The Domestic Chicken

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ANZCCART Facts Sheet

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Domestication

On the basis of archaeological and paleoclimatic evidence most authors consider chickens were first domesticated from the Indian and Southeast Asian red jungle fowl (domestic form *Gallus gallus*) well before the sixth millennium BC and became established in China about 6000 BC. They were domesticated in India about 2000 BC and introduced to Japan via Korea about 300 BC-300AD. The Iron Age was the main period for dispersion of chickens throughout Europe, derived from China via Russia (West and Zhou, 1989).

Modern poultry industry

The modern intensive poultry industry developed from the extensive system in the 1940s and 1950s to reduce areas of land required to run poultry and to protect birds from the extremes of environmental conditions. Under intensive systems, food and water are always available and duration and intensity of light can be controlled. Birds can be inspected regularly and diseases diagnosed quickly and treated without delay (UFAW, 1994). The poultry industry comprises the egg industry, where the majority of birds are reared on deep litter and then housed in cages in large commercial units, and the chicken meat industry, where meat chickens are raised entirely on deep litter in large sheds. Concern for the reduced freedom of egg layers housed in cages has seen a large research effort over many years into non-cage alternatives, none of which has proved to be commercially viable (FAWC, 1986; 1991). Changes in cage design have improved the welfare of the caged hen (Tauson, 1989; Glatz and Barnett, 1996). Chickens have always been associated with mankind, contributing about 25% of the world's current meat supply, but also being kept for sport and for showing.

Breeds

Commercial egg layers comprise light, medium and heavy cross breeds. The light breeds and medium-sized breeds mainly consist of White Leghorn line crosses or crosses with other breeds to produce white and tinted-shelled eggs, while the heavier crossbreds utilise the New Hampshire and Rhode Island Reds to produce brown-shelled eggs. In recent times the live weight of the traditional heavy-layer commercial strains has declined with the emphasis on genetic selection of lighter birds within these strains. Modern layers have been selected on the basis of high egg production, feed conversion efficiency, egg weight and livability. Commercial layer chickens or starter pullets are available from commercial suppliers.

Egg and meat production

Each hen has only one functional ovary, usually on the left side of the body, containing a mass of ova. Only some of these will eventually form an egg. Commercial egg layers commence egg production from 16-22 weeks of age and can produce 250-300 eggs by 70 weeks of age. Lighting must be held constant at 16 hours per day from maturity to achieve maximum egg production from hens. Meat birds grow quickly and reach market weight of 2.2 kg by 42 days of age.

Housing and husbandry

Chickens can be successfully raised in small rooms of an animal house, using spot or whole house brooding. To rear 20 layer type chicks spread shavings on the floor to a depth of seven cm and place a 30 cm high surround (masonite or metal) three m in diameter to enclose the brooding area. Suspend a gas or electric hover brooder about 60 cm above the floor level and warm the brooder area at chick level to 32-33^{o}C. Reduce the temperature by 1^{o} - 2^{o}C per week until a temperature of 23^{o}C is reached. Alternatively, a reverse cycle air conditioner can be used to maintain the room at the required temperature. Filters of the air conditioner need cleaning daily and an exhaust fan should be utilised to remove stale air if ventilation is inadequate. Place butcher's paper to cover about one third of the brooding area and provide chicks with a water bottle and one feed tray. Scatter feed on the paper to encourage the chicks to feed. After three days, remove the paper and allow the chicks to consume water from a bell waterer or a nipple line and to feed from a hanging tube feeder. Provide a minimum of one 60-watt globe of light for birds under time clock control to give chickens 16 hours light and 8 hours dark. Birds can be reared on the floor to maturity by providing an area for perching (from six weeks of age) and nest boxes installed for hens at 16 weeks of age 50 cm above the floor level.

Alternatively, when pullets reach 16 weeks of age they can be housed in layer cages. A small bank of cages with nipple waterers, trough feeders and egg rollout

can be purchased from poultry equipment agents. Trays containing sawdust can be suspended from the cages to collect faeces. Clean trays twice weekly. Check cage space allowances for birds from your institution's Animal Ethics Committee.

Meat chickens can be reared on the floor in the same manner as layer chickens. Meat chickens have been genetically selected to reach slaughter weight by six weeks of age under conditions of 23 hours light and one hour dark. It is not recommended that birds be kept beyond this age because of the possible development of leg problems.

It is recommended that bird handlers read the section of the Australian Model Code of Practice for the Welfare of Animals: Domestic Poultry, relating to bird handling. Day-old chicks should be picked up in one hand and gently restrained with thumb and fingers. Older birds should be removed from cages singly to avoid injury. They should be held by both legs and care taken to avoid their wings hitting solid objects. Birds should not be carried by the wings.

Feeding

The digestive tract of the chicken is simple, relatively short and highly efficient. Graniverous birds such as the domestic fowl have numerous well-developed mucous salivary glands in their upper and lower beaks and in the tongue. Food is coated with saliva to form a bolus before passing undigested through the oesophagus to the crop. The food then passes via the proventriculus to the gizzard (muscular organ). Food is moved by peristalsis through the small intestine where most of the digestion and absorption of food takes place. Digestion also occurs in the caeca, two blind sacs at the junction of the small and large intestine.

Because the chicken is economically important for the production of food, much effort has been expended to determine its critical nutritional needs (Standing Committee on Agriculture, 1987). For layer chicks, feed a layer chick starter ration from nought to six weeks, grower ration from seven - 16 weeks and layer ration from 17 weeks of age. Meat chickens are fed a broiler starter ration from nought to three weeks and a broiler finisher ration from four to six weeks.

Beak trimming

Cannibalism, egg eating, feather pecking and vent pecking are common traits where birds are housed together under high light intensity. Beak trimming is usually practiced to control these vices and must be performed according to the Australian Model Code of Practice for the Welfare of Domestic Poultry (1995), which states that not more than three mm of the upper beak and two and a half mm of the lower beak be trimmed at hatch, not more than four and a half mm of the upper beak and four mm of the lower beak trimmed at ten days (Glatz and Lunam, 1994) and not more than two mm of upper and lower beak removed when retrimming (Glatz, 1987). Trimming can be performed using an electric beak trimming machine which both cuts and cauterises the beak tissue. The welfare of birds subject to beak trimming was investigated by Lunam et al, 1996. A video is available to demonstrate best beak trimming practice (Glatz and Lunam, 1996).

Major poultry diseases

Coccidiosis - there are various species of *Eimeria* causing disease in chickens. The species affecting the caecum produce bloody faeces and are more acute than those which only affect the intestine. The latter species can produce diarrhoea and chronic wasting. Modern anticoccidials in the feed give a high level of control.
Fatty liver in layers - sudden death associated with haemorrhage from ruptured livers usually in overweight birds.
Roundworms - caecal worm, hair worms and large round worms (intestine) can cause considerable problems.
Infectious laryngotracheitis - a highly infectious herpesvirus disease in broilers, pullets and layers. The acute form results in coughing of blood. Vaccination is effective.
Leucosis - is the group name for several diseases caused by RNA tumour viruses, largely affecting chickens over about 20 weeks of age. Tumours occur in major organs. It has been virtually eliminated from major breeding units.
Lice - Parasites of the skin, especially around the vent and under the wings. Heavy infestation can affect birds' performance. Species include the yellow body louse, the head louse and the wing feather louse.
Fleas - brownish-black jumping insects which attach to the comb and wattle, then remain stuck fast.
Marek's disease - caused by a lymphotropic herpesvirus which varies widely in its ability to cause disease. Tumours can be seen at 6 weeks in unvaccinated birds and from 14 weeks in vaccinated flocks. It affects the nervous system and also produces tumours in many of the internal organs and the body muscles and enlargement of nerves. The vaccine given to day-old chickens has been very successful but occasional outbreaks occur.
Mites - blood sucking parasites which irritate the bird and can cause anaemia and depressed performance or even mortality. The red mite feeds off the fowl during the night and rests in crevices during the day. The northern fowl mite lives continuously on the fowl. There is also a scaly leg mite and an air sac mite, although the latter is rare in poultry.

Vaccination

Most of the economically important diseases can be prevented and controlled by vaccination. These include Marek's disease, infectious bronchitis (IB), infectious laryngotracheitis (IL), *Mycoplasma gallisepticum (*MG), coryza, cholera and fowl pox. Many vaccines can be given in the birds' water supply or by eye drop, while others may need to be given by injection. Chicks should be vaccinated at hatch against Marek's disease at two and four weeks and at four months for IB; at six and eight

weeks for MG and at ten to twelve weeks for ILT and fowl pox. A video is available to demonstrate vaccination via water (Critchley , 1996).

Zoonoses

Diseases transmissible to man include:

- *chlamydiosis* (psittacosis) — birds can carry this organism and show few signs until stressed. It is rare in chickens, but there are a number of reports in association with slaughter of ducks and close association with pigeons and parrot species.
- *insect-borne viruses*, such as Murray Valley Encephalitis and Ross River Fever. There are many viruses whose natural host is the bird and which in man can cause mild to severe disease. Domestic poultry are rarely infected but they do have the potential to harbour such viruses.
- *bacteria (Salmonella, Campylobacter)*. In common with most species, poultry can become infected with these enteric bacteria, usually from contaminated feed stuffs or environment. The organisms are shed in the faeces.

Blood sampling

Blood samples can be obtained from the wing (brachial) vein where it runs over the muscles surrounding the humerus. Depending on the bird's size, a 21-23 gauge needle can be used with a syringe or a vacutainer. Place the bird on a table on its side and gently extend the upper wing from the body. Antiseptic should be applied to clean the skin. Feathers located in the vicinity of the brachial vein can be removed with scissors to more clearly show the line of the vein from the abdomen to the wing. A small desk lamp is often needed to provide extra light. Insert the needle through the outer layers of the skin into the vessel, the best approach being to have the needle pointing toward the wing tip and away from the body. Approach from a low angle to the vein and in line with the vessel. Withdraw blood and after removing needle, apply pressure over the site for 30 seconds to seal the vein and minimise leakage of blood into surrounding tissue.

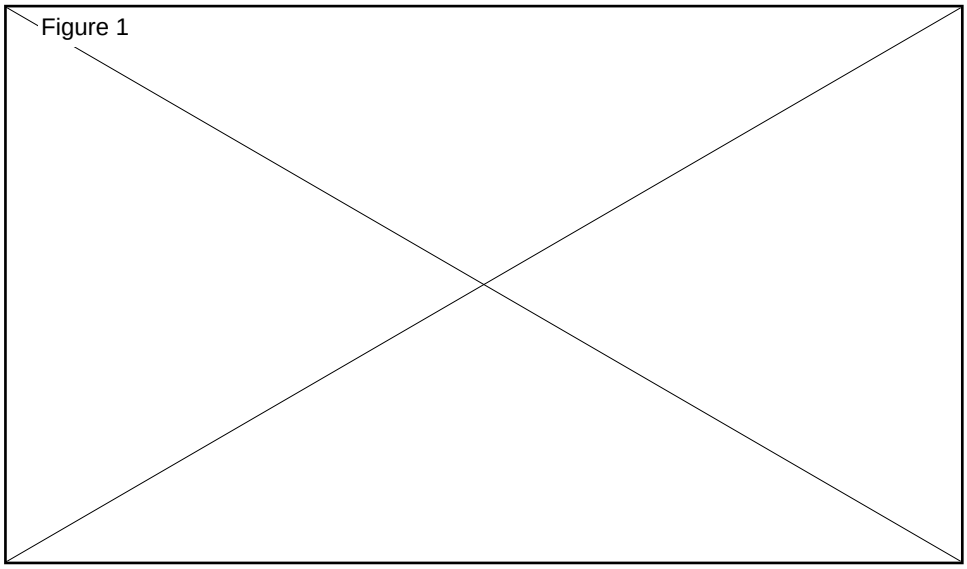
Anaesthesia

Birds, particularly small species and young chicks, possess a high basal metabolic rate reflected in a rapid heart rate and a body temperature of 42°C. In addition, birds have a less efficient ability to maintain body temperature compared to mammals and a complex respiratory system with associated air sacs. These features need to be accommodated for successful induction and maintenance during the periods of anaesthesia and recovery.

A wide range of anaesthetic agents has proven suitable for use in different species of birds. In the laboratory we use either tribromoethanol by injection or the inhalational anaesthetic agents halothane or isoflurane. The choice of the anaesthetic agent is dependent on the duration of anaesthesia required.

Tribromoethanol is particularly suitable for relatively short procedures. An intraperitoneal (i/p) dose of 200 mg/kg body weight provides induction within one to five minutes with a duration of anaesthesia of 15 - 25 minutes. To avoid penetrating the caudal air sacs, i/p injections are made in the mid-line, half way between the cloaca and sternum, the needle being inserted in a cranial direction, so that it lies just beneath and parallel to the abdominal wall.

The main advantage of inhalational anaesthetics is that the depth of anaesthesia can be readily altered, thereby decreasing the risk of overdosing. Ether, though inexpensive, is highly explosive and flammable and its use as an anaesthetic agent in many institutions is strongly discouraged. Halothane and isoflurane are non-flammable and are excellent for birds. Sevoflurane is a new inhalational anaesthetic agent that similarly to halothane is both non-explosive and non-flammable. In humans, the rate of induction and recovery from sevoflurane anaesthesia exceeds that with isoflurane. We have no local experience of sevoflurane anaesthesia with birds. Induction and recovery from isoflurane-induced anaesthesia is very rapid compared to that with halothane. This is because isoflurane is minimally metabolised out and is less soluble in blood and body tissues than halothane. Isoflurane provides excellent muscle relaxation. Halothane is frequently used in the laboratory as it is five times less expensive than isoflurane, does not irritate the respiratory mucosa and does not stimulate salivary secretion. Halothane and isoflurane have a similar potency. This is defined as the minimal alveolar anaesthetic concentration or MAC (Eger *et al.*, 1965) which at one atmosphere of pressure will abolish a reflex response to a painful stimulus in 50% of the animals. To minimise risk of exposure of laboratory personnel to the anaesthetic agents, (halothane is an hepatotoxic agent to certain susceptible individuals (Lunam *et a*l., 1985)) we



use a closed anaesthetic delivery system with the excess and expired gas vented directly into a fume hood(figure 1.)

The bird's head is placed into the glass anaesthetic mask with latex rubber forming a tight seal around the feathers. The latex is cut from a surgical glove and secured to the mask using a rubber band. The mask should be placed on an electric blanket heated to 40°C in a draft-free environment (not a fume hood) to minimise loss of body heat from conduction and convection. Feather removal should be kept to a minimum to maintain thermal insulation. Control of heat loss is particularly critical during anaesthesia of very young chicks.

After induction (one minute of 2 - 4% halothane in O_2 (flow rate of 1-2 1/min) the concentration of halothane should be immediately lowered to 0.8-1%. Anaesthesia approaches one MAC when the response to pinching either the comb or toes is abolished. To prevent accumulation of halothane (or isoflurane) in the air sacs, the flow of O_2 to the vaporiser is interrupted at ten minute intervals and diverted directly to the mask for one to two minutes. At the end of the anaesthetic procedure, 100% O_2 is delivered to the mask for two to five minutes. To minimise loss of body heat and prevent injury to the wings during recovery, the bird is wrapped firmly in aluminium foil and placed in a draft-free box heated from above using a 60 watt pearl light bulb.

Using this procedure we successfully anaesthetise chicks as young as three days of age. As birds are particularly prone to stress from handling, birds weighing more than 250g are sedated using tribromoethanol at 100 mg/kg i/p before placing into the anaesthetic mask.

The chicken as an experimental animal

Because chickens can be easily bred and housed they are being increasingly used as experimental animals in many areas of scientific research. The main technical and scientific studies since the 1960s are listed below:

- breeding and genetics, growth, performance and performance testing;
- embryology, incubation, fertility, artificial insemination, hatchability and anatomy;
- health, hygiene, disease, toxicology and pharmacology;
- husbandry, environment, housing, equipment, transport, behaviour and welfare;
- meat and egg science (processing and products), product quality, poultry by-products and waste;
- nutrition and feeding;
- physiology, biochemistry, endocrinology and neurobiology; and
- history and archaeology.

Physiological and biochemical data

Useful physiological data and biochemical data on poultry can be obtained from Freeman (1971, 1983 and 1984).

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