SCIENTIFIC HORIZONS

Journal homepage: https://sciencehorizon.com.ua
Scientific Horizons, 26(4), 33-42

UDC 636.02
DOI: 10.48077/scihor4.2023.33

Slaughter and meat quality of broiler turkeys using different light programmes during growing

Tetiana Prylipko*
Doctor of Agricultural Sciences, Professor
Podillia State University
32316, 13 Shevchenko Str., Kamianets-Podilskyi, Ukraine
https://orcid.org/0000-0002-8178-207X
Taras Ganzyuk
Postgraduate Student
Podillia State University
32316, 13 Shevchenko Str., Kamianets- Podilskyi, Ukraine
https://orcid.org/0009-0002-6685-7456
Alina Shuliar
Candidate of Agricultural Sciences, Associate Professor
Polissia National University
10008, 7 Stary Blvd., Zhytomyr, Ukraine
https://orcid.org/0000-0002-0823-6814
Alona Shuliar
Candidate of Agricultural Sciences, Associate Professor
Polissia National University
10008, 7 Stary Blvd., Zhytomyr, Ukraine
https://orcid.org/0000-0002-8462-2135
Svitlana Omelkovych
Candidate of Agricultural Sciences, Associate Professor
Polissia National University
10008, 7 Stary Blvd., Zhytomyr, Ukraine
https://orcid.org/0000-0002-9581-0043

Article's History:
Received: 26.01.2023
Revised: 27.03.2023
Accepted: 10.04.2023

Suggested Citation:
Prylipko, T., Ganzyuk, T., Shuliar, A., Shuliar, A., & Omelkovych, S. (2023). Slaughter and meat quality of broiler turkeys using different light programmes during growing. *Scientific Horizons*, 26(4), 33-42.

Abstract. The issue of selecting light programmes in poultry houses is of great importance in growing broiler turkeys, as neglecting it results in the deterioration of the movement of the bird. Such a factor leads to deterioration of general health and destabilises the proper functioning of body systems. The purpose of the research was to identify the effect of different lighting methods on the slaughter and meat qualities of broiler turkeys. The following methods were used in the research: histological, anatomical, morphometric, light-optical, statistical. The research was conducted in 2022 on two groups of Big-6 cross broiler turkeys in the poultry houses of the control group and two experimental production sites No. 7 poultry enterprises of Chernivtsi Oblast. The regulation of the light programs of each poultry house was implemented using fluorescent lamps

*Corresponding author

of the PSP1V2-36 type, which provide warm white colour (colour temperature 2700 K) lighting. The research results established that the most developed muscle tissue was found in turkeys grown by the method using high intensity lighting. In addition, another experimental group demonstrated results higher than the control group. In addition, the quality of the meat of different groups had specific minor differences: in the pectoral muscles of the experimental groups, a slight increase in the content of dry matter (by 0.4-0.6%), protein (by 0.3-0.4%) and a decrease in fat content (by 0.3-0.4%). The caloric content has actually not changed. The experimental groups had an advantage in the chemical composition and energy value of the meat. The results of the conducted research can be used to improve the system of growing broiler turkeys, to explore in more detail the reaction of the bird to various conditions and the impact of these conditions on the body. It will allow obtaining high-quality products faster and reduce the cost of production

Keywords: breeding; light regime; fattening young birds; protein; poultry houses

INTRODUCTION

Performance of the genetic properties of the efficiency of broiler turkeys is not complete without the organisation of proper conditions for growing them, considering the light regime control. The intensity, duration, and spectrum of light affect the shift in performance indicators and the physiological state of the bird in a positive or adverse areas. The research problem is to find the most balanced lighting regime, as feed consumption was reduced and problems with legs with too low lighting. And with the too-intense light, the development of cannibalism got problems with the psyche and worse uniformity of the group. Thus, it is extremely important to find exactly what is necessary to meet the expectations of everyone engaged in breeding broiler turkeys.

E.D. Fidan *et al.* (2017) point to the possibility of using daylight for the purpose of breeding and ensuring the vital activity of turkeys of each of the production links. Sunlight has a positive effect on the vitality of birds, their optimal development and growth. On the other hand, the rapid development of technologies in turkey breeding is based on using artificial lighting devices for poultry houses, which allow controlling the length of lighting time and the level of brightness in the poultry house without being subject to natural conditions and seasonal changes. It is important to understand that the selection of lighting systems has a significant impact.

In their research, S. Barbut and E.M. Leishman (2022) indicated that blue light has a calming effect on turkeys compared to white, red, or green light. In an experiment where turkeys were given the variability of choosing a place of life between poultry houses lit by monochromatic light of different colours, preference was given to poultry houses with blue and green light. In turn, R. Frank *et al.* (2020) noted that the highest growth rate of turkeys grown for meat production was observed when using green lighting devices. In addition, the green colour contributed to a decrease in the relative cost of feed and a decrease in the level of stress of the bird. J. Linhoss *et al.* (2020) and M. Aksit *et al.* (2017) found that before sixteen weeks of age, turkey poults performed better under blue light bulbs, but for the next 6 months they grew faster when either white or red lightbulbs were used. According to F.N.K. Soliman and K. El-Sabrout, (2020), T. Prylipko *et al.* (2020) light characterised by long waves affect the reproduction indicators of adult birds, i.e., the yellow-orange-red range has a positive effect. High-pressure sodium lamps have this lighting range.

Examining the quality of lighting, K. Weng *et al.* (2022) determined that the value of light level and wavelength for all species of birds has three important variables: the light spectrum, its intensity, and the duration of the light period. Light intensity and duration are better explored and may slightly alter the biological responses and behaviour of the bird. Combinations of waves of different wavelengths of electromagnetic radiation emitted by the lighting system in a specific order can change the spectrum of light. S. Parteca *et al.* (2020) demonstrated that differences in the light regime and spectrum affect the life of birds. An example of the consequences for broiler turkeys that were in the area of artificial light sources is the lack of ultraviolet light. Such a situation can have an adverse effect on poultry grown in closed premises, namely the inability to detect visual signals, plucking of feathers, behavioural deviations.

In their study, M.M. Abo Ghanima *et al.* (2021) explored that if the purpose of keeping turkey chicks is to obtain meat products, then it should be kept the light on throughout the day on the first day of life, and then the amount of lighting time can be reduced to 15-19 hours or less. However, notably, the result of using dark periods lasting 8 hours or more during the day can affect a partial decrease in the level of feed consumption, and the progress of growth of live weight. The accompanying problem is the problem of long periods of no movement of birds during such periods, which leads to a deterioration of the condition of the legs and plumage. J. Linhoss *et al.* (2023) found that a combination of three different factors that affect the space in the poultry house (radiation intensity, lighting duration and light spectrum) form the lighting programme. Each of the light emitting devices must meet the requirements for the synthesis of vitamin D, which saturates the

bones with minerals and, accordingly, guarantees their uniformity and growth.

A review of literature sources indicates the ambiguity of the topic of the quality of the influence of lighting systems on the growth and quality of products of broiler turkeys. Therefore, the purpose of the following research was to provide specifics in this matter.

MATERIALS AND METHODS

The experiment was performed on the growth of two groups of broiler turkeys of the Big-6 cross, which was conducted in the poultry houses of the control group, experimental group No. 1 and research experimental No. 2 of the industrial site No. 8 of the poultry enterprise of Chernivtsi Oblast. Choosing the method of control over the lighting program for the period of growing broiler turkeys for the purpose of obtaining meat products, it was decided to use PSP1V2-36 type fluorescent lamps, which provide warm white colour (colour temperature 2700 K) lighting. The computer programme fully provided control over both the duration of illumination and its intensity (Tables 1-3).

Table 1. *The lighting program approved by the Poultry Institute of the National Academy of Sciences for growing broiler turkeys (control group)*

Broiler age, days	1-3	4-21	21-56	56-112 (females)	56-161 (males)
Daylight hours, h	24	17	14	16	16
Light intensity, lux	50-100	30	15	5	5

Table 2. *Lighting programme adopted by Hybrid Turkeys Ltd (experimental group No. 1) for growing broiler turkeys*

Broiler age, days	1	2	3-5	6-9	9-105	105-126
Light intensity, lux	100	100	100	80-100	60-100	60-100
Daylight hours, h	24	23	20	18	16	16-18
Switching on and off time	-	2:00-3:00	2:00-22:00	3:00-21:00	5:00-20:00	4:00-20:00
Switching on the light for night feeding, h	-	-	-	-	1	1-2

Table 3. *Lighting programme adopted by British United Turkeys Ltd and Nicholas Turkeys Ltd (experimental group No. 2) for growing broiler turkeys*

Broiler age, days	1	2-6	7+	Last week before slaughter
Light intensity, lux	>50	<50	<50	<50
Daylight hours, h	24	14-18	14-16	24
Dark hours, h	-	6-8	8-10	-
Switching on the light for night feeding, h	-	1-2	1-2	-

Source: *compiled by the authors*

In the course of experimental studies, a certain list of indicators was considered: preservation of birds – every day, with the recording of the reasons for leaving the flock; the live weight of turkeys – by measuring the weight of each bird in the first and last days of growing; expenditure of resources per individual bird based on the task: in research of scientific and economic field and productive verification of theoretical programmes using the group method, during the growing period, in experiments of physiological field using the method of individual examination every day. Derived values were used to analyse the progress of the growth of young birds, namely: relative, average daily and absolute growth.

With the purpose of examining the influence of different lighting programmes during growing on the characteristics of meat and slaughter quality indicators of broiler turkeys, the chemical composition of meat, and the biological and energy value of muscles, 6 heads (3 males and 3 females) of turkeys were selected separately from all groups after the end of scientific and economic experiments No. 1, No. 4 and No. 5, and their control slaughter was performed according to the generally accepted methodology. Upon completion of the control slaughter, general deboning and anatomical processing of the raw material was implemented. Meat qualities of poultry were evaluated according to DSTU 3143-2013 (2014). Anatomical parameters of the carcass of broiler turkeys were calculated using the formulas of B.K. Hindze. Averaged samples of chest and leg muscles were selected for the purpose of chemical

analysis during anatomical processing and deboning of carcasses.

All experimental studies were conducted according to modern methodological approaches and in compliance with the relevant requirements and standards, in particular, they meet the requirements of ISO/IES 17025:2005 (2006). Birds were kept and all manipulations were performed according to Law of Ukraine No. 249 "On the Procedure for Conducting Experiments on Animals by Scientific Institutions" (2012), European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes (1986).

RESULTS

The Big-6 turkey breed is in high demand among other categories of this poultry. It has high meat prematurity and a significant level of reproductive factors. This cross can be defined as heavyweight. The composition of this breed is effective from an economic viewpoint, in particular heavy crosses and lines. An average of 21 to 25 kg from a male bred from this line or cross can be got, while the females can give 11 kg of live weight. Evaluating the meat qualities of Big-6 turkeys obtained from medium crosses and lines, it was determined that they are not marked by particularly large values, but are sufficient in comparison with other breeds. Each individual is characterised by white, in fact with no inclusions, feathers, and the only thing is the presence of an insignificant black tuft in the area of the sternum. Massive breasts and an extremely fast growth rate can be distinguished among the anatomical standards and features of this breed of turkeys. On average, the weight of the sternum occupies almost a third of the total weight of the carcass. The most understandable explanation for the intensity of growth of Big-6 turkeys is the following data: at the age of three months, turkeys can weigh up to 7.5 kg, and already at the age of 5 months, females can weigh up to 13 kg. A feature of this breed of turkeys can be called the final stop of growth upon reaching the age of 85-100 days, at which time they are slaughtered.

Based on the research results, notably, growing conditions, namely different light regimes, influenced the development of muscle tissue. Thus, in the experimental groups, this indicator amounted to 8077 g in the first experimental group and 7948.6 g in the second experimental group, which is 11.2 and 14.3% higher, respectively, than in the control group (Table 4).

Table 4. *Meat qualities of broiler turkey carcasses*

Indicators	Groups		
	Control (The Institute of Poultry of the National Academy of Sciences of Ukraine)	Experimental (Hybrid Turkeys Ltd)	Experimental (Nicholas Turkeys Ltd and British United Turkeys Ltd)
Pre-slaughter weight, g (%)	21286±18.71 (100)	24183.5±49.67 (100)	23798.3±31.89 (100)
Weight of semi-gutted carcass, g (%)	17411.9 (81.8)	19886.3±53.54 (81)	19347.7±33.82 (81.3)
Edible parts of the carcass, g (%)	12367.2±4.42 (58.1)	14218.9±4.9 (58.8)	13945.8±32.38 (58.6)
of which: edible viscera, g (%)	989.3±5.34 (8)	1192.78±7.45 (8.4)	1143.5±8.13 (8.2)
internal fat, g (%)	319.3±3.74 (1.5)	266±5.49 (1.1)	285.6±9.03 (1.2)
total muscles, g (%)	7066.9±21.73 (33.2)	8077.2±22.69 (33.4)	7948.6±12.42 (33.4)
incl. pectoral, g (%)	2171.2±16.54 (10.2)	2587.6±10.96 (10.7)	2498.8±10.61 (10.5)
leg muscles, g (%)	4895.8±11.1 (23)	5489.7±12.27 (22.7)	5449.8±4.6 (22.9)
skin with subcutaneous fat, g (%)	2831±17.09 (13.3)	3264.7±9.93 (13.5)	3236.6±20.83 (13.6)
inedible parts, g (%)	8918.8±38.36 (41.9)	9963.6±39.42 (41.2)	9852.5±19.52 (41.4)

Source: *compiled by the authors*

It was the most developed (8077.2 g) in the group where the recommended light regime was from a foreign breeding company (Hybrid Turkeys Ltd). In the second experimental group (the light regime of Nicholas Turkeys Ltd and British United Turkeys Ltd), this indicator was slightly lower (by 1.6%) than in the first experimental group, but by 11.2% more than in the control group (the light regime recommended by the Institute of Poultry of the National Academy of Sciences). Turkeys of the first and second experimental groups differed favourably from their peers of the control group in terms of the weight of edible offal (liver, lungs, muscle stomach, heart): 1143.5-1192.78 against 989.3 g in the control group. A similar trend was observed in the mass of the most valuable parts of the carcass, in particular, pectoral muscles 2498.8-2587.6 g in the experimental groups, which is 327 and 416 g more than in the control group, and legs 5489.7-5449.8 against 4895.8 g in the control group. In addition, the difference between the groups was observed in terms of the mass of the total

number of inedible parts of the carcass. Compared to the control group, it was 0.7% in the first experimental group, and 0.5% in the second.

As a result of the study of the obtained data, certain differences in quality indicators of meat in groups of turkeys were outlined, which may have been caused by using different lighting modes during their cultivation. Despite the fact that the differences were not confirmed, a slightly better result was obtained when considering the meat quality indicators of the broiler turkeys of the groups grown according to the methods of commercial companies. Thus, the pectoral muscles of young animals of the experimental groups were characterised by an increase in the amount of protein by 0.3-0.4%, dry matter by 0.4-0.6%, and a decrease in the amount of fat by 0.3-0.4%. The caloric content of this muscle group in turkey chicks of the experimental groups actually did not differ from the control group (119.3-119.9 and 120.0 kcal/100 g, respectively). Differences between the experimental groups and the control in the energy value and chemical composition of thigh muscles were significantly expressed in favour of the experimental groups of broiler turkeys. Thus, the indicators of dry matter content differed by 0.4-0.9%; fat – by 0.1-0.4%; ash – by 0.2-0.3% protein – by 0.3-0.6%, and the caloric component – by 2.0-3.1%. According to the index of relative biological value, femoral muscles of turkeys of experimental groups were characterised by an increase of 2.1-3.4%, and breast muscles – by 2.6-4.1%. Notably, the fluctuations in the quality composition of turkey muscles when using different lighting conditions were not constant, except for the biological value ($p<0.001$).

Determining the rate of live weight dynamics of broiler turkeys demonstrated that different lighting systems had significantly different effects on the progress of weight gain of young birds. Starting from the 2-4th day of life, the lighting period was reduced to 17 hours in the control group, to 20 hours in the experimental group No. 1 and to 18 hours in experimental group No. 2. The lag in the growth rate of broiler turkeys of the control group immediately became noticeable. Already at the age of 6 weeks, it was possible to observe a significant advantage in terms of live weight of turkeys of the experimental groups with increased daylight hours. The weight of individuals grown according to the recommendations of the Institute of Poultry of the National Academy of Sciences was noticeably behind the individuals grown according to the methods of Hybrid Turkeys Ltd, British United Turkeys Ltd and Nicholas Turkeys Ltd by 73 and 138 g, respectively (Table 5).

Table 5. *Effect of different lighting methods on the dynamics of live weight of broiler turkeys*

Age of broiler turkeys, weeks		1	3	6	12	16	20	23
Control	$\bar{X} \pm S_{\bar{X}}$, g	150±2.87	750±5.13	2750±8.26	9884±13.48	15354±15.35	19765±16.81	21286±18.71
	C_v, %	2.3	6.9	5.1	10.2	11.4	9.8	12.3
Experimental group No. 1	$\bar{X} \pm S_{\bar{X}}$, g	151±2.87	763±6.42	2823±9.11	11202±14.63	15975±19.14	20698±32.86	24183.5 ±49.67
	C_v, %	3.4	7.1	5.3	11	12.6	12.1	11.9
Experimental group No. 2	$\bar{X} \pm S_{\bar{X}}$, g	148±2.87	762±5.93	2888±9.88	10903±14.02	15786±17.98	20589±29.86	23798.3±31.89
	C_v, %	3.5	7.4	5.7	10.3	9.8	13.2	14

Source: *compiled by the authors*

Approaching the age of 12 weeks, the differences between different groups in terms of live weight became even greater. When the age of 12 weeks is reached, the light day for turkeys of experimental group No. 1 was the highest among the subjects. During the sixteenth week of the experiment, broiler turkeys of the first experimental group were characterised by the appearance of compensatory growth. However, the average daily and absolute increases in live weight of turkey chicks were not much higher than that of birds of the control group and experimental group No. 2. In the course of the experiment, it was found that the most significant cases of compensatory growth were observed in the turkeys of the second experimental group. 8-10 hours of dark period was used for them during the age of 2-20 weeks. At the age of 16 weeks, an obvious advantage in terms of live weight was on the side of turkeys of experimental group No. 1. Their live weight was measured to have higher values ($p\geq0.999$) by 625 g and 193 g compared to control group and experimental group No. in 2. During the sixteenth week, turkey chicks of experimental group No. 2 presented cases of compensatory growth due to an increase in the length of the light period.

Notably, the smallest manifestation of compensatory growth was characterised by turkeys of the control group, in which the limitation of the period of the light factor was the smallest. The highest limit of progressive weight gain in broiler turkeys of the control and experimental groups No. 2 continued for two weeks, while it was the largest and lasted three and a half weeks for the turkey chicks of experimental group No. 1. In addition to the absolute value of live weight, the characteristics of broiler turkeys have a major impact on the performance of the birds produced, and flock uniformity plays

a significant role. Using different lighting methods for broiler turkeys affected the quantitative characteristics of flock homogeneity. Before reaching the age of six weeks in each of the groups, the homogeneity of the herd by live weight was characterised by high indicators (each indicator of homogeneity was above 80%). At 9 weeks, the homogeneity of the herd of each of the groups decreased, but did not fall below the average level. The experimental group of broiler turkeys No. 1 and the control group lagged behind by 2.6%. Birds of experimental group No. 2, which were placed in conditions of constant light a week before slaughter, were characterised by the worst indicators of homogeneity in live weight (Table 6).

Table 6. *Homogeneity indicators by live weight of broiler individuals when using different light regimes, %*

Age of broilers, weeks		1	3	6	9	16	23
Light regime No. 1	Control group	85.1	94.9	81.2	77.8	76.5	75
Light regime No. 2	Experimental group No. 1	82.4	95.5	84.7	76.9	76.1	77.6
Light regime No. 3	Experimental group No. 2	81.8	93.8	83.9	76.5	75.9	70.5

Source: *compiled by the authors*

The calculation of the general indicator of the efficiency of growing broiler turkeys gave information that the greatest zootechnical efficiency of poultry keeping is provided by using lighting techniques with the highest intensity and a long time of limiting the light factor (experimental group No. 1). In addition, experimental group No. 1 was the best in the broiler index, by 13.6 and 8.1 points with respect to the control group and experimental group No. 2 of young meat. An indicator that describes the meat qualities of broilers, which is the preservation of young meat, is of great importance. It affects the work of factors that control the production of meat and meat products. In addition, the control group, which was grown according to the recommendations of the Institute of Poultry of the National Academy of Sciences for growing broiler turkeys, is characterised by the highest preservation rate (98.11%), which is characterised by the lowest intensity index among all groups, and a long dark period. Individuals that were grown according to the recommendation of the Hybrid Turkeys Ltd commercial company, i.e., using very high light intensity and a long light period, can be characterised by the lowest preservation index.

Using lighting techniques with a dark period of 10 hours from the 21st to the 56th day of keeping for broiler turkeys of the control group has a positive effect on the survival factor of broilers by 0.62% and 0.71%, respectively, compared to experimental groups No.1 and No. 2. Therewith, an increase in feed costs for broiler live weight gain was observed. The greatest zootechnical effect was obtained using the lighting method recommended by British United Turkeys Ltd and Nicholas Turkeys Ltd for growing broiler turkeys. The obtained data allowed understanding of the variable possibilities in growing broiler turkeys, demonstrate the ambiguity of each of the lighting methods and explain the nature of the effect of different periods of light and darkness on the bird's body.

DISCUSSION

According to the results of the study, it is indicated that the different lengths and intensities of daylight have different effects on the growth and development of the bird. Therewith, several contradictions were noticed in the above research. For a better understanding and to increase the certainty of this issue, it is worth getting acquainted with the opinions and conclusions of other authors.

V.S. Morita *et al.* (2020) determined that young birds need a higher level of illumination during the initial period of keeping (not less than 20 lux), compared to later growth, to provide the chicks with the opportunity to find feed and water without hindrance, and to familiarise themselves with the location. Over time, they get used to the placement of water bowls and feeders, thus, they are able to be oriented at a lower level of light. Accordingly, it is reduced to the level of 5-10 lux. Lower lighting during this period forms a calm behaviour of the bird, and reduces cases of cannibalism. By the way, a too low level of illumination (<5 lux) often becomes the cause of diseases of the organs of vision, the cause of which is the degeneration of the retina, and the probable development of glaucoma, myopathy, damage to the lens and blindness. It has an adverse effect on the plumage in the chest area due to the fact that the birds almost constantly sit on litter or a different type of floor. The accompanying significant decrease in the mobility of the bird and the related problems of dermatitis of the hind limbs, the formation of the reproductive system, and breast slime have an adverse impact on the development of the bird. In the study of broiler turkeys in the Chernivtsi Oblast, methods with low light intensity were not used, thus, it is only possible to confirm the advantages of a high level of light.

Therewith, the above research refutes the research done by U. Pandey (2019). In it, COBB 500 cross broilers were kept for the first 9 days under the conditions of a lighting system of 15, 25, 45 and 75 lux using the

programmes 23L:1D (0-9 days) and 20L:4D (10-55 days), which recommends reducing the level of illumination to 2-3 lux from the tenth day. The results presented that the chickens that were kept until the ninth day using 75 lux became a deviation from the general rule. They had the lowest mass indicators at the age of 9 days, the lowest yield of pectoral muscles and meat at the age of 55 weeks. Using additional methods, which included the use of 35 lux until the ninth day, did not demonstrate a destructive effect on the health and growth of the birds.

M.A. Arowolo *et al.* (2018) found that periods of night rest and daytime activity in turkeys are controlled by a part of the brain called the pineal gland. It happens by the method of isolating an enzyme that is responsible for the conversion of serotonin into melatonin. An increase in its amount in the blood causes a decrease in the body temperature of the birds and their falling asleep. Studies have demonstrated that the pineal gland is sensitive to light, but this reflectivity correlates with the time of day. It is believed that the length of the day is measured by an endogenous rhythm that contains a pair of half-cycles: "dark-sensitive" and "light-sensitive". Activation by light takes place only in those cases when the length of the light period during the day affects the "dark-sensitive" component of the half-cycles. According to recent data, the light-sensitive phase in turkeys begins 11 hours after the first light is turned on ("dawn") and lasts about 5 hours, although this period can be interrupted by short periods of darkness. In addition, this study is confirmed in an experiment on broiler turkeys of the Big-6 cross.

In turn, M.M. Romanovych *et al.* (2019), S.A. Lynch *et al.* (2018) explored that the duration of light and dark periods is one of the main variables influencing the development and reproductive phases of birds. As the length of daylight increases, the hormones responsible for this give impetus to puberty, and the initiation of egg-laying in turkeys. When the length of the light part of the day decreases, these hormones slow down puberty and stop the egg-laying period. Wild birds regulate these processes through seasonal changes, and domestic birds do this through humans, according to scientifically based light regimes. High illumination (over 40 lux), on the contrary, increases mobility, and therefore reduces the increase in live weight and increases feed consumption, but has a positive effect on the basic development of the physiological component of the organism. It is of great importance for birds that have entered the reproductive phase and young birds.

In their research, C.M. Poholsky *et al.* (2023) derived the following opinion: when growing turkeys in outdoor yards, the light intensity indicators can vary from a couple of hundred to several thousand lux. As mentioned above, sunlight increases vigour and improves the physiological condition of the bird. However, increased motor activity under such conditions leads to a certain decrease in live weight gain and increased feed consumption, and under conditions of improper feeding, and high density, it will affect the growth of cannibalism. In addition, these problems arise when using significant parameters of lighting intensity through artificial light sources. In such cases, it is recommended to reduce the lighting parameters to 6-2 lux. However, 1 lux is the minimum level of illumination at which turkeys can clearly distinguish individual objects. This observation was mentioned in the above research.

The effect of LED lighting on laying hens and broiler turkeys is well explored. For example, in studies conducted in Great Britain by H.M. Hiscock *et al.* (2022) and in USA by K. El-Sabrout *et al.* (2022), it was established that using LED lamps in laying hens contributed to a decrease in cannibalism and an increase in egg production; when growing young chickens, it increased survival by 0.5%, live weight by 4-8%, reduced specific feed consumption, increased poultry weight, and in all cases it reduced electricity consumption for lighting by 3-12 times.

I.C. De Jong and H. Gunnink (2019), O. Kilincceker and A.M. Karahan (2020) proved that using fluorescent and compact fluorescent lamps allows reducing the specific electricity consumption for lighting poultry houses by 3-5 times, depending on the type of lamp, and using lamps with blue or green light contributes to the increase in live weight and the survival of turkeys. With all types of lamps, it is helpful to use special lighting regulators that allow turning them on in the "dawn-to-sunset" mode. It reduces stress in the bird, reduces electricity costs for lighting and increases the life of the equipment. This study is partially confirmed by using the abovementioned fluorescent lamps of the PSP1B2-36 type, which reduced electricity consumption compared to the state before the experiment. Therewith, M.A. Erasmus (2018) mentioned that another way to reduce electricity costs for lighting is to use natural light. It can be done by installing window openings, while the area of the openings should be at least 1/10 of the floor area.

In the final study, A.B. Kotlyarova *et al.* (2019) mentioned the following opinions: the adverse aspects of using a low level of illumination in premises where birds are kept are a decrease in the mobility of birds. It adversely affects the development of their internal organs, and physiological indicators in general and stimulates the development of eye diseases. In addition, as birds spend a large part of their time perched on the floor, their feathers on the lower part of the body deteriorate. Therefore, a low level of illumination when raising poultry is recommended only in exceptional cases, for example, provided that the level of cannibalism has begun to progress in the group. Various studies have only confirmed that birds grown with optimal length of dark periods are less likely to have sudden death syndrome, limb disease and additional characteristic diseases, compared to birds deliberately grown with

lights that do not turn off. Moreover, there is a significant improvement in broiler fattening parameters such as feed conversion, average daily live weight gain and meat quality. However, too long periods of darkness (8 hours or more) during the day lead to a decrease in feed consumption and live weight gain, and prolonged sitting on litter leads to problems with legs and feathers, and sludge and hematomas. The guidelines used in the research above avoided the adverse effects of low light and long periods of darkness, but an increase in cannibalism and a decrease in group homogeneity were observed.

CONCLUSIONS

The research was conducted on individuals of broiler turkeys of the Big-6 breed in poultry enterprises of the Chernivtsi Oblast in 2022. The results of the study demonstrated that the most developed muscle tissue (8077.2 g) was in experimental group No. 1, which was grown using the method of lighting with the highest intensity, rather long daylight hours and night feeding at the end of the growing period. It was the leader in growth dynamics and slaughter weight, but the indicators of homogeneity in terms of live weight of individual birds were the lowest. In experimental group No. 2, which was grown under conditions of high intensity (however less than in experimental group No. 2), average duration of light day and night feeding from the first week of life, the value of the index of muscle tissue development was slightly lower (by 1.6%) than in the first experimental group, but by 11.2% more than in the control group. All other characteristics were average between the other groups participating in the study. A slight increase in the content of dry matter (by 0.4-0.6%), protein (by 0.3-0.4%) and a decrease in fat content (by 0.3-0.4%) was observed in the pectoral muscles of young animals of the experimental groups. The caloric content of this muscle group in turkey chicks of the experimental groups was almost at the level of the control bird (119.3-119.9 and 120.0 kcal/100 g, respectively). The control group, which was grown at a relatively low intensity, with an average length of light day and no night feeding, demonstrated the lowest mass values and the worst growth dynamics. Therewith, this group dominated in the indicators of preservation and homogeneity.

Prospects for further research may include an area of movement in exploring the influence of different wavelengths of light on the slaughter and meat qualities of broiler turkeys, under conditions of the same lighting systems and schedules. In addition, the question of researching different lighting systems specifically for turkeys remains open, as research with this bird is rarely conducted.

ACKNOWLEDGEMENTS

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

[1] Abo Ghanima, M.M., Abd El-Hack, M.E., Abougabal, M.S., Taha, A.E., Tufarelli V., Laudadio, V., & Naiel, M.A.E. (2021). Growth, carcass traits, immunity and oxidative status of broilers exposed to continuous or intermittent lighting programs. *Animal Bioscience*, 34(7), 1243-1252. doi: 10.5713/ajas.20.0328.

[2] Aksit, M., Kacamakli Yardim, Z., & Yalcin, S. (2017). Environmental enrichment influences on broiler performance and meat quality: Effect of light source and providing perches. *European Poultry Science*, 81, 1-10. doi: 10.1399/eps.2017.182.

[3] Arowolo, M.A., He, J.H., He, S.P., & Adebowale, T.O. (2018). The implication of lighting programmes in intensive broiler production system. *World's Poultry Science Journal*, 75(1), 17-28. doi: 10.1017/S0043933918000934.

[4] Barbut, S., & Leishman, E.M. (2022). Quality and processability of modern poultry meat. *Animals,* 12(20), article number 2766. doi: 10.3390/ani12202766.

[5] De Jong, I.C., & Gunnink, H. (2019). Effects of a commercial broiler enrichment programme with or without natural light on behaviour and other welfare indicators. *Animals*, 13(2), 384-391. doi: 10.1017/S1751731118001805.

[6] DSTU 3143-2013. (2014). Retrieved from http://online.budstandart.com/ua/catalog/doc-page?id_doc=81578.

[7] El-Sabrout, K., El-Deek, A., Ahmad, S., Usman, M., Tavares Dantas, M.R., & Freire Souza-Junior, J.B. (2022). Lighting, density, and dietary strategies to improve poultry behavior, health, and production. *Journal of Animal Behaviour and Biometeorology*, 10(1), 1-17. doi: 10.31893/jabb.22012.

[8] Erasmus, M.A. (2018). Welfare issues in turkey production. In *Woodhead Publishing Series in Food Science, Technology and Nutrition* (pp. 263-291). Sawston: Woodhead Publishing. doi: 10.1016/B978-0-08-100915-4.00013-0.

[9] European convention for the protection of vertebrate animals used for experimental and other scientific purposes. (1986). Retrieved from https://rm.coe.int/168007a67b.

[10] Fidan, E.D., Nazligul, A., Turkyilmaz, M.K., Aypak, S.U., Kilimci, F.S., Karaarslan, S., & Kaya, M. (2017). Effect of photoperiod length and light intensity on some welfare criteria, carcass, and meat quality characteristics in broilers. *Revista Brasileira de Zootecnia,* 46(3), 202-210. doi: 10.1590/S1806-92902017000300004.

[11] Frank, R., Pozza, P.C., Scherer, C., Schone, R.A., Avila, A.S., Carvalho, P.L.O., Broch, J., Eyng, C., & Nunes, R.V. (2020). Effects of feed particle size on energy values for broiler chickens at various ages. *South African Journal of Animal Science*, 50(6), 830-839. doi: 10.4314/sajas.v50i6.10.

[12] Hiscock, H.M., Leishman, E.M., Vanderhout, R.J., Adams, S.M., Mohr, J., Wood, B.J., Baes, C.F., & Barbut, S. (2022). Describing the relationships among meat quality traits in domestic turkey (*Meleagris gallopavo*) populations. *Poultry Science*, 101(10), article number 102055. doi: 10.1016/j.psj.2022.102055.
[13] ISO/IEC 17025:2005. (2006). Retrieved from http://online.budstandart.com/ua/catalog/doc-page.html?id_doc=50873.
[14] Kilincceker, O., & Karahan, A.M. (2020). The effect of buckwheat flour on some quality properties of chicken meatballs as an alternative to wheat flour. *Carpathian Journal of Food Science and Technology*, 12(4), 155-164.
[15] Kotlyarova, A.B., Kotyk, O.F., Yuryshinets, I.V., & Marchenko, S.M. (2019). Functioning of cationic channels of large conductivity of the nuclear membrane under the influence of nicotinic cholinergic receptors. *Physiological Journal*, 65(6), 30-37.
[16] Law of Ukraine No. 249 "On the Procedure for Carrying out Experiments and Experiments on Animals by Scientific Institutions". (2012). Retrieved from https://zakon.rada.gov.ua/laws/show/z0416-12#Text.
[17] Linhoss, J., Purswell, J., Lowe, W., & Chesser, D. (2020). Characterizing light leakage and spatial variation of illuminance in commercial broiler houses during tunnel ventilation. *Journal of Applied Poultry Research*, 29(4), 1091-1100. doi: 10.1016/j.japr.2022.100309.
[18] Linhoss, J.E., Davis, J.D., Campbell, J.C., Purswell, J.L., Griggs, K.J., & Edge, C.M. (2023). Light intensity and uniformity in commercial broiler houses using lighting programs derived from Global Animal Partnership (GAP) lighting standards. *Journal of Applied Poultry Research*, 32(1), article number 100309. doi: 10.1016/j.japr.2020.06.003.
[19] Lynch, S.A., O'Neill, E., Mullen, A.M., Drummond, L., & Alvarez, C. (2018). Opportunities and perspectives for utilisation of co-products in the meat industry. *Meat Science*, 144, 62-73. doi: 10.1016/j.meatsci.2018.06.019.
[20] Morita, V.S., Almeida, A.R., Matos Junior, J.B., Vicentini, T.I., Zanirato, J.L., & Boleli, I.C. (2020). Neither altered incubation temperature during fetal development nor preferred rearing temperature improves leg bone characteristics of broilers. *Journal of Thermal Biology,* 93, article number 102726. doi: 10.1016/j.jtherbio.2020.102726.
[21] Pandey, U. (2019). Effect of lighting in broiler production. *Acta Scientific Agriculture*, 3(6), 114-116. doi: 10.31080/ASAG.2019.03.0485.
[22] Parteca, S., Tonial, I.B., Do Prado, N.V., & Da Trindade Alfaro, A. (2020). Electrical stunning parameters: Impact on the quality of turkey meat (*Meleagris gallopavo*). *Journal of Food Science and Technology*, 57(7), 2612-2618. doi: 10.1007/s13197-020-04297-6.
[23] Poholsky, C.M., Erb, L.S., Lyons, A.M., Rohlf, P., & Boney, J.W. (2023). Improving pellet quality enhances Nicholas Select turkey performance in targeted phases of production. *Journal of Applied Poultry Research*, 32(2), article number 100340. doi: 10.1016/j.japr.2023.100340.
[24] Prylipko, T., Koval, T., Kostash, V., Tocarchuk T., & Tsvihun, A. (2020). Optimization of recipe turkey meat pate. *Carpathian Journal of Food Science and Technology*, 12(4), 98-112. doi: 10.34302/crpjfst/2020.12.4.11.
[25] Romanovych, M.M., Vishchur, O.I., Kurtyak, B.M., Matiukha, I.O., Mudrak, D.I., & Romanovych, M.S. (2019). Influence of probiotics on histostructure of the bursa of Fabricius in broiler chickens. *Journal for Veterinary Medicine, Biotechnology and Biosafety*, 5(1), 5-9. doi: 10.36016/jvmbbs-2019-5-1-1.
[26] Soliman, F.N.K., & El-Sabrout, K. (2020). Light wavelengths/colours: Future prospects for broiler behavior and production. *Journal of Veterinary Behavior*, 36, 34-39. doi: 10.1016/j.jveb.2019.10.014.
[27] Weng, K., Li, Y., Huo, W., Zhang, Y., Cao, Zh., Zhang, Y., Xu, Q., & Chen, G. (2022). Comparative phosphoproteomic provides insights into meat quality differences between slow- and fast-growing broilers. *Food Chemistry*, 373(Pt A), article number 131408. doi: 10.1016/j.foodchem.2021.131408.

Забійні та м'ясні якості індичат-бройлерів за різних світлових програм під час вирощування

Тетяна Миколаївна Приліпко
Доктор сільськогосподарських наук, професор
Подільський державний університет
32316, вул. Шевченка, 13, м. Кам'янець-Подільський, Україна
https://orcid.org/0000-0002-8178-207X

Тарас Олексійович Ганзюк
Аспірант
Подільський державний університет
32316, вул. Шевченка, 13, м. Кам'янець-Подільський, Україна
https://orcid.org/0009-0002-6685-7456

Аліна Леонідівна Шуляр
Кандидат сільськогосподарських наук, доцент
Поліський національний університет
10008, Старий бульвар, 7, м. Житомир, Україна
https://orcid.org/0000-0002-0823-6814

Альона Леонідівна Шуляр
Кандидат сільськогосподарських наук, доцент
Поліський національний університет
10008, бульвар Старий, 7, м. Житомир, Україна
https://orcid.org/0000-0002-8462-2135

Світлана Петрівна Омелькович
Кандидат сільськогосподарських наук, доцент
Поліський національний університет
10008, бульвар Старий, 7, м. Житомир, Україна
https://orcid.org/0000-0002-9581-0043

Анотація. Питання підбору світлових програм у пташниках має велике значення при вирощуванні індиків-бройлерів, адже нехтування ним призводить до погіршення рухового режиму птиці. Такий фактор призводить до погіршення загального стану здоров'я та дестабілізує належне функціонування систем організму. Метою досліджень було з'ясувати вплив різних способів освітлення на забійні та м'ясні якості індичат-бройлерів. У дослідженнях використовували такі методи: гістологічні, анатомічні, морфометричні, світлооптичні, статистичні. Дослідження проводили у 2022 році на двох групах індичат-бройлерів кросу Біг-6 у пташниках контрольної групи та двох дослідних виробничих майданчиках №7 птахопідприємств Чернівецької області. Регулювання світлових програм кожного пташника здійснювали за допомогою люмінесцентних ламп типу ПСП1В2-36, які забезпечують освітлення теплого білого кольору (колірна температура 2700 К). За результатами досліджень встановлено, що найбільш розвинена м›язова тканина була у індичат, вирощених за методом з використанням високоінтенсивного освітлення. Інша експериментальна група також показала результати вищі, ніж контрольна. Якість м'яса різних груп також мала певні незначні відмінності: у грудних м'язах дослідних груп спостерігалося незначне збільшення вмісту сухої речовини (на 0,4-0,6 %), білка (на 0,3-0,4 %) та зменшення вмісту жиру (на 0,3-0,4 %). Калорійність практично не змінилася. Дослідні групи також мали перевагу за хімічним складом та енергетичною цінністю м'яса. Результати проведених досліджень можуть бути використані для удосконалення системи вирощування індичат-бройлерів, більш детального вивчення реакції птиці на різні умови утримання та впливу цих умов на організм. Це дасть можливість швидше отримувати високоякісну продукцію та знизити собівартість виробництва

Ключові слова: розведення; світловий режим; відгодівельний молодняк; білок; пташники