Biotechnology in Animal Husbandry 25 (1- 2), p 23-34, 2009 ISSN 1450-9156
Publisher: Institute for Animal Husbandry, Belgrade-Zemun UDC 636.087.7

# THE EFFECT OF DIFFERENT LEVELS OF ORGANIC SELENIUM ON BROILER SLAUGHTER TRAITS**

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** Original scientific paper

**Abstract***:* The effect of different levels of organic selenium (selenized yeast) on slaughter meat traits of fattening chickens (broilers) was investigated. Trial was carried out on 120 Hybro-PN chickens divided into four groups, in duration of six weeks. All groups of chickens were fed complete mixtures, and selenium was added to the food in the form of selenized yeast in the amount of 0 (I ); 0,3 (II); 0,6 (III) or 0,9mg/kg (IV-group).

The highest average values of carcass yield »conventional processing«, »ready to roast« and »ready to grill« were recorded in chickens of group III (2059,6, 1851,97 and 1756,45g), with addition of 0,6mg Se/kg, followed by chickens of group II (2048,17, 1841,36 and 1748,57g) and group IV (1957,46, 1764,22 and 1676,05g) with 0,3 and 0,9mg/kg of added selenium, respectively, whereas the lowest values (1835,21, 1660,87 and 1572,61g) were established in chickens of group I without addition of this micro element.

Average values of slaughter yields »conventional processing«, »ready to roast« and »ready to grill« were approximately the same in chickens of all investigated groups, and established differences showed no statistical significance ($P > 0,05$).

The lowest breast mass was in I group (573,55g), and the highest in group III (657g). Chickens of groups II and IV (with 0,3 and 0,9mg Se/kg of feed) realized breast mass of 627,90 and 633,12g. Compared to group I, average breast mass of chickens in groups III and IV was considerably higher ($P < 0,05$ and $P < 0,01$).

Share of breast in the mass of processed carcass was the highest in groups III and IV (37,40 and 37,86%), and the lowest in group II (36,0%). In chickens of group I the stated value was 36,47%.

Average share of thighs in the mass of processed carcass was approximately the same in all investigated groups. The highest value (14,4%)

was established in chickens of group II, and the lowest (13,98%), in chickens of III investigation group.

Chickens fed organic selenium in diet (0,3, 0,6 and 0,9mg/kg) had by 3,80, 3,74 and 3,18% higher share of drumsticks in the mass of processed carcass compared to group I.

**Key words:** chickens, selenized yeast, slaughter properties

# Introduction

Selenium has biological function only when it is incorporated into different selenoproteins. Fist discovered selenoprotein was enzyme glutathione peroxidase (GSH-Px) which contains this micro element in its active place (*Rotruck* et al., 1973). Selenium dependant glutathione peroxidase has the role to defend the cell system from damages induced by the effect of oxygen. Presence of oxygen and its radicals has detrimental effect on cells. Location of the effect of free radicals is mainly double bonds of unsaturated fatty acids, free or incorporated into cells. Free radicals come into contact with these acids, lead to rearranging of double bonds, and bonding of oxygen molecules leads to forming of peroxil radicals of fatty acid (ROO ·). Subsequently, it attracts hydrogen from another molecule of unsaturated fatty acid forming hydro-peroxide of unsaturated fatty acid (ROOH) and new free radical. In this way a chain reaction occurs (*Combs* and *Combs,* 1986). Formed fatty acids are incorporated in cell membranes, disturb their function and destroy them. Activity of GSH-Px is different in individual organs, body fluids and subcell fractions (*Hassan,* 1987). Activity of glutathione peroxidase in poultry plasma is highly dependant on the level of selenium intake (*Hugue* and *Jensen,* 1985; *Todorović,* 1997; *Todorović* et al., 1999a). Activity of this enzyme varies considerably depending on the animal species and selenium status (*Burk,* 1983).

Recent investigations show that organic selenium increasingly suppresses the utilization of inorganic selenium (*Mahan, 1999; Surai,* 2000). Metabolic paths of the organic and inorganic selenium are different. Organic selenium is present in cereals, livestock feed and certain feed components, mainly in the form of selenomethionine, therefore its metabolic path is the same as methinone's. This is active transport through intestinal membrane and active accumulation in liver and muscle tissue (*Surai,* 1999). Recent results indicate that selenomethionine is not synthesized in animal or human organism, but it originates from plant sources. Inorganic selenium is retained for short time in tissues, incorporated slightly into selenoproteins, but large part of it is excreted

by urine. Animal organism has adapted to organic selenium as main feed component, whereas the inorganic selenium is no natural source. Therefore it can be used as antioxidants occasionally (*Surai*, 2000). Organic selenium provides more efficiently selenium-tissue reserves compared to selenite. During movement of proteins and stress, selenomethionine is released into free amino acid reserves and can be used for forming of selenoproteins of glutathione peroxidase. This means that the animals under stress and in incubation period have adequate antioxidation protection preventing the decrease of production and reproduction performances.

In poultry production selenium is added to food mainly for the purpose of prevention of certain diseases by its positive effect on immunological system and increase if production characteristics, primarily body mass and more efficient utilization of food (*Colnago* et al., 1984; *Todorović,* 1990; *Mihailović* et al.,1991; *Mahan,* 1999; *Combs,* 1977, *Jokić* et al., 2005). There are numerous papers in literature presenting the investigation of the effect of different selenium sources and levels on quality of broiler meat (*Downs, K.M.,* et al *,* 2000; *Surai* and *Dvorska,* 2002; *Edens,* 1996, 2001; *Ahn* et al., 1998; *Džinić* et al., 2006).

However, only few papers investigate the effect of selenium on slaughter properties of broiler meat. *Edens* (1997) established the correlation between vitamin E and organic selenium and their effect on increase of dressing percentage in broilers. Similar results are stated also by *Marković* (2007), establishing that addition of organic selenium and vitamin E, beside the positive effect on carcass mass and meat yield of broilers, also increases the share of most valuable parts in their carcass. Similar conclusions were reached also by *Naylor et al.* (2000) and *Payne* and *Southerm* (2005) in their researches. They have established that inclusion of organic selenium in food for chickens in fattening increased the carcass mass, dressing percentage and mass and share of breasts in the mass of processed carcass.

Objective of this research was to investigate the effect of addition of different levels of organic selenium originating from selenized yeast on carcass yield and yield of certain carcass parts (breasts, thighs and drumsticks).

## Material and methods

In trial 120 Hybro-PN chickens were used, divided into four groups (30 birds in each group). At the trial beginning chickens were weighed and marked with wing marks, and need for uniformity of groups was considered (I-group 36,17g; II-37,01g; III-37,16g and IV-36,59g). Fattening lasted 42 days and it was divided into three periods. In the first period (1-14th day) chickens were fed complete mixture with 23,01% of crude proteins and 12,95 MJ/kg ME, in the

second period (15-35th day) with mixture containing 22,36% of crude protein and 13,38 MJ/kg ME, whereas in the third period (36-42nd day) mixture with 21,25% of crude protein and of energy value of 13,61MJ/kg was used.

First group of chickens received mixture without added selenium. Other groups were fed mixtures in which 0,3 (II); 0,6 (III) and 0,9mg/kg (IV-group) of organic selenium in the form of selenized yeast was added.

At the end of trial on 42nd day, for the purpose of investigation of slaughter traits, 8 birds from each treatment were taken (4 males and 4 females). Chickens were slaughtered after 12 hour food deprivation, in order to eliminate the influence of outside factors on weight ratios. Processing of carcass was done according to methods of »conventional processing«, »ready to roast« and »ready to grill«. Yield of cooled carcasses or dressing percentage was calculated by establishing of relation of the mass of cooled carcass and weight prior to slaughtering.

Cooled carcasses were cut according to method laid down by the Rulebook on Quality of Poultry Meat (Official Journal of SFRY 1/81 and 51/88) to main parts (thigh, drumstick, breast, wings, pelvis and back) and weighed on automatic scale of ± 0,05g accuracy. Subsequent to measuring of carcass parts the shares of major carcass parts (breast, thighs and drumsticks) in cooled carcass of slaughtered birds were calculated.

Statistical processing of data was done using standard procedure according *Snedecor and Cochran (1971)*. Evaluation of significance of arithmetic mean of treatments was done by t-test.

## Results and discussion

Values relating to body mass prior to slaughtering, carcass yields and slaughter yields are presented in table 1.

Based on analysis of data given in table 1, it is established that values of carcass yields »conventional processing«, »ready to roast« and »ready to grill« were very uniform between groups II and III, with addition of 0,3 and 0,6mg Se/kg . The lowest values for stated parameter were established in groups I (0mg Se/kg) and IV (0,9mg Se/kg). These results are in accordance with those stated by *Payne* and *Southerm* (2005), who established that addition of organic selenium had increased the carcass yield compared to inorganic source. *Marković* (2007) presented in his research considerably higher ($P < 0,05$) carcass mass of broilers fed diets supplemented with 0,3mg/kg of organic selenium and 100IJ of vitamin E

By analysis of values of slaughter yields »conventional processing«, »ready to roast« and »ready to grill« it was established that there were no significant differences between investigated groups. Insignificantly higher

values for all three dressing yields were established in group I, without addition of selenium (83,08%, 75,21% and 71,21%), followed by group III with addition of 0,6mg Se/kg (83,02%, 74,66% and 70,80%, respectively), whereas values in group II (82,98%, 74,62% and 70,86) and group IV (82,51%, 74,39% and 70,67%), with addition of 0,3 and 0,9mg Se/kg were approximately the same. Contrary to our research (where level of selenium from selenized yeast had no significant effect on dressing percentage), *Edens* (1997) had established the correlation between vitamin E and organic selenium and their effect on increase of yield in broilers. *Payne* and *Southerm* (2005), also stated some positive effects of use of organic selenium on this parameter, compared to inorganic source (sodium-selenite). Similar results are stated by *Marković* (2007), establishing that addition of 0,3mg of organic selenium and 100IJ of vitamin E increased considerably ($P < 0,05$) yield of broiler meat.

**Table 1. Yield of processed carcasses**

| Group | Sex | Trait | Body mass prior to slaughter g | Carcass | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Conventional processing | | Ready to roast | | Ready to grill | |
| | | | | Mass g | Dress.Perc. % | Mass g | Dress.Per % | Mass g | Dress Perc. % |
| I | m+f | x | 2208,75 | 1835,21 | 83,08 | 1660,87 | 75,21 | 1572,61 | 71,21 |
| | | Sd | 87,38 | 262,33 | 0,86 | 62,91 | 1,14 | 59,38 | 1,15 |
| | | Cv | 3,96 | 14,29 | 1,04 | 3,79 | 1,52 | 3,78 | 1,61 |
| II | m+f | x | 2467,50 | 2048,27 | 82,98 | 1841,36 | 74,62 | 1748,57 | 70,86 |
| | | Sd | 300,16 | 256,99 | 1,12 | 224,55 | 0,97 | 213,44 | 1,03 |
| | | Cv | 12,16 | 12,55 | 1,35 | 12,19 | 1,30 | 12,21 | 1,45 |
| III | m+f | x | 2479,37 | 2059,60 | 83,02 | 1851,97 | 74,66 | 1756,45 | 70,80 |
| | | Sd | 183,89 | 170,41 | 1,01 | 151,59 | 1,13 | 148,45 | 1,31 |
| | | Cv | 7,42 | 8,27 | 1,22 | 8,18 | 1,51 | 8,45 | 1,85 |
| IV | m+f | x | 2371,25 | 1957,46 | 82,51 | 1764,22 | 74,39 | 1676,05 | 70,67 |
| | | Sd | 164,50 | 154,85 | 1,73 | 132,04 | 1,71 | 129,00 | 1,86 |
| | | Cv | 6,94 | 7,91 | 2,10 | 7,48 | 2,30 | 7,70 | 2,63 |

Average values and variability of the mass of individual carcass parts and their share in the mass of processed carcass ready to grill are given in table 2.

Data presented in table show that the lowest breast mass was registered in group I (573,55g), and the highest in group III (657g). Chickens of groups II and IV (with 0,3 and 0,9mg Se/kg of food) realized breast mass of 627,90 and 633,12g. Compared to group I, average breast mass of chickens from groups III and IV was significantly higher ($P < 0,05$ and $P < 0,01$). The share of breasts in percentage in the mass of processed carcass was also the highest in groups III

and IV (37,40 and 37,86%), and the lowest in group II (36,0%). Share of breasts in chickens of group I was 36,47%. No statistically significant differences were established between average values for share of breast in the mass of processed carcass (P > 0,05). Similar results in regard to use of different levels of organic selenium and related to mass and share of breasts in the mass of processed carcass were obtained by *Naylor* et al. (2000). Inclusion of organic selenium into diet for broilers in their research has significantly increased the mass (P < 0,05) and share of breasts (P < 0,05) in the mass of processed carcass. *Marković* (2007), states similar results, only the diet for broilers in this research was supplemented not only by organic selenium (0,3mg/kg) but also vitamin E (100IJ).

**Table 2. Yield and share of main parts in mass of cooled carcass ready to grill**

| Group | Sex | Trait | Carcass parts | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Breasts | | Thighs | | Drumsticks | |
| | | | Mass g | Share % | Mass g | Share % | Mass g | Share % |
| I | m+f | x | 573,55$^{aA}$ | 36,47 | 221,95 | 14,11 | 252,02$^{aA}$ | 16,02 |
| | | Sd | 31,03 | 1,33 | 15,35 | 0,74 | 16,73 | 1,07 |
| | | Cv | 5,41 | 3,65 | 6,92 | 5,28 | 6,64 | 6,68 |
| II | m+f | x | 627,90$^{ab}$ | 36,00 | 252,84 | 14,40 | 289,80$^{b}$ | 16,63 |
| | | Sd | 67,99 | 1,64 | 40,17 | 0,73 | 27,63 | 0,63 |
| | | Cv | 10,83 | 4,55 | 15,89 | 5,07 | 9,53 | 3,79 |
| III | m+f | x | 657,00$^{B}$ | 37,40 | 246,22 | 13,98 | 292,03$^{B}$ | 16,62 |
| | | Sd | 59,09 | 0,99 | 28,89 | 0,60 | 27,30 | 0,67 |
| | | Cv | 8,99 | 2,65 | 11,73 | 4,29 | 9,34 | 4,03 |
| IV | m+f | x | 633,12$^{b}$ | 37,86 | 239,71 | 14,28 | 277,61$^{ab}$ | 16,53 |
| | | Sd | 39,07 | 1,87 | 23,56 | 0,38 | 30,03 | 0,78 |
| | | Cv | 6,17 | 4,94 | 9,83 | 2,66 | 10,82 | 4,72 |

Differences between a and b are significant on level P<0,05
Differences between A and B are significant on level P<0,01

The greatest average mass of thighs (252,84g) was established in chickens fed diet with 0,3mg Se/kg, whereas the chickens of the first group fed diet without supplemented selenium had the lowest mass of thighs (221,95g). In chickens of groups III and IV (with 0,6 and 0,9mg Se/kg of food) established values for thigh mass were slightly lower than in chickens of group II (246,22 and 239,71g), which is by 10,93 and 8,0% higher compared to group I. Average share of thighs in the mass of processed carcass was approximately the same in all investigated groups. The highest (14,4%) was established in chickens of

group II, and the lowest (13,98%), in chickens of investigation group III. Established values in groups I and IV of chickens were 14,33 and 14,28%.

If data for average mass of drumsticks is analyzed, it is registered that chickens fed selenium in their diet (0,3, 0,6 and 0,9mg/kg) had realized the best results (289,8, 292,03 and 277,61g). Values established in chickens of groups II and III were considerably higher ($P<0,05$ and $P<0,01$), by 14,99 and 15,87% respectively, compared to chickens I. The same can be said for the share of drumsticks in the mass of processed carcass, since their share in percentage was higher (by 3,80, 3,74 and 3,18%) in chickens fed diets with addition of this microelement compared to chickens of group I, but established differences weren't statistically significant ($P > 0,05$).

## Conclusion

Based on obtained results for slaughter properties of broiler meat realized in this research, the following can be concluded:

1. Average values for carcass yields »conventional processing«, »ready to roast« and »ready to grill« were very uniform between groups II and III (with addition of 0,3 and 0,6mg Se/kg). The lowest values for stated parameter were determined in group I (0mg Se/kg) and group IV (0,9mg Se/kg).
2. Average values for slaughter yields »conventional processing«, »ready to roast« and »ready to grill«) were approximately same in chickens of all investigation groups, and established results weren't statistically significant ($P > 0,05$).
3. The lowest breast mass was in group I (573,55g), and the highest in group III (657g). Chickens of groups II and IV (with 0,3 and 0,9mg Se/kg of food) realized breast mass of 627,90 and 633,12g. Compared to group I, average breast mass of chickens in groups III and IV was significantly higher ($P < 0,05$ and $P < 0,01$).
4. The share of breasts in percentage in mass of processed carcass was the highest in groups III and IV (37,40 and 37,86%), and the lowest in group II (36,0%). Share of breasts in chickens of group I was 36,47%. Between average values for share of breasts in the mass of processed carcass no significant statistical differences were established ($P > 0,05$).
5. The highest average thigh mass (252,84g) was established in chickens fed diets with 0,3mg Se/kg (II group), whereas chickens of the first group fed mixture without addition of selenium had the lowest thigh mass (221,95g). Chickens of groups III and IV (with 0,6 and 0,9mg

Se/kg of food) had by 10,93 and 8,0% higher mass of thighs compared to group I.

6. The highest value (14,4%) for average share of thighs in the mass of processed carcass was established in chickens of group II, and the lowest (13,98%) in chickens of group III. Established values in groups I and IV were 14,33 and 14,28%.
7. Mass of drumsticks in chickens of groups II and III was by 14,99 and 15,87% higher than in chickens of group I ($P<0,05$ and $P<0,01$).
8. Addition of organic selenium in the form of selenized yeast (0,3, 0,6 and 0,9mg/kg) in the food for fattening chickens increased the share of drumsticks in the mass of processed carcass (by 3,80, 3,74 and 3,18%) compared to chickens of the first group ($P > 0,05$).

# UTICAJ RAZLIČITIH NIVOA ORGANSKOG SELENA NA KLANICNE OSOBINE BROJLERA

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## Rezime

Ispitivan je uticaj različitih nivoa organskog selena (selenizirani kvasac) na klanične osobine mesa tovnih pilića (brojlera). Ogled je izveden na 120 pilića provenijence Hybro-PN podeljenih u četiri grupe, u trajanju od šest nedelja. Sve grupe pilića hranjene su potpunim smešama, a selen je dodavan u hranu u formi seleniziranog kvasca u količini od 0 (I ); 0,3 (II); 0,6 (III) ili 0,9mg/kg (IV-grupa).

Najveće prosečne vrednosti za prinos trupova »standardna obrada«, »spremno za pečenje« i »spremno za roštilj« imali su pilići III grupe (2059,6, 1851,97 i 1756,45g), sa dodatkom 0,6mg Se/kg. Zatim sledi II (2048,17, 1841,36 i 1748,57g) i IV grupa (1957,46, 1764,22 i 1676,05g) sa 0,3 i 0,9mg/kg dodatog selena, dok su najmanje vrednosti (1835,21, 1660,87 i 1572,61g) ustanovljene u I grupi bez dodatka ovog mikroelementa.

Prosečne vrednosti za klanične randmane (»standardna obrada«, »spremno za pečenje« i »spremno za roštilj« su bile približno iste kod pilića svih ispitivanih grupa, a utvrđene razlike nisu pokazale statističku značajnost ($P > 0,05$).

Najmanja masa grudi bila je u I grupi (573,55g), a najveća u III (657g). Pilići II i IV grupe (sa 0,3 i 0,9mg Se/kg hrane) ostvarili su masu grudi od

627,90 i 633,12g. U odnosu na I grupu, prosečna masa grudi pilića III i IV grupe bila je značajno veća ($P < 0,05$ i $P < 0,01$).

Udeo grudi u masi očišćenog trupa bio je najveći u III i IV grupi (37,40 i 37,86%), a najmanji u II (36,0%). Kod pilića I grupe navedena vrednost je iznosila je 36,47%.

Prosečan udeo bataka u masi očišćenog trupa bio je približno isti kod svih ispitivanih grupa. Najveća vrednost (14,4%) ustanovljena je kod pilića II, a najmanja (13,98%), kod pilića III ispitivane grupe.

Pilići koji su u hrani dobijali organski selen (0,3, 0,6 i 0,9mg/kg) imali su za 3,80, 3,74 i 3,18% veći udeo karabataka u masi očišćenog trupa u odnosu na piliće I grupe.

**Ključne reči:** pilići selenizirani kvasac, klanične osobine

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