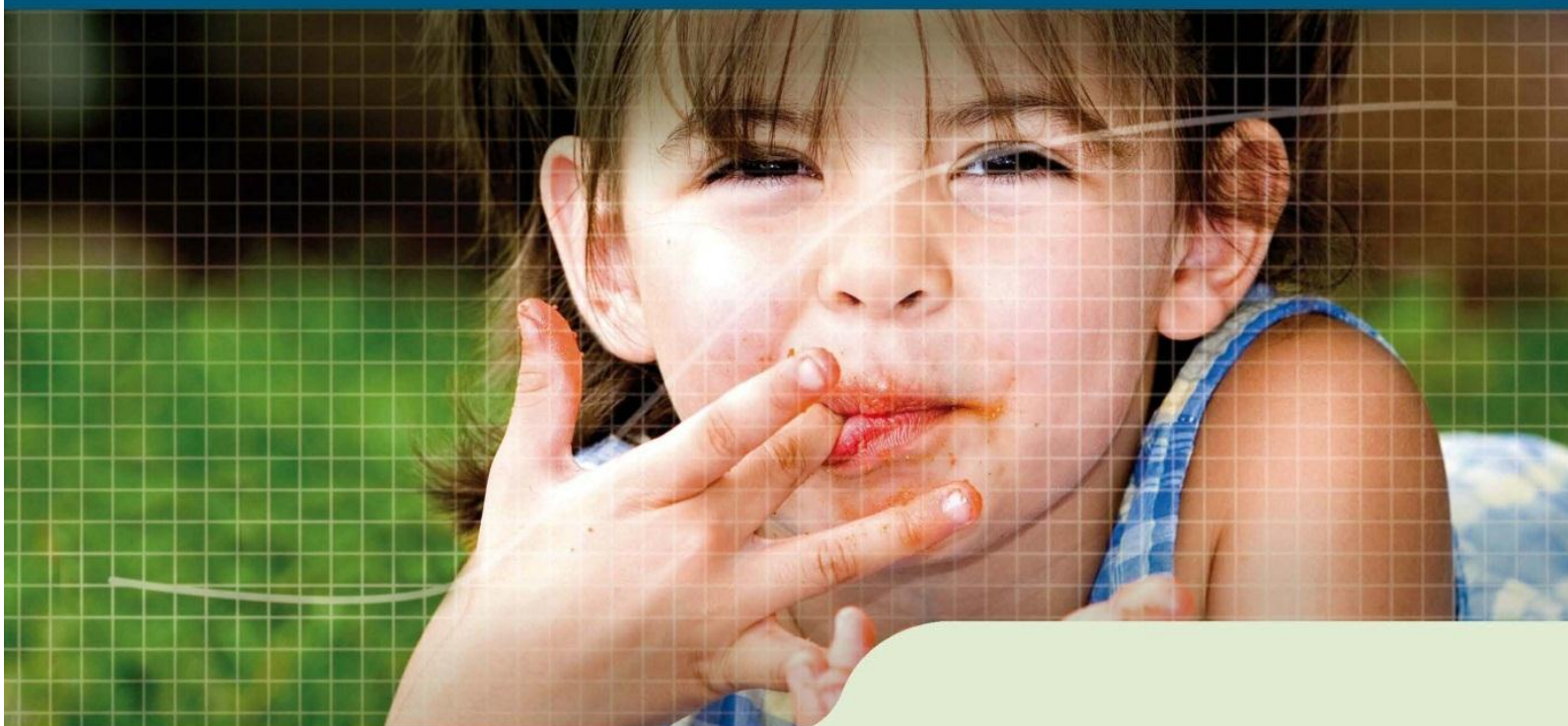


Wageningen UR Livestock Research

Partner in livestock innovations



Report 714

Antibiotic use in Brazilian broiler and pig production: an indication and forecast of trends

March 2014



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Abstract

To gain insight in antibiotic use in relation to imported products the current use of antibiotics in pork and broiler production in Brazil are identified and trend forecasting of antibiotic use in the coming 3-5 years is performed.

Keywords

Brazil, import, antibiotic use, poultry, pig

Reference

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Title

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March 2014

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Ministry of Economic Affairs

Preface

The project, ordered by the Dutch ministry of Economic Affairs, aimed to get insight in the current use of antibiotics in pork and broiler production in Brazil and to forecast trends in Brazilian antibiotic use in the coming 3-5 years. It turned out to be very difficult to gain *quantitative* insight in Brazilian antibiotics use in animal husbandry. Nevertheless, the interviews provided useful *qualitative* information about Brazilian livestock husbandry and veterinary practices in integrated chains, including strategies regarding the use of antibiotics. We kindly thank the interviewees in Brazil, in particular our spokesmen from the ministry of Agriculture (MAPA), BRF (Brasil Foods), Ubabef and the University of Sao Paolo, and the interviewees in The Netherlands for their willingness to cooperate.

M.H. Bokma-Bakker (team leader)

Summary

To gain insight in antibiotic use in relation to imported products, the Dutch Ministry of Economic Affairs (EZ) asked Wageningen UR to a) identify the current use of antibiotics in pork and broiler production in Brazil, and b) to forecast trends in Brazilian antibiotic use in the coming 3-5 years.

Characteristics of broiler and pork production in Brazil were described. Information about antibiotic-use strategies, guarantee systems, animal health management and legislation etcetera were gained from Brazilian stakeholders target groups. A questionnaire was used to interview the target groups: officers from meat production companies exporting to Europe/The Netherlands (e.g. Brasil Foods (BRF)), farmers' organisations, feed producers, antibiotics producers, veterinary services, research (Embrapa), and two Dutch organisations/experts with connections to the Brazilian poultry and/or pig production. The project findings are primarily based on qualitative information from desk research and interviews. Quantitative data on antibiotic use within the production chain in Brazil were not available.

The conclusion on antibiotic use in Brazilian livestock are:

- There is no information available about used/sold quantities of veterinary antibiotics in Brazil.
- Growth promoters (AGP's) are commonly used on pig and broiler farms producing for the home market.
- Production for the EU market at present is without the use of growth promoters and completely separated from other production.
- Based on qualitative information, the therapeutic use of antibiotics in Brazilian broiler production is estimated to be substantially lower than the average on Dutch broiler farms in 2011. There is no estimation for antibiotic use in Brazilian pig production.

The expectations for Brazilian veterinary antibiotic use in the next 3 to 5 years are:

- Monitoring of veterinary use will start in the future, but it might take 5 – 10 years to establish adequate monitoring systems. There is currently debate about extending the existing monitoring from 17 to 140 substances, including all antibiotics (Proposal Ordinance nr. 137, 2011).
- There will be an increasing pressure by EU and other markets regarding veterinary use of antibiotics. Brazil will accept more stringent regulations on antibiotics to keep the market.
- There will be an increasing pressure from the Brazilian Ministries of Health and of Agriculture. The expectation is that many 'critical' antibiotics will be banned.
- An on-going advantage of Brazil compared to Europe will be the strongly integrated animal production chain, with strict external (and internal) biosecurity measures for each production step. The use of antibiotics is strictly regulated within the integrations.
- A shift to further intensification of production in the Central West region of Brazil, with much larger farms, a hot climate and more mechanical ventilation, could put some pressure on the good animal health status and increase the need for therapeutic use of antibiotics in pig and broiler production.
- The use of AGP's in Brazilian broiler and pig production for the home market will probably go on, due to the expected economic benefits. In addition, there is a high pressure from pharmaceutical companies, which due to interviewees would hinder a reduction of use and restructuring of animal production systems.

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1 Introduction

Dutch livestock production is subject to restriction policies concerning antibiotic use. However, no such policies exist regarding the antibiotic usage in imported products (except the use of antimicrobial growth promoters and the absence of residues). Brazil is an important competitor for the Dutch livestock industry, both at the domestic market as in export markets. Large differences in antibiotic usage between the Dutch and Brazilian poultry and pig production might result in a competitive disadvantage for the Dutch sector. To gain insight in antibiotic use in relation to imported products, the Dutch Ministry of Economic Affairs (EZ) asked Wageningen UR to a) identify the current use of antibiotics in pork and broiler production in Brazil, and b) to forecast trends in Brazilian antibiotic use in the coming 3-5 years. The project findings are summarized below.

2 Methods

The project has been carried out by Wageningen UR Livestock Research (WLR), the Institute for Agricultural, Socio-Economic Research (LEI) and the Central Veterinary Institute (CVI) in close cooperation with the Latin America WUR-office in Brazil. Brazil WUR-office helped us to identify the Brazilian key organisations and representatives to include in the interview round, to arrange the appointments and to act as native Brazilian interviewer/translator during the interviews. The interviews in Brazil have been carried out during the Avesui Livestock Fair in Sao Paolo 2-4 April 2012 by two interviewers (WUR/LEI N. Bondt and Brazil WUR office S. Ruiten). To structure the interviews, a questionnaire was used (Annex A) and sent in advance to the interviewees. The target groups for the interviews were identified in cooperation with the Brazil WUR-office. It included officers from meat production companies exporting to Europe/The Netherlands (e.g. Brasil Foods (BRF)), farmers' organisations, feed producers, antibiotics producers, veterinary services, and research (Embrapa). We also conducted interviews with two Dutch organisations/experts with connections to the Brazilian poultry and/or pig production. The list with persons interviewed is displayed in Annex B.

Brasil Foods and UBABEF (the farmers organization for poultry producers) were requested about possibilities to supply us with quantitative data on antibiotic use within their production chain and about the possibilities to collect antibiotic data and the number of animals involved on a selection of their broiler farms. However, information on sold or used quantities of veterinary used antibiotics was not available (to us or in general). The project findings are therefore primarily based on qualitative information from desk research and interviews.

The following paragraph 3 displays the analysis made by the project team regarding antibiotics use in Brazilian broiler and pig sector and the usage expectations for the coming years. In paragraph 4, the main conclusions are summarised.

Annex A to C provides the detailed results of the desk study and the interviews on which the analysis and conclusions are based.

3. Analysis

3.1 Characteristics of broiler and pork production

Broiler production

A substantial amount of broiler products are exported to the EU including the Netherlands. Brazilian poultry production is characterized by a highly integrated production chain structure (almost 100%). The traditional housing for broilers, in which still a large part of the broilers is housed, consisted of simple, naturally ventilated barns with a low flock density (10-12 broilers per m²). An increasing number of broilers are housed in mechanical ventilated barns (14-16 broilers per m²). Traditionally, broiler production was concentrated in the Southern part of Brazil. The expansion of the last decade mainly took place in Central West, where broiler farms on average are (much) larger and make more use of mechanical ventilation systems than in the South.

Pork production

Brazilian pork is not exported to EU Member States yet. Main export markets are Russia, Hong Kong, Ukraine, Argentina, and Angola.

Brazilian pig production is concentrated in the Southern states, but expansion in other regions like the Central West and Southeast regions is evident. In the last decades the pig production has been moving away from the free market to integrated models of production. Small independent producers are increasingly being replaced by farmers working under contract.

3.2 Antibiotic usage in Brazil

Because Brazil wants to safeguard its export, it strictly follows the Codex Alimentarius recommendations on antibiotics. The Codex does not provide recommendations for national registration of antibiotic use in farm animal production. Therefore, there is no mandatory registration of veterinary antibiotic usage in Brazil. The quantitative information about antibiotic use available at integrators or drug manufacturing plants is not available for third parties. Veterinary used antibiotics are in principle free for sale. However, the almost complete integration rate in broiler production and central role for the integrator's responsible veterinarian seems to ensure that broiler farmers administer antibiotics only after prescription by the integration's veterinarian.

In general, the veterinary use of antibiotics can be divided into three categories: a) the use as growth promoter (low doses, continuously administered through feed); b) preventative use (group treatment with intermediate doses of antibiotics prior to or during critical transitions in the production process) and c) therapeutic use (high doses for treatment of diseases).

It is indicated that all broiler farms producing for the home market use antimicrobial *growth promoters* (AGP's). The use of AGP's decreased in the last 5, 6 years. There is still use of eleven types of AGP's, of which two are under discussion at this moment (lincomycin and tiamulin). Broiler production for the EU market is without use of AGP's, and is strictly separated from other production.

There are no indications that there is a structural *preventative use* of antibiotics on Brazilian broiler farms, apart from the AGP's. Rough estimations by one interviewee indicate a *therapeutic* antibiotic usage in Brazil with a frequency of 1 out of 40 flocks (2006; 2.5% of broilers were treated). The (qualitative) data suggest that some years ago the therapeutic antibiotic use on Brazilian broiler farms

was substantially less than the current use on Dutch broiler farms¹. This could be due to good climate conditions in Brazil, less densely populated housing systems and open stables with many fresh air, which results in a comparable or better animal health status than in the Netherlands (Van Horne and Goddijn, 2005). Probably also the use of antibiotics as AGP's plays a role here.

Interviewees could not give an indication about the extent of therapeutic use of antibiotics in pigs.

Antibiotic resistance

The interviewees state that veterinary antibiotic use and resistance is given high importance in Brazil, but until now without much pressure on livestock production. Although in scientific publications the frequent occurrence of ESBLs (typically CTX-M-2, and 8) in broiler raw meat products imported to Europe from Brazil is documented, human health threats related to these ESBL's seem to be seldomly discussed in Brazil until now. The residues surveillance program is highly emphasized by both MAPA and the integrations. Public and private actors' first priority is avoiding residues of antibiotics in food products. Recent scientific information reveals that many *Campylobacter* strains found in both Brazilian broilers flocks and pig carcasses and *Salmonella* strains found in pigs showed resistance against a wide range of antibiotics. The authors (Biasi et al, 2011) conclude that it is necessary to reduce the use of antimicrobials in veterinary (and human) medicine in Brazil.

At this moment, there are no regulations nor governmental guidelines available regarding categorizing antibiotics into first, second or third choice of veterinary used antibiotics with regard to the importance for human health care. Integrations use their own positive list of antimicrobial products (composed in cooperation with pharmaceutical companies). Integrations indicate that in case certain antibiotics are related to resistance in pathogens, a MIC analysis or antibiogram is made before administering them.

The human use of antibiotics was free until 2012: since then it is only available on doctor's prescription. At the moment, there is an effort coming from Anvisa, the sanitary agency, for the effectiveness of demanding prescriptions for the purchase of antibiotics. One of the interviewees stated that after regulating the human use, the veterinary use could become a priority. However, on the human side still a lot has to be improved: e.g. the policy regarding antibiotic waste in hospitals seems to be poor and the large number of hospitals complicates adequate supervision.

3.3 Forecast of trends in Brazilian antibiotic use in the coming 3-5 years

Monitoring of use

There is no information available about used/sold quantities of veterinary antibiotics in Brazil. A proposal to monitor all antibiotic use (used/sold quantities), e.g. extending the current monitoring from 17 to 140 substances, including all antibiotics, is currently debated (proposal Ordinance nr. 137, July 25, 2011). According to one interviewee, most probably monitoring of antibiotic use will start at some point in the future, it might however take five to ten years to establish adequate monitoring systems.

Growth promoters

The use of antibiotics as AGP's will most certainly continue in the production for the home market, according to one interviewee, because Brazil has a subtropical climate with relatively high temperatures and increasingly 'intensive' animal production systems. Brazil is an active member of the Codex Alimentarius and strictly follows the Codex rules. Some antibiotics are considered as highly or

¹ In the Netherlands, the average antibiotic usage in 2011 is calculated as almost 24 days per broiler per year (SDa, 2012). As flocks are (necessarily) treated as a whole, this implicates that, with on average 7 production cycles per year, the average Dutch broiler flock is treated for 3.4 days with antibiotics.

even critically important from human health perspective, e.g. cephalosporins, macrolides and others. In those cases the use as those growth promoter probably will be banned, according to one interviewee. A possible ban of the growth promoters, lincomycin and tiamulin, is believed to certainly affect the production of broilers and pigs. Two interviewees also mentioned the high pressure from pharmaceutical companies² to keep using antibiotics, for which reason it would be hard to restructure animal production e.g. the use of antimicrobial growth promoters.

Preventative/therapeutic antibiotic use

Unfortunately, it is impossible to predict the trends in veterinary antibiotic use in Brazil in the coming 3-5 years. Political developments suggest more pressure on the industry, possibly resulting in less antibiotic use, but on the other hand, intensification of the production could still lead to an increase. First the human antibiotic use will get regulated in Brazil, which already started in 2012. Also an increased pressure by EU and other markets regarding veterinary antibiotic usage is expected. Brazil will most likely accept more stringent regulations in order to keep the market. There will probably also be increased internal pressure from the Ministries of (human) Health and of Agriculture. Expectations are that many antibiotics will be banned for administration in livestock. There will be an increased governmental control of veterinary usage of antibiotics, maybe even an online registration system like the current registration system for human use.

There is a further intensification of broiler and pig production in the Central West area of Brazil: larger farms, hot climate, mechanical ventilation, more cost reduction driven and not always participating in integrations (Van Horne en Goddijn, 2005). This might enhance animal health problems compared to less intensive systems.

Resistance/human risks and animal production

It is not likely that farmers' organisations and integrators are willing to consider antibiotic usage in livestock a main reason for the development of resistant bacteria that threaten human health, until scientifically proven. Unlike the situation in the Netherlands, the intake of large amounts of antibiotics in humans is considered to have a larger impact on the exposures of the human population to resistant bacteria. Brazil's health ministry states that the excessive and often unjustified use of (human) antibiotics has been a factor in the development of highly resistant strains of bacteria (e.g. *Klebsiella pneumoniae* producing the carbapenamase KPC).³ The latest rules from the Brazil National Health Alert Agency (Anvisa) include, as stated before, a requirement that anyone wanting to buy antibiotics need a doctor's prescription. Physicians have been given updated guidelines for when to prescribe antibiotics.

² In Brazil, many pharmaceutical companies are active, with as leading companies: Elanco (USA), Idexx (USA), Merial (USA), MSD Animal Health (USA), Novartis (USA), Pfizer (USA), Phibro (USA), Boehringer Ingelheim (Germany), Ceva (France), DS Pharma (Brazil), Ourofino (Brazil), Vallée (Brazil)] .

³ <http://www.deccanherald.com/content/108604/brazil-restricts-antibiotics-bid-stop.html>

4 Conclusions

Our main conclusions are summarized below.

Antibiotic use in Brazilian livestock:

- There is no information available about used/sold quantities of veterinary antibiotics in Brazil.
- AGP's are commonly used on pig and broiler farms producing for the home market.
- Production for the EU market at present is without the use of growth promoters and completely separated from other production.
- Based on qualitative information, the *therapeutic* use of antibiotics in Brazilian broiler production is estimated to be substantially lower than the average on Dutch broiler farms in 2011. There is no estimation for antibiotic use in Brazilian pig production.

Expectations for Brazilian veterinary antibiotic use in the next 3 to 5 years:

- Monitoring of veterinary use will start in the future, but it might take 5 – 10 years to establish adequate monitoring systems. There is currently debate about extending the existing monitoring from 17 to 140 substances, including all antibiotics (Proposal Ordinance nr. 137, 2011).
- There will be an increasing pressure by EU and other markets regarding veterinary use of antibiotics. Brazil will accept more stringent regulations on antibiotics to keep the market.
- There will be an increasing pressure from the Brazilian Ministries of Health and of Agriculture. The expectation is that many 'critical' antibiotics will be banned.
- An on-going advantage of Brazil compared to Europe will be the strongly integrated animal production, with strict external (and internal) biosecurity measures for each production step. The use of antibiotics is strictly regulated within the integrations.
- A shift to further intensification of production in the Central West region of Brazil, with much larger farms, a hot climate and more mechanical ventilation, could put some pressure on the good animal health status and increase the need for therapeutic use of antibiotics in pig and broiler production.
- The use of AGP's in Brazilian broiler and pig production for the home market will probably go on, due to the expected economic benefits. In addition, there is a high pressure from pharmaceutical companies, which due to interviewees would hinder a reduction of use and restructuring of animal production systems.

Annex A Questionnaire for interviews at the Avesui Fair in Sao Paulo, Brazil

Introduction

Brazil appears to be an example of healthy production of broilers and pigs. In the Netherlands the improvement of animal health is a hot issue, partly because of serious concerns about antimicrobial resistance in humans and the overuse of antibiotics in veterinary practice.

The use of antibiotics in poultry and pig production in Brazil is probably low, at least compared to the Netherlands. Ordered by the Dutch ministry of Economic Affairs and Agriculture we carry out a project with the aim to identify the current use of antibiotics in pigs and poultry (broilers) production in Brazil, and to forecast trends in Brazilian antibiotic use in the coming years. Of course animal health management is a factor of crucial importance.

We will focus on pork and broiler meat that is produced for export to the Netherlands, because there could be an important difference in production systems for the Brazilian home market and the production for export markets.

Interview questions

1. Organization. How is pig/poultry production organized within the integration? Who is responsible for what concerning animal health management and prevention, animal treatment and antibiotic use?
2. Home market versus export market. Is there a difference in antibiotic-use strategies for the home market (Brazil) and for export markets?
3. Guarantee systems. How and how fast can the integration meet enhanced export market requirements concerning antibiotic use in pigs and poultry? What guarantee system is used?
4. Animal health management. How is sanitary quality and optimal animal health management ensured in the supply chain:
 - Breeding animals
 - Hatcheries
 - Broilers (or Fattening pigs)
 - Feed production: raw materials, use of additives such as enzymes
 - Transport
 - Private quality systems and certification
 - Training of farmers?
5. Animal health legislation. How is sanitary quality and optimal animal health management ensured by public legislation:
 - Regulations for production
 - Regulations for the use of veterinary medicines; specific measures to avoid resistance development and problems in human health care?
 - Sanitary inspections
6. Importance of antibiotic usage. Is antimicrobial resistance and veterinary antibiotic use “on the agenda” in Brazil?
 - Of the government?
 - Of politicians, ngo’s, media (radio, television, newspapers)?
 - Of the poultry (pig) supply chain, private companies?
 - Of veterinarians?
 - Of human health organizations, hospitals etc.?
 - How important is this topic? (importance low, medium, high?)
7. More information. What further information about antibiotic usage is available?
 - Use of certain groups of antibiotics, e.g. third and fourth generation cephalosporins, fluoroquinolones
 - Amount of antibiotics sold or used, expressed in tonnes active substance or average number of treatments or treatment days per broiler (or pig)?
 - Information on antibiotic usage per farm within supply chains, benchmarking, use of animal health plans?

General

8. Is veterinary antibiotic use in pigs and poultry in Brazil an important issue?
9. Ditto on antibiotic residues in animal products
10. Ditto on development of antimicrobial resistance
11. Attention from the Ministry of Public health?
12. Attention from the media: newspapers, radio, television?

Government

13. Has the government in Brazil certain goals and standards relating to registration of antibiotic usage and usage of other veterinary medicines?
14. Ditto for antimicrobial resistance development
15. Ditto for the amount of antibiotic use (current use, trends)
16. Ditto for quality of antibiotic usage
17. What is the legislation regarding the use of veterinary medicines?
18. Where is legislation to be found? (website Ministry of Agriculture?)

Insight into antibiotic usage

19. Is there an insight into the trends in usage?
20. Qualitative
21. Quantitative: tonnes active substance, number of treatments, # daily dosages (DDD's)
22. Sources, reports?
23. Extent of use of medicated feed?
24. What groups of antibiotics are mainly used in pigs and poultry? For what reasons / diseases?
25. Percentage group treatments versus individual treatments?
26. In pigs: 95% oral or also considerable amount of treatments by injections?
27. In broilers: 100% oral use? Use of antibiotics on broiler hatcheries?
28. Is there an insight into underdosing, overdosing?

Supervision of Food Safety

29. How is the supervision in relation to veterinary antibiotic usage organized?
30. To what extent are antibiotic residues found in pigs and poultry? What public information is available?
31. What role do private quality systems play? What are quality systems in pigs and poultry chains? Sources?
32. Is there an information flow on antibiotic use from livestock farms to slaughterhouse? Mandatory or voluntary? What information exactly?
33. Are irresponsible prescribers (veterinarians) and users (farmers) of antibiotics identified?
34. Availability of antibiotics: sold by pharmacies, veterinarians? Or sold by the integration?
35. Do veterinarians earn money from the sales of antibiotics? To what extent?
36. Is a prescription from the vet required to get antibiotics?
37. Purchase of antibiotics raw materials?

Producers / farmers

38. Do producers / farmers have insight into the use of antibiotics on the farm?
39. Registration of all veterinary treatments on farms? Mandatory or voluntary?
40. Inspection and enforcement?
41. Benchmarking of antibiotic usage?

Veterinarians

42. Is the issue "antibiotic usage" (or antimicrobial resistance) on the agenda of organizations of veterinarians?
43. Is there a quality label for vets? Good Veterinary Practice?
44. Veterinary disciplinary rules?

Annex B List of interviewees

Embassy of The Netherlands

- Ir Bart Vrolijk, agricultural counsellor; moved to Argentina/Chili, Buenos Aires in summer 2012
- Mrs Frederica Heering, agricultural assistant

University of Sao Paulo, school of Veterinary Medicine and Animal Health

- Professor Joao Palermo Neto

Ministry of Agriculture (MAPA)

- Leandro Moretti, Inspection
- Barbara Cordeiro, Veterinary and Products
- Leonardo Viana, Veterinary and Products
- Celso Nascimento, Agriculture and Livestock Products Inspection Service

Embrapa Suinos e Aves

- Mr Luizinho Caron, Medico Veterinario

UBABEF

- Mrs Marilia Rangel R. Martins, market relations coordinator
- Mrs Maia Burmeister, technical analyst
- Mrs Sullivan Pereira Alves, technical coordinator
- Mr Ariel Antonio Mendes, director de producao e tecnico cientifico
- Mr Vanius Pacheco Pires, Brasil Foods

Dutch Brazilian poultry expert

Poli-Nutri, animal feed production

- Mr Julio Flavio Neves, technical director for nutrition and products,

Latin America Office Wageningen UR

- Stephanie Ruiten, project manager

DSM

- Rodolfo Agustin Pereyra

Pig breeding farm TOPGEN (not member of an integration): unknown spokesman.

HydroAll (water quality advisers): unknown spokesman

Annex C Results desk study and interviews

C1 Broiler and pig production in Brazil

C1.1 General characteristics Brazil agriculture

Brazil consists of 26 states and 1 federal district, grouped into 5 geographical regions: North, Northeast, Centralwest, Southeast and South. These administrative regions, set by Instituto Brasileiro de Geografia e Estatística (IBGE, 2011), are composed of states with similar cultures and economical, historical and social aspects. The country covers 8,500,000 km² and has 190 million inhabitants (2011).



Figure 1 States and regions within Brazil (Source: Van Horne and Goddijn, 2005)

Livestock production is important in many parts of the country, with rapid growth in the poultry, pork, and milk industries. In Brazil the poultry farming employs 4.5 million people direct or indirectly, and accounts for around 1.5% of the National Gross Domestic Product (UBABEF).

C1.2 Broilers

Poultry is an important and growing industry in the Brazilian agricultural sector. In 2010/11, chicken accounted for nearly half of total meat production in Brazil and Brazil was the world's third leading producer of broiler meat (USITC, 2012). 70% of the chicken produced is consumed in Brazil itself, 35% is exported to more than 150 country's (UABEF; www.abef.com.br). The Middle East is the main region for export, followed by Asia, Africa, Europe and Oceania (UABEF, 2012). Agribusinesses that export poultry from Brazil can be split into two distinct tiers. The first tier, made up of the biggest companies, among which Brasil Foods, accounts for almost one-half of total Brazilian poultry production. These major companies typically export about 80% of their production. Firms in the second tier are mostly regional actors and tend to export closer to 50% of their production. The future export markets for Brazil are China, India and others.

The Brazilian poultry industry, which has been developed around the concept of strategic groups for commodities (chicken) and specialties (processed products), is characterized by high productivity and high technology use. The integration model is largely adopted bringing strict control of the entire supply chain (Rabobank, 2011). It is estimated that approximately 90% of the industrial poultry production is under the integrated system of production (UBABEF).

Brazil's broiler flock is heavily concentrated in the South and Southeast regions of the Country (USITC, 2012). In 2010, more than 50% of Brazil's poultry was located in the South and 27 % in the Southeast. Paraná, a southern state, had the largest poultry flock size, accounting for 24% of the country's broilers (IBGE, 2011). Information by BRF and UBABEF reveals that in the South there is an average of 45.000 broilers per farm, in the Central-West farms are much larger with 400.000 broilers (4 units of 4 houses per unit, 25.000 broilers per house, in total). In Central-West more mechanical ventilation of houses is used, because of the hot climate. Litter in broiler farms is disinfected by fermentation (always), generally new litter after 5 or 6 production rounds, because of the very high costs of litter. Important advantage of production in Brazil is the surplus of water (and land).

In 2011, chicken slaughter reached 5.3 billion animals, a rise of 5.6% in relation to 2010. The Central-West region was a highlight in 2011, followed by the South and Southeast regions (IBGE, 2011). Broiler production for 2012 is estimated to be 13.3 million metric tons, up 3% from 2011. The increase in production is mostly driven by domestic demand and a small recovery in exports. Domestic consumption of broiler meat in 2012 is projected to increase by 3% to 9.9 million metric tons (IBGE, 2011).

C1.3 Pigs

In 2011, the amount of pigs in Brazil was 39.3 million head, including 4,806 breeding sows (12.2% of the total), which maintained the stability of their herd compared to 2010. In 2011, 34.9 million pigs and hogs were slaughtered, accounting for an increase of 7.2% in relation to the previous year. The South region remained as the main slaughtering region of swine, accounting for 65.9% of all the national slaughter. (IBGE, 2011). Although pig production is concentrated in the states of the South, in recent years the expansion of pig farming in other regions has been evident, with growth in production and the installation of large slaughterhouses and processing plants in the Central West and Southeast regions (Santos Filho and Bertol, 2012 B). Small independent producers are increasingly being replaced by farmers working under contract (Stewart, 2012). In the last fifteen years the Brazilian pig production sector has been moving away from the free market ("spot") towards coordinated models of production. There are different organisational arrangements ranging from own production, independent production, middleman, partnership, lending, and partner-integrator, among others. The production system within the new organizational forms of production has grown significantly in Brazil over the past 15 years. In Santa Catarina, a traditional pig producer state, it already represents over 80% of commercial slaughter. A similar picture occurs in the other states and in the new areas of expansion of the activity in the Central-West, where 100% of the new investments are implemented with some form of non-traditional organization of production (mostly in partnership) (Santos Filho and Bertol, 2012 A).

Graph 3 – Brazilian regions, type of swine production and density of pigs, 2008.

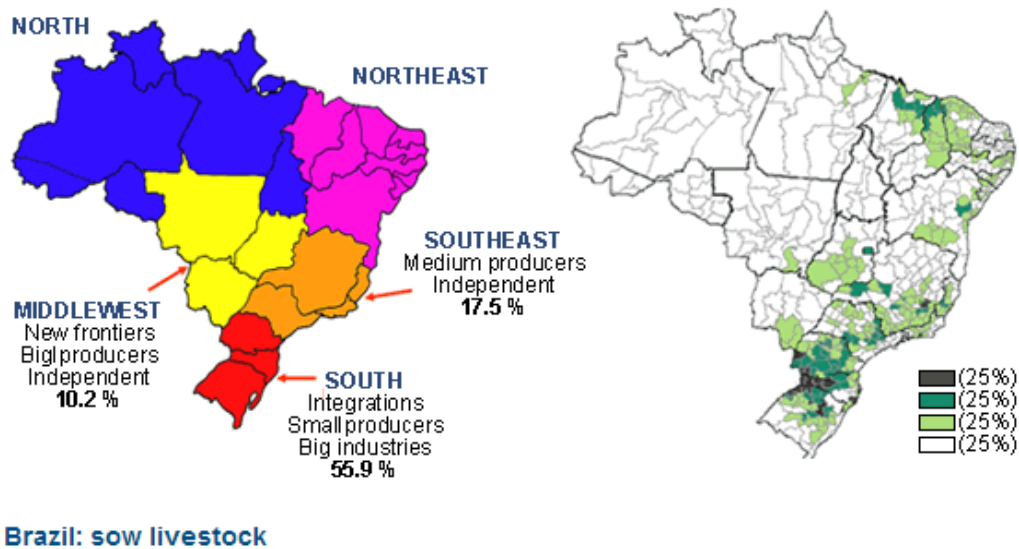


Figure 2 Brazilian regions, type of swine production and density of pigs (Roppa, 2008)

In 2011 there were about 40 thousand swine producers in Brazil, this number is decreasing (Abipecs, 2011). Production costs differ between states. For example, production in Mato Grosso is € 1,00 per kg carcass weight cheaper than in Santa Catarina (the traditional pig producer state). Opposite the lower production costs, however, are higher transport costs for the pork to population centres or the harbours for further transport (Hoste, 2011).

Brazil exports approximately 17% of produced pork. The main export markets in 2011 were Russia, Hong Kong, Ukraine, Argentina, and Angola. Total pork export was 582 10³ million ton in 2011 (United States International Trade Commission, 2012). Imports into the EU pork market are negligible due to the stringent levy system. The current negotiations with the Mercosur countries (Argentina, Brazil, Paraguay, Uruguay) on a bilateral trade agreement with the EU might result in the EU opening its market to Brazilian pork in the near future. In these current proposals there seems not to be a level playing field because of different legislation (Welfare, GMO, tracking & tracing) (Rabobank, 2011).

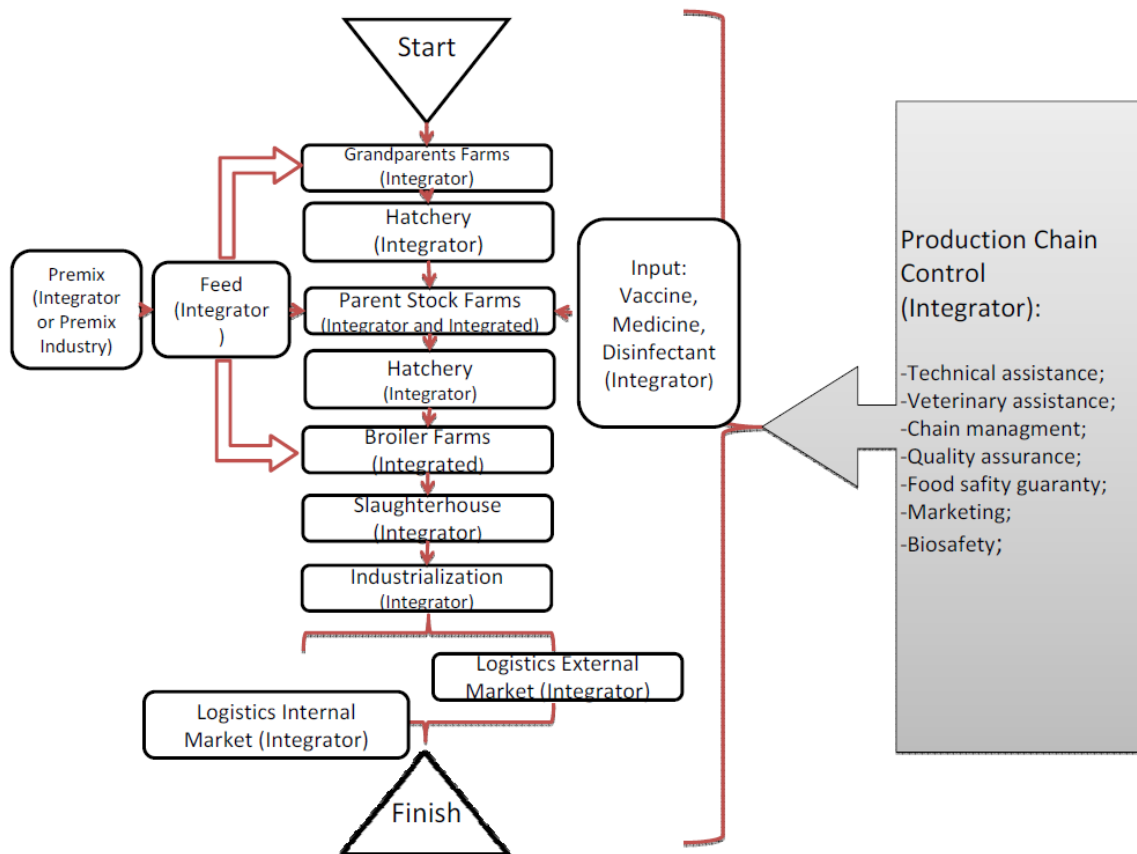
C2 Results of the interviews

This chapter reflects the facts and opinions given to us by the interviewees. It is not the interpretation of the research team.

C2.1 Interview results Brasil Foods/UBABEF

UBABEF and Brasil Foods have been interviewed simultaneously during the Avesui Fair in Brazil (April 2012). On forehand, UBABEF has filled out the questionnaire and during the meeting the representatives of both organisations gave further information and insights. Below is a compilation of the interview results.

How is pig/poultry production organized within the integration?



In the organizational model adopted in the integration system, the poultry or pig producer is part of the production chain linked to a slaughter and processing agribusiness which also coordinates the bonds in the primary production. Thus, the provision and control of raw materials, especially drugs and feed, is fully coordinated by the integrating industry in their programs to promote livestock, that's it, animals, feed, drugs and technical assistance belong to the integrating company and the producer is the premises owner and responsible for animal handling following the integrators technical guidelines. Under the integrated production system, the agri-industry companies and cooperatives supply the integrated rural producer with chicks, feed, veterinary inputs, technical and veterinary assistance, **which includes antibiotics and its usage**. The farmer is responsible for the installations, equipment, labour and handling.

How is animal health management and sanitary quality ensured by the supply chain?

Every flock receives regular technicians and veterinarians visits. All establishments have a GPP program, which includes laboratory monitoring, restriction and control of visits, disinfection programs, isolation, "all in all out" rearing. Every flock to be slaughtered must be released by the integration veterinarian. Every flock before being slaughtered must be inspected and released for slaughter by the Official Veterinarian.

- *Breeding animals* – Controls by a veterinarian, constant monitoring of the parent stock, biosecurity, isolation, visitors restriction;
- *Hatcheries* – Biosecurity measures, GPP with emphasis on cleaning and disinfection;
- *Broilers (or Fattening pigs)* – Medication only under prescription, buy prohibited, veterinary monitoring;

- *Feed production: raw materials, use of additives such as enzymes* – feed produced by its own integration or specifically for them, medication under the supervision of the veterinarian, specific formulation for each stage or situation, guarantee traceability. Suppliers of raw material must first be registered with GMP, must be audited periodically by the companies and must submit negative reports for certain substances;
- *Transport* – Integrations own, specific to each function or phase;
- *Private quality systems and certification* - All integrations have their own quality systems, specific monitoring programs BPP; some integrations are certified by international systems;
- *Training of farmers* - Companies and organizations have training programs for farmers and all chain participants.

Is there a difference in antibiotic-use strategies for the home market and for export markets?

Brazil, as a Codex Alimentarius¹ member, adopts the scientific basis defined by its Committee for the elaboration of national standards on the use of antibiotics. However, when other countries introduce additional regulations, based on controls that carry the risks that they consider important in their territory, they can be met, which is made after negotiations between the health authorities. Nonetheless, it is hardly possible to segregate lots, and especially regarding drugs use the most stringent requirement becomes standard, being adopted as a general rule for any market, including domestic. When economically feasible, some companies select specific units for export purposes.

How and how fast can the integration meet enhanced export market requirements concerning antibiotic use in pigs and poultry? What guarantee system is used?

A major advantage of the integration system is precisely the possibility to control and deploy with more efficiency a traceability system, since all the procedures and information on production are managed by the industry.

All sanitation procedures performed in a poultry farm are recommended by the veterinarian of the integrating company. Regarding the use of drugs: the Integrated are forbidden to administer medicines in flocks. Thus, if there is a need for antibiotics, they are prescribed by the company veterinarian, who prescribes the dose, use duration and the feed withdrawal period prior to slaughter, according to manufacturer's recommendations, in order to comply the required withdrawal period to avoid residues in the carcass.

Any medication administered to the animals is described in the Sanitary Report. This document contains all the information about the procedures performed in a flock. The Sanitary Report reproduces information contained in the schedule accompanying the flock (the producers/integration control document) and has to be issued and signed by the veterinarian responsible for the animals sanitary safety.

According to the SDA Ordinance nº 210 of April 10th, 1998, Annex IV, the Sanitary Report has to reach the Federal Inspection Service - SIF, within 24 (twenty four) hours prior to the birds slaughter, containing the following information:

- Data from the establishment of the birds' origin;
- Initial and final bird numbers housed per house;
- Diseases detected in the lot during the housing;
- Type of treatment to which the flock was subjected specifying the therapeutic agent used and treatment duration;
- Date and time of food withdrawal, and;
- Signature of the veterinarian responsible for the establishment.

The Animal Transport Certificate which the Sanitary Report should refer to, accompanies every animal load from the farm to the slaughterhouse.

At the slaughterhouse, the Official Veterinary receives the Sanitary Report and evaluates the related information to plan and conduct the ante mortem inspection procedures according to the data reported in the field considering the provisions in other applicable regulations and governmental circulars (DIPOA/DSA). Such information is used for the international certification basement. The Sanitary Report is also checked by the company's veterinarian, as a Critical Control Point – CCP from the HACCP. Companies often make monitoring of residues in animals by means of rapid tests.

The central Ministry of Agriculture authorities conduct, through the General Coordination Laboratory, monitoring by means of the Brazilian Residues and Contaminants Control Plan – PNCRC. Companies follow quality programs and are fully open to audits that along with MAPA inspection (including feed manufacturing, veterinary prescriptions and so on), will guarantee what is required by importers. In addition, some exporting companies are routinely audited by sanitary authorities and international certification systems such as GlobalGap, BRC, TESCO, Wallmart, Mc Donald's, Swiss Law Ordinance, et cetera.

How is sanitary quality and optimal animal health management ensured by public legislation?

There are many legislations available at the governments website. The main one on the production is *IN 56/2007 (Normative Instruction No. 56/59, December 4th, 2007)*. Establishes registration procedures, inspection and control of breeding and trade for poultry establishments; *Ordinance n° 193, September 19th, 1994*, consolidated and structured the National Poultry Health Program (PNSA), of the Ministry of Agriculture Livestock and Supply.

Legislations within the PNSA:

- *Normative Instruction n° 17, April, 7th, 2006* – provide the National Avian Influenza Prevention and Control and Prevention of Newcastle Disease Plan;
- *Normative Instruction n° 78, November 3th, 2003* - provide the Technical Standards for Control and Certification of Poultry Nucleus and Facilities as free of Salmonella gallinarum and Salmonella pullorum and Free of or Under Control for Salmonella enteritidis and Salmonella typhimurium, enclosed.
- *Normative Instruction n° 44, August 23th, 2001* - provide the Technical Rules for the Control and Certification of Poultry Organizations and Nucleus for Avian Mycoplasmosis (*Mycoplasma gallisepticum, synoviae e melleagridis*);

What is the legislation regarding the use of veterinary medicines?

There is various legislation regarding veterinary drugs:

- *ORDINANCE n° 137, July 25th, 2011* - subjected to public consultation - Draft Normative Instruction that provides measures to detect, identify, assess, report and monitor adverse events of veterinary products and zootechnical additives grow promoters and anticoccidial, registered with the Ministry of Agriculture, Livestock and Supply (veterinary pharmacovigilance).
- *Normative Instruction n° 15, May 26th, 2009* - Regulate the registration of establishments and products intended for animal feed.
- *Normative Instruction n° 26, July 09th, 2009* - Technical Rules for Manufacture, Quality Control, Marketing and Use of Veterinary Antimicrobials Products.
- *Normative Instruction n° 65, November 21th, 2006* - Provides the Technical Regulation on the procedures for the manufacture and use of feed supplements, premixes, and concentrate with medicines for farm animals.
- *Decree n° 5053, April 22th, 2004* - Approves the control regulation of veterinarian products use and of the establishments that manufacture or commercialize them (Ministry of Agriculture, Livestock and Supply)
- Article 18 (commercialization of veterinary products – technical responsible)

For the commercialization of veterinary products referred to in this regulation, an establishment that commercializes must be regularly registered and assign a professional as Technical

Responsible duly qualified and approved by the Ministry of Agriculture, Animal Production and Supply (MAPA) in addition of being legally registered at his/her professional class/organization.

- Article 64 (veterinary prescription)

This article refers to mandatory veterinary prescription and divides it into four categories depending on usage / substances class: I-Official prescription to be filed at the Ministry; II-Ordinary veterinary prescription to be filed; III-Veterinary prescription or; IV-Free for sale Responsibility (professional known as technical responsible for the product commercialization). Chapter V describes several responsibilities of the referred professional such as approval of labels and products, quality and sales of veterinary products.

- *Normative Instruction n° 13, November 30th, 2004* - Technical Regulation on additives for products intended for animal feed.
- *Normative Instruction n° 12, April 10th, 2001* - To adopt the MERCOSUR Technical Regulation, Analytical Methods, Acceptable Daily Intake and Maximum Residue Limits for Veterinary Drugs in Animal Origin Foods.

According to the interviewees, antibiotic usage in animals is not considered the main reason for the development of resistant bacteria that will threaten humans, until this is scientifically proven. Nevertheless regulations include a wider range of aspects besides preventing development of antibiotic resistance. Care is taken to prevent unnecessary usage of antibiotic in animals, but proper vaccination, sanitation, feeding and husbandry programs along with proper feed and food hygiene programs are essential to diminish antibiotic use. Brazil has a surveillance program named *PNCRC* (National Plan for the Control of Residues and Contaminants) that checks routinely the referred residues on animal-origin products and takes appropriate measures when illegal residues are detected. All of these aspects are strongly emphasized by both integrations and MAPA. Integrations must follow proper handling of antibiotic in feed mills through appropriate rules and are subjected to regular inspections by MAPA.

Sanitary inspections: the government audits farms, feed plants and slaughterhouses. There are also audits from other countries (sanitary authorities). The following regulations are relevant:

- *RIISPOA* - Regulation on Industrial and Sanitary Inspection of Animal Origin Products - concerns industrial and sanitary inspection of products of animal origin.
- *Ordinance n° 210, November 10th, 1998* - Approve the Technical Regulation for Technological, Hygienic and Sanitary Inspection of Poultry Meats;
- *Circular n° 175 – May 16th, 2005* - Verification Procedures for the Self-inspection Programs;
- *Circular n° 176 – May 16th, 2005* - Modification of the Instructions for PPHO verification, sent by the Circular n°201/97 DCI/DIPOA, and application of the procedures of verification of the Elements of Inspection as laid down in Circular n°175/2005 CGPE/DIPOA.

Is antimicrobial resistance and veterinary antibiotic use 'on the agenda' in Brazil?

The interviewees state that antibiotic use and resistance is given high importance. All aspects of antimicrobial resistance are seriously taken into account both by the Brazilian authorities and companies involved in animal production. Brazil follows scientific principles in order to guarantee the health of both humans and animals. Activities of various actor groups:

By government: MAPA, through Ordinance n°428/2009 established a Working Group within the Supplies Livestock Inspection Department - DFIP / SDA, with the goal of updating the technical scientific studies on growth promoters used in animals. This group is composed of MAPA's agencies and entities representatives, of various state Federation Universities, of the Health Ministry (National Health Surveillance Agency - ANVISA), in order to analyse specific situations including the need for evaluation studies on risk to human health due to the use of certain additives in food producing animals. For example, spiramycin and erythromycin were banned at this group's suggestion.

By politicians, NGO'S, media (radio, television, newspapers); campaigns by Green Peace, Carne a.o.
By the poultry (pig) supply chain, private companies; International certifications; class entities have discussed the banishment on certain molecules with the ministry.

By veterinarians; Class Boards Discussions, capacity building courses.

By human health organizations, hospitals etc.; Some examples: ANVISA, in partnership with the Pan American Health Organization - PAHO and the Public Health General Coordination Laboratories - CGLAB/SVS/MS, has instituted measures to monitor and control antimicrobial resistance in health services. The Monitoring and Prevention of Microbial Resistance Project in Healthcare aims to fund scientific research, encouraging the establishment of quality control in microbiology laboratories and Central Public Health Laboratories (LACENs), the rational use of antimicrobials and the creation of a National Microbial Resistance Monitoring Network in Health Care (RM Network). The RM Network consists of Sentinel Hospitals (Microbiology Laboratories and Hospital Infection Control Committees), Public Health Laboratories (LACENs), State and Municipal Sanitary Surveillance, State and Municipal Commissions of Hospital Infection Control and various collaborators.

Information on antibiotic usage?

Has the government in Brazil certain goals and standards relating to registration of antibiotic usage and usage of other veterinary medicines? Ditto for antimicrobial resistance development?

There is no mandatory (national) registration of antibiotic usage or usage of other veterinary drugs. The interviewees state that Brazilian authorities and the poultry sector work constantly to limit the antibiotic use to the minimum required for the maintenance of animal health and welfare. Antibiotics are only one part of the whole animal production system and must be properly used and preserved. Brazilian legislation limits the use of antibiotic associations in feed and only allows such associations for therapeutic purposes under veterinary prescription. Control by each company, according to the prescription and use authorization on approved Plants (IN 65). If related to resistance it is checked through the MIC analysis (antibiotic minimal inhibitory concentration) and antibiogram (sensitivity antimicrobial agents test by dilutions). Regarding antibiotic resistance development, there is MAPA's working group, according to Ordinance nº 428.

Insight into antibiotic usage and trends?

This information is not available to the private sector. The amount of antibiotics used is variable, depends on the sanitary challenge of each company, time of year et cetera. Control by each company. The usage information is recorded in the producer form and in the Sanitary Report for the government. Only the integrators have insight into the use of antibiotics on their farms.

Use of certain groups of antibiotics, e.g. 3rd and 4th generation cephalosporins, fluoroquinolones?

Under veterinary prescription and therapeutic use. Use of approved products by the government with recommendations for each specific case.

Percentage group treatments versus individual treatments?

Over 90% of the prescriptions for broilers are through water. The use is restricted to farms, no use on broiler hatcheries.

Insight into underdosing, overdosing?

Yes, done by each company and supervised by MAPA. The recommendations and requirements are based on the product registration by the government and body weight kg and treatment duration.

Availability of antibiotics: sold by pharmacies, veterinarians? Or sold by the integration?

Antibiotics are sold by pharmacies only, except for integrations that will typically purchase directly from antibiotic manufacturers.

Do veterinarians earn money from the sales of antibiotics? No.

Are there veterinary disciplinary rules? Yes. The Technical Responsible vet must follow the veterinarian regional council rules.

Use of antimicrobial growth promoters (AGP's)?

The interviewees mention that probably all broiler farms producing for Brazilian home market use antimicrobial growth promoters. It is estimated that without AGP's production costs will increase with 10% (except for the farms producing for the EU-market). For those companies that export to the EU, which is less than 10% of total production in approximately 25 companies, the most strict requirements became standard: absolutely no use of antimicrobial growth promoters.

Tetracyclines, beta lactams (including cephalosporins), quinolones and sulfonamides were banned, only as growth promoters, in 1999: no severe impact on production. A possible ban on lincomycin and tiamulin as growth promoters will certainly affect the production of respectively broilers and pigs. Heavy metals like copper and zinc are not banned as alternative for antibiotics in feed, but will probably be used mainly in pigs, less in broilers. Almost 100% of broiler parent stock get probiotics.

Expectations regarding antibiotic usage for the next 3 – 5 years?

There will be an increased pressure by EU and other markets regarding antibiotic usage. Brazil will accept more stringent regulations for keeping the market. OIE discussions are planned in September 2012, in Paris. There will also be an increasing pressure from Ministries of Health and of Agriculture. Many antibiotic products will be banned.

It is important that first the human antibiotic use gets regulated, and then veterinary use will follow. The production of broiler meat is 100% integrated. The integration veterinarian is responsible for animal health on 50 to 60 farms, he always sees the animals before prescribing any medication. Minimum quantities of antibiotics are used. If certain antibiotic is related to resistance, the standard procedure is to do some analyses, i.e. MIC analysis and antibiogram before administering it. Companies have their own positive list of products: the reason not to use a certain antibiotic that is available on the market can be due to specific market requirements (e.g. product without MRL). The positive lists are developed together with a pharmaceutical company like Elanco or others.

There is a proposal to monitor all antibiotic use: Ordinance nr 137, July 25, 2011. The farmers' organisation UBABEF finds antibiotic usage an important issue. E.g. she organized workshops about antibiotic use in poultry. Information about use of veterinary medicines is registered on the Producer Control Document, that goes with the broilers from farm to slaughterhouse. PNCRC nr 8: there is a National residue plan; annual report. Monitoring of antimicrobial resistance since 2003/2004.

Advantage in Brazil, compared to Europe: very strict external biosecurity measures.

In organic production no antibiotic use at all. In case of illness alternatives for antibiotics are used. Organic broiler (whole chicken) in supermarket costs 20 Reias more than regular broiler.

C2.2 Interview results MAPA

Four representatives of the Ministry of Agriculture, Animal Production and Supply (MAPA) were interviewed during the Avesui Fair 2012 in Brazil. The findings are summarized below.

How is sanitary quality and optimal animal health management ensured by public legislation?

Important drivers for the policy regarding animal health and use of antibiotics are: Codex and pressure from the own Brazilian Ministry of Health. Brazil strictly follows the Codex Alimentarius. No regulation regarding the use of copper and zinc, probiotics and enzymes as feed additives; only formal acceptance of all raw materials is obliged. First priority = residues of antibiotics in food products; many withdrawal periods were extended, even doubled. National inspection plan "SISRES" (1999, nr 42) includes risk-based statistics and inspection on farms if needed. The veterinarian signs to declare proper use of withdrawal periods. No regulation about first, second, third choice of antibiotics, that is only an issue in academic literature.

There are governmental brochures about good veterinary practice, primarily for general public and education purposes.

Information on antibiotic usage?

There is no information about quantities of antibiotic sales available. The Union of Veterinary Pharmaceutical Companies (Sindan) might have (unofficial) data. There is discussion about the monitoring of 17 substances, i.e. to extend this to 140 substances including all antibiotics (proposal Ordinance nr. 137, currently debated). AGP's are also discussed because of human health issues and residues.

Expectations regarding antibiotic usage for the next 3 – 5 years?

MAPA's expectations for antibiotic use in the coming years: decrease of choices; increased control of usage; maybe an online registration system, just like the system for human use now.

C2.3 Interview results University of Sao Paolo

The results of the interview with a professor from the University of Sao Paolo, School of Veterinary Medicine, are summarized below.

Is there a difference in antibiotic-use strategies for the home market and for export markets?

Production for EU is completely separated from other production, at higher costs. No AGP's allowed when exporting to EU.

Use of antimicrobial growth promoters (AGP's)?

Use of antimicrobial growth promoters (AGP's) will certainly go on. Brazil has a subtropical climate with relatively high temperatures and intensive animal production systems. Also high pressure from pharmaceutical companies. It is impossible to restructure animal production.

Ractopamine is a beta agonist drug that is used in Brazil as a feed additive and growth promoter to promote leanness in pigs raised for their meat (more muscle, less fat). Ractopamine has been banned in the European Union. It's not a hormone. Ractopamine has not yet been approved by the Codex Alimentarius Commission as safe for human consumption, but is currently in the last step of the approval process (<http://en.wikipedia.org/wiki/Ractopamine>).

How is sanitary quality and optimal animal health management ensured by public legislation?

Brazil is an active member of the Codex Alimentarius and strictly follows the Codex rules. Many AGP's were already withdrawn. Some antibiotics are considered as highly or even critically important from human health perspective, e.g. cephalosporins, macrolides and others. In those cases the use as growth promoter will be banned. There is no scientific reason to ban AGP's for gram-negative bacteria like Salmonella and E-coli, because the AGP-agents in feed only act against gram-positive bacteria. Zinc is also used as an AGP (gram-positive). The interviewee does not know about the use of heavy metals like copper or iron. Focus is on four bacteria: Salmonella, Campylobacter, E-coli, Enterococcus). Now there is a monitoring of these four bacteria by the Ministry.

What is the legislation regarding the use of veterinary medicines?

The Ministry of Agriculture is worried about veterinary antibiotic use. However, ESBL's were seldom discussed. The use of antimicrobial growth promoters decreased in the last 5, 6 years. Still use of 11 molecules, of which 2 are under discussion at this moment (i.e. lincomycin and tiamulin). The interviewee has found information about possible risks of lincomycin and/or tiamulin in only 3 of 65 scientific papers.

All brands of medicine are revised to get license (every 10 years), then the company has to prove that their product is effective. Long acting antibiotics will disappear from the market, in the long term, because there are no references. Alternatives like probiotics et cetera will be increasingly important. Human use of antibiotics was free until last year, but now you need a prescription. The policy regarding antibiotic waste in hospitals is poor and there are far too many hospitals to be able to control this. The size of Brazil is a problem.

Veterinary use of antibiotics might be part of the problem. There is a good brochure of the Ministry of Agriculture about good veterinary practice. Very good legislation regarding use of antimicrobial agents in animals (nr 24 or 26). Many products are currently being revised. No use of guidelines regarding first, second or third choice of products.

Is antimicrobial resistance and veterinary antibiotic use "on the agenda" in Brazil?

Some products in Brazilian supermarkets promote "no use of antibiotics", like in organic meat. There is regulation in place for organic production. There is some pressure from the consumers. The interviewee searched in hospitals, but he could not find even one person who died from resistant bacterial infection. Probably more effective to campaign to professionals in animal production, instead of to consumers in media et cetera.

Information on antibiotic usage?

There is no information about quantities of antibiotic usage available. Most probably monitoring will start in the future, however, policies change a lot, maybe 5 to 10 years needed to establish adequate monitoring systems.

C2.4 Results other (small) interviews

Dutch Brazilian poultry expert

A Dutch expert with knowledge of Brazilian broiler and pig production gave us a rough indication of antibiotics use, based on information from 2006: 2,5% of year production broilers treated with antibiotics in 2006 (e.g. 1 out of 40 flocks is treated).

Other information by this spokesman: If there is no separation in production lines for home market and export market, no antimicrobial growth promoters are used. Since 2005, there has not been a substantial intensification of broiler production, maybe a minor increase in number of animals per square meter, due to cost reduction aims (for that reason, foot pad lesions start occurring in Brazilian broiler production). In Midwest Brazil, farms are larger, more cost reduction driven, not always participating in integrations (in that case mostly producing for the home market (Van Horne en Goddijn, 2005). In the South, there is a 100% broiler production within integrations, smaller farms, less incentives to reduce costs to a minimum.

There is a limited therapeutically use of antimicrobial drugs in Brazil, due to:

- Good climate conditions, natural ventilation, open barns, no necessity to use heaters
- The sale of medicines is not linked to the income of the veterinarian

Growth promoters are not used to reduce costs, but for animal health reasons, for example to reduce problems with Clostridium in densely populated broiler barns.

Does this expert consider the antibiotic use in Brazil comparable to the use of antimicrobials by farmers in the USA? No, American farmers are much more independent than their Brazilian colleagues, can order antibiotics if they want to; USA vet's also have a much larger influence. Parts of the USA have a less favourable climate than Brazil, colder, necessity of production in closed barns with artificial ventilation and the associated potential health problems.

Pig production in Brazil also takes place in open barns, natural ventilated, application of all in –all out for all pig production categories (reduces appr. 75% of all health problems according to this expert). Low number of animals per square meter, cleansing of barns is relatively easy, cheap labour, lot of water available (rain) et cetera.

Embrapa (governmental research institute)

There are no experiments with use of data regarding veterinary antibiotics. Important Embrapa research issues are the improvement of the environment, both for pigs and poultry. Brazil is fairly strict on environmental legislation. Interesting study about 'family system' for sows and piglets, in experimental phase. Objective is to avoid stress and improve animal health.

Organic broiler meat is available in shops in Brazil. The appeal for the consumers is more about animal welfare than about antibiotics. Organic is also connected with (the absence of) negative aspects like hormones in meat et cetera.

Pig breeding farm TOPGEN (not a member of an integration)

The use of antibiotics is strongly influenced by the industry, that puts pressure on using medicines.

Poli-Nutri animal feed production

This company uses separate lines of feed production: no risk of cross-contamination with antibiotic residues. Poli-Nutri produces special feed for during transport of day-old chickens, not as an alternative for antibiotics. There are antibiotics in part of the premixes that the company produces.

HydroAll (water quality)

70% of the broiler farmers use some product with chlorine, or a similar product to decrease infection pressure from the environment. There are serious problems with water quality in Brazil; farmers know everything about feed quality, but much less about water quality.

DSM

Emphasizes that it is prohibited to use antibiotics as growth promoters when exporting broiler meat to the EU. Residues of copper et cetera in meat: different MRL's for internal market and export market like EU.

C3 Scientific information on antibiotics use and resistance in Brazil

There is limited scientific information available on antibiotic usage and resistance in Brazil.

There are no general statistics of the use of antibiotics in commercial Brazilian livestock (Jussara Borges Regitano and Rafael Marques Pereira Leal, 2010).

A scientific paper (Nonaka et al, 2011) gives some insight in the occurrence of antimicrobial residues in Brazilian food animals in 2008 and 2009. Antibiotics can be used as growth promoters (low doses), treatment (high doses) or prevention (intermediate doses) of diseases in food-producing species. Nonaka et al state that the agriculture industry is subject to policies and bills that restrict, limit or forbid certain products as feeding additives. And that many industries also obey prohibitions that are in force in other countries, especially in the EU, in order to comply with the international market. According to IN No. 65, Brazil is not allowed to use non-authorized drugs in animal feed. This is inspected by the Ministry of Agriculture, Livestock and Food Supply (MAPA). In Brazil, the monitoring of animal products is accomplished through the National Residues and Contaminants Control Plan (PNCRC) by MAPA. The main goal of the PNCRC is to check the correct and safe use of veterinary drugs in accordance with the required veterinary practices (withdrawal periods) and technology used during production processes. The Brazilian PNCRC follows the guidelines set by the Codex Alimentarius Commission and checks compliance with maximum residue limits (MRL's) to ensure the quality of the commodities. In 2008, 1459 samples were analysed with only 1 sample exceeding Brazilian legislation limits (> MRL). In 2009, 1519 samples were analysed and none exceeding the MRL's.

A study of Kuana et al (2008) assessed the antimicrobial susceptibility of 62 *Campylobacter* spp. strains obtained from Brazilian broiler flocks using the agar diffusion method. The antimicrobial susceptibility test revealed a 62.5% resistance to at least one drug, especially to enrofloxacin (71%), neomycin (50%), lincomycin (50%), tetracycline (43%), penicillin (42%), ceftiofur (33%) amoxicillin (27%), spiramycin (20%), ampicillin (18%) and norfloxacin (14%), whereas a lower percentage of strains was resistant to erythromycin (10%) and doxycycline (10%). All strains were sensitive to gentamicin and lincomycin-spectinomycin and 80% of them to colistin. The authors state that these results indicate that it is necessary to reduce the use of antimicrobials in veterinary and human medicine in Brazil.

Kich et al (2011) determined the distribution and types of *Salmonella* in 12 swine finishing herds and a slaughter facility in Santa Catarina, Brazil. A total of 1258 samples, consisting of environmental, feed, carcass, lymph node, and fecal material were collected and submitted to bacteriological isolation of *Salmonella*. From 487 positive samples, 1255 isolates were recovered and confirmed to be *Salmonella*. A total of 59 different antimicrobial resistance profiles were observed in 572 *Salmonella* isolates. From these isolates, 17% (97/572) were susceptible to all 15 antibiotics tested, 83% (475/572) were resistant to at least one, and 43% (246/572) were resistant to four or more antibiotics (multi-resistant).

Biasi et al (2011) investigated the rate of contamination, species identification and antimicrobial resistance of thermophilic *Campylobacter* spp. in pig carcasses during the slaughter process in a slaughterhouse in Brazil. *Campylobacter* was found in 18.9% of the carcasses and 3.5% of the samples. All *Campylobacter* strains were confirmed by real-time PCR and showed multi-drug

resistance to cephalothin, nalidixic acid, norfloxacin, tetracycline and trimethoprim. None of the strains were resistant to amoxicillin/clavulanic acid, ampicillin and chloramphenicol. The authors state that, despite the low occurrence of *Campylobacter* spp. in pig samples, the antimicrobial resistance of *Campylobacter* strains represents a considerable risk for the consumption of pork meat and confirms the need for continuous monitoring of *Campylobacter* in the pig production chain.

C4 Codex Alimentarius

Several interviewees emphasize that Brazil strictly follows the Codex recommendations. What does that implicate regarding veterinary use of antibiotics and control of residues in animal products? The Codex Alimentarius Commission is an intergovernmental body with over 180 members, within the framework of the Joint Food Standards Programme established by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO), with the purpose of protecting the health of consumers and ensuring fair practices in the food trade. The Commission also promotes coordination of all food standards work undertaken by international governmental and non-governmental organizations. The Codex Alimentarius (Latin, meaning Food Law or Code) is the result of the Commission's work: a collection of internationally adopted food standards, guidelines, codes of practice and other recommendations.

A short summary of relevant Codex guidelines in relation to antibiotics use:

- **Maximum Residue Limits for Veterinary Drugs in Food (CAC/MRL2)**

Residue limits for all kinds of veterinary drugs in tissues of all kind of feed animal species

- **Guidelines for risk analysis of foodborne antimicrobial resistance (CAC/GL 77- 2011)**

This guideline provides a structured risk analysis framework to address the risks to human health associated with the presence in food and animal feed, including aquaculture, and the transmission through food and animal feed, of antimicrobial resistant (AMR) microorganisms or determinants linked to non-human use of antimicrobial agents.

- **Guidelines for the Design and Implementation of National Regulatory Food Safety Assurance Programmes Associated with the Use of Veterinary Drugs in Food Producing Animals (CAC/GL 71-2009)**

This guide is intended to provide the overarching principles and guidance for governments on the design and implementation of national and trade related food safety assurance programmes for residues of veterinary drugs.

Programmes for the control of residues of veterinary drugs in foods should:

- i. Be based on risk using realistic risk profiles assessed as reasonably likely to be associated with food derived from the relevant production system(s);
- ii. Be prevention focussed based on the realistic risk profiles associated with the probable or known use of approved, non-approved and prohibited veterinary drugs in the production system;
- iii. Include regulatory measures proportionate to the relative human health risk associated with these hazards compared with other food-associated hazards;
- iv. Ensure all parties involved in the production, marketing and processing system of the animals and/or the food products derived from them are held accountable to ensure that unsafe animal products will not be sold as a result of their action or inaction;
- v. Recognise that pre-harvest controls and practices are the primary means for ensuring safe food;
- vi. Recognise that the primary role of audits and sampling programmes is to verify the implementation and effectiveness of the pre-harvest controls and practices;
- vii. Focus on system and population based assurances; and
- viii. Be cost effective and have the support of stakeholders.

- **Code of practice on good animal feeding (CAC/RCP 54-2004)**

This Code is to establish a feed safety system for food producing animals which covers the whole food chain, taking into account relevant aspects of animal health and the environment in order to minimize risks to consumers' health. Medicated Feed is defined as: any feed which contains veterinary drugs as defined in the Codex Alimentarius Commission Procedural Manual. Antibiotics should not be used in feed for growth promoting purposes in the absence of a public health safety assessment. Animals receiving medicated feed should be identified and managed appropriately until the correct withholding period (if any) has been reached and records of these procedures must be maintained.

As Brazil indicates that it strictly follows the Codex recommendations, it will also follow the Codex recommendations on food safety programs, MRL's in food, antimicrobial resistance and good animal feeding as mentioned above. The Codex, however, does not provide in recommendations on national registration of antibiotic usage, nor does it set target values for maximum numbers of treatments per herd or maximum average number of treatment days per animal per year.

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