The Eurasia Proceedings of Science, Technology, Engineering & Mathematics (EPSTEM)
ISSN: 2602-3199

The Eurasia Proceedings of Science, Technology, Engineering & Mathematics (EPSTEM), 2019

Volume 6, Pages 52-62

ICRES 2019: International Conference on Research in Education and Science

# Determination of the Effect of Age of Broiler Breeders on General Performance, Egg Interior-Exterior Quality and Some Incubation Features

**Hakan YILDIRIM**
Mustafa Kemal University

**Zekeriye AKCIMEN**
Mustafa Kemal University

**Abstract**: In this study, the effect of age on the performance of broiler breeders, egg interior-exterior quality and hatching characteristics were determined. The study was conducted on a total of 6900 broiler on Ross 308 genotype. In addition to this, the rate of male-females was 1/10, and 690 cocks were used. Broilers were divided into 3 treatment groups (23-34, 35-49, 50-61 weeks). Under each age treatment 4 replicates and 575 birds with similar live weights were coincidentally placed. The study continued for a total of 39 weeks, starting at 23 weeks of age and up to 61 weeks of age. During the experiment, 1170 eggs were collected on the same day each week for the purpose of determining 30 egg internal-external quality characteristics. In the study, the effect of age on egg yield, feed consumption, feed convertion ratio, live weight, egg weight, shell thickness, shell weight, shape index, yolk index, white index, Haugh unit, fertilization rate, infertil egg ratio, hatchability of fertil egg, embryo deaths, hatching efficiency, number of double yolked egg, number of thin shelled egg, number of non-hatching egg was significant (P <0.05), while the effect on shell breaking resistance and number of dirty eggs was not significant (P> 0.05). According to the findings of the study, age was found to be an effective factor on performance, egg quality and hatching characteristics.

**Keywords:** Broiler, Parent stock, Performance, Hatchability, Egg quality

## Introduction

In broiler breeder rearing, due to the developments in genotype, rearing systems, nutrition and health, annual egg production per animal has reached to 183 units. Approximately 176 of this amount of hatching eggs can be used as hatching (Anonymous, 2019). This figure shows that 96% of breeding eggs produced can be evaluated as hatching. The increase in egg production makes the importance of egg quality more pronounced.

Therefore, genotype, flock age, cultivation system, feeding, health, storage, transportation and operation technology affecting egg quality should be planned well (Türkoğlu and Sarıca, 2009).

In breeding poultry farming, genetic and environmental factors (maintenance feed, in-house environmental conditions, instrument equipment, etc.) and technological developments are the main factors in increasing egg production. With the increase in the number of breeding eggs, increasing the quality of the eggs is the main target. This situation requires more studies on increasing egg quality. There are many factors affecting egg quality before and after ovulation. An egg that has been spawned has the highest quality.

The main aim in poultry farming is to increase the egg yield and to create a marketing system for the delivery of high quality eggs to the hatchery. (Abdallah et al., 1993; Elibol et al., 2000; Atasoy et al., 2001; Simsek et al., 2009).

In the poultry sector, the entire grand parent stock (large parental) chick needs are met from abroad through imports. Parent stock chicks and breeding hatching eggs are also supplied from abroad and some of them are produced in our country.


- Selection and peer-review under responsibility of the Organizing Committee of the Conference

In parental flocks, important issues such as egg quality monitoring and nutritional problems, some diseases, fertility problems, in-house care feeding conditions and incubation results can be controlled (Staldeman and Owen, 1996; Coleman, 1999). As a result, it is possible to determine the current problems in the flock and to take measures in the early period.

Obtaining quality chicks from parents depends on the production of high quality eggs. The production of high quality hatching eggs is a condition related to correct application of breeding rules as well as the genotypes of parents. Although the conditions of good breeding are provided, the egg weight increases with the increase in the age of the breeder but this increase is not realized in the amount of egg shell. As a result, one of the reasons for the deterioration of egg quality characteristics is the progression of age (Wilson, 1991).

Physical structure changes in breeders due to advancing age is one of the reasons of negative changes in internal and external quality of eggs. It is a fact that the negative changes in egg quality characteristics will negatively affect the incubation results. Therefore, it is inevitable that undesirable results will also arise on the quality of chicks (Söğüt and Sarı, 2009; Nacar and Uluocak, 1995). Most importantly, the hatchability of incubation is affected negatively. In addition to providing suitable incubation conditions to ensure a successful chick output, eggs must have the desired quality characteristics.

For the quality of chicks to be used in broiler breeding breeding, hatching criteria (temperature, humidity, conversion etc.) are not enough to be applied alone; however genotype, age, live weight, egg external quality characteristics (egg weight, shell quality, thickness, color, shape index etc.) and internal quality characteristics (Haugh unit, white and yellow index) are also known to be based on factors such as (Elibol et al., 2000; Nacar and Uluocak, 1995; Simsek et al., 2009; Wilson, 1991 ).

Decrease in the performance values of the female parents and decrease in the internal and external quality of the eggs can occur. As the hens age, the decrease in egg yield and increase in live weight is an expected result.

Although the results of the studies on feed consumption and feed conversion ratio vary, it is known that the.
There is a direct relationship between hen age and egg weight. Egg weight increases with age. The accepted opinion is that hatching is better in medium-weight eggs (Wilson, 1991; Narushin and Ramanov, 2002; Seker et al., 2004). There is a linear relationship between egg weight and incubation.

It has been reported that the hatchability of fertil agg obtained from eggs between 46-50 g and 66-74 g is 8-10.5% lower than those between 50-66 g. The 10 g increase in egg weight reduces the hatching yield by 10.7%, while the decrease in egg weight by 10 g causes a decrease of 3.9%. A similar relationship was reported in Japanese quail eggs (Narushin and Ramanov, 2002).

The proportion of abnormally shaped eggs increases in aging chickens. For a successful incubation, the shape index should be between 72-76% in the eggs. The hatching of normal shaped eggs was reported as 87.2%, 48.9% in defective eggs, 68.1% in eggs with defect in air space and 70.25% in cleaned eggs (Kamanlı et al., 2010; Elibol, 2009; Narushin and Ramanov, 2002).

Witt and Schwalbach (2004) investigated the effect of hatching egg weight on hatching results of hens in different genotypes. The results showed that the hatchability and the daily chick weight increased with the increase of the weight of the hatching eggs of the New Hampshire and Rhode Island Red breed.

In their study, Zglobica and Wezyk (1995) reported that eggs with normal shape in Isa Brown genotypes have higher output power than eggs without normal shape. However, they reported very low hatching from very round eggs.

Sarıca et al. (2010) compared the egg characteristics of native genotypes developed by the use of foreign lines (white laying lines and brown laying lines). As a result of the evaluations of the foreign white genotype eggs up to the age of 76 weeks, it was reported that the eggs were better in terms of internal and external quality characteristics compared to domestic hybrids.

In this study, The effects of different age groups on performance of broiler breeders, eggs internal-external quality and some incubation characteristics were investigated.

## Method

This research was carried out in broiler houses belonging to a poultry company in Hatay province. Trial animals were obtained from breeding flock of Ross 308 chicks of daily age. The study was carried out at the age of 23 weeks with a total of 6900 hens; however, 690 cocks were used.

Male and female animals were reared in different houses and were placed according to 1/10 cock-hens ratio at the age of maturity. The pellet feed used in the research was obtained from the factory which is in its own integration.

Table 1. shows the nutrient content and time of use of feeds.

Table 1. Energy and crude protein values of commercial feeds used in the experiment

| Feed material | Age (week) | Energy (Kcal/Kg-ME) | Crude Protein (%) |
|---|---|---|---|
| Chick starter feed | 0-3 | 2750 | 20 |
| Chick growing feed | 4-6 | 2750 | 18 |
| Chicken development feed | 7-23 | 2650 | 14 |
| Layer feed | 24 | 2720 | 15 |
| Rooster feed | 24 and after | 2600 | 12 |

The study was carried out in open poultry houses with 15m × 32m × 3m (width, height, height), floor area 480 m², curtain, natural ventilation and deep litter. Since the placement of the trial set is located in the east-west direction, more suitable ventilation is provided.

In the research, channeled chain feeders were used. Feeding was carried out in the first 2 weeks on the ground, from the third week on the chain feeders and from the 5th week on the fully automatic channel chain feeders. Ducted chain feeders were placed and used as two rows of 64 m per house.

In this study, the water type bowls with 0.6 cm/hen water area were used. In the first week the chicks were given water in the floor type water bowls, and from the second week on, bell-type waterers were used. The water level in the drinking water was kept 0.5 cm high. It was then gradually increased to approximately 1.25 cm at the end of the first week. In order to reduce the contamination, the line height in the drinkers was increased regularly according to the growth rate of the chickens.

In the study, metal nests were preferred for easy cleaning and avoiding the damage of the parasites. 10 cm thick sawdust with moisture absorption feature is used as abutment material. The nests were placed side by side and two floors. The top of the pads is inclined. This prevents the roosting and circulation of chickens. The nesting-box has a width of 30 cm, a depth of 35 cm and a height of 35 cm. A nest box was used for each 4 chickens. The eggs were collected 6 times manually from the nests.

In the research, it was used in artificial lighting in addition to daylight. 60 watt yellow light emitting bulbs were used in lighting. The bulb range is set to reduce 4 watts of light per square meter. In total, 24 ampoules were used in three rows of 3 m transverse and longitudinal. Natural lighting was applied during the growing period. In addition to daylight until the 23$^{rd}$ week, 2 hours, 14 hours of total illumination was applied. When egg yield reached 10%, 15 hours lighting was performed. In the peak egg yield, the lighting was increased by 1 hour and the lighting was applied as 16 hours.

Since broiler breeder hens are kept in the same coop for a long time, the selection of litter is very important. In order to provide thermal insulation, a mixture of 10-15 cm thick, 60% wood shavings and 40% paddy was laid on the poultry house.

Egg measurements were performed with a digital caliper with a sensitivity of ± 0.01 mm.
The incubators belonging to the farm were used. The incubator has a capacity of 56,700 eggs, with a height of 3.5 m and a height of 4.3 m, with a height of 2.35 m. The hatching section has a capacity of 19.200 eggs with a width of 2.1 m and a height of 3.5 m with a height of 2.35 m.

The experiment was conducted on a total of 6900 broiler breeder hens. In addition, male female ratio was calculated as 1/10 and 690 cocks were used in total. The trial was based on 3 age factors (23-34, 35-49, 50-61 weeks). Each factor was created 4 replicates. In each repetition, 575 chickens with similar live weight were randomly placed.

The experimental design is shown in Table 2.

Table 2. Experimental plan

| Treatment groups | Groups (week) | N | Replicate |
|---|---|---|---|
| 1 | 23-34 | 575 | 4 |
| 2 | 35-49 | 575 | 4 |
| 3 | 50-61 | 575 | 4 |

The study started when animals were 23 weeks old and continued for a total of 39 weeks until 61 weeks of age. During the trial, 390 eggs of each age group and 1170 eggs in total were collected and their internal and external quality characteristics were determined. However, the same amount of eggs were collected and incubated to determine the incubation characteristics.

Performance characteristics (live weight, egg yield, feed consumption, feed efficiency ratio) of the breeder hens were determined, and the external quality characteristics of the eggs obtained from each laying period (egg weight, shell weight, shell thickness, shell fracture resistance, shape index) in laboratory environment It has been identified.

At the same time, internal quality characteristics (index index, yellow index, Haugh unit) were determined.Eggs were collected by hand 6 times a day. Collected eggs are divided into hatching and non-hatching eggs. Non-hatching eggs are classified as abnormal, dirty, broken and double yolked eggs. Abnormal egg expression refers to the eggs which are deformed, and the dirty eggs are eggs that are contaminated with faeces.

The total number of eggs obtained from the experimental groups daily is divided into the number of chickens. The result is multiplied by 100 and the egg yield is determined as a percentage. Abnormal eggs, dirty eggs, broken eggs and double yolked eggs divided by the total number of eggs and multiplied by 100, the rates of non-hatching eggs were determined separately. The results obtained daily were recorded during the study.

Daily feeding was performed during the trial. The chickens used in the experiment were fed the same time each day. Feed consumption was determined on a daily basis and evaluated weekly. The feed conversion rate was calculated according to the following formula.

Feed convertion ratio: Feed consumption (g) / Egg weight (g) x Egg yield (%)

The chickens were randomly selected from each treatment group by starting from the 23$^{rd}$ week and weighed 16 times once every 14 days. The weighing was carried out with a precision 6 hours after feeding.

In the trial, egg weights were determined by weighing 30 eggs every week from 23$^{rd}$ weeks to 61$^{st}$ weeks according to age groups. ± 0.01 grams sensitive electronic scales were used in the weighing of eggs.

In order to determine the weight of the shell, the shells of the weighed eggs were stored in a drying cabinet at 70 °C for 24 hours after breaking. It is then weighed on a precision scale of ± 0.01 g.

The thickness of the shell was measured with a 0.01 mm sensitive digital caliper. The shell thickness was measured by taking 3 samples from both ends and equatorial regions of the egg. Then the shell thickness was determined by taking the average.

5% egg samples were taken from the treatment groups each month, and after standing at room temperature for 24 hours, the fracture resistance was measured by measuring instrument (kg/cm$^2$). For the measurement of this parameter, Çukurova University Laboratory of Animal Science was used.

The width and length of the eggs were measured by digital calipers and the shape index was calculated with the help of the following formula.

Shape Index = Egg Width (mm) / Egg Length (mm) x 100

The eggs were broken and their white height, white length and white width were measured by digital compass. white index calculated by the following formula.

White Index = Albumin height (mm) / [White length (mm) + white width (mm)] / 2 x 100

Yolk height, yolk width and length are measured with digital caliper in broken eggs. The yolk index was also calculated by the following formula:

Yolk Index = Yolk height (mm) / Yolk diameter (mm) x 100 (Efil and Sarica, 1997).
The Haugh unit was calculated using the following formula (Stadelman, 1986).
HB = 100 log (h + 7.57-1.7 G0.37)
HB = Haugh unit
h = white height (mm)
G = Egg weight

Incubation characteristics were calculated by the following formulas.
Hatchability = (Number of chick / Number of eggs placed in machine) × 100
Hatching rate = (Number of hatches / Number of fertil eggs placed on machine) × 100
Fertility rate = (Number of eggs with fertilization / Number of eggs placed on machine) × 100
Embryo Deaths = (Number of embryonic deaths / Number of eggs placed in machine) × 100

The experiment was designed according to the trial plan of coincidence plots. The data were analyzed by using SPSS-21 package program according to variance analysis method (Kinnear and Gray, 1994). Duncan multiple comparison test was used to compare the averages of experiment groups (Bek and Efe, 1999). The mathematical model of the experiment is as follows.

$Yij = \mu + ai + eij$
Yij = i. ovulation period, j. observation value (internal-external quality characteristics and incubation characteristics)
$\mu$ = Population average,
ai = The effect of ovulation period (1st, 2nd, 3rd period),
eij = chance-dependent error

## Results and Discussion

In this study, age of sexual maturity, egg production, feed consumption, feed conversion rate and live weight characteristics were investigated.

One of the important factors affecting performance and egg quality criteria in chickens is the age factor. Groups started to spawn at 23$^{rd}$ week and continued until 61st week. The peak yield was reached at the age of 30 weeks and it's yield was 89%. Egg yield continued over 80% for 15 weeks, but as the age progressed, egg yield decreased. As the parent stocks get older, the egg quality decreases as well as the egg quality (Roberts and Nolan, 1997). The egg yields obtained from these groups during ovulation period are given in Table 3. Significant differences were found between the ages of the groups and the egg yields ($P < 0.05$).

During the ovulation period, it was started with a daily feed rate of 110 g/hen, the feed rate was increased as the egg production increased and the feed was given as 158 g/hen in the peak yield. In the same way, the amount of feed was reduced as the egg yield decreased at later ages and feed was given as 145 g/chicken at the age of 61 weeks. The average daily feed consumption was calculated as 1825.42 kg/house in the first period (23-34 weeks), 1926.78 kg/house in the medium term (35-49 weeks) and the average 2060.92 kg/house in the last period (50-61).

The average daily feed intake and feed conversion rates of the groups from the beginning of ovulation to the age of 61 weeks are given in Table 3.

Table 3. Average egg production, egg weight, feed consumption and feed conversion ratio according to age groups

| Groups (week) | N | Egg yield (%) | Egg weight (g) | Feed consumption (g/hen) | Feed conversion rates |
|---|---|---|---|---|---|
| 23-34 | 2300 | 65.87±0.06 $^{a}$ | 52.13±0.40$^{a}$ | 148.98±1.02$^{a}$ | 4.34±0.044$^{a}$ |
| 35-49 | 2300 | 80.35±0.04 $^{b}$ | 62.18±0.62$^{b}$ | 157.29±1.13$^{b}$ | 3.15±0,017$^{b}$ |
| 50-61 | 2300 | 71.01±0.01 $^{a}$ | 69.59±0.36$^{c}$ | 168.24±1.25$^{c}$ | 3.41±0.028$^{c}$ |

*: There is statistical variability between figures shown in different letters in the same column (P<0.05)

When the weekly feed consumption values of the table were analyzed, it was seen that there was a significant difference between the average feed consumption and feed conversion rates between the age groups (P <0.05). As the age of the chickens progressed, an increase was observed in live weight, while the consumption of feed increased due to the need for living. On the other hand, the feed conversion rate has deteriorated.

The weighing of the hens was carried out every 14 days by taking 3% of each treatment group. Accordingly, a total of 69 animals were used in each weighing from each treatment group. According to this, live weight values were calculated as 3394.24 g in the 1$^{st}$ age group (23-34 weeks), 3734.50 g in the 2$^{nd}$ age group (35-49 weeks) and 3981.93 g in the 3$^{rd}$ age group (50-61 weeks). There was a significant difference between the age groups in terms of live weight values (P <0.05).

A linear relationship between live weight and age. There was also an increase in live weight as the age increased. The chickens used in the study started to ovulation with an average of 2883 g. At the age of 61 weeks in which ovulation ended, the chickens weighed 4274 g.

In our study, egg weight, shape index and shell properties were examined as external characteristics of eggs. Characteristics such as white index, yolk index and Haugh unit were also investigated under the title of egg internal quality.

The mean data on egg weight are shown in Table 3. according to age groups. The lowest value of egg weight was determined as 52.13 g in the first age group (23-34 weeks) and the highest value was 69.59 g in the 3$^{rd}$ age group (50-61 weeks). As seen, a statistically significant difference was found between age groups in terms of egg weight (P <0.05). This result Van Den Brand et al., 2004; Petek et al., 2009's has been consistent with the study.

The findings related to the shape index are shown in Table 4. When we examine the table, we see that the difference between the groups is statistically significant (P <0.05). The highest value in terms of shape index was found to be 75.71 in the 3$^{rd}$ age group.

Zita et al. (2009), 3 different age period taking into account their studies on egg quality, egg weight and shape index were reported to be statistically significant (P <0.05). However, Sekeroglu et al. (2014), in the study of the effects of different age stages on the quality of eggs in egg chickens, the effect of age on the shape index was found to be insignificant. According to these statements, we can say that there is not exactly a linear relationship between age and shape index.

Table 4.. Egg shape index depending on age

| Groups (week) | N | Shape index |
|---|---|---|
| 23-34 | 390 | 75.55±0.45$^{a}$ |
| 35-49 | 390 | 72.08±2.16$^{b}$ |
| 50-61 | 390 | 75.71±0.29$^{a}$ |

*: There is statistical variability between figures shown in different letters in the same column (P<0.05)

The egg shell thickness, shell weight and shell fracture resistance averages of age groups are shown in Table 5. While the mean values between shell thickness and shell weight were found to be statistically significant (P <0.05), the difference between the mean values of the shell fracture resistance was insignificant (P>0.05).

Table 5. Age-dependent egg shell thickness, egg shell weight and shell breaking resistance

| Groups (week) | N | Egg shell thickness (mm) | Egg shell weight (g) | Break resistance ($kg/cm^2$) |
|---|---|---|---|---|
| 23-34 | 390 | 0.39±0.005[a] | 4.96±0.75[a] | 2.68±0.121[a] |
| 35-49 | 390 | 0.28±0.005[b] | 5.89±0.74[b] | 2.75±0.131[a] |
| 50-61 | 390 | 0.35±0.005[c] | 6.08±0.50[c] | 2.64±0.122[a] |

*: There is statistical variability between figures shown in different letters in the same column (P<0.05)

In our study, a linear relationship between age and shell weight was found. As the age increased, the shell weight increased. In general, this is an expected situation and the increase in egg size also increases in the shell. In other words, there is a positive correlation between egg weight and shell weight (Poyraz, 1989).

The thickness of the shell decreases depending on the age. Although the increase in egg weight is seen to be directly proportional to the increase in the amount of the shell, this is due to the fact that the increase in the amount of shell is not sufficient to maintain the egg shell thickness. Therefore, due to the increase in egg weight in old hens, the crust becomes thinner and weaker (Yannakopoulos and Tserveni-Gousi, 1986; Narayanankutty et al., 1989; Nagarajan et al., 1991). The herd age affects the white, yolk and shell ratios as well as the egg weight. While the rate of yolk increases in the eggs of old herds, the white ratio and shell rate decrease (Flethcher et al., 1983).

The egg shell quality deteriorates as the hen ages. It was observed that the ability to synthesize crust decreased with increasing age and the shells were thinner and weaker towards the end of the ovulation period (Flethcher et al. 1983; Akbaş et al. 1996).

Nagarajan et al. (1991) and Basmacıoğlu (1999) reported that egg shell thickness decreased with age. Izat et al. (1985) stated that the thickness of the crust decreased with increasing age, but this decrease was not statistically significant.

In this study, as the age of the flocks progressed, the shell thickness was reduced, the shell fracture resistance decreased and significant negative correlations were found among these examined properties. The same relationship was also found between the egg weight-shell thickness-fracture resistance.

In addition, some research results showed a positive correlation between egg weight and shell thickness and weight (Poyraz 1989; Narayana et al. 1991; Işcan and Akcan 1995; Özçelik 2002).

According to the research, yolk index, white index and Haugh unit are given in Table 6.

Table 6. Yellow index, white index and haugh unit averages depending on age groups

| Groups (week) | N | Yolk index | White index | Haugh unit |
|---|---|---|---|---|
| 23-34 | 390 | 52.72±0.34[a] | 13.32±0.30[a] | 91.37±0.73[a] |
| 35-49 | 390 | 47.44±0.43[b] | 9.23±0.29[b] | 80.89±0.97[b] |
| 50-61 | 390 | 51.12±0.29[c] | 9.94±0.22[b] | 82.60±0.74[b] |

*: There is statistical variability between figures shown in different letters in the same column (P<0.05)

The difference between yolk index values was found to be statistically significant among age groups (P<0.05). Besides, the difference between age groups in terms of white index values was found to be statistically significant (P<0.05).

On the other hand, the white index values in the 2nd and 3rd groups were 9.23 and 9.94, respectively. Haugh unit averages decreased with age and it was found to be 91.37, 80.89 and 82.60 in the 1st, 2nd and 3rd age groups, respectively.

Petek et al. (2009) found that the effect of the hosting system and animal age on the Haugh unit was significant (P<0.01). However, their effect on white index and yolk index was statistically insignificant (P>0.01). Studies using foreign and domestic genotypes were similar in age-related changes. On the other hand, differences in white index, yolk index, Haugh unit and yolk color were found to be significant (P<0.01) (Sarıca et al., 2010).

The fertility, hatchability of fertil agg, embryo death, infertil egg rate and hatchability in different age groups are shown in Table 7. The effect of age on the fertility, embryo deaths, fertilization rate and hatchability were found to be statistically significant among the groups (P <0.05).

Table 7. According to age groups, fertility, hatchability of fertil egg, embryo mortality, infertil egg ratio and hatchability averages

| Groups (week) | N | Fertility (%) | Hatchability of fertil egg (%) | Embryo mortality (%) | Infertil egg (%) | Hatchability (%) |
|---|---|---|---|---|---|---|
| 23-34 | 390 | 86.88±1.53[a*] | 88.16±0.015[a] | 11.84±1.05[a] | 13.12±1.53[a] | 75.04±2.46[a] |
| 35-49 | 390 | 92.08±0.25[a] | 95.03±0.004[b] | 4.97±0.34[b] | 7.92±0.38[b] | 87.11±0.25[b] |
| 50-61 | 390 | 82.87±2.40[b] | 90.27±0.014[a] | 9.73±1.15[a] | 17.13±1.83[a] | 73.14±2.40[a] |

*: There is statistical variability between figures shown in different letters in the same column (P<0.05)

According to Table 7, it is seen that the statistical difference between groups is important in terms of fertility rate (P <0.05). The highest fertility rate was in the second age group. This can be explained by the peak yield period.There was also a statistical difference between the groups in the hatchability of fertil aggs (P <0.05). However, the highest value was found to be in the 2nd age group as 95.03.The highest values for embryo deaths and fertilization rates were 11.84% and 17.13% in 1st and 3rd age groups, respectively.The results of hatchery yield were found to be the highest in the second age group.

The age of the breeder flock is an important parameter to be considered in the management of incubation. There is a close relationship between the age of the breeder flock and the hatching and embryonic deaths (Elibol et al., 2000). Zglobica and Wezyk (1995) stated that with the increase in chicken age, there is a difference in hatching in fertil eggs. However, they found that the hatching decreased with the increase of age. At the same time there is a high positive relationship between age and egg weight (North and Bell 1990). As the egg weight increases, the hatching decreases (Altan et al. 1995; Narushin and Romanov 2002).

Table 8. shows the ratio of double yolked eggs, thin shelled eggs (cracked, broken), dirty eggs and abnormal eggs that can not be incubated in the eggs collected during the ovulation period. In the treatment groups, the differences between the double yolked eggs, the thin shelled eggs and the abnormal eggs were found to be statistically significant (P <0.05), the difference between the number of dirty eggs was insignificant (P >0.05).

Table 8. The rates of double yolked egg, broken eggs, abnormal eggs and dirty eggs between age groups

| Groups (week) | N | Double yolked egg ratio (%) | Broken egg ratio (%) | Abnormal egg ratio (%) | Dirty egg ratio (%) |
|---|---|---|---|---|---|
| 23-34 | 390 | 3.14±0.81[a*] | 0.76±0.02[a] | 1.29±0.18[a] | 1.11±0.39[a] |
| 35-49 | 390 | 0.44±0.07[b] | 0.67±0.04[a] | 1.09±0.16[a] | 0.81.±0.11[a] |
| 50-61 | 390 | 0.09±0.04[b] | 0.92±0.08[b] | 1.91±0.25[b] | 1.02±0.20[a] |

*: There is statistical variability between figures shown in different letters in the same column (P<0.05)

It was observed that the rate of double yolked egg decreased as the age progressed and it was determined as 3.14%, 0.44% and 0.09% in the 1st, 2nd and 3rd treatment groups, respectively.

Broken egg rates increased with advancing age and were found to be 0.76%, 0.67% and 0.92% in the 1st, 2nd and 3rd age groups, respectively. We can explain this situation as a result of thinning of the egg shell with the progression of the animal age and hence the deterioration of the egg shell quality.

The number of abnormal eggs increased with age. It is possible to explain the reason for this by age-related negative changes in animal physiology. For example, the genetic or environmental effects on the egg shell during egg formation may have a negative effect on the structure of the egg shell.

Although no statistically significant difference was found between the treatment groups at the rate of dirty eggs, a numerical decrease was recorded. This is due to the fact that, with the age, the number of laying on the ground is increased, but because of the hardness of the litter structure, the eggs are less polluted.

## Conclusion

The differences between age and performance characteristics were statistically significant (P <0.05). Egg yield was found to be highest as 80.35% in the second age group (35-49 weeks) and egg yield decreased with the progression of age. It was observed that egg peak yield reached 30 weeks. Egg production continued for more than 80% over 15 weeks (27-42 weeks). In this study, egg yield was obtained over Ross-308 yield averages. It was determined that egg yield would increase in better maintenance and feeding conditions.

Feed consumption increased as the age of the animal progressed. The highest feed consumption values were found in the 3rd age group (50-61 weeks). In this age group, it was found that a daily average of 168.24 g of feed was given per animal.

The feed conversion rate was found to be the highest in the $2^{nd}$ age group (35-49 weeks) with a feed rate of 3.15. As age progressed, an increase in live weight was observed due to increased feed consumption.

A double yolked egg is an undesirable condition in enterprises that produce breeding eggs. The number of double yolked eggs decreased with the progression of age, and in the last weeks of the experiment, no double yolked egg was encountered.

With the increase in age, the number of broken eggs increased due to the deterioration of the shell quality. The highest rate of broken eggs was found in the 3th age group (50-61 weeks) with a rate of 0.92%.

Similarly, the number of abnormal eggs increased with the progression of age and the highest rate of abnormal egg (1.91%) occurred in the $3^{rd}$ age group (50-61 weeks).

The difference between age and dirty egg ratio was not statistically significant ($P>0.05$). The change in the number of dirty eggs has been found to be related to the humidity of the material used in the nest base, not with age.

The changes in egg weight, shape index, shell thickness and shell weight parameters were found to be statistically significant with the progression of chicken age ($P <0.05$). The change in shell fracture resistance parameter was insignificant ($P>0.05$).

As the ages of breeder hens changed, the egg weight increased.Egg weights were found to be 52.13 g, 62.18 g and 69.59 g in the $1^{st}$, $2^{nd}$ and $3^{rd}$ age groups, respectively. If the shape index of the eggs is smaller than 72, it is called long and it is determined to be round if it is greater than 76. In our experiment, shape index changed with age and it was found to be between 72-76 in 3 age factor.

The thickness of the shell was the lowest in the $2^{nd}$ age group (35-49 weeks). This can be explained by the fact that the 2nd age group (35-49 weeks) has reached the peak period of egg production. The fracture resistance was 2.68 kg/cm$^2$, 2.75 kg/cm$^2$ and 2.64 kg/cm$^2$ in the $1^{st}$, $2^{nd}$ and $3^{rd}$ age periods, respectively.

## Recommendations

It is expected that performance values will decrease with increasing age. However, performance decreases can be slowed down by increasing the age by selecting the most suitable genotype for the environment and applying better maintenance and feeding conditions. Thus, the number of eggs obtained per animal can be increased.
With the increase in flock age, egg weight increased and egg shell quality deteriorated. In order to slow the increase in egg weight with increasing age, the feed content and feed programs of breeder chickens are very important.

With the balanced and regular feeding of breeding animals, the rate of increase in egg weight can be slowed down and more hatching eggs can be obtained by this slowdown. Since breeding flocks stay in the same house for a long time, the selection of litter should be done well in order to reduce the animal welfare as well as the pollution in the eggs.

The moisture content of the litter material used in the nesting-box can be adjusted well to reduce the number of dirty eggs, thus increasing the number of hatching eggs. In addition to flock care and management, more chicks can be obtained with the measures taken depending on the quality of the eggs and the enterprises can increase the income.

As a result, superior eggs with internal and external quality characteristics should be obtained to increase hatchability. Also the age of the breeder flock must be taken into account.

## Acknowledgements or Notes

This study was carried out from the MSc thesis titled EFFECTS OF AGE DETERMINATION OF BROILER BREEDERS ON GENERAL PERFORMANCE, INTERIOR-EXTERIOR QUALITY and SOME INCUBATION FEATURES by Sciences institute of Hatay Mustafa Kemal Üniversity.

We would like to thank "Beyza Piliç A.Ş." for providing and assistance the opportunity to this research.

## References

Abdallah. A. G.. Harms. R. H. ve Elhusseiny. O.. 1993. Performance of Hens Laying Eggs with Heavy or Light Shell Weight When Fed Diets with Different Calcium and Phosphorus Levels. *Poultry Science*. 72 (10). 1881-1891.

Akbaş, Y., Ö. Altan ve Ç. Koçak. 1995. Tavuk Yaşının Tavuk Yumurtasının İç Ve Dış Kalite Özellikleri Üzerine Etkileri. *Türk Veterinerlik Ve Hayvancılık Dergisi*, 20: 455-460.

Altan, Ö. and İ. OĞUZ. 1995. Japon Bıldırcınlarında (Coturnix Coturnix Japonica) Yaşın Ve Yumurtlama Zamanının Kimi Yumurta Özellikleri Üzerine Etkileri. Tr. *Journal Of Veterinary And Animal Science*, 19: 405- 408.

Anonymous, 2019. *http://eu.aviagen.com/tech-center/download/1054/308SF-PS-EU-PO-EN-16.pdf* date: 26.05.201908:06

Atasoy. F.. Onbaşılar. E. ve Apaydın. S.. 2001. Denizli ve ticari tavuk sürülerinde yumurta kalite özelliklerinin karşılaştırılması. *Lalahan Hay. Araş. Ens*. D.. 41 (2): 89. 100.

Basmacıoğlu, H. 1999. Yumurta Tavuklarında Yumurtanın Kolesterol İçeriği İle Diğer Bazı Özelliklerine Etki Eden Etkenler Üzerinde Bir Araştırma. Doktora Tezi, *Ege Üniversitesi Fen Bilimleri Enst., Bornova, İzmir,* s.1-94.

Bek, Y. ve Efe, E. 1999. Araştırma Deneme Metodları 1. *Çukurova Üniversitesi, Ziraat Fakültesi, Ofset ve Teksir Atölyesi, Adana*, 395s.

Coleman, M. 1999. Quality Control İn The Hatchery, The Fresh Egg Break Out Part 1. *Mac Associates. Incubator Co. Usa.*

Efil. H. ve Sarıca. M.. 1997. Yumurtada kalite tanımında güçlükler ve son gelişmeler. *OMİ Ziraat Fakültesi Dergisi.* 12 (3): 141. 150.

Elibol, O. 2009. Embriyo gelişimi ve kuluçka. *Tavukçuluk Bilimi, Yetiştirme, Besleme, Hastalıklar. (Ed. M.Türkoğlu, M. Sarıca) Bey Ofset Matbaacılık*, 3. Basım, s., 588.

Elibol, O., Türkoglu, M. ve Erol, H. 2000. "Bir Broiler Damızlık Sürüsünde Farklı Yaşlarda Üretilen Yumurtalarda Yumurta Agırlıgı ve Kuluçka Yerlesim Düzeninin Kuluçka Sonuçlarına Etkisi". *Tavukçuluk Araştırma Dergisi* 2(1):17-24.

Fletcher, D.L., Brıtton, W.M., Pesti, G.M., Rahn, A.P., Savage, S.I., 1983. The relationship of layer flock of age and egg weight on egg component yields and solid content. Poultry Sci. 62:1800.

Izat, A.L., Gardner, F.A., Mellar, D.B., 1985. Effects of age bird on season of the year on egg quality. 1.Shell quality. *Poultry Sci.* 64:1900.

İşcan, K.M. ve A. Akcan. 1995. Broyler parent yumurtalarında yumurta ağırlığı, yumurta özgül ağırlığı ve bazı yumurta kısımları arasındaki ilişkiler. *Hayvancılık Araştırma Dergisi*, 5: 49-52.

Kamanlı, S., Durmuş, İ., Demir, S. 2010. Hatching characteristics of abnormal eggs. *Asian Journal of Animal and Veterinary Advances*, 5(4): 271-274.

Kinnear, P.R., ve Gray, C.D.,1994. SPSS for Windows. Department of Psychology Univ. of Aberdeen, UK.

Nacar, H., Uluocak, AN., 1995. Etlik Bıldırcın Üretiminde Anaç Yaşının Etkileri. *Uluslar Arası Tavukçuluk Fuarı ve Konferansı* 24-27 Mayıs 1995 İstanbul. 81-89

Nagarajan, S., D. Narahari, I.A. Jayaprasad and D. Thyagarajan, 1991. Influence of Stocking Density And Layer Age On Production Traits And Egg Quality İn Japanese Quail. *Brit. Poult. Sci.*, 32:243-248.

Narayana, R., S.K. Varma and U.D. Gupta. 1991. Inheritance Of Plasma Protein, Cholesterol And Glucose And Their Association With Egg- Quality Traits İn İnbred Lines Of White Leghorn. *Indian Journal Of Animal Sciences*, 61(4): 445-448.

Narayanankutty, K., A. Jalaludeen and A. Ramakrishnan. 1989. Effect Of Age On Quality Characteristics Of Japanese Quail (*Coturnix Coturnix japonica*) Eggs. *Cherion*, 18(2): 97-98.

North, M.O. and Bell, D.D. 1990. Commercial Chicken Production. Manuel 4th Edition. Ogunshile, G. and N. Sparks. 1995. Effect Of Broiler Egg Weight On Hatchability. *Wpsc Assoc. Proceedings Of Spring Meeting Scarborough*, 22-23 March.

Narushin, V.G., and Romanov, M.N. 2002. Egg physical characteristics and hatchability. *World's Poultry Science Journal*, 58(3):297-303.

Özçelik, M. 2002. Japon Bıldırcını Yumurtalarında Bazı Dış Ve İç Kalite Özellikleri Arasındaki Fenotipik Korelasyonlar. *Ankara Üniv. Veteriner Fakültesi Dergisi,* 49: 67-72.

Petek. M.. Alpay. F.. Gezen. S. S. ve Çıbik. R.. 2009. Ticari Yumurtacı Tavuklarda Barındırma Sistemi ve Yaşın Erken Dönem Yumurta Verimi ve Kalitesi Üzerine Etkileri. *Kafkas Universitesi Veteriner Fakultesi Dergisi.*

Poyraz Ö (1989). Tavuk Yetiştirme ve Üretim Teknikleri. AÜ Vet Fak Yayınları, Ankara.

Roberts, J. and J. Nolan. 1997. Egg and egg shell quality in five strains of laying hen and the effect of calcium source and hen age. Proc. *The 13th and 7th European Symposium on the quality of poultry meat and on the quality of eggs and egg products.Poznan, Poland,* Sept. 21-26

Sarıca. M.. Yamak. U. S., Boz. M. A.. 2010. Changes in egg quality parameters due to age in laying hens from two commercial and three local layer genotypes. *Journal of Poultry Research*. 9 (1).

Şeker, İ., Kul, S., Bayraktar, M. 2004. Effects of parental age and hatching egg weight of Japanese quails on hatchability and chick weight. *International Journal of Poultry Science,* 3(4):259-265.

Söğüt, B.,Sarı, M., 2009. Bıldırcınlarda (Coturnix coturnix japonica) Anaç Yaşının ve Yumurtlama Zamanının Yumurta Özellikleri Üzerine Etkisi: 2. Yumurta İç Kalite Özellikleri Üzerine Etkisi. *YYU Veteriner Fakültesi Dergisi,* 2009, 20 (2),49-53:

Stadelman, W.J., 1986. The preservation of quality in shell eggs. In W.J. Stadelman. O.J. Cotteril (Eds), Egg science and technology. *Avi Puplishing Com Inc Westport, Connecticut*, U.S.A.

Stadelman W.J. and J. Owen. 1996. *Egg Science and Technology. Haworth Press Inc New York.*

Şimşek, Ü.G., Gürses, M., Yıldız, N., 2009. Farklı Anaç Yaşına ve Ovipozisyon Zamanına Sahip Kuluçkalık Yumurtalarda Lamba Kontrolüyle Ayıklama İşleminin Etlik Piliç Damızlıklarında Kuluçka sonuçları Üzerine Etkisi. *F.Ü.Sağ.Bil.Vet.Derg*. 2009: 23 (3): 147- 151

Türkoğlu, M., Sarıca, M., 2009. *Tavukçuluk Bilimi. Yetiştirme, Besleme, Hastalıklar*. Sayfa: 268-271.

Van Den Brand. H.. Parmentier. H. ve Kemp. B.. 2004. Effects of housing system (outdoor vs cages) and age of laying hens on egg characteristics. *Br Poult Sci*. 45 (6). 745-752.

Wilson HR., 1991 Interrelationship of egg size, chick size, posthatching growth and hatchability. *World's Poult Sci J* ; 47: 5-20.

Witt, F.D.E. and L.M.J. Schwalbach. 2004. The Effect Of Egg Weight On The Hatchability And Growth Performance Of New Hampshire And Rhode Island Red Chicks. South African J. Animal Science, 34(2): 62-64.

Yannakopoulos AL, Tserveni-Gousi AS (1986). Quality Characteristics of Quail Eggs. *British Poultry Sci,* 27(2): 171-176.

Zglobica, A. and S. Wezyk. 1995. Relationship Between External Egg Quality Traits And Hatchability Of Laying Hens. *Roczniki Naukowe Zootechniki*, 22: 113-123.

Zita. L.. Tůmová. E. ve Štolc. L.. 2009. Effects of Genotype. Age and Their Interaction on Egg Quality in Brown-Egg Laying Hens. *Acta Veterinaria Brno*. 78 (1). 85-91.

## Author Information

**Hakan Yildirim**
Hatay Mustafa Kemal University
Agriculture Faculty Animal Science
HATAY/TURKEY
Contact E-mail: hakanyld@gmail.com

**Zekeriye Akcimen**
Hatay Mustafa Kemal University
Agriculture Faculty Animal Science
HATAY/TURKEY