



EMTECH HATCHERY HANDOUT #1

THE YOLK SAC

DESCRIPTION

The yolk sac is one of several temporary embryonic organs which cease their functions once the chick or poul has hatched. It grows rapidly from the body folds during the second and third day of incubation to envelop most of the yolk by the sixth day. Blood vessels are present in about half the yolk sac by the sixth day and all of it by the fourteenth day. The internal surface of the sac forms folds to increase its capacity for yolk resorption.

Blood circulation begins in the yolk sac around 45-49 hours of incubation and this vitelline system develops rapidly.

FUNCTION

Up to the ninth day, absorbed yolk is mainly used for growth of the yolk sac tissues. Digestion of nutrient substances is well provided for by enzyme systems. Up to the eighth day of incubation the yolk is additionally diluted by water which enters from the albumen. Absorbed nutrients pass from the epithelial cells of the yolk sac into the numerous blood vessels, to the hepatic portal system to be treated by digestive juices secreted by the liver cells.

The yolk sac is basically the primitive digestive organ of the embryo. Additionally, it performs a respiratory function to the fifth day, when the allantois takes over this role (Rol'nik 1970).

YOLK SAC WITHDRAWAL

The yolk sac is drawn into the body cavity on the nineteenth day of incubation. According to Lillie (1952) this occurs as a result of contractions of the internal layers of the allantois and amnion, however Kuo (1932b) believes the function to be performed by a combination of abdominal muscles and leg movements. The structure of the yolk sac helps it to be drawn in through a relatively small umbilical opening. After the yolk sac has been withdrawn and resorbed the yolk stalk remains as an appendage of the duodenum.

The nutrient substances present in the yolk sac will be used by the chick during the first few days of development.

PRACTICAL CONSIDERATIONS

Poor retraction of the yolk sac is an unfavourable sign when evaluating the quality of the chick. This may be due to insufficient uptake of the yolk during incubation (due to excessive temperatures or humidities during incubation) or a weakening of the muscle fibres, perhaps indicating a loss of embryo vitality. The degree by which the yolk sac is withdrawn can be used as an index of chick "maturity". Walker and Voitle (1973) and Laughlin (1977) developed a system of navel scoring. Walker and Voitle used their system to measure the stimulatory effects of light during incubation. They found that generally, the presence of light accelerated embryo development and more rapid and complete navel healing. A fully developed chick should possess a completely healed navel.

Laughlin has produced a scale for the assessment of navel healing in newly hatched turkey poults. This scale was developed using poults from an experiment where water loss was measured when turkey eggs were incubated at different relative humidities. With lower humidity, there were many poults with dried urates attached to the navel. These poults were lighter than those on the high humidity conditions.

Further investigation of this problem is required. Laboratory studies of mechanisms involved in correct yolk sac withdrawal, together with a field survey of field incidence of the problem, related to various aspects of the commercial operation. It is recognised that several factors such as egg storage and incubator conditions (temperature and humidity) influence the occurrence of this condition.

Egg storage before incubation can devitalise the embryo to the extent that irregular development occurs during incubation (Mather and Laughlin 1976) and it is known that the incidence of unhealed navels increases when old eggs are incubated.

In practical terms, incomplete retraction of the yolk sac presents a much greater problem with turkeys than in chickens. It has been estimated that approximately 1 million day old turkey poults are culled on the hatching trays (Hodgetts 1979). Approximately two-thirds of these second grade poults would have been down-graded due to unhealed navels. For comparison, broiler chick hatcheries enjoy a much lower level of down-grading, probably between 0.75 and 1% of hatched chicks.

YOLK SAC INFECTION AND OMPHALITIS

Under poor incubator conditions (high humidity, fluctuating temperatures and poor hygiene) infection of the yolk sac readily occurs. Chicks often hatch in a devitalised state with large watery yolks. Subjecting the chicks to further stress (chilling, delays in placement under the brooders) stimulates the multiplication of any yolk digesting bacteria (Bacillus cereus, Staph. aureus, Clostridium sporogenes and welchii) which have contaminated the chick during hatching (Harry 1957), Harry and Gordon 1966). Infection of the yolk sac and navel are responsible for the majority of deaths in chicks up to 3 days after hatching (Gordon 1977). Overheating the embryos during the final 3 days in the setter can weaken them and trigger off yolk sac problems.

Hatcher hygiene is of great importance in controlling this type of infection. A breakdown in the hygiene programme can increase the possibility of similar problems in subsequent hatches in the same machines as a result of a build-up of contaminated fluff. An efficient terminal disinfection programme will help to reduce the level of contamination in both machines and hatcher trays. Steps should also be taken to limit the spread of fluff from and between hatcher rooms during the hatching process. For hatching each day of the week, separate hatcher rooms are desirable (Harry 1966).

Omphalitis usually results from chicks hatched under conditions of low humidity. Dried portions of the shell membrane can become withdrawn through the navel orifice, causing irritation and devitalisation of the surrounding tissues leading to their infection with such bacteria as Staph. aureus and certain Clostridium spp. Omphalitis usually results from an imperfect healing of the navel, which in cases of acute yolk sac infection is usually perfectly healed (Gordon 1976).

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