ABSTRACT

Protecting farm animals in production systems is nowadays a goal of most civil societies. Meat producing countries are seeking the development of norms and directives to assist standardizing broilers’ farm conditions, which facilitate auditing. This research aimed to compare the rearing and welfare aspects of demands in poultry rearing manuals of good practices and norms. Scores were given to the items within the manuals, and the mean values were calculated and compared. The Analytic Hierarchic Process (AHP) was used for selecting the most appropriate set of rules with respect to welfare issues. Results indicated that GLOBALGAP and RSPCA present the most appropriate set of norms. They also pointed the RSPCA as the most adequate set of rules related to animal welfare.

KEYWORDS: multi criteria analysis, broiler production, welfare, laws.

NORMAS DE BEM-ESTAR PARA A PRODUÇÃO DE FRANGOS DE CORTE

RESUMO

Protector animais em sistemas de produção hoje é um objetivo da maioria das sociedades civis. Países produtores de carne estão buscando o desenvolvimento de normas e diretrizes para auxiliar a padronização de condições de produção de frangos de corte, o que facilita a auditoria das mesmas. Esta pesquisa teve como objetivo, comparar a criação e os aspectos de bem-estar das exigências dos manuais de boas práticas de criação de aves e normas. Pontuações foram dadas para os itens dentro dos manuais, e os valores médios foram calculados e comparados. O Processo Analítico Hierárquico (AHP) foi utilizado para selecionar o conjunto mais adequado de regras no que diz respeito às questões de bem-estar. Os resultados indicaram que os manuais GLOBALGAP e RSPCA apresentaram os conjuntos mais adequados de normas. Foi apontado também que o manual RSPCA, como o manual mais adequado de normas relativas ao bem-estar animal.
INTRODUCTION

The primary role of farm animals is for human food consumption, and the level of inputs such as feed, housing, disease control and environment management, has reached a high degree of technology driven success. The production process has been pushed to their biological limits, and there is an increasing challenge to meet the animals well-being, or yet human-perceived welfare (DAWKINS et al., 2003; MC INERNEY, 2004; FRASER, 2009; JAYSON, 2011; TOMA, 2012). Handling procedures, stocking density, sufficient access to feed and water, adequate housing and air quality are well documented in literature and have been regulated by several countries (SILVA et al., 2001; WATHES et al., 2002, PAWELEK & CRONEY, 2003; CORDEIRO et al., 2013).

Comprehensive knowledge of farm animals’ behavioral activities is essential for the improvement of animal husbandry, and related information has been used for establishing appropriate directives and legislation for animal welfare worldwide (DAWKINS et al., 2003; PAUL et al., 2005; KEHLBACHER, 2012; NAPOLITANO, 2012).

Analytic hierarchy process (AHP) is a decision-making tool that can help to describe the general decision operation by decomposing a complex problem into a multi-level hierarchical structure of objectives, criteria, sub-criteria and alternatives (SAATY, 1990). The use of AHP has been reported in numerous fields such as performance assessment, project selection, budget allocation, transportation, health care, and manufacturing (GARCIA et al., 2012; LIBERATORE & NYDICK, 2008; ROSADO JR et al., 2011). AHP hierarchic structure reflects the natural tendency of the human mind to select elements of a system into different levels, and to group them in each level (SAATY, 1990).

This research aimed of comparing the contents of the codes of good practices with the international norms, and to select the most appropriate set of rules aimed to be applied to rearing of broiler welfare in Brazilian conditions.

MATERIAL AND METHODS

Welfare of animals is not a single state, and it needs to be analyzed as a wide range of identified outcome (reference needed). It can vary according to the levels in which the human perception judges, and around a certain threshold varying from “bad” (low welfare standard) to “excellent” (high welfare standard). Existing norms (codes of good practices and producers norms) were considered as guidance to be adopted by producers, in the absence of laws and directives which application needs to be either advisory or compulsory. Although on a voluntary basis, those texts were taken into account in this research, as existing regulation.

This research was carried out in two steps: (1) the comparison of norms with welfare standards from countries which adopt strict rules on this subject; and (2) the use of the multi criteria method Analytical Hierarchic Process (AHP) to select the most appropriate set of rules applied to animal welfare in broiler production. The norms used in this study were: Brazilian Good Practice Manual – MBPB (EMBRAPA, 2007), which is followed by producers in Brazil; GLOBALGAP (2009), which is
accepted by most export countries; EHS (2007) and NCC (2008) which are adopted by producers in the USA; and RSPCA (2008), adopted in European Union.

**Comparison of international and national norms**

Adequate information on the following items was considered in the comparison: environment, management production and traceability; environmental data (temperature, relative humidity, ventilation, ammonia concentration and dust); drinking water quality; management (housing disinfection, adequate flock density); and transportation.

Scores were given to each specific demand in relation to its requirement in international codes, using the adapted Likert scale, in range varying from 1 to 5, such as 1 = very bad (there is no norms regarding that subject when compared to the international standards); 2 = bad (there are few norms and few or none compliance); 3 = average (there are norms for at least half of the international standard); 4 = good (there is a great deal of norms and regulations regarding several events during production and a good degree of compliance); and 5 = very good (codes and regulations agree totally with the international norms, and there is a high degree of compliance).

Tables were built, and the average of the scores was calculated both for the demand, for each set of rules, in order to verify and quantify how much they depart from or agree with the international trade codes, on the selected animal well-being issues. Comparative analysis of the mean score values was used for evaluating the performance of each set of rules in the manual, in terms of addressing welfare legislation for broiler, regarding the chosen types of demand, at a confidence interval of 95%, and using the software MINITAB (2005).

**Multi criteria analysis**

The Analytic Hierarchy Process (AHP) process is based on basic principles of analytical thinking. First, the problem is decomposed into hierarchical levels for assessment; next, priorities are pairwise compared on a determined criterion; and finally, the model prioritization may be evaluated for its consistency (SAATY, 1990).

A pairwise comparison matrix was formed in which rows and columns represent the components that belong to the same parent component in the decision hierarchy. The weight of component $i$ compared to component $j$ with regard to the parent component is determined using Saaty’s scale (1 – 9 scale), where 1 = equal importance; 3 = moderate importance; 5 = strong importance; 7 = very strong or demonstrated importance; 9 = extreme importance; and 2, 4, 6 and 8 are related to intermediate values. If factor $i$ has one of the above numbers assigned to it when compared to factor $j$, then $j$ has the reciprocal value when compared with $i$ (SAATY, 1990).

The matrix is formed by the $(i, j)^{th}$ position of the pairwise comparison matrix, in order to support comparisons with a limited range but sufficient sensitivity. The reciprocal of the assigned number is assigned to the $(j, i)^{th}$ position. Once the pairwise comparison matrix is formed, weights of the components are calculated by solving for the eigenvector with the highest eigenvalues (SAATY, 1990). Eigenvector components establish the priority levels of each element, and the highest eigenvalue ($\lambda_{\text{max}}$) is used to measure consistency index, according to Equation 1:

$$\text{CI} = (\lambda_{\text{max}} - n)/(n - 1)$$

Eq.1
where $CI = \text{consistency index}; \lambda_{\text{max}} = \text{highest eigenvalue}; \text{and } n = \text{number of matrix elements.}$

A consistency ratio (CR; Eq. 2) with a value $\leq 0.1$ should be maintained for the matrix to be consistent; otherwise, the pairwise comparisons should be revised.

$$\text{CR} = \frac{\text{CI}}{\text{RI}}$$  \hspace{1cm} \text{Eq. 2}

Where $\text{CR} = \text{consistency rate}; \ CI = \text{consistency index}; \ RI = \text{average random index.}$

The following criteria were used to compare the norms: (1) ease assessment; (2) understandable by user; (3) in accordance to international rules; (4) adequate rearing standard; (5) high possibility of being used; (6) safety; and (7) adapt to overall Brazilian rearing condition. The alternatives were the manuals studied: MBPB, GLOBALGAP, EHS, RSPCA, and NCC.

The adopted criteria weights in the second level were given by two specialists who were familiar with the international animal welfare norms. Calculations were done using the software EXPERT CHOICE (2005).

RESULTS AND DISCUSSION

Table 1 shows the comparison between norms related to “management of production”, “environmental management”, and “traceability” in poultry production systems. The item “management of production” presented high scores compared with other items analyzed, due to the clear and broad presentation of guidelines. GLOBALGAP (2009) received a smaller score compared to others, as the items in the guidelines are not specific, and the focus remains on administrative registrations. EHS (2007) presents numbers above average in the items related to “environmental management” and “traceability” issues. The Brazilian manual did not have text about “traceability”, for instance, and this may indicate that traceability could be considered a critical point to be revised in this manual.

<table>
<thead>
<tr>
<th>Item</th>
<th>MBPB</th>
<th>GLOBALGAP</th>
<th>EHS</th>
<th>RSPCA</th>
<th>NCC</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management of production</td>
<td>4.0</td>
<td>3.5</td>
<td>3.5</td>
<td>4.5</td>
<td>2.0</td>
<td>3.5</td>
</tr>
<tr>
<td>Environmental management</td>
<td>3.5</td>
<td>3.5</td>
<td>4.0</td>
<td>2.5</td>
<td>3.5</td>
<td>3.5</td>
</tr>
<tr>
<td>Traceability</td>
<td>1.5</td>
<td>3.5</td>
<td>4.0</td>
<td>3.0</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Average</td>
<td>3.0</td>
<td>3.5</td>
<td>3.6</td>
<td>3.3</td>
<td>2.8</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Table 2 presents a comparative analysis of the mean score values which were used for evaluating the performance of each norm in terms of addressing rearing conditions, health and welfare legislation. Regarding the “building and environment”, “ventilation and temperature control” conditions the manuals’ text present the subject in a quite concise form but it contains all necessary information to be followed. For “flock density”, even though there is available material in current literature (DAWKINS et al., 2003; NÄÄS et al., 2010), Brazilian and UE manuals (GLOBALGAP, 2009 and
RSPCA, 2008) present items with specific measurements and indications, while others do not even mention these points.

**TABLE 2** - Comparative analysis of the mean score values was used for evaluating the performance of each studied norm, in terms of addressing welfare legislation for both broiler, regarding the chosen types of demand

<table>
<thead>
<tr>
<th>Rearing, management and welfare</th>
<th>MBPB</th>
<th>GLOBALGAP</th>
<th>EHS</th>
<th>RSPCA</th>
<th>NCC</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building and environment</td>
<td>4.0</td>
<td>4.0</td>
<td>4.5</td>
<td>3.0</td>
<td>3.0</td>
<td>3.7</td>
</tr>
<tr>
<td>Flock density</td>
<td>4.5</td>
<td>4.0</td>
<td>0.0</td>
<td>4.5</td>
<td>3.5</td>
<td>3.3</td>
</tr>
<tr>
<td>Ventilation and temperature control</td>
<td>4.0</td>
<td>4.5</td>
<td>4.0</td>
<td>4.5</td>
<td>3.5</td>
<td>4.1</td>
</tr>
<tr>
<td>Lighting</td>
<td>4.0</td>
<td>4.0</td>
<td>4.0</td>
<td>4.5</td>
<td>3.5</td>
<td>4.0</td>
</tr>
<tr>
<td>Litter</td>
<td>4.5</td>
<td>4.0</td>
<td>4.0</td>
<td>4.5</td>
<td>3.5</td>
<td>4.1</td>
</tr>
<tr>
<td>Feeding and water</td>
<td>4.0</td>
<td>4.0</td>
<td>4.5</td>
<td>4.5</td>
<td>4.0</td>
<td>4.2</td>
</tr>
<tr>
<td>Health</td>
<td>4.5</td>
<td>4.5</td>
<td>4.0</td>
<td>4.5</td>
<td>4.0</td>
<td>4.3</td>
</tr>
<tr>
<td>Harvesting and transportation</td>
<td>4.5</td>
<td>4.5</td>
<td>2.0</td>
<td>4.5</td>
<td>4.0</td>
<td>3.9</td>
</tr>
<tr>
<td>Welfare of poultry</td>
<td>2.5</td>
<td>2.5</td>
<td>3.0</td>
<td>4.2</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>4.0</td>
<td>4.0</td>
<td>3.1</td>
<td>4.3</td>
<td>3.5</td>
<td>3.8</td>
</tr>
</tbody>
</table>

Regarding items related to “management of production” in the RSPCA and Brazilian manuals there is more information than in GLOGALGAP and EHS, but in NCC insufficient information about this item is mentioned. Regarding “light” the Brazilian norm only mentions housing design related to natural lighting, lacking data with respect to artificial lighting. GLOBALGAP is highly descriptive in the light measurements, allowing the reader to easily follow and meet the requirements. In the NCC set of norms, no chapter is presented on this matter. In contrast, this issue is addressed in DEFRA norms (DEFRA, 2008). “Litter” use and management are mentioned in details in both Brazilian and European manuals, but in the NCC, only the cleaning of litter is addressed, not specifying the litter materials. “Feed and water” quality and availability are well described, and all critical points mentioned in manuals from the EU. Brazilian and the USA norms follow the rules dictated by the Ministry of Agriculture, which are somehow unclear, while the USA manuals follows the rules dictated by FAO (1998).

Using the AHP method for selecting the most appropriate set of norms related to animal welfare, and given the weight to the selected criteria, values for the alternative classification were found (Figure 1). The most appropriate set of rules, considering the criteria used, was the GLOBALGAP (0.217), followed by RSPCA (0.215), NCC-USA (0.195), MBPB (0.189), and EHS-USA (0.184). When comparing this result with that of Table 2, it is clear that both GLOBALGAP and RSPCA manuals guidelines are appropriate with most criteria used. However, with respect to animal welfare, the text of the RSPCA seems most appropriate as it addresses most issues related to rearing and welfare of poultry.
Different from the EU, poultry producing countries in South America, Asia, or Africa do not specifically address animal welfare issues in their norms or legislation. As a consequence, producers who are involved in the international meat export market rely on standards and information found in codes of good practices published by extension and research institutions (SILVA et al., 2009; SILVA, 2012). All the manuals present written information on environmental conditions. There is valuable information available in the literature related to heat stress and ammonia control (e.g., WATHES et al., 2002; PILECCO et al., 2012). Regarding “health” questions all countries follow the OIE rules, but the item of hygiene is not found specifically in the USA material. “Harvesting and transportation” are discussed in the analyzed material from Brazil and European Union; however, in the American manuals (EHS and NCC) they are scarcely mentioned. Welfare related issues are well addressed in the RSPCA (2008) manuals, GLOBALGAP (2009), in the USA norms, and in Brazilian manuals this matter is adequately mentioned or discussed, for instance numbers are not used for indicating the spaces.

As a common sense, welfare standards should preferably be supported by scientific evidence (BARNETT, 2007). However, the author states that there are a large number of issues considered important for animal welfare, which scientific knowledge is still absent to develop measurable standards (DAWKINS et al., 2003; PAUL et al., 2005; FRASER, 2009; FAÇANHA et al., 2013). Today’s available knowledge of farm technicians allows the basic standards to be achieved, in order to make meat production possible within desirable animal welfare standards. There is, however, great need for meat producer countries to develop appropriate norms in order to help auditing actions. The development of a welfare audit rules for the Australian chicken meat industry started around 2001, and it was only completed in 2004 (BARNETT, 2004).

General standards are suggested for achieving sustainable improvements in animal welfare based on national and international benchmarks, scientific evaluation and research, as well as proper education available to producers, taking into account changes in whole of community standards (GEMMELL, 2009). Similar initiatives were
taken by the European Union and the USA and completed by now. Being the largest poultry meat export, Brazil needs to properly address this issue with focus and depth.

CONCLUSION

Norms adopted for rearing poultry vary considerably, and are not necessarily related to the specific needs in a country or region. They differ most in items related to rearing, housing and welfare and they lack in proper specifications. High degree of common norms' characteristics is greatly needed in order to help international trade.

ACKNOWLEDGEMENT

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