**Lecture -1 Hatching and H. management (theory) 3d Animal Resources**

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**Factors effect on incubation (hatching)**

 **First: Factors that effect on fertility of breeder stocks:**

 **A**- **Factors Influencing on breeders:**

 1 - **Public health of stock**: Most of diseases affecting on birds’ reproductive system, in the **male depression or stop production of sperms**, thus in **female eggs production stop**, it noticed when the stock exposed to pandemic (epidemic) diseases or **internal and external parasites**, or **under debilitate and continuous management** influenced by (**extreme heat, overcrowding, poor ventilation, malnutrition, mistakes in rearing**) leads to **decreases in egg production**, also the **weak cocks lose their sexual ability** which **led to decreases in fertility**.

**2 - Age of cocks**: Fertility decreases whenever the stock **progress in age**, thus a reduction in hatching rate, so does some producers **replace the older cocks with younger cocks** in the **second half of the production stage**, noticed that the survival of the stock in another year result decrease in the fertility rate up to 25%, also eggs incubated at the starting of egg laying in stock (directly after sexual maturity) was a noted decline in the hatching percentage due to the decline in the fertility of the stock at the beginning of egg laying.

**3 - Season and temperature effect on hatching:**
 **A- In Summer:**  In hot months of summer as in many opened (backyard) fields results **decreases in fertility rate**, **the process of hatching stopped and eggs sold as eaten**, because **fertility begins to decline** also **egg size decreases**, **decline in egg production** therefore the stock begins the **molting**, moreover the **male less interest in mating**.

 but in the modern closed farms there were artificially lighting, ventilation, and coolers provide suitable weather to get rid the heat in summer that’s necessary for production, also the incubators and hatcheries halls supplied with cooling that be possible in production and eggs fertilization and good for hatching rate all over the year.
**B - In Winter**: In cold weather (in areas lives under low temperatures below zero), the **fertility extremely decreases** if exposed directly to low temperature shows that the **combs and wattles freezes and turn to blue color**, the **mating or sexual appetite decreases in roosters**, the **poultry producers perform to cut or remove combs and wattles** **of hatched chicks** in the winter, especially in **species with large combs** such as **Leghorn**, therefore; chicks must reared in artificially heated rooms.

**4 - Lightning:** The increases of lighting hours must Increase the efficiency of sperm; therefore must increasing the lighting period (hours) for stocks in winter at least 16 hours so as the fertility not affected in rate.
**5 - Insemination:** There are several factors affecting on the efficiency of insemination:
**A** - **The expansion of mating place**: Roosters mating a lot and be freedom in the expanded places also noticed the rate of fertilization be less in crowded fields.
**B** - **Predominance of some cocks**: cocks with his powerful dominant in the field and prevent other cocks to mating, therefore the weak cocks isolate oneself for the strong cocks frighten and quarrelsomeness, led to variety of cocks proportion in stock.
**C** - **A preference of some female chickens**: cocks prefer some hens without others, some hens' stills without mating therefore the fertility and hatching ratio decline.
**D** - **Alienated (escape) of some females**: some females dislike some cocks or roosters for mating because the ferocity of this cocks they have large spur that is tearing apart aspects of the female chickens.

**E** - **Lack or increase the number of cocks to female:** In heavy breeder the ratio of a cock up to 5-8 female, medium breeder species a cock up to 8-12 female, and light breeder (layers) species each cock up to 12-18 female, if the cocks percentage become less than this ratio the fertility decreases as a result of an inability of the cocks to accommodate the number of females, while increasing the number of roosters (cocks) on average hold it constantly quarreling and prevent mating of some females, also the fertility rate decreases.

**F** – **Time of mating**: The most successful mating when no complete egg in oviduct which prevent the sperms to reach infundibulum in female oviduct where fertilization of the egg take place, the presence of complete egg in the uterus collide by the sperm to do difficult to arrival to the area to fertile, so the best time for fertilization is when the absence of solid egg with shell from the uterus or vagina. The percentage of fertilization successful after the time (10 am to 2 pm).
**6 –**  **The percentage of egg production:** We observed that birds layed high percentage of eggs gave high percentage in fertility, because the oviduct of hens with high yields, be active and efficient instead of birds with low production.

**7 - Relating of fertility on status or remove of cocks:** The fertility appears after the addition of cocks to stock at duration of 4-7 days then can give a reasonable percentage of fertilized eggs, depending on the proportion or the number of roosters (cocks) to females in the stock, it has been found in medium-weight breeds roosters when added **10:1** (females: cock) increases the stock fertility to (**93-98%) after 9 days**, but if put females: cocks **15:1** up this percentage to (**93-98%**) **after 11 days**, also the proportion of **18:1** females: cocks up to (**93-98%**) **after 14 days** and so on.
\* When you **remove the roosters** from the stock was found that fertility will last **for 7-8 days** and gradually decreased until it reaches **zero in a month**, when incubating eggs that has been removed cocks more than 10 days the embryos die after a few days of incubation. This indicates that the sperms that swim in the oviduct to meet the egg in infundibulum can live for two weeks after insemination to fertile the egg, but the vitality of stored sperms decreased than caused lower fertility.

**8 -** **Genetic factors**: Genetic factors play a major role in influencing the rate of hatching, it found when using **Inbreeding** reduces hatching ratio, while using **outbreeding** (Hybrid) gave more percentage of hatching

**9-Effect of nutrition on hatching ratio:** The most factors that effect on hatching rates, **unbalanced diet** especially **lacks in protein** or **vitamins** and **minerals** effect on layers that product of hatching eggs. Any deficiency in vitamins and minerals shows impact **first** on the **egg production** and on the **embryo growth** and **hatching ratio**, before it shows its effects on the layer stock itself. When deficient be high the effect of this lack lead to stop of eggs production.

A- **Effect of vitamins deficiency on hatching ratio**:

 1- **Vitamin A**: It’s important for embryos normal growth, the largest amount of vit. A found in egg yolk, but the limited quantity is more important to the embryos, which give its food from the white (albumin) at the first stages of embryonic development, and then from the yolk in the final stages, so the lack of vitamin A in diet leads to embryos death in early days.
2 - **Vitamin D**: This vitamin is important to **get normal rate of hatching**, **it supplies through diets** or **exposing the chickens to direct sunlight** or **ultraviolet rays** at least **15 minutes** per a day.  Chickens that producing eggs, which not intake necessary amount of vitamin led to **reducing of blood Ca+2**, also **laying** **small** and **irregular egg shapes** and **lower percentage of calcium in eggshell**. The forming structures of embryo show Chondrodystrophy The embryo spent its life at days 18-20. It also found that increasing of vitamin D in the diet lead to decline in hatching ratio until it reaches to zero.

3 - **Vitamin E**: Vitamin E is important to reaches the normal hatching percentage, it must be supplied insufficient amount in parents diet by because it important in the early stages of embryonic development, lacks of vitamin E leads to **bloody spots appearance** and **imbalance in blood circulation at the early stages of embryonic development**, so the embryos **die during the first week** of incubation does not exceed the **ninth day**, therefore; the peaks of embryonic mortality as a result of a lack of vitamin E appears after 3-4 days of incubation.

4 - **Vitamin B1**:The lack of vitamin B1 has not effect on hatching percentage.

5 - **Vitamin B2 (Riboflavin)**: One of the most important vitamins, that play a major role in determining hatching ratio, which must be provided in breeder layers diet to reach the standard rate of hatching, any shortages even if it's a little bit in the diet of breeder affects negatively on the hatching rate. There are two major periods of embryonic deaths due to lack of vitamin B2 in diet:
  **A- First period of mortality**: Between 9-12 days, it appears **Odema** on embryos.
 **B -** **Second period of mortality**: Between 18-21 days, embryos show **dwarfing**, Chondrodystrophyand **Clubbed Down**. To produce eggs with high hatching rate, the breeder diet must contain B2 at least 2-4 mg/kg diet.
6 - **Vitamin B6 (Pyridoxine)**: The deficiency of this vitamin has a limited effect on hatching rate.
7 - **Vitamin B12**: This vitamin is essential for the process of hatching, the lack of it in diet leads to death of embryos between 8-14 days of incubation, it shows the following symptoms: **Swelling around the eyes** - **a palace in the beak** - **curled toe** - **weakness** in the muscles composition. If given a diet lacks of vitamin B12 for a long time, the embryo dies very early and appear as if the egg is unfertilized.

**B- Effect of minerals deficiency on hatching ratio**

 1- **Calcium (Ca+2)**: The lack of calcium in the diet affects on hatching rate, through the **role of vitamin D in calcium absorption**. Also, found increasing of calcium in the diet may lead to a shortage in the percentage of hatching and the embryos death in last three days. Found the addition of **calcium carbonate lead to better** results in hatching as compared with **calcium sulfate** added.

 **2-** **Manganese (Mn+2)**: It's important for embryos development. Lack of Mn+2 in diet reduced the hatching rate and occur higher embryos mortality in three last days, the symptoms of mortality as seen **micromelia** and **parrot beak** , **changes in head forms** and **abnormally** in **fluff forming**. ومنقار الببغاء
 It found the addition ofMn+2 (50-150) g/ton breeder layers diets, the symptoms disappear and improved the hatchability.
**3 -** **Selenium (Se**): Selenium has a **toxic** effect on embryos. It found when given a diet with selenium ppm (10 g /ton) to layers diet for two weeks, the percentage of hatching drop to zero, because all embryos death, which shows an **oedema on head** **and neck** as it **extends to the legs, eyes**, and the composition of the **fluff is weak**, The maximum rate of selenium in diet (2g / ton) that important in hatching percentage.
**C-** **Effect of protein on the hatching:**
   It found using **low-protein** in breeder diet producing hatching eggs, it results **decreases in egg production** thus **reduces of hatching rate**, because lack of essential amino acids needs to form eggs and embryos. The percentage of hatching reduced if one of the essential amino acids absences especially decreases in lysine and methionine. If protein rate in diet increased to 30%, it leads to a **decline** in **hatching rate**, and **eggs production, thin shell** or **a large mount of eggs without shell.** It found the added of4% **cottonseed meal** has a negative effect on hatchability, the percentage of **hatching decreased from 80% to 50%,** also the hatchability sharply decreased when added **25-30%** cottonseed meal to layers diet, because of the toxic material in seeds called **gossypol**, also cottonseed meal **lacks** of vitamin **B12** and **lysine**. The crude soybean grains contain **growth inhibitor** this factor effects on chicks growth, therefore the **soybean grains must heated** before it used in diet, if crude soybean grains used in breeders diet without heating leads to decreasing in hatchability. Also, soybeans are **free of hatchability factor, while** it found with a large amount in fish and meat meal, and smaller a mount in milk powder and alfalfa meal.

us negatively effects on hatching rate.

 **Factors that effect on hatching eggs before storage**

**\* The following points prevent the effects of hot weather on blastoderm:**
**a** - Eggs should be **collected every two hours** at least four times per a day.
**b -** After each collection of eggs transferred to the egg cooling room under 19ºC temperature and 75% humidity.
**c -** Eggs (which collected from the breeder fields) must put in incubators within one week of storage.
**d -** Eggs should not expose to varying temperatures.  **Factors that affect on hatching eggs during storage:**

 **1 - The temperature during storage of eggs:** Eggs must store under **physiological zero** **temperature** which **embryos cannot divide**. The physiological zero for chicken eggs is in the range of **18-20** C°, therefore, the temperature of storage eggs must be under **20 C°**. Showed that if eggs stored under temperature (**zero - 4**) C° **increased the rate of** **abnormalities** in embryos, thus **reduced the percentage of hatching**.

**2 – The period of egg storage:**

**a**- If the egg stored for a **long time** the embryo **loses** its **vitality**, even after a period the eggs become **unfertile**.

**b**- If the eggs incubated within a **week**, the percentage of hatching **up to the maximum rate** (**82-88**) %, depending on the **efficiency of incubators**.

**c**- In the **second week** of eggs storage the hatching rate decreases to (**70-80) %**, while reached to (**55-70)**% in **the third week**, whenever; in the **fourth week** up to (**25-50**)%, in the **fifth week** reached to (**0-20**)%.

**3 - Eggs turning during storage:** if the eggs stored for less than a week not need to turning, but prefer to turn the eggs in the second week of storage.
**4 - Shaking of eggs during transport:** Severe shaking during transport causes **separate** or **move the air sac** and **torn shell membranes** also lead to **abnormalities** in embryos growth.

 **Factors related to hatching machines:** Differ in the hatching percentage depending on the **type** and **efficiency** of hatching machines (hatcheries). Modern hatcheries increased the percentage of hatching than the same eggs when hatched in old hatcheries, it was reflected on a large numbers of hatched eggs, if 1% increase in hatching percentage represents 10,000 chicks of every million eggs for hatching, depended on hatching elements (heat - ventilation - cooling - humidity and turning), these factors affect in the success and completeness of the hatchability.

**Egg quality effecting on hatched eggs:
1 - Egg size:**
   **a**. **Medium eggs**: medium breeds size is the one who gives the best percentage of hatching e.g, white Leghorn gives the highest rate of hatching when egg weight between 55-62 g.
 **b**. **Large size eggs**: Hatching percentage decreases in large size eggs because the **large amount of albumin caused an insulating layer that prevent the arrival of sufficient heat to the embryo**. Also the proportions of embryos nutrition **(albumin: yolk) have disequilibrium**. It found that **large eggs increased the period of hatching a few hours** as compared with the small eggs in size.
 **c. Small eggs:** The small size eggs decreases hatching percentage, because **albumin and yolk is relatively lower than normal for embryos requirement**, the **albumin and yolk consumed in a short time**, therefore; the opportunity of the embryo for normal growth reduced, the embryo dies before hatching or the hatched chicks is small or disabled.

**2 - Eggs shape:**

**a. Oval** eggs give the best hatch rate because it is the best shape that consistent of the embryos deposition after completing its growth then perform better chance of hatching.

**b**. **Spherical** eggs.

 **c**. **Elongated** with a **narrow-pointed peak**, it does not fit to embryos normal growth at hatching stages because **it presses on some parts of embryo then prevent its growth and reduces eggshell to break then led to decreases hatching percentages**.
     Abnormal rate varies in hatched eggs between 1-5 % in layer breeder stocks; the **heredity** plays a major role, also **diseases** changes eggs shape such as **infectious bronchitis** and **Newcastle disease**.

**3 - Internal defects in egg:** The internal defects as**:**
  **a**- Air sac in a position far from the **width side** of egg.

 **b**- **Unstable or mobile** air sac.
 **c**- **Spots** or **points of blood** found in albumin or yolk.
 **d**- **Abnormal ratio** of yolk to albumin (normal ratio of yolk: albumin is 1:2).

 These defects do not give a chance of normal hatching, therefore; eggs should candle before incubation.

**4 - Shell specifications:** Shell **protects the embryos from external shocks**, **supply them with enquire calcium**, also its a **medium for gas exchange between egg contents and the outside (air)**, egg shell contains about **7500-17000 pores** (gap), therefore, any changes in the

**Specifications of the shell reflects impact on hatching rate according to the following**:

 **a – Eggshell thickness**: thick eggshell **prevents the process of hatching**, and the light shell is fragile or cracked as a result of any external stimulation.
**b - The eggshell safety**: Any friction on the eggshell lead to the **entry of many bacteria that proliferate strongly** during the hatching **made up of some gases** during the embryos growth **which** increased the pressure **inside the eggs then lead to eggs explosion**.

**c - Shell cleanness**: Eggshell contaminated with chicken feces or the dirt in litters or nests, if incubated these dirty eggs without cleaning, these dirt close up the shell pores, then prevent natural gases exchanging, that negatively affected on hatchability, the dirt lead many bacteria to entry eggs, salmonella is most dangerous that finds its way into the egg through any small crack, thus lead to embryos death.
**d - Shell porosity:** The increases of eggshell porosity helps to speedily evaporating of egg contents that lead to decreases in hatching rate.
**e - Shell color**: Eggshell color does not effect on hatching ratio, but any changes in shell color concentration it sign of trouble whiteness in the stock, for example, Newcastle disease may change the eggshell color in chickens which lay white eggs it shows brown spots.

also Newcastle disease and infectious bronchitis disease may turn dark brown color of eggshell to light color or white. The addition high concentration of sulfa compound or anti-coccidiosis or antibiotics to layer diets or water drinks for a long time prevents the brown color deposition on eggshell changed to white color.

**The bacterial contamination of eggs and its effect on hatchability:**
 1 - **Salmonella**:

 Salmonella pullorum is the only bacteria have a certain impact on **reducing the hatching ratio**. Other types of salmonella have limited influence on hatchability.
 Salmonella pullorum found mainly in egg yolk is due **the ovary** injury **that produces yolk**, the infected eggs be great if the concentration of the bacteria is high in the ovary. The **eggshell may bacterial contaminated as it passed through the vent during laying eggs process, because the intestine secrete salmonella with feces**, when hatching eggs contaminated with bacteria it penetrate the eggshell through the pores to attack the embryo. Generally the infected embryo die within the age **14-18 days**, the infected chicks that hatch die within **4-5 days** after hatching and be a source of infection of the non-infected chicks. That characterized by **inflammation** and **swelling** of the **liver** and **spleen** by **presence of hemorrhagic spots** on them, as well as **severe inflammation in not absorbed yolk sac**.

2- **Newcastle (ND) and infectious bronchitis** (**IBV**):

 When laying breeder infected of these diseases, the chicken ovary affected, by inflammation resulting from chicks’ infection **large numbers of deformed eggs**, and **abnormal eggshell and irregular**, the **egg white becomes non-integrated**, as you can see **many air bubbles swimmers** **in white instead of air sac in a wider end of the egg**. This disrupted the suitable specifications for hatching eggs and does not hatch when incubated, as shown by the many abnormal embryos, then continue to decline the percentage of hatching from 3-5 week.

3- **Parasitic diseases**: Is indirectly affect on the hatching process, but it directly affected when withdraw nutrients and vitamins from the gut, also affected in the vital health of bird and reducing eggs production and hatching ratio.