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The past, present and future of force-feeding and "foie gras" production

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Force-feeding is an ancient practice, first recorded in ancient Egypt, but until the 1950's foie gras production remained somewhat limited in volume. Foie gras is currently produced in various countries but approximately 80% of world production and consumption takes place in France.
Geese, which were the most common specie been force-fed until recently, now account for less than 10% of the total world foie gras production. Ducks such as the Muscovy duck (*Cairina moschata*) account for less than 5%, and mule ducks for the rest. Thus, over 35 million mule ducks were force-fed in France in 2001, accounting for nearly 95% of the domestic foie gras production. This increase was made possible by technical progress in specific breeding programmes and force-feeding practice.
However, the future of this production is uncertain, at least in Europe. Indeed, although a number of experimental approaches have shown that there is no scientific evidence that validates such adverse comment, this procedure is highly criticised in terms of animal welfare. The Council of Europe therefore adopted two specific recommendations in 1999 and although its practice is not banned at present, it is limited to the areas where it is already practised and only under specific rearing conditions. Therefore, the question is: will it be still possible to produce foie gras in France or elsewhere in Europe in the future and, if not, where and how will it be produced?

Keywords: foie gras; waterfowl; geese; ducks; production; rearing conditions; legislation

Introduction

The tradition of force-feeding is very old, probably originating from Egypt; where there is early evidence in paintings. The Greeks and the Romans perpetuated the tradition, later expanded during the Middle Ages by Jewish populations. At present, 80% of the world foie gras production originates from France (CIFOG, 2002), although the genotypes used and the procedure itself have changed. This paper gives a brief historical review of production, describes the present situation and provides a prospective overview.

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Production overview

PAST: FROM ANTIQUITY TO THE XIXth Century

It is generally accepted that geese were one of the first species of bird domesticated in antiquity (Deffarges, 1973). The first indication of geese being force-fed comes from Saqqarah in Egypt, with representations of the practice in paintings found in a tomb dated at 2500 BC. The details of these paintings show meal preparation and the force-feeding procedure. The operators are seated, hanging ducks and geese from their left hands and introducing food through the beak with the right hand. Cranes, migratory birds found in this area, are also represented while being force-fed but, as they are taller birds, the operator stands. Egyptians were thus probably the first to perform force-feeding, a practice that lasted in this part of the world for more than 2000 years. A number of bas-reliefs show such scenes, clearly demonstrating that fatty meat of waterfowl and other species of birds was appreciated, whereas we have no direct evidence of any specific interest in foie gras consumption.

As revealed by different texts from Athénée, the Greeks later adopted this practice, for both meat and foie gras production. The Roman army later discovered this product in Greece and Egypt, and the Roman aristocracy soon considered foie gras as a delicacy, force-feeding being mainly performed by Jewish slaves. Geese were then force-fed with figs and the foie gras was given the Latin name "*jecur ficatum*"; in other words, liver obtained with figs. The word *jecur* gradually disappeared and the word *ficatum* (figs) was used alone for the organ. It became later figido on the VIII century, then *fedie* or *feie* in the XII and finally foie in French, *fegato* in Italian and *higado* in Spanish.

Although it is known that force-fed ducks and geese were consumed during the medieval period, there is little information regarding the practice. We know that the tradition was maintained by at least the Jewish population as a way of producing a substitute for pork fat. It is thought to be the main reason why it spread to various areas and countries in Europe such as Poland, Hungary, Alsace and South-West France. At the end of the XVI century, foie gras was regularly present on French aristocratic tables. However, it was only around the XVIII century that foie gras became a delicacy in France, numerous recipes being reported from various provinces such as Béarn, Alsace and Périgord. In the meantime, major technical advances were made, such as the use of corn instead of wheat, barley or other cereals and the piston funnel, used to drive food down in the crop, first used in South-West France. Furthermore, by facilitating preservation, transportation and commercialisation, the development of the sterilisation techniques led to improved production. Last but not least, although Muscovy duck and probably its hybrid with the common duck, the mule duck, were already present in farms after the discovery of America, geese were more or less the only species being force-fed for foie gras production until the XX century.

PRESENT: FROM THE XX CENTURY

Since the 1950's tremendous changes have occurred in foie gras production such as the strains or genotypes involved, the equipment and the overall management used, leading to substantial increases in production.

Species of interest

The major site of lipogenesis in birds is the liver, whereas in mammals it is the adipose tissue (Leveille *et al.*, 1975). Birds are consequently more likely to show non-pathological steatosis. However, although cranes were force-fed in ancient Egypt and turkeys reported to respond too, only few species and hybrids of waterfowl are nowadays used for foie gras production. Indeed, only three waterfowl genotypes are currently used for force-feeding in

France: the grey Landaise goose strain (*Anser anser*), the muscovy duck (*Cairina moschata*) and the mule duck, a hybrid resulting from an inter-cross between a muscovy drake and a female common duck (*Anas platyrhynchos*). In order to warrant the name "foie gras" the liver should weigh more than 300g and 400g for ducks and geese, respectively (Decree 95-625). For mule ducks, only livers originating from force-fed males may be sold as foie gras (Decree 95-625). Furthermore, "magret", which corresponds only to the breast meat from a force-fed waterfowl, and "foie gras" labelling are officially defined and recognised (Decree, 1993). The average respective performances of these three genotypes evaluated at that time, are reported *Table 1* (Guy *et al.*, 1995). The common duck (*Anas platyrhynchos*) has also a predisposition to adipose tissue deposition, but has both a lower ingestion capacity and ability for liver steatosis; it is therefore not used for cramming (Guy *et al.*, 1999, Hermier *et al.*, 2002, Davail *et al.*, 2003). It has been shown that a failure in the channelling of hepatic lipids towards secretion in the plasma and peripheral adipose storage is favourable to establishment of steatosis (Blum, 1990). For the same reason, several strains of geese are much less efficient for foie gras production than the grey Landaise goose strain (Fournier *et al.*, 1997).

Table 1 Characteristics of 3 different genotypes of waterfowl submitted to force-feeding (adapted from, Guy *et al.*, 1995).

	Geese (M & F)	Mule Duck (M)	Muscovy Duck (M)
Body Weight (g)	7434[a]	6473[b]	6565[b]
Breast Muscle Weight (g)	214[c]	273[b]	318[a]
Foie gras Weight (g)	768[a]	677[b]	553[c]
Foie gras fat loss (%) after cooking	13.9[a]	40.7[b]	56.0[c]
Lipids (%) foie gras	54.6[a]	60.5[b]	62.6[b]
Triglycerides (% / total lipids)	92.2[a]	94.4[b]	95.7[b]
Phospholipids (% / total lipids)	3.5[a]	1.95[b]	1.5[b]

M: male, F: female.
[a, b, c] means associated with different letters differ statistically ($P < 0.01$).

Geese produce the heaviest livers with the least fat loss, however they currently account for less than 5% of French production (approximately 8% of world production). Geese have poor reproductive ability and consequently gosling cost is high, their meat yield is low and their management is more time consuming. Muscovy ducks produce a large amount of meat, but the liver is smaller in size and of somewhat different quality. Furthermore, this duck is more sensitive to disease. Finally, the mule duck appears as to be the best choice for force-feeding purposes. It has a good potential for production and is easier to manage. Moreover, the problems of infertility in the production of this hybrid have been mostly solved with artificial insemination.

In France, five breeding companies are working on genetic improvements in waterfowl genotypes used for force-feeding. Their activities are mainly focused on duck genotypes, but three of them still have ongoing programmes on geese. Most if not all the breeding programmes appear to be taking place in France, although some of the genetic resources presently used (such as the female Pekin duck) may originated from foreign countries. The adaptability of mule ducks to force-feeding has been improved, because both the female Pekin duck and more recently the Muscovy drake have been submitted to specific selection programmes. The first parameter to be selected was the production of foie gras. The average weight of foie gras is now sufficient and these programmes are no longer a priority; breeding companies will now aim to reduce the duration of cramming. Due to the

demand by the slaughtering houses for better carcass presentation, the breeding companies have also recently selected parental strains in order to obtain hybrids with white plumage. This has also been achieved by fixing this character in the female and by using phenotypic mutation in muscovy ducks. Lastly, as the French market requires, body conformation has been improved to produce larger breast muscle *i.e.* "magret". As shown in *Table 2*, the improvement over the last 10 years has been marked. A recent substantial increase in the demand for duck meat was associated with the BSE crisis in Europe. Although the crisis has passed, demand remains high.

Table 2 Evolution of zootechnical performance of mule ducks (GTE Palmipèdes gras: CIFOG, 2002, 2003).

	1991	1996	2001	2002
Number of force-fed ducks / flock	173	290	558	618
Age at force-feeding (days)	89.3	86.7	88.6	89.4
Duration of force-feeding (days)	15.8	14.9	13.8	13.4
Amount of corn (kg)	12.3	11.4	10.7	10.5
Foie gras weight (g)	516	526	539	549
Meat (2 legs + 2 breast) (kg)	2.30	2.35	2.50	2.50

Equipment

Around 1950, the composition of the diet used during the force-feeding period for foie gras production only consisted of moderately cooked non-ground corn grains. The need for an appropriate way to deliver the feed led to the development of a manual screw dispenser, which was later automated by the addition of a motor. This equipment has been constantly upgraded, and nowadays a number of producers are using different models of this equipment, some of them being very sophisticated. By the end of the 1980's, French producers brought a new concept from Israel, the pneumatic dispenser, a device that can deliver a corn mash diet mixed with water at a high speed. This method was adopted within a short period and drastic changes have been observed in field practice.

Rearing conditions were also modified over the same period and ducks were placed in individual cages during the cramming period instead of in collective pens, the main advantages being that there is no risk of confusing the ducks and that they always remain in the right position. These practical changes together contributed to enhancing productivity, with up to 400 ducks being force-fed by one person per hour. However, new improvements were still to come. The general concept of food delivery was retained but improved by using a hydraulic dispenser, which is more powerful than the pneumatic dispenser. The advantage of this equipment was the opportunity to incorporate a certain amount of uncooked whole corn grain into the mixture. This was important for geese because, in contrast to the mule ducks, they are unable to obtain maximum value from corn when incorporated in the diet under mash form. (*Table 3*).

Table 3 Foie gras weight (g) according to corn presentation in the diet: whole grain, mash or as a mixture for mule ducks (Robin and Castaing, 1996) and geese (Dubois *et al.*, 1994).

Foie gras weight (g)	Grain	Mixture	Mash
Male mule Ducks	559	559	557
Geese	959	931	664

Other features have been added, such as an incorporated mixer, an automatic shift and automated control of the amount of corn delivered. This new equipment has been very successful and is presently the most widespread, especially in larger units having up to one thousand ducks at a time.

Specific barns to raise ducks during the cramming period have also been set up. Working conditions have been optimised and ambient conditions, such as temperature, moisture and air renewal, fully controlled. The development of this kind of building has contributed to better economic performance.

There will be a new revolution in rearing conditions in the near future, with the official ban on individual cages (T-AP 95-20).

Breeding and force-feeding management

Waterfowl have a spontaneous tendency to overfeed, a tendency which, at least for geese, is probably related to the pre-migratory behaviour of their ancestors. Force-feeding results in an extra-physiological state, with extreme lipid storage in the liver and in subcutaneous tissue. Knowing that lipid synthesis and storage capacities can be spontaneously and transiently stimulated, producers have developed specific feeding programmes adapted to waterfowl, which are to be force-fed later. In practice, the duck breeding period can be subdivided in three phases:

- **Starting period**: Birds are fed *ad libitum* from the time of hatching until 6 to 9 weeks of age.
- **Growing period**: Birds are feed restricted for a period of 3 to 5 weeks.
- **Pre-force-feeding period**: Birds are fed as much as possible for 3 to 10 days.

Two procedures are commonly practised during the growing and pre-force-feeding periods; *i.e.* hourly feed restriction and quantitative feed restriction (Robin and Castaing, 2002). Under the hourly feed restriction procedure, ducks are provided with a large amount of food, but access to feed troughs is limited to a given period of time. Under the second, ducks are provided with an amount of food which is lower than *ad libitum* consumption. During the pre-force-feeding period, the duration of access (hourly) or amount of food available (quantitative) is increased in order to reach consumption levels higher than regular *ad libitum* levels. Most of the ducks are ready to be force-fed at 10 to 14 weeks of age, depending upon the type of production (standard or "label"). This procedure of pre-force-feeding has three objectives:

- Increase in "crop" size, which is poorly developed in waterfowl species.
- Stimulation of digestive secretions necessary for the assimilation of a large amount of food.
- Onset of liver steatosis (the liver can weigh up to 180g by the end of this period).

As recently shown (Robin and Castaing, 2002), such a specific programme results in a reduction in the duration of the force-feeding period. For example, these authors reported that mule ducks produced foie gras of average weights of 546g (hourly programme) and 572g (quantitative programme), respectively, after a force-feeding period lasting 9.5 days (19 meals) and an overall ingestion of 8.5kg of corn.

In addition to the productivity resulting from the procedures described above, new diet presentations have provided nutritional advances favourable to establishment of steatosis. Corn remains the main ingredient in the force-feeding diet, both because it is a low cost ingredient and also because of its high starch content, starch being one the best substrates to stimulate neo-lipogenesis in bird livers. However, although corn remains the basis of the diet, preparation as a water mash makes possible the addition of various minor ingredients, with two main objectives:

- Enhancement of the response to force-feeding; faster establishment of steatosis can either increase the final foie gras weight or allow a reduction in the duration of cramming.
- Improvement in the technological quality of the foie gras by reducing fat loss during cooking.

As indicated in *Table 4* (Robin and Castaing, 1998), recent results suggest that the field of investigation is large and promising.

Table 4 Influence on liver quality of supplementing the force-feeding diet with starch or milk powder. Adapted from Robin and Castaing, 1998.

Parameters	Control	Starch	Milk powder	Starch & milk powder	ANOVA P< 0.01
Starch content (% diet)	71.9	74.3	72.1	74.3	
Protein content (% diet)	8.44	8.44	10.04	10.04	
Foie gras raw weight (g)	574^{c}	647^{b}	602^{c}	688^{a}	**
Fat loss (%) cooking	14.9^{a}	22.9^{b}	13.9^{a}	22.4^{b}	**
Foie gras (g) cooked	489^{b}	491^{b}	522^{a}	531^{a}	**

Economy

As already stated, France is the world leader in foie gras production and consumption. Indeed, France even reinforced her world leadership position in 2002, with the production of 83% of the available world supply compared to 74% in 1995. Duck foie gras represents the greater part of national production (16429 tons, over 95%, <5% from Muscovy ducks), in spite of a significant recent increase in the production of goose foie gras (586 tons, or about 25% of the world goose foie gras production). However, production has also increased throughout the world, although in most countries local production represents only small volumes. It includes most of the Eastern Europe countries, with the noticeable exception of Poland, which has recently banned foie gras production, Belgium, Spain and also all the countries from the American continent. Although mule ducks are used for meat production in Asia, little information is available on practices there. African countries do not seem to be involved in foie gras production with the exception of Madagascar. The countries with significant foie gras production in 2002 were:

- **Spain**: foie gras production is only a recent development in this country but it contributes to about 1% of the world production (WP).
- **Israel**: It is a traditional producer of goose foie gras, with a stable production representing around 1.5% of the WP.
- **Bulgaria:** Produces mainly duck foie gras (5% of the WP). There has been a significant increase in production recently and the major part of its production (88%) is exported to France.
- **Hungary**: It is the leading country in the world for goose foie gras production, with 60% of the WP (about 1780 tons) and around 9% of the total foie gras WP (2850 tons in 2001). The grey Landaise goose strain is used for force-feeding. Duck foie gras is also produced in this country and accounts for approximately 40% of their total production.

In France, producers can be subdivided in two types of organisations:

- Small units using a short path strategy. In such units, producers are involved in all the stages of production: bird rearing, cramming, slaughtering on the farm, meat and foie gras processing and lastly direct marketing of their products. It is difficult to evaluate the

exact contribution of these small producers to the national market, but it is thought to represent around 12% of total French production (Magdeleine, 2003). The number of units is estimated to be between 1000 and 1500.

- Large units using to a long path strategy. In this approach, specialised operators undertake the different stages. The different participators in this path of production are generally associated in co-operatives. There are at present about 45 companies, but there is a strong tendency to increased size after take-overs and restructuration. The first stage is focused on breeding (specific feeding strategies described above) of ducks and geese. Then there are farmers who specialise in the force-feeding stage. These producers generally work under contract with a co-operative. Such organisation of production has been associated with increased production and reduction in prices, and producers have progressively compensated for this by increasing the sizes of units to preserve their income (*Table 5*). Thus, duck flock size can reach up to 4000 birds during the rearing period and up to 1000 ducks during the cramming period. Special administrative authorisation is required to operate units over a threshold of 1000 ducks (Decree 95-625). The number of flocks raised per year per farm ranges from 9 to 10, while a producer can force feed around 20 flocks per year, successively.

Table 5 Evolution of prices and duck flock sizes between 1995 and 2002 (CIFOG, 2002, 2003).

	1995	2001	2002
Price: one duck redy to be force-fed (€)	8.83	7.91	8.06
Average flock size during the rearing period	1745	2324	2486
Price: foie gras (€/kg)	18.23	17.07	18.91
Price: one force-fed duck (€)	15.76	15.25	14.89
Average flock size during the force-feeding period	289	558	618

Birds are usually slaughtered in large, modern slaughterhouses, *i.e.* having a potential for slaughtering over 2500 birds per hour. Whatever the procedure of liver extraction, whether immediate or on the following day after cooling, carcasses are always processed according to automated conditions. Thirty-one companies are involved in this activity in France. The next processing stage is even more concentrated and involves only 16 units. After being processed, the product is marketed as a delicacy, directly to consumers, restaurants and delicatessens on the one hand, and in supermarkets on the other; the latter having approximately 75% of the total production. Foie gras production leads to the marketing of a variety of products, such as the meat parts, *i.e.* the breast muscles corresponding to the *Pectoralis major* which are called "Magret" and are the more valuable, and the "Aiguillette" corresponding to the *Pectoralis minor*. They are prepared in different ways and sold as fresh meat, roasted, smoked, dried, or even cooked in their own fat. This last form is called "Confit" and is also used for legs, wings and gizzards. Other parts such as hearts and small pieces of meat are also marketed fresh or in various preparations. Foie gras is served as a fresh product in top of the range restaurants. The tinned and the half-cooked foie gras, with duration of preservation of four years at room temperature and six months at +4°C, respectively, represent the highest quality preserved products. They are sold as "foie gras entier" and "foie gras". The second choice foie gras, called "Bloc", are crushed and then mixed and presented as a roll. Foie gras can also be prepared with truffles (up to 3%). Last but not least, various products include pieces of foie gras, but they cannot be called foie gras. However, if it represents more than 50%, it can be called "Products containing foie gras". The economic importance of foie gras production is high since it is estimated that it involves about 30.000 direct and 100.000 indirect jobs (CIFOG, 2002).

Animal welfare

Foie gras production is strongly criticised in Europe as it is considered to be detrimental to animal welfare. However, no scientific data is to date available to prove these allegations. In order to evaluate the impact of such practices for birds, a number of scientific investigations have been set up in the major fields of physiology and endocrinology, behaviour and nociception.

PHYSIOLOGY

One of the first studies conducted in this area concerned the reversibility of steatosis. Several experiments were carried out (Babilé *et al.*, 1996, 1998; Bénard *et al.*, 1996, 1998) and they indicated that steatosis is fully reversible, after a short period both for geese and mule ducks, even after 3 successive force-feeding periods. Moreover, liver function and histological structure are preserved (Babilé *et al.*, 1996, 1998; Bénard *et al.*, 1996, 1998). Different stress indicators such as changes in corticosterone (Faure *et al.*, 1996, Guémené *et al.*, 1996, 1998a, 2001) have been used to investigate acute and chronic stress related to force-feeding and have reinforced our knowledge regarding duck and goose physiology. It has been reported that neither the first episode of force-feeding nor subsequent episodes induce any significant increase in plasma corticosterone levels when ducks are kept in individual cages. On the other hand, significantly higher corticosterone levels were

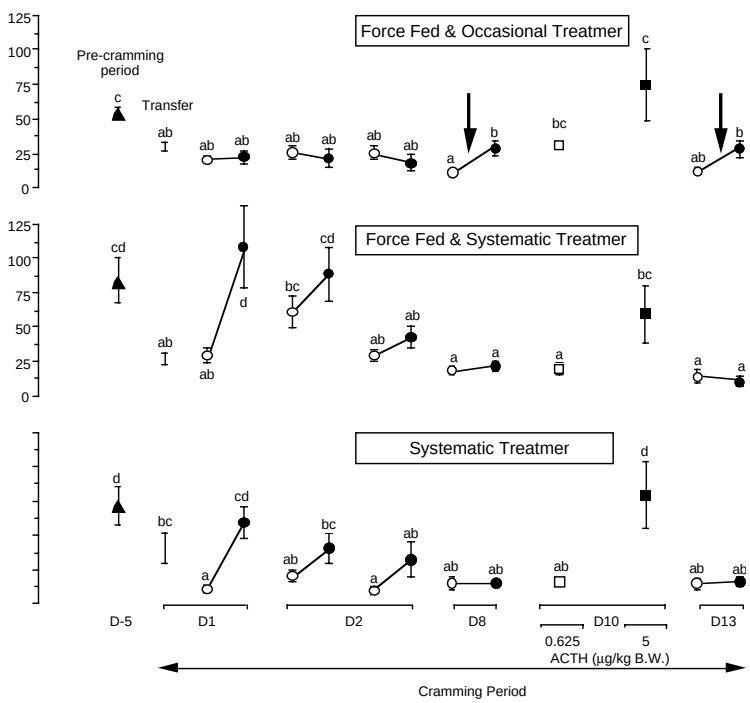

Figure 1 Changes in corticosterone concentrations (ng/ml plasma) in male mule ducks during the rearing period (, floor pen), at the time of transfer to individual battery cages () and during the cramming period while being force-fed twice daily and/or occasionally (arrows, upper panel) or systematically (2 lowest panels) tightly constrained in a net for 15 min [before ( ) and 15 min after constraint ( )], or 10 mn after injection of ACTH at doses of 0.625 ( ) or 5mg/kg B.W. ( ). (Mean ± SEM). a, b, c & d: means for a specific group with different letters differ significantly (P <0.05).

measured after handling during the rearing period in birds raised in collective pens. Further experiments have shown that the corticotrope axis was fully functional, and that these ducks were able to secrete corticosterone after a physical stress such as restraint in a net for 15min (Guémené *et al.*, 1998b) (*Figure 1*).

Behaviour

One major criticism based on the excessive amount of food that the birds have to ingest daily during the force-feeding period was counteracted by the observations of geese spontaneously ingesting large amounts of grass or over 3kg of carrots per day. Likewise, spontaneous hyperphagia in ducks has been confirmed in that spontaneous daily intake (up to 750g) has been reported (Guy *et al.*, 1998). The behavioural responses of geese and ducks previously trained to move from their rearing pen to a feeding pen in order to have access to their food have also been studied. After a training period, half of the birds were fed using a force-feeding procedure, the amount of food ingested being adjusted to the amount spontaneously ingested by control birds. Ducks exhibited only partial avoidance of force-feeding and no sign of aversion was observed in geese (Faure *et al.*, 1998, Guémené *et al.*, 1998b). Moreover, it was observed in a subsequent experiment (Faure *et al.*, 2001) that the flight distance of ducks was greater when faced with an unknown person than with the caretaker, *i.e.* the person who performed the force-feeding procedure. Furthermore, there was no development of aversion to the operator throughout the force-feeding period since the flight distance became shorter with time (Faure *et al.*, 1998, 2001). Lastly, behaviour has been observed in ducks force-fed in different housing systems. No significant changes were observed in duck behaviour throughout the procedure, with the exception of panting behaviour, which increased in frequency by the end of the force-feeding period, the increase being greater for ducks housed in individual cages. This could indicate a defect in the thermoregulatory process. On the other hand, individual cages were not associated with the expression of stereotypy, passive behaviour or any indication of frustration (Faure *et al.*, 2000). Ducks housed in these cages were even found to be more active than those raised in collective cages.

Nociception

Animal activists often maintain that this procedure is painful for the birds. Further investigations have been set up to look at potential signs of pain in ducks at different stages of the force-feeding period. These practical situations have been compared to pharmacologically treated ducks in which necrosis of the crop was provoked under anaesthesia by an irritating substance (Servière *et al.*, 2002). Local inflammatory processes resulting in extra-vasation responses, revealed by a specific marker, were very intensive in treated control ducks, but were not observed in force-fed ducks at the beginning or in the middle of the force-feeding period. Nevertheless, slight symptoms were observed in a few ducks by the end of the force-feeding period, probably due to moderate inflammation. In similar experimental conditions, observations of peripheral and central neuronal activation showed indications of pain signalling in the medulla and brains of chemically treated birds, but not in force-fed ducks.

Although there is a need for further investigations in all these areas, the present results do not support criticisms of force-feeding and foie gras production.

Is there any future?

"Grammont's Law", passed in France in 1850 at the instigation of the founders of the French Society for Animal Protection (SPA) was one of the first, if not the first, laws

devoted to animal protection in the world. Under this law, mistreatment of domestic animals was subject to punishment, but only if performed in public. Since then, concern about animal welfare has sharply increased and European legislators have now introduced specific welfare regulations. In Europe, two independent organisations are in charge of the legislation concerning domestic animal welfare: these are the Council of Europe and the European Union. A general convention covering all domestic species (1976) and a similar directive (98/58/CE, 1998) have been adopted by the standing committee of the European Convention (Council of Europe) and the European Union, respectively. Both of these texts apply to all domestic species and therefore to waterfowl. Furthermore, the standing committee of the European Council adopted three specific recommendations concerning waterfowl in 1999. These three recommendations specifically concern domestic ducks (*Anas platyrhynchos*) (T-AP [94/3]), Muscovy ducks (*Cairina moschata*); mule ducks, (a hybrid of domestic and muscovy ducks) (T-AP [95/20]) and domestic geese (*Anser sp.*) (T-AP [95/5]). Article 9 paragraph 3 of the Convention states that these recommendations should come into force in December 1999, and recommendations will to apply to new accommodation or the replacement of existing systems from 31st December 2004. All husbandry systems will be required to meet the requirements of the recommendations from the 31 December 2010.

The most important implications of the recommendations are:

- the use of completely slatted floors and individual battery cages will be forbidden.
- the production of foie gras must be carried out only where it is current practice and then only in agreement with the already existing legislation in the member states concerned.
- feed restriction strategies, ahemeral rhythms and split photoperiods are to be banned.
- the use of pipette type watering systems is to be prohibited.
- mutilation of ducks shall be prohibited and therefore beak and claw trimming are not allowed for domestic ducks and geese and only tolerated under severe restrictions for Muscovy and mule ducks.
- waterfowl should not be plucked alive.
- carrying birds with their heads hanging downwards or by the legs alone will not be tolerated.

Moreover, a potential implication of two articles of the recommendations is that commercial duck breeders may have to obtain specific authorisation before a new strain can be introduced to the market.

Meanwhile, the European Commission has commissioned a report from the scientific veterinary committee on practices designed to fatten waterfowl. Expert advice from the scientific committee on animal health and animal welfare stated that *"force-feeding, as currently practised, is detrimental to the welfare of the birds"*. It is therefore possible that the Commission will issue a directive on the husbandry of waterfowl that is even more restrictive than the existing proposals concerning the production of commercially bred birds.

In short, no more individual cages can be built after December 2004, and this equipment should have disappeared by December 2010, in spite of the fact that there is no scientific evidence of having negative consequences for the ducks housed under such conditions. There is no such system available on the market at present. Production costs will therefore rise and, in the meantime, working conditions will become worse for handlers. In addition, with regards to the specific problem of foie gras production, it is stated that it will be possible to carry out this procedure only in traditional areas of production. Mainly for political reasons, a number of European states have decided to ban foie gras production, among them Italy and Poland which had a tradition of production at that time. There is therefore strong pressure in Europe from small but very effective animal protection groups

to forbid its production everywhere. However, current and proposed regulations only apply to existing EU State members and/or the EC members who have ratified the convention, whereas due to the WGO agreement trade cannot be prohibited. Current regulation of poultry husbandry practices does not apply to other foreign countries. Such countries could then expand poultry production such as foie gras to a considerable degree, so as to meet market demands in Western European countries. Such a situation would result in unfair competition because products would be imported without the sanitary and welfare warranties applicable to present EU members. If such a situation were to occur then welfare and sanitary problems will not disappear but will be swept under the carpet only to occur elsewhere.

Conclusion

Although they are not involved in the production of foie gras, a number of European state members want to ban it in all European state member countries. Practised for thousands of years, foie gras production can be considered as part of French culture and is of great economic significance. Based on the extra physiological use of a natural fattening phenomenon, foie gras has been recognised as a non-pathological and non-harmful product. Many changes have been made in order to improve both working conditions for the producers and animal welfare. It has been shown that physiological indicators of stress, nociceptive signs and behavioural responses were hardly affected by the force-feeding procedure. Other research programmes are still in progress in various fields such as genetic adaptability of birds, environmental preservation and rearing conditions and they should also contribute to improvements in the overall conditions of foie gras production. Such scientific results and the economic background should be taken into account when new laws and recommendations are established rather than anthropomorphic considerations. However, it is at present rather difficult to anticipate what the overall context of this type of production will be in Europe in the future.

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