

INFLUENCE OF MODIFIED INCUBATION FACTORS ON CARCASS CHARACTERISTICS OF BROILER CHICKENS

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Abstract: Incubation factors have a great influence on embryonic and postnatal development of broiler chickens. The aim of changing of incubation factors is to obtain the best possible production characteristics of broilers. In previous studies, it was determined that the application of monochromatic green light and thermal conditioning during incubation give the most satisfactory results on the postnatal development of chickens. This paper examines the effects of green monochromatic light and thermal conditioning during incubation on the carcass characteristics of broilers. In this paper four experimental groups were set. The first group was incubated under the standard conditions (37.8 ° C, no light). In the second group incubation temperature were increased, while in the third group incubation was carried out under green monochromatic light. In the fourth group temperature and light conditions of incubation were changed simultaneously. In all groups, changes of incubation factors were made at precisely defined time intervals. After hatching, chickens were grown up to day 42, when they were sacrificed and their carcass characteristics examined. Analysis of results showed that all treated groups have significant higher body weight, weight of drumsticks, thighs and toes. The fourth group have significant higher weight of breasts and wings compared to control group. These results are explained by the influence of the temperature and light changes during incubation on the increased proliferation of myoblasts, the growth of skeletal muscle cells, and the activity of satellite cells, which are reflected in changes of carcass characteristics.

Key words: broiler chickens, carcass characteristics, incubation factors

Introduction

Previous research showed that changing of light and temperature conditions of incubation had a significant effect on embryonic and postnatal

development of chickens, and their carcass characteristics as well (*Halevy et al., 2006c*). It was found that green monochromatic light and narrow variation in temperature influences the development of skeletal musculature of chickens (*Andrews and Zimmerman, 1990; Halevy et al., 2006b*).

Treatments of high temperature and green monochromatic light during incubation results in increased proliferation of myoblasts, as well as in increased development of satellite cells, which causes changes in the development of skeletal musculature (*Yahav et al., 2004; Rozenboim et al., 2004*). Such changes are certainly reflected in the carcass characteristics of broilers (*Halevy et al., 2006c*).

The aim of this study was to explore the effect of altered incubation factors (high temperature and green monochromatic light) on carcass characteristics of broilers.

Materials and Methods

In the experimental part of this paper, eggs that were incubated were divided into 4 groups (A, B, C, D). Incubation of eggs is carried out in incubators for 100 eggs (Phenyl, Beska, Serbia).

Group A was incubated under standard incubation conditions. In group B temperature conditions were changed (temperature of 39°C for 3 hours during 16th, 17th and 18th day of incubation). In group C from 6th day of incubation eggs were incubated under the influence of monochromatic green light, in a way that from 6th to 15th day of incubation intermittent light regime were applied (15 minutes of light, 15 minutes of darkness), and from 16th day of incubation eggs were exposed to constant light. Group D was incubated under the modified both light and temperature conditions, such as temperature change by the mode of group B, and light change by the mode of group C.

Temperature and humidity were controlled using analog polymer ("Web", Berlin, Deutschland). Monochromatic green light were obtained with LED (light-emitting diode) lighting, using "JCDR LED 18" light source ("Vito Industrial Limited", Zhuhai, China), which provided light of wavelength range of 535-585 nm, and the intensity of 6.21 lx. Light intensity and homogeneity of light were controlled with digital luxmeter "Peak Teck 5025" ("Peak Technologies, INC", Columbia, USA).

After hatching, chicks were transferred to the farm, where they were bred to 42nd day of life, when their carcass characteristics were determined.

Results and Discussion

It was established that on 42nd day after hatching, chickens of group B, C and D have a significantly higher body weight, body weight after bleeding and body weight without entrails ($p < 0.01$) comparing to group A (Table 1).

Table 1. Body weight (g), body weight after bleeding (g) and body weight without entrails (g) of broilers on 42nd day after hatching ($\bar{X} \pm SD$)

Group	Body weight	Body weight after bleeding	Body weight without entrails
A	2029,29 ± 94,18 ^A	1947,86 ± 81,08 ^A	1702,14 ± 72,45 ^A
B	2243,57 ± 142,06 ^B	2150 ± 137,23 ^B	1886,43 ± 131,08 ^B
C	2222,14 ± 125,49 ^B	2129,29 ± 123,17 ^B	1852,86 ± 88,40 ^B
D	2272,14 ± 119,12 ^B	2190 ± 122,20 ^B	1948,57 ± 116,39 ^B

^{A-B} Means within the same parameter, without same capital letter superscript differ significantly ($p < 0,01$).

It is established that chickens of group D have significantly higher ($p < 0,05$) breast weight compared to group A and C. Weight of drumsticks and thighs were significantly higher ($p < 0,01$) in the chickens of group B, C and D compared to group A. Weight of toes were significantly higher ($p < 0,05$) in the chickens of group B, C and D compared to group A. Wings weight were significantly higher ($p < 0,05$) in the chickens of group D compared to groups A, B and C (Table 2).

Table 2. Body weight with entrails (g), weight of entrails (g), breasts (g), drumsticks and thighs (g), toes (g), heads (g), wings (g) and backs (g) on 42nd day after hatching of chickens ($\bar{X} \pm SD$)

Weight of body parts	Group			
	A	B	C	D
Body weight with entrails	1947,86±81,08 ^A	2150±137,23 ^B	2129,29±123,17 ^B	2190±122,20 ^B
Entrails	245,71±28,49	263,57±40,38	276,43±44,41	241,43±16,76
Breasts	469,29±20,70 ^a	500,00±67,02 ^{ab}	472,14±30,53 ^a	557,14±85,33 ^b
Drumsticks and thighs	371,43±38,70 ^A	442,86±34,98 ^B	432,86±29,13 ^B	450,71±42,66 ^B
Toes	75,00±12,25 ^a	96,43±12,49 ^b	91,43±8,52 ^b	99,29±8,38 ^b
Heads	68,57±7,48	63,57±5,56	62,14±9,51	63,57±6,90
Wings	161,43±25,61 ^a	174,29±12,39 ^a	176,43±14,35 ^a	192,86±9,51 ^b
Backs	329,29±19,02	352,86±68,55	346,43±58,79	347,86±37,95

^{a-b} Means within the same parameter, without same small letter superscript differ significantly ($p < 0,05$).

^{A-B} Means within the same parameter, without same capital letter superscript differ significantly ($p < 0,01$).

It is established that percentage of breasts in relation to the body weight is significantly higher ($p < 0,05$) in the chickens of group D compared to group C. Percentage of drumsticks and thighs in relation to the body weight is significantly higher ($p < 0,05$) in the chickens of group B and D compared to group A. Percentage of heads in relation to the body weight is significantly higher ($p < 0,05$) in the chickens of group A compared to group B, C and D (Table 3).

Table 3. Percentage of weight of entrails (%), breasts (%), drumsticks and thighs (%), toes (%), heads (%), wings (%) and backs (%) in relation to the body weight on 42nd day after hatching of chickens ($\bar{X} \pm SD$)

Percentage of weight of body parts	Group			
	A	B	C	D
Entrails	12,11 ± 1,28	11,76 ± 1,72	12,39 ± 1,46	10,64 ± 0,70
Breasts	23,16 ± 1,41 ^{ac}	22,21 ± 1,65 ^{ac}	21,27 ± 1,36 ^{bc}	24,42 ± 2,59 ^a
Drumsticks and thighs	18,27 ± 1,29 ^a	19,73 ± 0,35 ^{bc}	19,49 ± 1,00 ^{ac}	19,80 ± 0,89 ^{bc}
Toes	3,68 ± 0,50	4,29 ± 0,42	4,13 ± 0,54	4,39 ± 0,54
Heads	3,39 ± 0,45 ^a	2,83 ± 0,16 ^b	2,80 ± 0,43 ^b	2,81 ± 0,40 ^b
Wings	7,94 ± 1,12	7,78 ± 0,60	7,98 ± 0,98	8,51 ± 0,71
Backs	16,25 ± 1,10	15,72 ± 2,75	15,56 ± 2,36	15,36 ± 1,97

^{a-c}Means within the same parameter, without same small letter superscript differ significantly ($p < 0,05$).

The effect of modified conditions of incubation on improved productive characteristics of adult chickens can be explained by influence of green monochromatic light and increased temperature on growth and differentiation of skeletal muscle cells (Rozenboiom et al., 2004; Halevy et al., 2006b; Halevy et al., 2006c). The applied treatments affect on increased diameter of skeletal muscle cells in the postnatal period of development in the treated groups, which affects on increased weight of white meat, drumsticks, thighs and wings of chickens. Also, these treatments affect on the increased proliferation of myoblasts (Collin et al., 2005; Halevy et al., 2006a; Piestun et al., 2009), resulting in increased number of cells within a muscle. A great number of cells cause greater muscle mass in later stages of postnatal development.

In previous studies it was established that these treatments have a stimulatory effect on the proliferation of satellite cells, which affects on increased growth and development of skeletal musculature in the postnatal period of development (Halevy et al., 2006c; Piestun et al., 2009), which could also affect on the production parameters of broilers.

The achieved results of this study are similar with results of other authors. When chickens during the incubation were exposed to monochromatic green light the increase of the weight of *m. pectoralis superficialis* (Halevy et al., 2006a), the weight of *m. supeficialis pectoralis* and *m. pectoralis profundus*, as well as the

body weight at 42nd day after hatching of chicks (*Rozenboim et al., 2004*) were established. When chickens during the incubation were exposed to increased temperature, the increase of the body weight (*Halevy et al., 2006b; Piestun et al., 2009*), the percentage of *m. pectoralis superficialis* in relation to the body weight (*Piestun et al., 2009*) and the breast weight (*Collin et al., 2007*) were established.

Conclusion

Analysis of the obtained values of the observed parameters showed that modified light and temperature conditions during incubation influence on the increased proliferation of myoblasts and the increased growth of skeletal muscle cells. Such occurrences are the cause of differences in carcass characteristics between the control group and treated groups of chickens. Examination of carcass characteristics showed that body weight, weight of drumsticks, thighs and toes in all treated groups were significantly higher than in the control group, and the weight of breasts and wings were significantly higher in the group which was incubated under modified both temperature and light conditions compared to the control group. Percentage of weight of drumsticks and thighs in relation to body weight was significantly higher in the group that was incubated under modified temperature conditions and in the group that was incubated under modified both light and temperature conditions compared to the control group.

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Uticaj modifikovanih faktora inkubacije na klanične osobine teških hibrida pilića

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Rezime

Uslovi inkubacije u velikoj meri utiču na karakteristike embrionalnog i postnatalnog razvoja pilića. Promenom faktora inkubacije teži se dobijanju što boljih proizvodnih karakteristika teških hibrida pilića. U dosadašnjim istraživanjima, utvrđeno je da primena zelene monohromatske svetlosti i termalnog

kondicioniranja tokom inkubacije imaju najpovoljniji uticaj na postnatalni razvoj pilića. U ovom radu je ispitano delovanje zelene monohromatske svetlosti i termalnog kondicioniranja tokom inkubacije na promene klaničnih osobina teških hibrida pilića. U ogledu su postavljene četiri eksperimentalne grupe. Prva grupa je inkubirana pod standardnim uslovima (37,8°C, bez osvetljenja). U drugoj grupi je u određenim vremenskim intervalima povećavana temperatura inkubacije. U trećoj grupi, inkubacija je vršena pod zelenom monohromatskom svetlosti (od 6. do 15. dana u intermitentnom režimu, a od 16. dana pod konstantnim režimom osvetljenja). U četvrtoj grupi su promenjeni i temperaturni i svetlosni uslovi inkubacije, tako da je temperatura menjana po režimu druge grupe, a svetlost po režimu treće grupe. Nakon leženja, pilići su uzgajani do 42. dana, nakon čega su određivane njihove klanične osobine. Analizom dobijenih rezultata je utvrđeno da između kontrolne grupe i svih tretiranih grupa postoje značajne razlike u telesnoj masi, masi bataka i karabataka i masi nogu, dok između prve i četvrte grupe postoje značajne razlike u masi belog mesa sa kostima i masi krila. Dobijeni rezultati se objašnjavaju uticajem promenjenih temperaturnih i svetlosnih uslova inkubacije na povećanu proliferaciju mioblasta, rast skeletnih mišićnih ćelija, kao i na aktivnost satelitskih ćelija, što se odražava i na promene u klaničnim osobinama.

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