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The Effect of Early Setting inside Single Stage Incubator on Stored Eggs

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ABSTRACT

Eggs weight loss during storage has been documented well due to water loss. The single stage incubators are designed to use egg water loss as humidity source during incubation. In this experiment one week old eggs (n=430840) were collected in Salman hatchery, Pakistan and divided into two groups, group A was (eggs n=215420) immediately shifted to incubators before 10 hours of incubation to avoid further weight loss) and eggs from group B (n=215420) was stored in eggs room at 23.8^0 C and 65% humidity with 2cfm/1000 eggs ventilation for 10 hours. After 10 hours of storage both groups were pre-heated at 80 ^{0}F for 5 hours leading to incubation conditions. Hatchability % (84.502±2.9221, 84.217±3.0279) candling% (6.5418±0.5605, 6.7682±0.5705) dead in shell% (6.5418±2.3112, 6.7682±2.3702) and hatch window (hours) (22-24±0.142, 26-28±0.1324) were significantly better for A compare to B respectively, Water loss% (11.556±0.1399, 11.545±0.1486), chick yield% (68.835±0.0926, 68.818±0.0928) and chick waste (gram) (19.67±1.721, 19.69±1.7653) were insignificant due to same incubation conditions inside incubator. The water loss from eggs of group A retained inside incubator have an impact on embryonic mortality including the duration of first and the last chick that hatches out. So, the deleterious effects of storage can be avoided by shifting the eggs inside a single stage incubator before 10 hours of incubation including pre-heating.

Keywords: Water loss, Egg storage, Single stage incubator, Candling, Dead in shell, Hatch window.

INTRODUCTION

Egg storage is a critical issue in poultry industry, both internal as well as hatchability parameters are badly affected by the storage of fertile eggs in different storage conditions. A number of scientists provided different solutions in order to remedy the deleterious effects of storage. Tercic et al. (2016) described that pre-storage heating is based on the fact that embryos at the pre-gastrula stage at ovi position are less able to withstand the stress of storage compared with embryos at the later, gastrula stage.

The major loss during egg storage occurs due to egg weight loss, increasing the days of storage the conditions for the growing embryo becomes more harmful due to increase water loss. Akeem et al. (2013) found that the storage of fertilized eggs at 18 °C for 0, 4, 8 and 12 days becomes a source of egg weight loss and decreases hatchability parameters. Storage of eggs also effects the interior quality (Haugh unit, albumen and yolk indices) with the effect of storage time might indirectly affect the fertility and hatchability of fertile eggs (Khan et al., 2017). Eggs storage effects can be minimized with small end of egg up for 14 days at 18 °C have effect on early embryo mortality, improving hatchability (Lima et al., 2012). The smaller eggs end up with a decreased surface area for the water loss (Lima et al., 2012). Water loss is a critical factor to achieve standard hatchability, chick yield and

quality chicks. 11.93-12.24% water loss is necessary to achieve standard quality chicks from 24-65 weeks broiler breeder's eggs during incubation. The only factor we can manipulate to achieve better chick yield is water loss during incubation (Jabbar et al., 2017). Eggs of Rhode Island Red hen (RIR) were stored for 2, 3, 5, 7 or 9 d at 16 °C and 78% humidity, the fertility was not effected as compared to egg weight, hatchability, embryonic development, chick weight as well as a decrease in the albumen weight, yolk weight, albumen index, yolk index and haugh unit value of RIR eggs (Khan et al., 2014). Regardless of the storage of eggs in different storage conditions, to achieve standard quality chicks the water loss should be at 11.93-12.24 % and chick yield should be at 68.46-68.90% from 24-65 weeks broiler breeder's eggs during incubation (Jabbar et al., 2017). So, if water loss occurs during storage we can never achieve standard chick yield and the hatch window necessary to attain best post hatch performance (Bergoug et al., 2013). The aim of study was to evaluate the effect of early setting on hatchability parameters inside single stage incubator on stored eggs.

MATERIALS AND METHODS

Ethical approval

This experiment was a routine field work in hatchery considering the all rules and regulations regarding animal rights and ethics according to (SPCA) society for protection and care of animals. University of veterinary and animal sciences Lahore Pakistan

Selection of breeder's flocks

Broiler breeder flock Ross, Hubbar and Cobb 35-70 weeks of age from Sadiq poultry farms and Islamabad poultry farms were selected for eggs collections. SP (ross) (Sadiq Poultry) 101(Flock No.101)-AI (Artificial Insemination)-A (House A), SP101(ross)-AI-B, SP101(ross)-C, SP108-1(cob), SP108-2 (cobb), SRB (ross) (Sarghoda Farm-B)-AI-C, IS (ross)(Islamabad Poultry)-132-C, SP(hubbard classic)106-1, SP(hubbard classic)106-2, SRA (ross) (Sarghoda Farm-A)-AI-A, SRA(ross)-AI-B, SRA(ross)-AI-C, SRA(ross)-AI-D, IS(ross)-135, SP(ross)102-AI-A, SP103(cob)-AI-A, SP105(ross)-AI-A. Farm name its number and location is necessary for back tracking also helps in abbreviations

Eggs Selection

Best-quality hatching egg (n=430840) with good quality shells, without ridges or small lumps of calcified material (pimples) were selected from mention farms after one week of storage at 18^0C at farm. The grading of eggs on the basis of egg weight was performed through egg grading machine MOBA 9A. While the poor shell, crack, bloody stained, elongated eggs were rejected (Khan et al., 2016). Egg room temperature and humidity were kept at $20C^0$ and 65% respectively with fresh air 2 CFM/1000 eggs during the course of the study.

Eggs grading is necessary to achieve quality chicks. If we don't perform eggs grading then at the end of hatch the chicks grading will be very long and difficult. It's easy to grade eggs than chicks to get uniform chicks that will give uniform performance at farm.

Site selection

This experiment was carried out at Salman Poultry (Pvt) limited Chakri hatchery Rawalpindi which is situated 5 kms from chakri interchange on motorway (M2). The hatchery contains the latest Heating Ventilation and Air Conditioning (HVAC) automation, having ISO (international standard organization) 1s900-2000 certified. This hatchery is one of the largest eggs capacity hatcheries in south of Asia, which is producing 65,00,000-70,00,000 of best quality broiler chicks per month through single stage incubation system (Avida G4, Chick Master USA).

Group classification

The experimental eggs were divided into two groups group A and group B both contained same number of eggs (n=215420). Both groups' eggs were stored at 18 °C at the farm for one week. Each farm contributed equal number of eggs.

Weight of eggs

Before setting the eggs weight of each individual group was calculated by setting eggs into one setter tray then applying the formula,

$$\text{Egg weight (gram):} \quad \frac{\text{full tray weight at Setting- weight of empty tray}}{\text{Total No. of eggs in tray}}$$

Egg fumigation

Before the weighing, the trial eggs were fumigated with 20 g KMnO4 and 40 ml formalin (40%) and 40 ml of water for 100ft 3 areas for 15 minutes through an automatic fumigation process provided by Chick Master (this system is used for fumigation from last two years on commercial level).

Incubation programme

Eggs were received in the hatchery at the same time for both A and B groups with 20 °C receiving temperature. Eggs from group A were immediately shifted to single stage incubator after receiving and kept inside incubator for next 10 hours at 20 °C and 10% ventilation. While for

group B eggs were kept in eggs room at 20 °C and 65% humidity with 2fcm/1000 eggs ventilation for 10 hours. After 10 hours in eggs storage the eggs from group B were shifted to the incubator. Both the groups had been pre-heated at 27 °C for 5 hours inside incubators. After completion of the pre-warming the setter started automatically the incubation stage profile (recommended by Chicks Master USA). Incubation duration for young, prime and old was 456 hours in setter (19th day) and 50 hours in hatchers.

Setter hall and hatcher hall

Environmental conditions in setter hall were at $27C^0$ temperatures and 40% relative humidity; whereas in the hatcher hall temperature was at $27C^0$ and relative humidity had been increased up to 60%. The positive pressure in setter and hatcher hall was 15 Pascal and 10 Pascal respectively, while negative pressure inside the setter and hatcher plenum was -25 Pascal during the course study (Chick Master USA)

Candling

Fertility of eggs was performed through candling then they were shifted to the hatchers for next 50 hrs. This entire incubation stage program has been recommended by chick master USA.

Egg's weight loss

Before being transferred from setter to hatchers water loss or egg weight loss was measured for from each group individually after 456hrs of incubation in setters by the given formula:

$$\text{Water Loss \%: } \frac{\text{Full tray weight at setting- full tray weight at transfer}\times 100}{\text{Full tray weight at setting- empty tray weight}}$$

Chick yield

After hatch pull out immediately, the chick's weight was measured through electrical weight balance to know the chick yield using following formula:

$$\text{Chick Yield \%: } \frac{\text{Weight of chick's} \times 100}{\text{Egg weight}}$$

Hatch window

The hatch window is the duration between the 1st chicks to the last chick's hatching out (Noiva et al., 2014). The range of hatch window is 22-24 hours for group A and it was 26-28 hours for group B.

Chick grading

The chicks pulling were performed by chick shell separator provided by (KUHL USA). Grading of chicks was performed on a conveyer and an automatic grading table while chicks counting and packing was performed through chick counter (KUHL-USA). Only stranded (shining eyes, soft legs and nose, healed naval and healthy chicks) were shifted to the chick's box after counting, while under weight, weak, and unhealed naval chicks were removed according to the international standard as described by Yousaf et al. (2017).

Hatch out analysis

Hatch out analysis was performed to investigate the reason of embryo's mortality inside the eggs as described by Jabbar et al. (2017).

Statistical analyses

All data were analyzed by using Statistical Analysis System package software (SAS version 9.2, SAS Institute Inc., Cary, NC, USA). All means were compared using t-test and results were presented as mean ± SEM (standard error of mean). Results were considered significant if $P<0.05$.

RESULTS AND DISCUSSION

The eggs from group A shifted to single stage incubators before 10 hours to incubation. These kinds of incubators don't have humidity system e-g spray nozzles inside like multistage setters. The single stage incubator uses the eggs water loss as a humidity source for growing embryos. Water loss from eggs retains inside incubator becomes source of humidity for growing embryos throughout incubation. The appropriate humidity level inside the incubator avoids extra water loss from eggs and enhances survival of the embryo. This survival of embryo was significantly ($P<0.05$) better for group A as compare to group B (Table 1). The maximum hatchability difference was recorded for old age flocks of group A e-g SRA-AI-C, SP102-AI-A and SP103-AI-A and minimum for Prime flocks SP 108-1, IS-132 and IS-135 (Figure 1).

Both groups contain same number of eggs from every flock. The column in blue and red colors presents hatchability% of groups A and group B flocks minimum 75% and maximum 88%. The age of broiler breeder's flock significantly affects the water loss during incubation. The older breeder's eggs have more water from the egg as compared to young or prime flocks. This high quantity of waters helps them to minimize the deleterious effects of storage due to water loss (Stępińska et al., 2017). The eggs of young or prime age breeder's flock were more affected by storage due to less proportion of water as compared to older breeder's eggs. The percentage of water loss remains same for the all kind of breeder's eggs during incubation, but quantity of water loss was different due to different

proportion of water inside eggs. This water loss difference due to age became source of hatchability difference (Figure 1).

Candling

The pre-gastrula stage of embryo at ovi position is less able to withstand the stress of storage compared with embryos at the later, gastrula stage. There is higher embryo livability and hatchability, and shorter incubation when hypoblast stage is achieved before long storage periods (Silva et al., 2008). So, if embryo mortality occurs at pre-gastrula stage/hypoblast stage, the embryo detection through candling not possible and fertile egg will be counted as clear/candling egg. The high hatchability of group A flock was due to significantly (P<0.05) low candling (Table 1 and Figure 2).

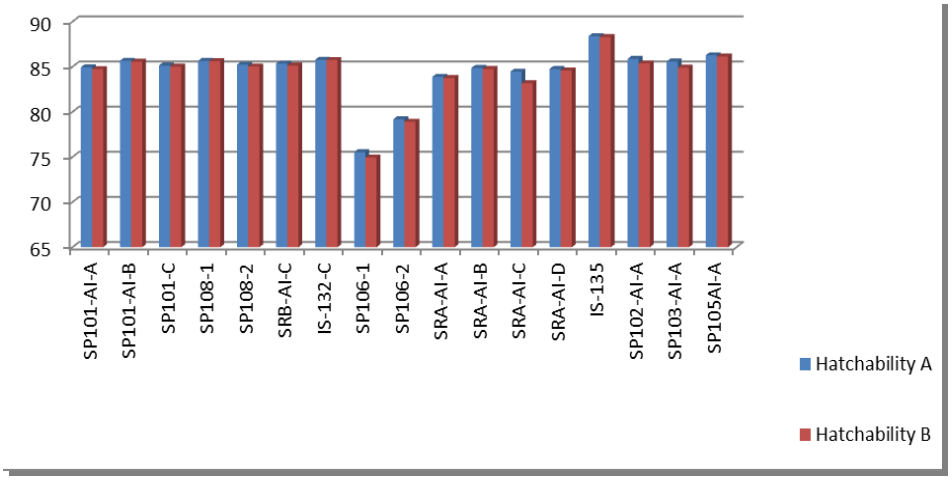

Figure 1. Effect of early setting inside single stage incubator on hatchability at Salman hatchery Chakri Rawalpindi Pakistan during April 2017. The column in blue and red colors presents candling % of groups A and group B flocks respectively from 4.5 to 13.9%. Both groups contain same number of eggs from every flock.

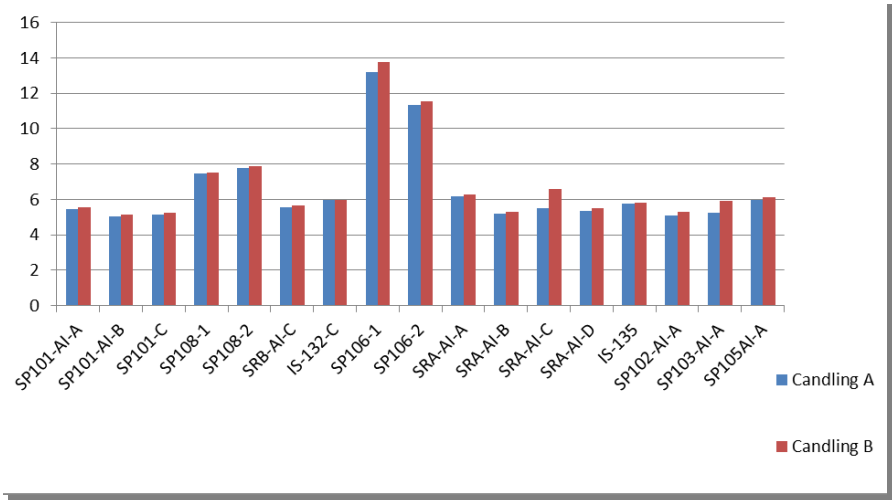

Figure 2. Effect of early setting inside single stage incubator on candling at Salman hatchery Chakri Rawalpindi Pakistan during April 2017

Water loss and chick yield

Water loss and chick yield were insignificant (P<0.05). The percentage of water loss was the same for both groups due to similar incubation conditions inside incubators that's why the chick yield was also same for both groups (Table 1). Flocks from group B show an increasing trend of water loss as compared to group A (Figure 3). The water loss from group A was retained inside incubator and when subjected to incubation temperature show less water loss as compare to group B. Water loss and chick yield are related to each other. If egg weight loss up to pipping has been correct, but the chick yield is lower than 66 % of the fresh egg weight, then incubation duration is too long. It needs to be adjusted by setting eggs later or by pulling chicks earlier. Every one per cent loss in chick yield is equivalent to about three hours extra in the hatcher (Tullett et al., 2010).

Dead in shell and hatch Window

Embryo development starts in the oviduct of the hen. After ovi-position, the embryo development becomes latent until the egg has been placed in optimal conditions for incubation. Due to excess water loss during storage, the optimum humidity requirement inside eggs for growing embryo can't be fulfilled by incubators. The hatching chicks become dry and chicks die in the egg shell during hatching process figure 4 (Bergoug et al., 2013). Moreover the hatching process from first to last chick hatches out (hatch window) becomes too long (Egbeyale et al., 2013). The dead in shell and hatch window of A and B were significantly ($P<0.05$) different for all flocks (Table 1).

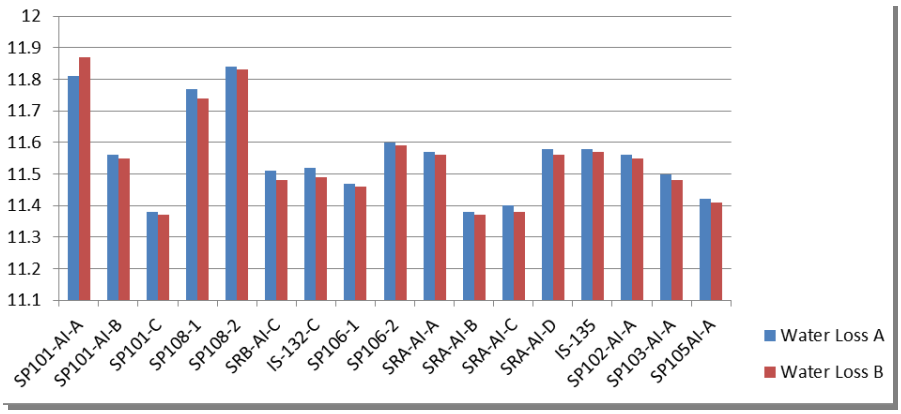

Figure 3. Effect of early setting inside single stage incubator on water loss at Salman hatchery Chakri Rawalpindi Pakistan during April 2017. The column in blue and red colors presents water loss % of groups A and group B flocks respectively from 11.35 to 11.85%. Both groups contain same number of eggs from every flock.

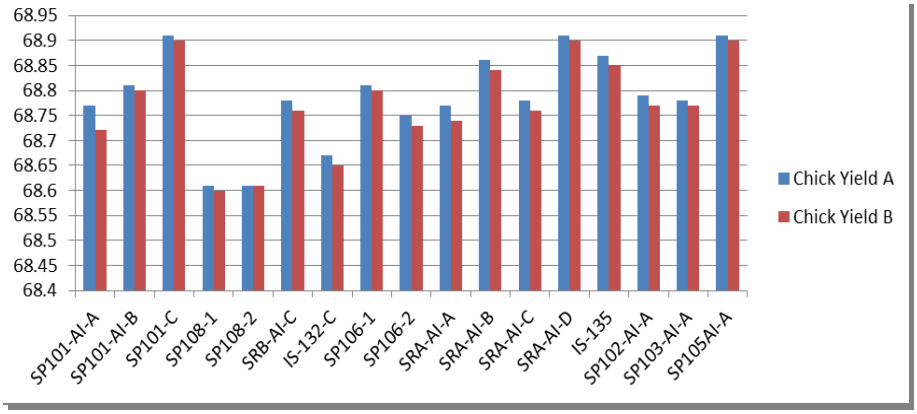

Figure 4. Effect of early setting inside single stage incubator on chick yield at Salman hatchery Chakri Rawalpindi Pakistan during April 2017. The column in blue and red colors presents chick yield% of groups A and group B flocks respectively from 68.6 to 68.95%. Both groups contain same number of eggs from every flock.

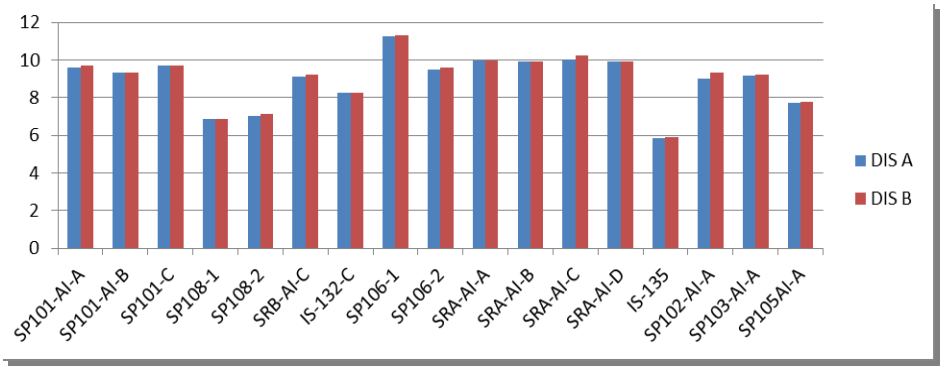

Figure 5. Effect of early setting inside Single Stage Incubator on dead in shell at Salman hatchery Chakri Rawalpindi Pakistan during April 2017**.** The column in blue and red colors presents dead in shell% of groups A and group B flocks respectively from 5.94 % to 11.8%. Both groups contain same number of eggs from every flock.

Table 1. The effect of early setting inside single stage incubator on hatchability, candling, water loss, chick yield, dead in shell, chick waste and hatch window at Salman Hatchery Chakri Rawalpindi, Pakistan (April, 2017)

Parameters	Group A	Group B
Hatchability	84.502±2.9221[a]	84.217±3.0279[b]
Candling	6.5418±0.5605[a]	6.7682±0.5705[b]
Water loss	11.556±0.1399[a]	11.545±0.1486[a]
Chick yield	68.835±0.0926[a]	68.818±0.0928[a]
Dead in shell	6.5418±2.3112[a]	6.7682±2.3702[b]
Chick waste	19.67±1.7213[a]	19.69±1.7653[a]
Hatch window	22-24±0.142[a]	26-28±0.1324[b]

[a-b] denote difference between parameters of group A and group B ($P < 0.05$)

CONCLUSION

Setting of stored eggs inside single stage incubator avoids further water loss from fertile eggs. The water loss from stored eggs retained inside incubator becomes a source of humidity for the growing embryos/single stage incubators cab be used to store eggs for short time by providing ideal condition for storage and may enhance hatchability by improving hatch window and avoiding candling and dead in shell.

DECLARATIONS

Author's contribution

All authors have equally contribution in this work.

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Competing of interest

The authors declare that they have no conflict of interest with respect to the research, authorship, and/or publications of this article.

REFERENCES

Tercic D and Pestotnik M (2016). Effect of flock age, Pre storage heating of egg, Egg position during srorage GG and storage duration on hatchability parameters in layer parent stock. Acta argiculturae Slovenica Supplement, 5: 138–142. http://aas.bf.uni-lj.si/zootehnika/supl/5-2016/PDF/5-2016-138-142.

Akeem A, Ekunseitan DA and Sogunle O (2013). Effect of different pre-incubation storage periods of hatching broiler chicken eggs on embryonic development Research Gate1184-1186. https://www.researchgate.net/publication/259082136

Khan MJA, Khan SH, Bukhsh A, Muhammad IM Abbass and Javed M (2017). Effect of Different Storage Period on Egg Weight, Internal Egg Quality and Hatchability Characteristics of Fayumi Eggs. Italian Journal of Animal Science, 12:2, e51, volume 12:e51 323-328 DOI:10.4081/ijas.2013.e51 DOI: http://dx.doi.org/10.4081/ijas.2013.e51

Lima JCS de, Silva PL, Coelho LR, Borges MS, Freitas AG de and Fonseca BB (2012). Effects of the Reduction or Withdrawal of the Vitamin Premix from the Diet on Chicken Performance and Meat Quality. Brazilian Journal of Poultry Science 14(4): 233-304.

Jabbar A and Yousaf A (2017). Effect of age wise incubation programme on broiler breeder hatchability and post hatch performance. Online Journal of Animal and Feed Research, 7(1): 13-17

Khan MJA, Khan SH, Buksh A and Amin M (2014). VETERINARSKI ARHIV, 84 (3): 291-303.

Jabbar A and Ditta YA (2017). Effect of Broiler Breeders Age on Hatchability, Candling, Water Loss, Chick Yield and Dead in Shell. World's Veterinary Journal, 7(2): 40-46. DOI: http://dx.doi.org/10.5455/wvj.20170493

Bergoug H, Burel C, Guinebretiere M and Tong Q (2013). Effect of pre-incubation and incubation conditions on hatchability, hatch time and hatch window, and effect of post-hatch handling on chick quality at placement. World's Poultry Science Journal, DOI: 10.1017/S0043933913000329

Khan A, Rind R, Shoaib M, Kamboh AA, Mughal GA, Lakho SA, Malhi KK, Nizamani AR and

Yousaf A (2016). Isolation, identification and antibiogram of Escherichia coli from table eggs. Journal of animal health and production, 4(1): 1-5. DOI: http://dx.doi.org/10.14737/journal.jahp/2016/4.1.1.5

Noiva Rute M, Menezes António C and Peleteiro Maria C (2014). Influence of temperature and humidity manipulation on chicken embryonic development. BMC Veterinary Research, 10:234. DOI:10.1371/journal.pone.0103040

Yousaf A, Jabbar A and Ditta YA (2017). Effect of pre-warming on broiler breeder eggs hatchability and post-hatch performance. Journal of Animal Health and Production,

5(1): 1-4. DOI: http://dx.doi.org/10.14737/journal.jahp/2017/5.1.1.4

Stępińska M, Mróz E, Krawczyk M, Otowski K and Górska (2017). A Ann. Anim. Sci., Vol. 17, No. 2 447–462 DOI: 10.1515/aoas-2016-0057

Silva FHA, Faria DE, Torres KAAF, aria Filho DEC, oelho AAD, Savino VJM (2008). Revista Brasileira de Ciência Avícola, 10(1). DOI: http://dx.doi.org/10.1590/S1516-635X2008000100003

Tullett S (2010). Investigating Hatchery Practice-Monitoring Egg and Chick Weights. The Poultry Site Aviagen. http://www.thepoultrysite.com/articles/1606/investigating-hatchery-practice-monitoring-egg-and-chick-weights/

Bergoug H, Burel C, Exadaktylos and Bahr C (2013). Effect of pre-incubation and incubation conditions on hatchability, hatch time and hatch window, and effect of post-hatch. World's Poultry Science Journal · DOI: 10.1017/S0043933913000329

Egbeyale LT, Bosa MK, Sogunle OM and Adeleye OO (2013). Effect of Pre-Incubation Storage Periods on Weight Loss, Embryonic Development, and Hatchability of Pullet Eggs. http://www.akamaiuniversity.us/PJST.html