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REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL

on the impact of genetic selection on the welfare of chickens kept for meat production

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1. BACKGROUND

Article 6(1) of Directive (EC) 2007/43/EC[1] *laying down minimum rules for the protection of chickens kept for meat production* states that:

"Based on a scientific opinion of the European Food safety Authority, the Commission shall no later than 31 December 2010 submit to the European Parliament and to the Council a report concerning the influence of genetic parameters on identified deficiencies resulting in poor welfare of chickens. That report may be accompanied by appropriate legislative proposals, if necessary."

This report is the Commission's response to this obligation.

To prepare this report, in 2010 the Commission requested a scientific opinion from the European Food Safety Authority (EFSA)[2] which was updated in 2012[3] and mandated an economic study[4], completed in 2013.

The present report only addresses chicken within the scope of Directive 2007/43/EC[5].

The unexpected additional time needed to obtain comprehensive scientific and economic data explains the delay in adopting this report.

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1 OJ L 182, 12.7.2007, p. 19.

2 EFSA Panel on Animal Health and Welfare (AHAW): Scientific Opinion on the influence of genetic parameters on the welfare and the resistance to stress of commercial broilers. EFSA Journal 2010; 8 (7):1666. [82 pp.]. doi:10.2903/j.efsa.2010.1666. Available online: www.efsa.europa.eu

3 de Jong I, Berg C., Butterworth A., Estevéz I.; Scientific report updating the EFSA opinions on the welfare of broilers and broiler breeders. Supporting Publications 2012:EN-295. Available online: www.efsa.europa.eu/publications

4 Study of the impact of genetic selection on the welfare of chickens bred and kept for meat production (January 2013): http://ec.europa.eu/food/animals/docs/aw_practice_farm_broilers_653020_final-report_en.pdf

5 See Article 1(1)(b) and the first subparagraph of Article 1(2) of Directive 2007/43/EC.

2. THE CHICKEN MEAT SECTOR

2.1. Production, trade and consumption in the EU

In 2014, EU chicken meat production (chickens for meat production are also called "broilers") reached 10.5 million tonnes, representing about 6.5 billion birds[6] and around **12% of world production**[7].

Three quarters of EU production is concentrated in seven Member States: Poland, France, United Kingdom, Germany, Spain, Italy and the Netherlands (see Annex I).

In 2010 there were more than 2.2 million **broiler farms** in the EU-27. However, there were only **20.000 farms** with more than 5.000 broilers (see Annex II).

In 2014, the **self-sufficiency rate[8] in the EU was 103.9%**. Intra-EU trade is mainly based on fresh chicken meat. The Netherlands dominates intra-EU trade in chicken meat (around 30% of total intra-EU cross-border movements) followed by France, Germany and Poland.

In the EU, the main **buyers** of chicken meat are the Netherlands, United Kingdom, Germany and France. These four countries also account for 62% of all chicken meat imports in the EU, mainly frozen natural breast meat from Brazil or frozen cooked breast meat from Thailand.

With an **average consumption of 26.8 kg per capita per year in 2014**, chicken meat constitutes the second largest consumed meat in the EU (around 30% of total meat consumption, after pig meat[9]). The consumption of chicken continues to grow in almost all Member States.

2.2. Breeding selection

The chicken meat production system is highly sophisticated and starts before the chicken is born. Chickens for meat production are the result of complex genetic combinations, which are performed several generations upstream.

Genetic selection identifies the most appropriate birds to become the parents of the next generation. It determines the traits for which a specific line is selected in order to meet the market demands.

The production of broilers is the result of a crossing bred in **four steps** (see Annex III). The starting point in this pyramidal production process is the genetic selection of a number of **pure lines** (also called **pedigree**) by the breeding company. Birds of selected purebred lines are interbred and kept at high biosecurity levels on a specific pathogen-free

6 Source: Eurostat.

7 http://www.avec-poultry.eu/system/files/archive/new-structure/avec/Communication/Study%20final%20version.pdf

8 The self-sufficiency rate expresses the magnitude of EU production in relation to domestic use (self-sufficiency rate = production/(production + imports - exports).

9 http://ec.europa.eu/agriculture/external-studies/2013/origin-labelling/fulltext_en.pdf

status and geographically spread to avoid contamination that could lead to significant economic and genetic losses.

Pure line birds that will contribute to the next generation are allocated into the **multiplication process** after their selection. This process includes **three steps**: first at great-grandparents level, second at grandparent level and third at parent stock level to produce day-old chicks that will become commercial broilers.

To date, **a few companies dominate the worldwide market for broiler breeding stock**. These companies have not disclosed details to the Commission on breeding sites or birds mainly because they consider this information commercially sensitive.

2.3. Models of chicken production in the EU

The EU chicken industry mainly operates within two organizational models, **vertical integrated production** and **independent links** of the production chain.

Through the **vertical integrated** model, several or all links within production (breeding, hatchery, housing, feed mill and processing plant) are controlled by the integrating firm. The integrator provides the day-old chicks, feed and sometimes housing and owns the birds at any time. The farmers are paid a set rate for their labour and variable costs. This system is used in the United Kingdom, Italy, France and Spain.

Within the second model of **independent links**, each link works through an open market, assuming its own risks. The farmer is the owner of the birds and is more directly confronted with the fluctuations in price for feed and the demand for poultry meat. This system is used in the Netherlands and Belgium while in Germany both models exist.

Most of the genetic selection is oriented to meet the need for fast growing birds which is the predominant system of production in the EU.

For this purpose the EU chicken meat sector uses **fast growing broilers**. These broilers achieve the target **live weight of 2-2.5 kg** in around **35-45 days**. However, variations exist depending on the country, region or market segment which has to be supplied. The general trend in Europe is to keep broilers selected for rapid-growth in closed and controlled housing systems, with litter and automated supply of feed and water.

However, part of the production, and therefore the genetic selection is also designed for slow growing birds.

Slow-growing broilers (from **70 to 81 days**) are gaining interest in many EU countries in the last years. These broilers are used in free-range and organic production, with low densities and permanent access to an outdoor area. However, industry experts consider that slow growing chickens will remain a niche market. Additionally, there is a **certified broiler production**, which includes slow-growing broilers kept indoors until they are **56 day**-old, as an intermediate production between regular broilers and organic production.

No statistics are available on the exact numbers of alternative broilers (slow-growing or certified broilers) in the EU; however industry experts estimate a market share to be between 5 to 10% of the total production[10].

3. GENETIC SELECTION AND ITS IMPACT ON THE WELFARE OF BROILERS

Genetic selection of broilers has changed considerably over the past 50 years. In particular, the growth rate of commercial broilers has greatly increased, with standard broilers now reaching 1.5 kg body weight in less than 30 days whereas 120 days were needed in the 1950s. Initially, selection was aimed at greater growth rates and meat yields. However, in order to avoid undesirable consequences of one-sided production selection, in the recent years there has also been selection against susceptibility to certain types of disease and welfare traits.

Most of the welfare problems in broilers are the result of multiple factors, like environmental factors, management factors and genetic factors. However, scientific opinions recognize that **some welfare problems are essentially related to genetic factors** and others are mainly related to environmental/management factors such as stocking density and litter quality, light and barren environment.

3.1. Genetic selection: heritability and selection pressure

Breeding programmes are organised to supply commercial flocks with day-old broiler chicks in a multiplication pyramid (see section 2.2.). The breeding pyramid facilitates crossbreeding between genetically distinct lines to select defined traits included in the genetic programme. The response to one generation of selection depends on the **heritability[11] of the trait** and the **selection pressure** applied (the proportion of birds with a defined trait used as parents of the next generation). In addition the progress made by genetic selection in pedigree flocks does not guarantee that a similar change will be observed in commercial broilers since the **environments in which broilers are kept commercially are not the same as that in breeder's flocks[12]**.

There are significant difficulties in obtaining data on the **heritability** of the trait selected, because on the one hand several hundred birds are needed for obtaining reliable data and on the other hand the time required for a genetic change to appear in commercial flocks is never less than 4 years (see Annex III).

When selection applies to several traits at the same time, response to selection per trait is less than if this trait was the only one selected for, therefore reducing the **selection pressure**. For example, assuming that selection programme A includes growth rate and

[10] http://www.avec-poultry.eu/system/files/archive/new-structure/avec/Communication/Study%20final%20version.pdf

[11] Heritability reflects the proportion of differences among individuals that is due to genetics. Heritability analyses the relative contributions of differences in genetic and non-genetic factors to the total observable variance in a population. For instance, some humans in a population are taller than others; heritability attempts to identify how much genetics play a role in part of the population being taller.

[12] Study of the impact of genetic selection on the welfare of chickens bred and kept for meat production (January 2013): http://ec.europa.eu/food/animals/docs/aw_practice_farm_broilers_653020_final-report_en.pdf

disease resistance and selection programme B includes only growth rate, response to selection for growth rate in programme A will be slower that in programme B.

In the past, production traits were the sole criteria in breeding and selection programmes. Since the cost of feed is the major factor affecting the economics of chicken meat production, **feed conversion efficiency[13] has been the main selection criteria**. Over the past years, however, this has been changing with emphasis being increasingly placed on non-production traits, such as bone quality, cardiovascular efficiency and resistance to ascites (see Annex IV).

The way these **traits are included in genetic selection** programmes **constitutes commercially sensitive information** and is not divulged by breeding companies. Therefore the precise selection pressure on production and non-production traits is not known.

3.2. Animal welfare impact

In the last decades, a wide range of metabolic and behavioural traits in broilers have been modified by genetic selection, leading to various **welfare issues,** as described below:

- ***Legs and locomotion***

Leg problems affecting the locomotion system, such as bone deformities and lameness, are a major cause of poor welfare in broilers and can have a genetic component. EFSA has pointed out that around 30% of commercial intensively reared broilers presented leg abnormalities. These biomechanical limitations are a likely consequence of the morphological changes such as the rapid growth of breast muscle moving the centre of gravity forwards and the relatively short legs in relation to the birds' bodyweight.

That scientific opinion evidenced how the bones of a fast-growing selected strain are more porous and less mineralised than those of a slower-growing control strain. Furthermore, studies showed that slow-growing broilers reared until 56 days had significantly better walking ability than others reared until 42 days of age.

Birds suffering from severe gait abnormalities have difficulties in moving around and are likely to modify their feeding activities, i.e. increasing their time spent lying down due to pain from moving and as a result suffer from higher levels of contact dermatitis (see below).

- ***Ascites and sudden death syndrome (SDS)***

Ascites is the accumulation of fluid in the abdominal cavity and is a metabolic disorder resulting of dilatation and hypertrophy of the heart which leads to cardiac failure and changes in liver function. SDS is the most frequent cause of death in flocks of broilers affecting mainly fast growing male birds[14]. It is generally assumed that the main cause of both is insufficient oxygen supply or a demand for oxygen that is too high. Additional factors such as nutrition, air quality or light conditions can also influence the incidence of ascites and SDS.

[13] Feed Conversion Rate: amount of feed consumed to increase body weight by one kg.

[14] Maxwell and Robertson (1997;1998) concluded that 4.7 % of broilers on a world basis were affected

Several studies quoted by EFSA showed that susceptibility to ascites had a hereditary background. Fast growth rates achieved by genetic selection increase the risk of these two diseases by increased oxygen demand that puts pressure on the cardio-pulmonary system. Several studies concluded that there is a higher percentage of mortality caused by ascites in fast growing broilers (slaughtered at 42 days of age) than in slow growing broilers (slaughtered at 56 days of age).

- ***Contact dermatitis***

Skin diseases such as contact dermatitis (erosions of the breast, hock and feet can develop into ulcerations and become infected) are mainly related to management practices, since wet litter along with feed composition (to a lesser extent) seemed to be the most important factors in preventing its occurrence[15]. However, several studies have shown that contact dermatitis has a moderate degree of heritability and therefore genetic selection could reduce this major welfare problem.

3.3. Animal welfare and selection goals

From a genetic standpoint, the desirable outcome of selection will be a bird that effectively combines production, reproduction, health and welfare traits. The estimation of genetic correlations between production and welfare traits used as selection criteria in animal breeding programmes would help to anticipate how a direct selection would influence other traits.

There might be low or high correlation between some health and welfare traits on one side and production traits on the other. When the correlation is high between two traits, it means that genetic selection cannot be made separately. Where production traits have a high negative correlation with health and welfare traits, it means that improvement in a production trait (e.g. growth rate) will compromise the other ones (e.g. ascites). This presents a challenge that can be dealt with in a balanced breeding programme using appropriate selection indices.

Ideally, breeding programmes should combine traits into a selection index that takes into account the impact on various traits of the birds.

Regarding the main welfare impacts described above, scientific studies quoted by EFSA have shown that:

- The genetic correlations between traits such as specific **skeletal problems** and growth should permit a genetic improvement in leg health along with a continued, though more modest, improvement in growth rate.

- It is possible to develop a resistant line to **ascites** since it appears that there are only a few genes responsible for ascites susceptibility and they have a high heritability. Sudden Death Syndrome has a correlation with ascites.

- There is a low genetic correlation between **contact dermatitis (**food pad and hock burn) with body weight suggesting that selection against susceptibility to footpad dermatitis should be possible without adverse effect on weight.

[15] Prevalence of contact dermatitis is varied and the results differed according to age of the birds at the time of assessment.

Against this background positive signals of a better integration of welfare issues into the selection process of breeding programmes can already be found. For instance recent surveys in commercial flocks report a decrease in the incidence of leg problems and ascites during the last 10 years. According to the industry data these results are due to the fact that they integrate health and welfare traits in their selection schemes.

4. THE CURRENT SITUATION

4.1. Available data on selection programmes

New technologies based on genetic markers can assist in the genetic selection to identify birds that carry desirable genes. The genetic selection in breeding programmes has contributed to ensuring a competitive broiler production in the EU, however, the level of genetic improvements or of individual traits cannot be quantified in this report due to the **lack of access to** confidential breeder **data**.

In addition, these selection processes are essentially based on flocks controlled by breeding companies. Only few breeding companies supply broiler breeders and broiler chickens in the world[16]. Producers have limited access to detailed information about the selection criteria in the breeding programme.

Furthermore, in general, **market pressure does not** currently **provide** breeding companies with **sufficient incentive** to **give welfare traits greater weighting in their breeding programmes**.

Competition in the chicken meat market has been mainly focused on reducing prices. Feed represents around 65 % of production costs so genetic selection has mainly focused on fast-growing rates to reduce costs. Lower feed conversion efficiency of broiler selected for welfare traits increases production costs.

4.2. Genetic diversity

Selection programmes are a useful tool for the improvement of certain production traits in commercial lines. However, they have also led to a **loss of genetic diversity** leading to the possible involuntary elimination of genetic traits that might be useful in the future if the conditions of production change (resistance to new diseases, new climatic conditions, etc.).

This is the reason why the EU Community programme on the conservation, characterization, collection and utilization of genetic resources in agriculture promotes genetic diversity. In this context, the Commission funded the project *Globaldiv*[17] with the main objective of gathering international experts from different fields related to the characterization of farm animal genetic resources to review the main drivers of biodiversity loss and strategies for conservation.

[16] Approximately 60-70 % of the broiler breeding is conducted by European companies and the demand for their products is increasing in particular from developing countries (China, Brazil, India).

[17] http://ec.europa.eu/agriculture/genetic-resources/actions/f-067/067-executive-summary_en.pdf

5. CONCLUSIONS

Breeders progressively take into account traits related to chicken health and welfare in their selection programmes.

The current legislation provides a monitoring system for animal welfare indicators[18] in commercial conditions which could be further exploited in a context of genetic selection.

The consumers express increasingly interest for broilers selected for welfare traits which are produced under increased costs.

The presence of animal welfare information at different levels and tailored specifically for each type of audience (school, media…) could help to increase the demand for animal welfare friendly products.

No legislative proposal is deemed necessary at this stage. In line with its mandate on animal welfare and through the existing tools, the European Commission is willing to facilitate improvements in this area.

[18] See Article 6 (2) of Council Directive 2007/43/EC.

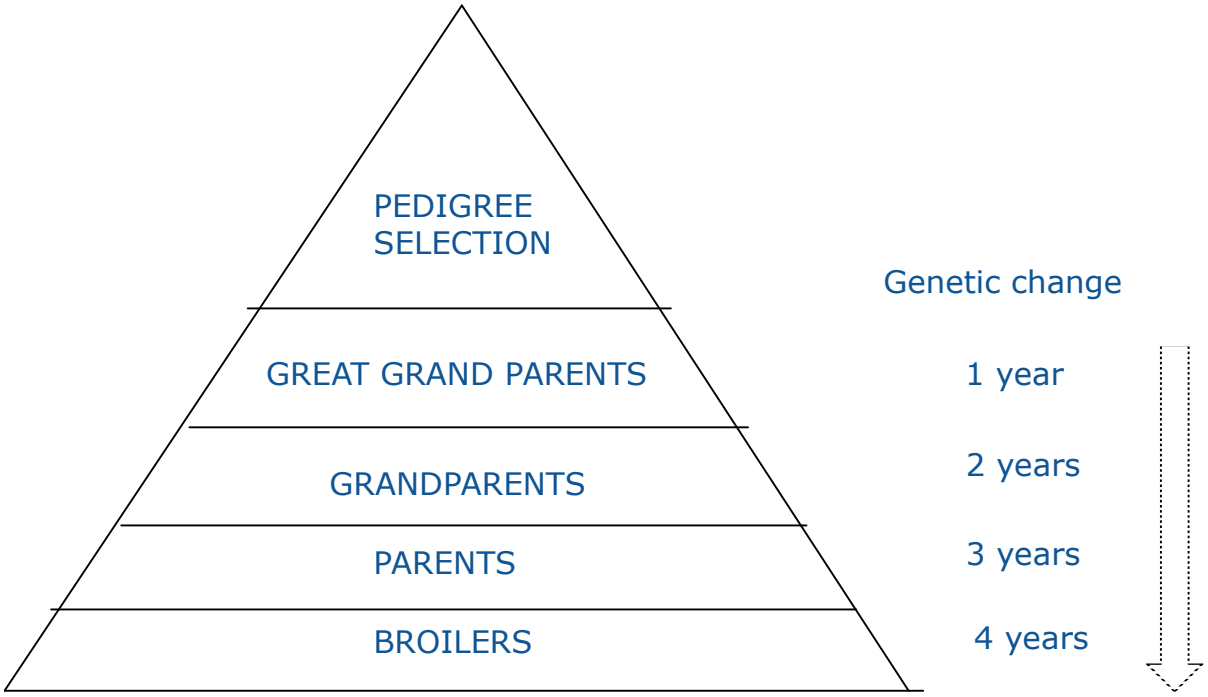
ANNEX I: EU CHICKEN MEAT PRODUCTION 2010-2014 (1000 tonnes)

	2010	2011	2012	2013	2014
Belgium	497.117	487.05	401.747	379.33	425.01
Bulgaria	72.763	73.428	74.482	69.81	71.53
Czech Republic	182.723	166.636	148.986	143.85	143.87
Denmark	184	185.7	153.9	159.3	142.8
Germany	802.781	853.525	864	911	969
Estonia	11.244	11.244	11.244	11.244	11.244
Ireland	108.554	108.554	108.554	108.554	108.554
Greece	175.898	173.05	179.999	177.73	187.86
Spain	1,115.86	1,111.91	1,128.37	1,133.70	1,236.83
France	1,037.00	1,060.00	1,044.00	1,078.00	1,047.00
Croatia		48.5	50	48.8	49.8
Italy	864.969	894.744	922.353	902.74	919.55
Cyprus	27.473	27.22	25.148	21.83	21.48
Latvia	23.394	22.807	24.491	26.71	28.56
Lithuania	63.994	67.943	73.773	82.94	86.69
Luxembourg	0	0	0	0	0
Hungary	208.275	219.828	240.09	235.59	261.26
Malta	4.398	4.155	4.252	4.13	3.94
Netherlands	781.454	840.922	888.521	920.8	956.12
Austria	96.562	95.063	92.681	94.94	97.27
Poland	1,000.29	1,046.25	1,270.70	1,365.61	1,477.09
Portugal	248.848	245.633	244.311	245.4	248.9
Romania	298.386	298.386	298.386	301.877	301.877
Slovenia	54.626	52.903	53.957	52.81	55.64
Slovakia	71.315	71.315	71.315	69.739	69.739
Finland	86.544	92.493	98.183	102.33	104.55
Sweden	111.993	111.528	109.671	117.42	126.12
United Kingdom	1,379.37	1,357.00	1,378.97	1,442.55	1,437.64
EU	9,509.83	9,727.78	9,962.09	10,208.73	10,589.92

ANNEX II: EU-27 NUMBER OF BROILERS FARMS IN 2010

Country	> 1 broiler	> 5000 broilers	% of EU-27 total (> 5000 broilers)
Belgium	930	620	3.2
Bulgaria	19470	140	0.7
Czech Republic	280	130	0.7
Denmark	280	170	0.9
Germany	4540	1040	5.3
Estonia	120	0	0.0
Ireland	550	170	0.9
Greece	102280	630	3.2
Spain	36570	3360	17.1
France	41710	5780	29.4
Italy	13200	1550	7.9
Cyprus	2570	40	0.2
Latvia	480	0	0.0
Lithuania	13190	10	0.1
Luxembourg	40	*See BE*	0.0
Hungary	18760	250	1.3
Malta	160	40	0.2
Netherlands	640	620	3.2
Austria	1190	300	1.5
Poland	337540	2330	11.8
Portugal	105010	750	3.8
Romania	1532550	300	1.5
Slovenia	2910	170	0.9
Slovakia	470	60	0.3
Finland	100	100	.05
Sweden	180	80	0.4
United Kingdom	1740	1040	5.3
EU-27	2237460	19680	100.0
Source: Eurostat (2010)			

ANNEX III: CROSSBREEDING PYRAMIDAL STRUCTURE FOR COMMERCIAL BROILERS



ANNEX IV: TRAITS IN CURRENT BOILER SELECTION PROGRAMMES

Areas for selection	Major trait categories (may include multiple traits)
Health and welfare	Immune response, skeletal integrity, heart and lung fitness, liveability/survival/low mortality, feathering, absence of breast lesions
Reproduction	Hatchability, egg number, fertility, age at sexual maturity
Production	Feed conversion, growth profile, meat quality, breast meat yield, weight, lower fat content