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1



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Can Farm Animal Welfare Standards be Compatible with Free Trade?

49

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Introduction

In the livestock agriculture of developed countries a predominant tendency over the last 50 years has been a drive for cost efficiency – for cutting the cost of producing each egg or unit of meat or milk. One result has been the development of intensive farming and other practices causing problems for animal welfare, and this is also now occurring in many developing countries. But meanwhile there has been increasing concern in many countries for the welfare of farm animals. This has restricted practices deleterious to welfare or conversely led to standards for the protection or promotion of welfare, albeit very unevenly. Are such standards compatible with the increase in international trade and competition between countries, which tends to increase the pressure for cheap food production?

Production Cost and Welfare

The decline in cost of food production in developed countries was initiated by public policies in favour of more abundant, cheaper food. However, in recent years it has acquired its own momentum. Continuing decline in food prices is sometimes attributed to pressure from consumers, but it would be more accurate to say that it now pri-

marily results from competition between producers and between retailers.

This competition sometimes causes problems for animal welfare, but does not always do so. First it must be noted that some producers claim that the welfare of their animals is satisfactory almost by definition, because poor welfare would be associated with poor production and hence self-defeating. This indicates an emphasis on those physical aspects of welfare that are associated with production. However, people vary in their attitude to welfare, emphasising physical aspects, mental aspects, naturalness, or a combination of these (Figure 49.1; Fraser et al., 1997), and these do not all correlate with production.

Furthermore, profit from a group of animals often does not correlate with welfare of its individual members. So there are many instances where measures to increase profit have caused welfare problems, for example decreasing space allowances for rearing pigs (Figure 49.2). One of the main effects of competition has been intensification of livestock farming: in the case of pigs, keeping them indoors, increasing stocking densities, using crates and stalls, selecting for growth rate and reducing weaning age.

It is true, of course, that emphasis on production does militate against severe mistreatment or neglect of animals,

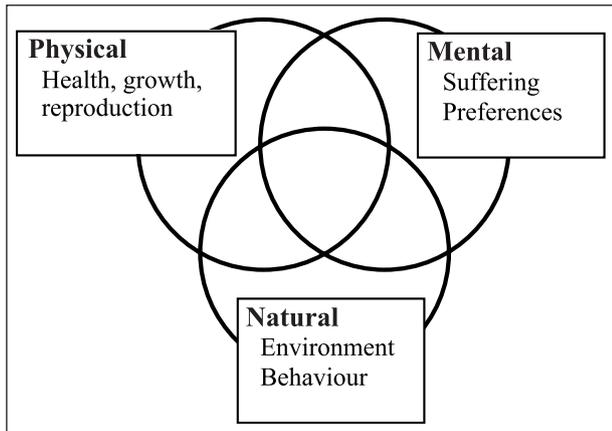


Figure 49.1. Different approaches to welfare overlap, but not completely (Appleby, 1999).

and that conversely there are many instances where measures to reduce costs will improve welfare, for example measures to prevent disease and mortality. Nevertheless, a focus on efficiency has not always identified the best methods even to achieve its own aims. It took an alternative approach, aimed at reducing problems for the animals concerned, to identify the fact that humane treatment of livestock by workers improves growth rate and reproduction (Table 49.1; Hemsworth, 2004). A similar approach showed that understanding animal behaviour can improve design of handling systems and hence efficient use of labour in handling livestock (Grandin, 2004). In both cases the unit cost of producing or handling animals can be reduced, after an initial investment in worker training or facilities, while also improving animal welfare. So a positive attitude to welfare may benefit both animals and producers despite a competitive market. However, people do not always recognise or act on such opportunities, needing education and help to do so, partly because there may be a requirement of short-term expenditure to achieve long-term benefit.

A positive attitude to welfare by individual farmers may thus produce a degree of protection of farm animal welfare that is completely compatible with, and potentially even promoted by, competition, including that from free trade. This is in some sense a basic farm animal welfare standard, but most discussions of standards concerns more formal, agreed guidelines for animal welfare.

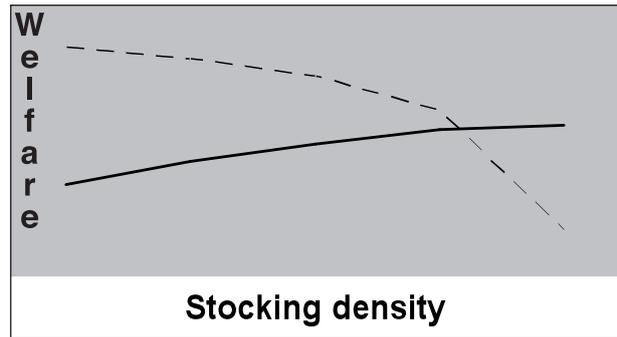


Figure 49.2. Profit from a group of animals often does not correlate with welfare of its individual members. In this hypothetical diagram the broken line represents growth rate and welfare of individual piglets as their stocking density is increased, while the solid line represents profit from the house.

Farm Animal Welfare Standards

Standards for farm animal welfare – or for other aspects of food production – operate at a number of levels of authority. Some are informal agreements among, say, a number of producers. Some are more formal agreements. Some involve assurance, with measures for verification (usually by independent assessors) that the standards are being met. A further level is legislation, which should also involve verification and enforcement.

Standards may also be categorised by the type of entity setting them up, as follows.

Producer group

In a number of countries, farmers or production companies form associations, which may agree on standards of

Table 49.1. Gentle treatment of pigs, compared with rough treatment, reduces cortisol (which indicates stress), decreases their fear of humans, as indicated by the speed with which they approach a person, increases pregnancy rates in young sows (gilts) and accelerates maturation in boars (from Hemsworth et al., 1993).

	Handling		
	Gentle	Minimal	Rough
Blood cortisol (ng/ml)	1.7	1.8	2.4
Time to touch person (s)	48	96	120
Pregnancy in gilts (%)	88	57	33
Age of mating by boars (d)	161	176	193

Table 49.2. Topics covered by the Swine Welfare Assurance Program of the US's National Pork Board (2005) encourage producers to review their practices that affect welfare but do not introduce any new criteria for housing systems.

1	Herd health and nutrition
2	Caretaker training
3	Animal observation
4	Body condition score
5	Euthanasia
6	Handling and movement
7	Facilities
8	Emergency support
9	Continuing assessment and education

good practice to safeguard and promote their behaviour, reputation and sales. In recent years these have responded to public opinion by including consideration of welfare, although they vary in how much they actually raise standards above customary practice. For example, in the US the National Pork Board has set up the Swine Welfare Assurance Program, which encourages producers to review their practices that affect welfare but does not introduce any new criteria for housing systems (Table 49.2). By contrast the American Veal Association announced in 2007 that its members would phase out individual crates for veal calves.

Production, processing or retailing company

Companies are also responsive to public opinion and in the US several large companies have introduced standards. In 2000 the McDonalds Corporation started requiring its suppliers to provide laying hens with the same space allowance as in Europe, and not to practise forced moulting. Other fast food chains followed suit, and subsequently the National Council of Chain Restaurants (NCCR) and the Food Marketing Institute (FMI, which represents the major supermarket chains) developed a collaborative programme, producing husbandry guidelines for their suppliers of animal products. More recently some large production and processing companies have acted similarly: for example in 2007 Smithfields, the world's largest pork production and processing company, decided to phase out gestation crates for sows on all its farms.

More stringent standards are being developed by a company that emphasises ethical issues of food, the US/UK chain of food stores Whole Foods Market. Its Animal Compassionate Standards will, for example, prohibit bill trimming in ducks.

Speciality producers

Some producers also address consumer concerns about food production methods by developing niche markets, obtaining higher selling prices to offset their higher production costs – if, indeed, their production costs are really higher, which is often a matter of debate. They do this either because they share consumer concerns, or for business reasons, or both. As well as welfare, such concerns include the following, and production methods that take these into account may also improve the welfare of livestock: the environment (especially organic production) (Appleby, 2005), food safety and quality, food security, local food production, family farms, farm workers, rural communities and developing countries. Standards that specifically address animal welfare are generally endorsed and verified by welfare organisations: in the UK, the Royal Society for Prevention of Cruelty to Animals; in North America, the American Humane Association, Humane Farm Animal Care, the Animal Welfare Institute and the British Columbia SPCA.

States and countries

In some countries, individual states can pass their own legislation, and there are instances of legislation favouring animal welfare. In the US, Florida banned gestation crates for sows in 2002 and California legislated in 2004 to phase out force feeding of poultry for *foie gras* production. However, market forces militate against such legislation because there is resistance to any measures that reduce competitiveness with other states.

Many countries are developing legislation for animal welfare. This varies from codified lists of actions that are prohibited to simple statements that animals must not be ill-treated. Both may be backed by more detailed advisory codes. In European countries, however, legislation is increasingly subject to the wider groupings discussed in the next section.

Groups of Countries

The European Union (EU) has more comprehensive legislation for animal welfare than anywhere else in the world. This is partly influenced by the wider grouping of the Council of Europe, with 47 countries and the EU as members. This has stated that ‘the humane treatment of animals is one of the hallmarks of Western civilisation’. The EU passes Directives, which then have to be translated into national legislation. In the current context there are two particularly relevant Directives. A Directive on husbandry systems for laying hens was passed in 1999. It included provisions for a review in 2004 taking into account ‘the socio-economic implications of the various systems,’ but at the time of writing that review has still not been produced. A Broiler Directive was passed in 2007. This was weaker than earlier drafts, apparently because of concerns over the pressure of imports of chicken meat and the threat to the industry of avian influenza.

There are some moves to include consideration of animal welfare in other groupings, such as Free Trade Areas. The EU is including measures for animal welfare in bilateral trade agreements, for example with Chile: primarily those that overlap with measures to protect food hygiene, such as controls over handling and slaughter methods.

Intergovernmental Organisations

On a worldwide scale, the World Organisation for Animal Health (OIE) has recognised that animal health is affected by other aspects of animal welfare. It has therefore established the first global animal welfare standards, starting with transport and slaughter practices (OIE, 2005) and following up with consideration of husbandry. These have been agreed by the 167 member countries, but many countries have not yet made progress on implementation.

Other intergovernmental organisations are recognising the contributions of animal treatment and animal welfare to economics and to poverty and hunger reduction. For example, the International Finance Corporation, part of the World Bank Group, has issued guidelines on ‘Creating business opportunity through improved animal welfare’ and on ‘Animal welfare in livestock operations.’

Are Standards Compatible with Free Trade?

The multiplicity of standard-setting agencies and standards outlined in the previous section suggests that the

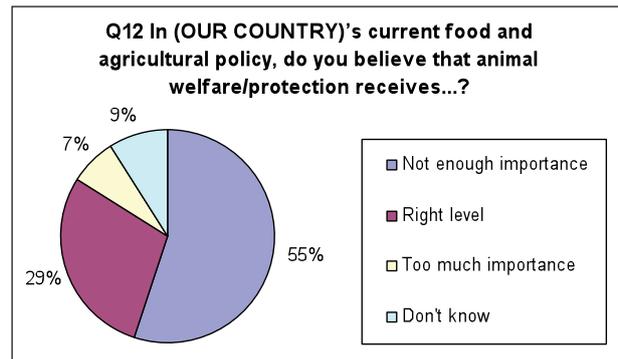


Figure 49.3. Public concern for animal welfare in developed countries continues to grow. The illustration analyses 24,708 replies from the countries of the EU to one of the questions in a survey by Eurobarometer in 2005.

answer to whether such standards are compatible with increasingly competitive trade is not simple, but is nevertheless in many or even most cases positive. The main motivation for creation of standards is increasing public concern for farm animal welfare, in both developed countries (Figure 49.3) and developing countries (as evidenced by the unanimous support for standards from all member countries of the OIE). As such, few standard-setting agencies will back down in the face of competition, in a business environment that is increasingly requiring corporate responsibility and accountability for ethical matters including animal welfare. Thus a senior executive of Burger King commented in 2002 that their customers expect them – the restaurant company – to ensure that the animals supplying them with food are properly looked after. Indeed, the fact that corporate decisions on animal welfare are based on consumer attitudes means that they are based on broad market considerations rather than on narrow accounting of only the cost of food animal production (which is anyway just a small component of final product price) (Appleby et al., 2004). This grounding in consumer preferences means that availability of information on the welfare of food producing animals is often important, whether by product labelling or by other means such as company or national websites.

Some standards are neutral for production costs – although it has to be said that this includes some anodyne ‘standards’ that do little or nothing more than codify existing practices rather than actually improving welfare.

Some reduce costs – and it is important to note that, as with the work by Hemsworth (2004) and Grandin (2004) described above, this may be a surprise. When the US group United Egg Producers started to phase in larger space requirements for hens in cages in 2002, many producers introduced the final target space allowance rapidly rather than slowly. Contrary to their expectation that housing the maximum number of hens per cage would maximise profits, they found that reducing stocking density improved production and feed conversion efficiency by individual hens, saved on feed costs and improved profit overall.

Some standards do increase costs, but will survive for various reasons. Some generate greater income, particularly in niche markets, and there is every indication that speciality markets will continue to grow, including for high-welfare products, becoming less of a minority ‘niche.’ As noted above, standards for welfare also overlap with those for other criteria such as organic production. This is important both for niche sales and because wider welfare standards will be protected and even promoted by the fact that they have common characteristics with other imperatives such as environmental protection and food hygiene (Appleby et al., 2003).

Trade is thus not wholly free, and this is particularly true of international trade. A country’s own animal food products, produced to certain welfare standards, may be promoted by its authorities (by advertising, use of tariffs etc.) and favoured by its citizens both because of those standards themselves and for other reasons such as local food security. There are also practical factors supporting in-country production, notably transport costs and hygiene controls – although these certainly do not always overwhelm other factors. Thus egg production in Europe is subject to competition from imports (partly because of costs associated with higher welfare, but more because of other costs such as labour and feed being greater than in competitor countries). This will probably have little impact on sales of European-produced whole eggs, but more on those of liquid and dried egg products, which are both more easily transported and sterilised.

Where restrictions on international trade exist, not directly warranted by the World Trade Organisation, they may be challenged under that authority, and the precedents for welfare safeguards being permitted are not

good. However, no challenges on welfare grounds have yet been made, and one possible defence increasingly mentioned is Article XX of the General Agreement on Tariffs and Trade, which says:

‘Nothing in this agreement shall be construed to prevent the adoption or enforcement by any contracting party of measures (a) necessary to protect public morals [or] (b) necessary to protect human, animal or plant health.’

Nations faced with imports from countries with lower welfare standards could argue that protecting the welfare of their farm animals was important for public morals and both human and animal health.

It remains true that the pressure of increased trade, both domestic and international, makes creation, strengthening or even maintenance of animal welfare standards even more difficult than in a less competitive market. Some standards may prove incompatible with an increasingly free market, although the arguments presented above suggest that these will be few. Perhaps the strongest effect of freer trade will be a reduction in the creation of new standards, or a weakening of any created – as with the European Broiler Directive discussed earlier.

Yet free trade does not occur in a vacuum: it could be argued that other changes in the environment within which food production occurs are equally important, such as information exchange. Increased communication about animal welfare is maintaining the upward trend in international awareness. People concerned for animals hope, with some justification, that the positive effects of such awareness on farm animal welfare and on welfare protection standards are accelerating (Turner and D’Silva, 2006).

Conclusions

Programmes setting standards for farm animal welfare have increased markedly in recent years, varying in strength from cosmetic to demanding, and in the agencies establishing them from individual farmers to intergovernmental organisations. The main motivation is increasing public concern for farm animal welfare, which overlaps

with other concerns for food hygiene and environmental protection. Most will therefore survive the pressure of increasingly free trade: indeed, some prove in practice to reduce costs or to increase or protect income in other ways. Increasing competition may prevent or weaken creation of standards in future, but the impetus for high food quality (in a broad sense, including its provenance and effects) will continue to increase worldwide, thus requiring any further freeing-up of trade to be compatible with continuing standards for farm animal welfare and other aspects of food production.

References

- Hänsch, F., Nowak, B and Hartung, J. 2009. Behavioural and clinical response of turkeys stunned in a v-shaped carbon dioxide tunnel. In: *Animal Welfare*. Vol.18 pp. 81-86.
- Jago, J.G., Harcourt, R.G. and Matthews, L.R. 1997. The effect of road-type and distance transported on behaviour, physiology and carcass quality of farmed red deer *cervus elaphus*. In: *Applied Animal Behaviour Science*. Vol. 51, pp. 129-141.
- Knezacek, T.D., Audren, G.F., Mitchell, M.A, Kettlewell, P.J, Hunter, R.R., Classen, H.L., Stephens, S., Olkowski, A.A., Barber, E.M. and Crowe, T.G. 2000. Temperature heterogeneity and moisture accumulations in trailers transporting broilers under canadian winter conditions. In: *Poultry Science*. Vol. 79, supp.1, p.31
- Liste, G., Villaroel, M., Chacon, G., Sanudo, C., Olleta, J.L., Garcia-Belenguer, S., Alierta, S. and Maria, G.A 2009. Effect of lairage duration on rabbit welfare and meat quality. In: *Meat Science*. Vol.82 pp. 71-76.
- Ministry of Agriculture, Fisheries and Food MAFF. 1989. *Code of recommendations for the welfare of livestock. Farmed deer*. London, UK: MAFF Publications.
- Mitchell, M.A. and Kettlewell, P.J. 2004. Transport and handling. In: Weeks, C.A. and Butterworth, A. (eds.) *Measuring and auditing broiler welfare*. Wallingford. UK: CABI Publishing. pp. 145-160.
- Mitchell, M.A., Carlisle, A.J., Hunter, R.R. and Kettlewell, P.J. 2003. Weight loss in transit. An important issue in broiler transportation. In: *Poultry Science*. Vol. 82, supp.1, p.52
- Mitchell, M.A., Hunter, R.R., Kettlewell, P.J and Carlisle, A.J. 1998. Heat and moisture production of broilers during transportation. A whole vehicle direct calorimeter. In: *Poultry Science*. Vol. 77, supp.1, p.4
- Nijdam, E., Arens, P., Lambooi, E., Decuyper, E. and Stegeman, J.A. 2004. Factors influencing bruises and mortality of broilers during catching, transport and lairage. In: *Poultry Science*. Vol.83 pp. 1610-1615.
- Pollard, J.C., Littlejohn, R.P., Asher, G.W., Pearse, A.J.T., Stevensen-Barry, J.M., McGregor, S.K., Manley, T.R., Duncan, S.J., Pollock, K.L. and Prescott, J. 2002. A comparison of biochemical and meat quality variables in red deer *cervus elaphus* following either slaughter at pasture or killing at a deer slaughter plant. In: *Meat Science*. Vol.60. pp. 85-94.
- Smith, R.F. and Dobson, H. 1990. Effect of pre-slaughter experience on behaviour, plasma cortisol and muscle pH in farmed red deer. In: *Veterinary Record*. Vol.126, pp. 155-158
- Tarrant, P.V. 1990. Transportation of cattle by road. In: *Applied Animal Behaviour Science*. Vol.28, pp. 153-170.
- Voisinet, B.D., Grandin, T., O'Connor, S.F., Tatum, J.D. and Deesing, M.J. 1997. *Bos indicus* cross feedlot cattle with excitable temperaments have tougher meat and a higher incidence of borderline dark cutters. In: *Meat Science*. Vol.46, pp.367-377.
- Waas, J.R., Ingram, J.R. and Matthews, L.R. 1997. Physiological responses of red deer *cervus elaphus* to conditions experienced during road transport. In: *Physiology and Behaviour*. Vol. 61, pp. 931-938
- Waas, J.R., Ingram, J.R. and Matthews, L.R. 1999. Real-time physiological responses of red deer *cervus elaphus* to translocations. In: *Journal of Wildlife Management*. Vol. 63, pp. 1152-1162.
- Warriss, P.D., Brown, S.N., Edwards, J.E. and Knowles, T.G. 1998. Effect of lairage time on levels of stress and meat quality in pigs. In: *Animal Science*. Vol. 66, pp. 255-261
- Weeks, C.A. 2008. A review of welfare in cattle, sheep and pig lairages with emphasis on stocking rates, ventilation and noise. In: *Animal Welfare*. Vol. 17 pp.275-284
- Wotton, S. and Wilkins, L.J. 2003. Primary processing of poultry. In: Weeks, C.A. and Butterworth, A. (eds.) *Measuring and auditing broiler welfare*. Wallingford, UK: CABI Publishing. pp. 161-180.

Chapter 48

- 93/119/EC Council Directive of 22 December 1993 on the protection of animals at the time of slaughter or killing
- EC No 854/2004 Regulation of the European Parliament of the Council of 29 April 2004 laying down specific rules for the organization of official controls
- EC No 1099/2009 Council Regulation of 24 September 2009 on the protection of animals at the time of killing
- Grandin, T. 2006. Progress and challenges in animal handling and slaughter in the U.S. In: *Applied Animal Behaviour Science* 100: 129-139
- Sandström, V., Wotton, S.B., Berg, C. and Algers, B. 2008. *Proposal of monitoring system for the assessment of cattle welfare in abattoirs*. Welfare Quality sub project 2, WP 2.3, Report December 15th, 55 pp
- Wotton, S. and Wittington, P. 2008. Capacity building & training for animal welfare: slaughter. In: Algers, B., Blokhuis, H. and Keeling, L. (eds.) *Proceedings 'Animal welfare at slaughter and killing for disease control – emerging issues and good examples'*, Sweden, 2008. Pp 48-52.

Chapter 49

- Appleby, M.C. 1999 *What should we do about animal welfare?* Oxford: Blackwells.
- Appleby, M.C. 2005 Sustainable agriculture is humane, humane agriculture is sustainable. In: *Journal of Agricultural and Environmental Ethics* 18, 293-303
- Appleby, M.C., Cutler, N., Gazzard, J., Goddard, P., Milne, J.A., Morgan, C. and Redfern, A. 2003 What price cheap food? In: *Journal of Agricultural and Environmental Ethics* 16, 395-408
- Appleby, M.C., Mench, J.A. and Hughes, B.O. 2004. *Poultry behaviour and welfare* (including chapter on Economics). Wallingford, UK: CAB International.
- Fraser, D., Weary, D.M., Pajor, E.A. and Milligan, B.N. 1997 A scientific conception of animal welfare that reflects ethical concerns. In: *Animal Welfare* 6, 187-205
- Grandin, T. 2004 Principles for the design of handling facilities and transport systems. In: Benson, G.J. and Rollin, B.E. (eds.) *The well-being of farm animals: Challenges and solutions*. Ames: Blackwell. pp. 145-166
- Hemsworth, P.H. 2004 Human-livestock interaction. In: Benson, G.J. and Rollin, B.E. (eds.) *The well-being of farm animals: Challenges and solutions*. Ames: Blackwell. pp. 21-38

- Hemsworth, P.H., Barnett, J.L. and Coleman, G.J. 1993. The human-animal relationship in agriculture and its consequences for the animal. In: *Animal Welfare* 2, 33-51
- National Pork Board. 2005. *Swine welfare assurance program*. Available at www.porkboard.org/SWAPHome
- OIE (World Organisation for Animal Health). 2005 http://www.oie.int/eng/press/en_050602.htm
- Turner, J. and D'Silva, J. (eds.) 2006 *Animals, ethics and trade: The challenge of animal sentience*. London: Earthscan.
- ## Chapter 50
- Benson, G.J. and Rollin, B.E. (eds.) 2004. *The well-being of farm animals: Challenges and solutions*. Ames, IA: Blackwell Publishing.
- Rollin, B.E. 1995. *Farm animal welfare* (Ames, Iowa: Iowa State University Press.
- ## Chapter 51
- Algers B., 2009. A risk assessment approach to animal welfare. In: Smulders, F.J.M and Algers, B. (Eds.). Food safety assurance and veterinary public health, Vol. 5, Welfare of production animals: assessment and management of risks. Wageningen Academic Publishers, the Netherlands, 223-237.
- Blokhuis, H.J., Jones R.B., Geers R., Miele M. and Veissier I., 2003. Measuring and monitoring animal welfare: transparency in the food product quality chain. *Animal Welfare*, 12, 445-455.
- Blokhuis H. J., Keeling L. J., Gavinelli A., Serratoso J., 2008. Animal welfare's impact in the food chain. *Trends in Food Science & Technology*, 19 (1), S75-S83.
- Blokhuis, H.J., Veissier, I., Miele, M. and Jones, R.B., 2010. The Welfare Quality® project and beyond: safeguarding farm animal well-being. *Acta Agriculturae Scandinavica A, Animal Science*, 60, 129-140.
- CAC, 2001. Codex Alimentarius Commission. Food Hygiene, Basic texts, FAO/WHO, Rome, Italy.
- CAC, 2002. Codex Alimentarius Commission. Principles and Guidelines for the Conduct of Microbiological Risk Assessment. Document CAC/GL 30.
- Candiani, D., Ribó, O., Afonso, A., Aiassa, E., Correia, S., De Massis, F., Pujols, J; Serratoso J., 2007. Risk assessment challenges in the field of animal welfare. In: Proceedings of the XIII international congress in animal hygiene, ISAH, June 17-21, Tartu, Estonia. 587-581.
- Candiani D., Ribó O., Barbieri S., Afonso A., Grudnik T., Berthe F., Serratoso J., 2009. Development of a risk assessment methodology for animal welfare in EFSA's scientific opinions. In: Sustainable Animal Production. The challenges and potential developments for professional farming. Eds. Andres Aland and Francois Madec. Wageningen Academic Publishers, pp. 421-434.
- EC, 2002. European Commission. Regulation (EC) No. 178/2002 of 28 January 2002, laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. *Official Journal L31, 1/2/2002*, p. 1-24.
- EC, 2005. European Commission. Community Action Plan on the Protection and Welfare of Animals (2006-2010). http://ec.europa.eu/food/animal/welfare/actionplan/actionplan_en.htm
- EC, 2006. European Commission. Future Strategy on Animal Health for 2007-2013 http://ec.europa.eu/food/animal/diseases/strategy/final_report_en.htm
- EFSA, 2004a. European Food safety Authority. Opinion of the Scientific Panel on Animal Health and Welfare related to the welfare of animals during transport. *The EFSA Journal* (2004) 44, 1-36.
- EFSA, 2004b. European Food Safety Authority. Scientific Opinion of the AHAW Panel on the welfare aspects of the main systems of stunning and killing the main commercial species of animals. *The EFSA Journal* (2004) 45, 1-29.
- EFSA, 2006. European Food Safety Authority. Scientific Colloquium "Principles of Risk Assessment of Food Producing Animals: Current and future approaches" http://www.efsa.europa.eu/en/science/colloquium_series/no4_animal_diseases.html
- EFSA, 2009a. Scientific Report on the effects of farming systems on dairy cow welfare and disease. Report of the Panel on Animal Health and Welfare. Annex to the *EFSA Journal* (2009) 1143, 1-38
- EFSA, 2009b. Scientific Opinion on the overall assessment of dairy cows welfare. Scientific Opinion of the Panel on Animal Health and Animal Welfare. *The EFSA Journal* (2009) 1143, 1-38.
- EFSA, 2009c. Scientific Opinion on the impact of housing, nutrition and feeding, management and genetic selection on leg and locomotion problems in dairy cows. Scientific Opinion of the Panel on Animal Health and Animal Welfare. *The EFSA Journal* (2009) 1142, 1-57.
- EFSA, 2009d. Scientific Opinion on the impact of housing, nutrition and feeding, management and genetic selection on udder problems in dairy cows. Scientific Opinion of the Panel on Animal Health and Animal Welfare. *The EFSA Journal* (2009) 1142, 1-60.
- EFSA, 2009e. Scientific Opinion on the impact of housing, nutrition and feeding, management and genetic selection on metabolic and reproductive problems in dairy cows. Scientific Opinion of the Panel on Animal Health and Animal Welfare. *The EFSA Journal* (2009) 1140, 1-75.
- EFSA, 2009f. Scientific Opinion on the impact of housing, nutrition and feeding, management and genetic selection on behavioural problems in dairy cows. Scientific Opinion of the Panel on Animal Health and Animal Welfare. *The EFSA Journal* (2009) 1139, 1-66.
- EU, 1997. European Commission. Treaty of Amsterdam - Protocol on protection and welfare of animals. *Official Journal C 340, 10/11/1997*, p. 110.
- Keeling, L. and Veissier, I., 2005. Developing a monitoring system to assess welfare quality in cattle, pigs and chickens. In: A. Butterworth (Ed.) *Science and society improving animal welfare*. Welfare Quality conference proceedings 17/18 November 2005, Brussels, Belgium, 46-50.
- Müller-Graf C., Candiani C., Barbieri S., Ribó O., Afonso A., Aiassa E., Have P., Correia S., De Massis F., Grudnik T., Serratoso J., 2008. Risk assessment in animal welfare – EFSA approach. *AATEX 14, Special Issue*, March 31, 789-794.
- OIE, 2004a. Handbook on Import Risk Analysis for Animals and Animal Products. Volume 1. Introduction and qualitative risk analysis. pp. 57.