://dx.doi.org/10.7120/09627286.24.1.045>>. Accessed: Mar. 23, 2015.
- TUYTTENS, F. et al. The animal welfare status of EU-imported versus locally produced broiler meat. In: WAFL, 6., 2014, Clermont-Ferrand. **Proceedings...** Clermont-Ferrand: Wageningen Academic Publishing, 2014. p.65.
- VAN HORNE, P.L.M.; ACHTERBOSCH, T.J. Animal welfare in poultry production systems: impact of EU standards on world trade. **World's Poultry Science Journal**, v.64, n.01, p.40-52, 2008. Available from: <<http://dx.doi.org/10.1017/S0043933907001705>>. Accessed: Nov. 30, 2014. doi: 10.1017/S0043933907001705.
- VEISSIER, I. et al. European approaches to ensure good animal welfare. **Applied Animal Behaviour Science**, v.113, n.4, p.279-297, 2008. Available from: <<http://dx.doi.org/10.1016/j.applanim.2008.01.008>>. Accessed: Dec. 11, 2014.
- WAIBLINGER, S. et al. Assessing the human-animal relationship in farmed species: a critical review. **Applied Animal Behaviour Science**, v.101, n.3-4, p.185-242, 2006. Available from: <<http://www.sciencedirect.com/science/article/pii/S0168159106000475>>. Accessed: Dec. 10, 2014. doi: 10.1016/j.applanim.2006.02.001.
- WELFARE QUALITY®. **Welfare Quality® Assessment protocol for poultry (broilers, laying hens)**. Lelystad: Welfare Quality Consortium, 2009. 114p.
- WELFARE QUALITY®. **Report n. 18: the assessment of animal welfare on broiler farms**. Cardiff, 2010. 106p.