CARCASS AND MEAT QUALITY OF NEW ZEALAND WHITE RABBITS AS AFFECTED BY GIBBERELLIC ACID AND ANTIOXIDANTS.

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(Received 17/2/ 2012, Accepted 5/4/ 2012)

SUMMARY

The objective was to evaluate the effects of gibberellic acid (GA_3) and vitamin E and Selenium as antioxidants (AO) on carcass characteristics, chemical composition and meat quality of New Zealand white rabbits. After weaning age, all experimental rabbits were distributed into four treatments groups. The treatments 1, 2 and 3 were given 75 mg of GA_3/1litr, 1 ml of AO/1litr and mixture of them (same concentrations) in drinking water, respectively during fattening period (20 weeks). While, the control group (C) had no addition in drinking water. The obtained results confirmed that gibberellic acid and antioxidants added groups had significant ($P \leq 0.05$) higher dressed carcass, liver percentages, carcass lengths, fatness, protein, Ca and Fe percentages of meat content. Likewise, significant effects were found on sensory attributes (tenderness and juiciness), texture and pH of meat. However, no significant differences in percentages of heart, kidney, dissectible fat, Lean: bone ratio, moisture, ether extract, ash, P, aroma, taste, flavor and water holding capacity (WHC) were found among all groups. Also, Na of meat content of antioxidants added groups were significantly lower than the control and GA_3 groups. In conclusion, using gibberellic acid with or no antioxidants as a water supplement confirms its potentiality and non-harmful effect which matches with the consumer's desire and health.

Keywords: *rabbits; gibberellic acid; antioxidants; carcass characteristics; meat quality.*

INTRODUCTION

Rabbits meat consider an excellent alternative source of animal protein and may offer considerable potential for bridging the gap between supply and demand for animal protein, especially in Egypt. Rabbit meat is wholesome, tasty with appreciable juiciness and tenderness as well as it has a high amount of protein, essential fatty, amino acids, water-soluble vitamins and minerals, such as iron and zinc and low fat or cholesterol (Lebas *et al*, 1986; Wattanachant *et al.*, 2004; Das and Bardoloi, 2005; Barroeta, 2006; Hernàndez and Gondret, 2006; Cavani and Petracci, 2006; Hernández, 2008). In addition, rabbit has a quite high dressing percentage when compared to ruminants (Lebas *et al*, 1986). These attributes are determined by biological and productive factors as well as slaughter age, weight, breed, genetics, sex, diet, feed additives, physical activity (Ouhayoun, 1998; Xiccato, 1999; Dalle Zotte, 2002; Fletcher *et al.*, 2000; Hernández, 2008; McKee *et al.*, 2009).

Feed additives as growth promoters and antioxidants can influence, the hormonal profile of animals consequently, meat quality (Barroeta, 2006; King *et al.*, 2006; Hernández, 2008). Use of Gibberellins for promoting plant growth and the presence of potentially high residual levels on plant materials which can be used in rabbits feeds, and then some studies have studied the effects of GA3 on rabbits growth as growth promoter (Alkhiat *et al.*, 1981; Leewrigho, 1993; Abd-Elhamid *et al.*, 1994; Baydar, 2002; Azza *et al.*, 2003, Azza 2004). However, relative dearth information is available on GA3 potential metabolic effects in meat quality of rabbits (Gawienowski and Chatterjee, 1980).

Antioxidant has been shown to play a major role in the development and maintenance of the defense systems against diseases and other stresses (Yu, 1994). In order to improve the oxidative stability, different substances such as carotenoids, vitamin E, vitamin C and selenium have been tested in several experiments in order to verify their potential antioxidant effect on poultry meat (King et al., 2006; Fisinin et al., 2008). Physiological importance of AO was recognized when it was found to be an essential structural component of the glutathione peroxidase enzyme (Rotruck *et al.*, 1973), which has an important role in preventing oxidative damage in erythrocytes or tissues. Tawfik (1998) reported that vitamin E protects polyunsaturated fatty acids from oxygen effects, and inhibits lipid peroxidation enhanced as a free radical scavenger (Situnayake *et al.*, 1990). In Egypt, different residuals of growth promoters such as gibberellic acid can be found naturally in many edible plants for rabbits as feedstuffs, which can affect meat quality consequently health human. Although gibberellic acid and antioxidants are of low mammalian toxicity, it was of interest to investigate the effect of both compounds together on carcass and meat quality of New Zealand white rabbits.

MATERIALS AND METHODS

Thirty two weaned New Zealand white rabbits were distributed into four treatments groups (8 rabbit each) to evaluate the effects of gibberellic acid (GA) and vitamin E and Selenium as antioxidants (AO) on carcass characteristics, chemical composition and meat quality of New Zealand white rabbits at the Research Poultry Farm of Animal and Poultry Production Department, Faculty of Agriculture, Assiut University, Assiut, Egypt. At weaning age, all experimental rabbits were distributed into four treatments groups. The treatments 1, 2 and 3 were given GA3 (75 mg/1litr), vitamin E (100 IU/1litr and 0.5 mg Se/kg) and mix. of GA3+ vitamin E and selenium in drinking water, respectively during fattening period. While, the control group (C) had no additives in drinking water. Rabbits were housed in galvanized wire cages and were kept under the same managerial, hygienic and environmental conditions. All animals were fed *ad libitum* containing 2460 ME kcal, 15% CP, 11.17% CF, 0.9% Ca and 0.31 available phosphorus. At the end of the growing period (20 weeks), three rabbits were selected for slaughter, weighing around average mean body weights of each treatment. Dorsal length, thigh length and lumbar circumference were measured. After 24 h chilling at 4°C, carcasses were graded by a specialized evaluator for conformation (scale value from 1, poor, to 5, optimum), fatness (from 1, scarce, to 3, optimum, to 5, excessive) and colour (from 1, pale, to 3, optimum, to 5, red). Carcass weight was considered as the weight of fore part, intermediate part and hind part. The weight of additional edible parts included the weight of the liver, heart and kidneys. Dressed meat weight was obtained as the sum of the carcass weight and the weight of the edible parts. Dressing yield was calculated by dividing the dressed meat weight by preslaughter weight and expressed as a percentage. Lean and bone were separated and meat-to-bone ratios were calculated. Dressing out percentage (chilled carcass weight × 100/liveweight) was calculated. Meat to bone ratio of the hind leg was calculated as the relationship between dissected meat weight and bone weight of the hind leg. Chemical composition of muscles was determined according to AOAC (1990) procedures. Each sample was divided into two parts: one for chemical analyses and the other for sensory evaluation.

Sensory evaluation: A test panel consisting of five panelists judged the meat samples for color, texture, tenderness, juiciness, and flavour, taste, aroma and acceptability of rabbit meat with grades of 10 points. To estimate the water holding capacity (WHC) sections of LD muscles (size mm 25 x 25 x 5), after being weighed, the paper with meat was placed between two glass plates. The weight losses were evaluated after pressure in paper filter for 10 minutes by loads of 1.0 kg, measuring the weight losses. Water holding capacity was first expressed as percentage: Damp filter paper weight-dry paper filter weight/ Meat sample weight *100. The ultimate pH (pHu) was determined on the left *Longissimus dorsi* muscle next to the 5th lumbar vertebra on the 24 h chilled carcass using a pH meter.

Statistical analyses: One Way Analyses of Variance (ANOVA) using general linear model (GLM) of SAS software (SAS Institute, 1996) statistically analyzed Data. Significant differences between treatment means were determined using Duncan's new multiple ranges test (Duncan, 1955).

RESULTS AND DISCUSSION

Carcass appearance (lengths, colour and conformation):

Data presented in Table, 1 showed carcass lengths, colour and conformation of all treatments. It is noteworthy that the trend of increasing carcass length and circumference in both the GA3 and AO added groups was similar and numerically higher than those of the control group. Carcass conformation and color of all treatment were less different ($p<.05$) except fatness. Attractive appearance to consumer of meat is performed by its carcass conformation or meat color which might be related to genotypes, feeds, rearing system or even processing condition. Previous studies reported that GA3 groups had higher body weight (Abd El-Hamid *et al.*, 1994; Azza *et al.*, 2003; Elkomy 2003; Azza, 2004), and then increased carcass lengths and circumference. Moreover, Marey (1974) reported that live body weight due to GA3 treatment was increased, this may be attributed to GA3 physiological effect on regulation of the cell division; stimulation of digestive enzymes production and synthesis of protein. The results obtained here are in accordance with those of Abd-Elhamid *et al.* (1994) who concluded that, the percentage of muscular fat deposition was increased in broiler chicks fed rations containing GA3. It can be observed that this effect of GA3 is similar to the effect of estrogen. Pale carcass (color) is a rising problem among high yielding meat animals. Ferket and Foegeding, (1994) reported that high levels of antioxidants could control a great amount of the pale carcass problem in turkeys. This report suggests that there may be an oxidative problem associated with post-mortem development of pale carcass. Also, Van Laack *et al.* (2000) reported that pale carcass develops when there is accelerated post-mortem glycolysis and rapidly decreasing pH in meat that is still warm. These conditions yield meat that is pale with decreased water holding capacity and poor texture (Ferket and Foegeding, 1994).

Table (1): Effect of gibberellic acid on carcass appearance of New Zealand rabbit.

Traits	Treatments			
	C	T1	T2	T3
Dorsal length, cm (DL)	24.22±0.20 [b]	26.34±0.26 [a]	25.04±0.33 [b]	26.88±0.24 [a]
Thigh length, cm (TL)	7.44±0.18	7.54±0.32	7.34±0.44	7.63±0.17
Carcass length, cm (CL)	31.74±1.00 [b]	33.93±0.69 [a]	32.44±0.81 [b]	34.32±0.59 [a]
Lumbar circumference, cm (LC)	16.50±0.66	16.66±0.72	16.42±0.44	16.81±0.88
CL: LC ratio	1.92±0.11	2.04±0.13	1.98±0.10	2.00±0.14
Conformation	4.40± 0.08	4.32±0.18	4.36±0.08	4.42±0.19
Fatness	2.72± 0.06 [b]	3.74±0.10 [a]	2.80±0.07 [b]	3.19±0.12 [ab]
Colour	3.29± 0.05	3.33±0.11	3.42±0.05	3.28±0.11

[a and b] *Means within each row for each division (C,T1 and T2) with no common superscripts are significantly different (P≤0.05).*

C, T1, T2 and T3= Rabbits were treated with no, Ga3, AO and Ga3+ AO addition in drinking water, respectively.

Carcass characteristics:

Dressed carcass components are presented in Table 2. No significant differences (P>0.05) in the percentages of heart, kidney, whole fate, fore part, intermediate part hind part and lean: bone ratios were found among all groups except dressed carcass and liver percentages. Most carcass traits are greatly affected by the weight of rabbit before slaughter. Therefore, pre-slaughter weight is considered to be one of the most important factor affecting carcass traits in rabbits. *Rao et al.* (1978) and Ristic *et al.* (1988) reported the important effect of preslaughter body weight on carcass traits.

Table (2): Effect of gibberellic acid on carcass traits of New Zealand rabbits.

Traits	Treatments			
	C	T1	T2	T3
Heart, %	0.30±0.00	0.29±0.01	0.30±0.01	0.29±0.01
Liver, %	2.60± 0.05 [b]	2.69±0.10 [b]	2.89±0.05 [a]	2.68±0.1 [b]
Kidney, %	0.70±0.02	0.72±0.01	0.74 ± 0.02	0.72 ± 0.01
Whole fat, %	2.04±0.05	2.10±0.10	1.94±0.06	2.00±0.07
Dressed Carcass, %	56.36±0.21 [b]	57.94±0.26 [a]	56.62±0.35 [b]	57.92±0.31 [a]
Fore part, %	32.72±0.18	32.92±0.09	32.96±0.25	32.96±0.25
Intermediate part, %	29.62±0.55	29.82±0.09	29.72±0.10	29.83±0.62
Hind part, %	36.95±0.28	36.94±0.26	36.89±0.22	36.94±0.16
Lean:bone ratio	4.01± 0.05	4.28±0.12	4.11±0.05	4.22±0.11

[a and b] *Means within each row for each division (C,T1 and T2) with no common superscripts are significantly different (P≤0.05).*

C, T1, T2 and T3= Rabbits were treated with no, Ga3, AO and Ga3+ AO addition in drinking water, respectively.

From previous results can be seen that the increasing in rabbit's dressed carcass due to increase body weight that was pronounced with the GA3 and AO, that reported by some previous researches (Vesely and Rochat, 1980, Alkhiat *et al.*, 1981 and Abd-Elhamid *et al.*, 1994; Azza *et al.*, 2003; Elkomy 2003; Azza 2004). They mentioned that GA3 was known to increase the growth of animals. This effect may be due to that GA3 enhanced guanylate cyclase activity (an enzyme known to be associated with growth) in animals at the cellular levels. Also, Physiological importance of selenium as antioxidant was recognized when it was found to be an essential structural component of the glutathione peroxidase enzyme (GSHpx) (Rotruck *et al.*, 1973), which has an important potent role in preventing oxidative damage in erythrocytes or tissues. As well as the present results are in accordance with those of Azza (2004) who reported that the administration of GA3 to growing rabbits significantly affected carcass percentage (high dressed carcass and liver percentage). The liver glycogen content was also significantly higher in the GA3 treated groups, which was accompanied by the increase of the liver relative weight (El-komy 2003). While, Alkhiat et al., (1981) returned the increasing in the liver of GA3 treated rats to mitotic activity and protein synthesis. It was shown that vitamin E prevents alterations in ionic permeability of cellular membrane occurred after GA3 intake. On the other hand, Abd-Elhamid *et al.* (1994) and Azza (2004) reported that the percentages of the kidney, heart, and abdominal fat of GA3 treated rabbits were significantly decreased.

Nutritional value of meat (chemical composition):

Tables (3 and 4) summaries the effect of GA3 and AO administration on chemical composition of rabbit's meat. No significant differences in the percentages of moisture, ether extract, ash, P and meat content were found among all groups except protein, Ca, Na and Fe percentages. Consistency in such meat quality depends on controlling rearing, nutrition, management, and processing through to consumer use (Berri, 2000). Rabbit meat may also be considered as "functional foods", which provide bioactive substances with favourable effects on human health, like conjugated linoleic acid (CLA), vitamins and antioxidants, and a balanced n-6 to n-3 polyunsaturated FA (PUFA) ratio (Barroeta, 2006; Hernàndez, 2008).

Table (3): Effect of gibberellic acid on chemical composition of New Zealand rabbit's meat.

Traits	Treatments			
	C	T1	T2	T3
Moisture, %	70.82±0.66	71.11±0.72	70.92±0.44	71.11±0.88
Protein,%	21.23±0.19 ^{b}	22.04±0.11 ^{a}	21.12±0.21 ^{b}	21.96±0.20 ^{a}
Ether extract , %	2.00±0.23	2.00±0.34	1.92±0.30	1.95±0.19
Ash, %	1.21±0.32	1.14±0.22	1.11±0.18	1.21±0.27

a and b Means within each row for each division (C,T1 and T2) with no common superscripts are significantly different (P≤0.05).

C, T1, T2 and T3= Rabbits were treated with no, Ga3, AO and Ga3+ AO addition in drinking water, respectively.

Table (4): Effect of gibberellic acid on mineral composition (mg/100g) of New Zealand rabbit's meat.

Traits	Treatments			
	C	T1	T2	T3
Calcium (Ca), mg	10.72±0.66 ^{b}	12.26±0.72 ^{a}	10.88±0.44 ^{b}	11.91±0.88 ^{a}
Phosphorus (P) mg	203.0±0.20	204.2±0.26	203.5±0.33	204.8±0.24
Sodium (Na), mg	65.94±0.09 ^{a}	63.64±0.09 ^{a}	62.29±0.18 ^{b}	63.82±0.18 ^{a}
Iron (Fe), mg	1.11±0.11 ^{b}	1.44±0.06 ^{a}	1.24±0.10 ^{b}	1.43±0.05 ^{a}

a and b Means within each row for each division (C,T1 and T2) with no common superscripts are significantly different (P≤0.05).

C, T1, T2 and T3= Rabbits were treated with no, Ga3, AO and Ga3+ AO addition in drinking water, respectively.

Rabbit meat well fit the current consumer demand for a low-fat meat with a high unsaturation degree of fatty acids (FA) and low sodium and cholesterol levels (Hernàndez and Gondret, 2006; Cavani and Petracci, 2006). Fat content and fatty acid composition of triacylglycerols in muscle are strongly related to meat quality, especially in terms of flavor, juiciness and tenderness. Any decrease in rabbits fat metabolism is accompanied by decrease of rabbits blood total lipids concentration, while the protein content was increased in the GA3 treated groups (Azza 2004). The decrease in the meat lipids content of the GA3 treated rabbits was in agreement with Abd-Elhamid *et al.* (1994) with broiler chicks and Alkhiat *et al.* (1981) with rats as well as Azza (2004) in rabbits. The increase in meat protein content may be due to that GA3 stimulates synthesis of protein, as reported by El-komy (2003) with hens. Abd-Elhamid et al. (1994) found that, GA3 raised blood protein significantly when the broiler chicks were fed rations containing different levels from GA3. Increasing plasma total lipids concentration in the GA3 treated groups compared to the control, may be due to that GA3 activates the fat metabolism. *Azza et al.* (2003) proved that GA3 hormone has estrogenic-like action, and then it may be affect Ca and protein percentage.

Vitamin E is generally considered as a potent antioxidant in meat (Sheldon *et al.*, 1997; Barroeta, 2006). Tawfik (1998) reported that vitamin E protects polyunsaturated fatty acids from oxygen effects, and inhibits lipid peroxidation (Situnayake *et al.*, 1990). Also, selenium has been associated with its antioxidant activity which protects biological systems from oxidative degeneration. It considered as essential structural component of the glutathione peroxidase enzyme, which has an important role in preventing oxidative damage in tissues (Rotruck et al., 1973).

Sensory attributes (SA):

From Table (5) it can be seen that GA3 significantly increased rabbit's tenderness and juiciness. However, no significant differences were found in aroma, color, taste, flavour and susceptibility among all groups. Aroma, texture, juiciness, firmness, tenderness and flavor are among the most important and perceptible meat features that influence the initial and final quality judgment by consumers. Meat colour, one of the most important criteria in initial selection by the consumer, is related to the concentration of pigments, mainly myoglobin, hemoglobin, and cytochrome c (Froning, 1995).

Table (5): Effect of gibberellic acid on sensory attributes of New Zealand rabbit's meat.

Traits	Treatments			
	C	T1	T2	T3
Aroma	8.89±0.48	8.29±0.34	8.96±0.65	8.26±0.45
Color	8.05±0.38	8.39±0.44	7.96±0.55	8.46±0.36
Taste	8.40±0.43	8.28±0.37	8.55±0.64	8.30±0.29
Flavor	8.75±0.53	8.62±0.32	9.00±0.75	8.70±0.45
Tenderness	7.55±0.43 [b]	8.88±0.53 [a]	8.25±0.63 [ab]	8.92±0.30 [a]
Juiciness	7.70±0.39 [b]	9.00±0.38 [a]	8.92±0.55 [a]	9.00±0.28 [a]
Susceptibility	8.25±0.41	8.69±0.44	8.46±0.63	8.72±0.33

a and b Means within each row for each division (C,T1 and T2) with no common superscripts are significantly different (P≤0.05).

C, T1, T2 and T3= Rabbits were treated with no, Ga3, AO and Ga3+ AO addition in drinking water, respectively.

The color of meat is not only dependent on the concentration and chemical state of heme pigments, it is also determined by muscle structure. Also, Marey (1974) reported that GA3 consider as regulator of the cell division, stimulation of digestive enzymes production and synthesis of protein. The tenderness of meat is the sum of total of the mechanical strength of skeletal muscle tissue and it's weakening during the post-mortem aging of meat. Toughness can be defined as the ease with which meat can be cut and masticated, and is principally related to the muscle proteins. Also it is affected by intramuscular fat, structure of the connective tissue, the size of the muscle bundles, rigidity and water retention capacity. The juiciness of meat is perceived in two ways, first the sensation of moisture in the first moments of mastication produced by the rapid release of juices, followed by the slow release of serum and the stimulating effect of fat on the secretion of saliva. The basic flavour of meat is related to water soluble compounds in the muscle, such as sugars, amino acids and nucleotides, which are common to different species. The characteristic flavour of meat of a particular species is determined, however, by the proportions of different fatty acids in the fat, and, in particular, by the unsaturated fatty acids, which are more susceptible to oxidation to volatile compounds of low molecular weight, which contribute to the aroma of meat. Phospholipids, which are rich in polyunsaturated fatty acids, also play a fundamental role in the flavour of meat. Abd-Elhamid *et al.* (1994) concluded that, the percentage of muscular fat deposition was increased in broiler chicks fed GA3. Breed, sex, system of management, nutrition, and post slaughter treatments of the carcass, all can affect carcass fat and hence the flavour of the meat (Young *et al.*, 1997).

Poultry meat color is affected by many different factors like bird gender, age, strain, processing treatments, freezing and other factors (King *et al.*, 2006). Several factors impact meat color including pH, myoglobin concentration, nitrites, and others (Fletcher, 1999a). Ferket and Foegeding, (1994) reported that high levels of vitamin E supplementation in the diet could control a great amount of the pale problem in meat (color) that there may be an oxidative problem associated with post-mortem development of PSE meat. Tawfik (1998) reported that vitamin E protects polyunsaturated fatty acids from oxygen effects, inhibits lipid peroxidation enhanced and prevents lysis of phospholipids (Situnayake *et al.*, 1990). The effect of Se in poultry nutrition is associated with its participation in maintaining the antioxidant system of the cells. Addition of Se and vitamin E or their combination on chicken feed had no significant impact on perceived intensities of sensory and texture profiles of the chicken breasts or thigh muscle in general. Juiciness is an important contributor to eating quality of meat (Lyon *et al.*, 2004). Se supplementation in feed had no significant effect on fresh meat odor intensities.

Physical traits of meat (pH, water holding capacity, texture):

Results in Table (6) show that the addition of GA3 and AO affected significantly ($P \leq 0.05$) texture and pH values. In addition, no significant differences were found among treatments in water holding capacity. The main factor determining the quality of meat is its pH, which is related to biochemical processes during the transformation of muscle to meat. Muscle pH and meat color are highly correlated. As mentioned by Fletcher (1999a, b), that higher muscle pH is associated with darker meat whereas lower muscle pH values are associated with lighter meat.

Table (6): Effect of gibberellic acid on physical traits of New Zealand rabbit's meat.

Traits	Treatments			
	C	T1	T2	T3
Texture	4.44±0.04 [b]	4.78±0.03 [a]	4.64±0.05 [ab]	4.80±0.07 [a]
WHC	16.62±0.62	16.92±0.55	16.72±0.46	16.89±0.32
pH	5.88±0.11 [a]	5.44 ±0.21 [b]	5.82±0.12 [a]	5.53±0.20 [b]

[a and b] *Means within each row for each division (C,T1 and T2) with no common superscripts are significantly different (P≤0.05).*

C, T1, T2 and T3= Rabbits were treated with no, Ga3, AO and Ga3+ AO addition in drinking water, respectively.

One effect, as noted earlier, is that many of the haem-associated reactions are pH dependent. In addition, muscle pH affects the water binding nature of the proteins and therefore directly affects the physical structure of the meat. In addition, pH affects enzymatic activity of the mitochondrial system thereby altering the oxygen availability for haem reactivity (Fletcher, 1999a). Bacteria usually grow in a pH range of 4.5 to 7.5, while fungi have a wider growth range, from 2.0 to 9.0. Fresh poultry meat has an average pH of 6.4. Lactic acid production and the resultant decline in pH after death result in protein denaturation, loss of protein solubility and in an overall reduction of reactive groups available for water binding on muscle proteins. Meat texture is perceived as a combination of tactile sensations resulting from the interaction of the senses with physical and chemical properties, such as toughness, moisture and elasticity. Water holding capacity affects the retention of vitamins, minerals and salts, as well as the volume of water retained. Factors such as pH, sarcomere length, ionic strength, osmotic pressure, and development of rigor mortis influence the WHC by altering the cellular and extracellular components (Northcutt et al., 1994; Offer and Knight, 1988). Marey (1974) reported that GA3 consider as regulator of the cell division, stimulation of digestive enzymes production and synthesis of protein.

Water holding capacity (WHC) is the ability of meat to retain its water constituent when an extraneous force or treatment is applied to it. This property affects the retention of vitamins, minerals and salts, as well as the volume of water retained. Water binding potential (WBP) was defined as the ability of the muscle proteins to retain water in excess and under the influence of external forces. Expressible moisture refers to the quantity of water that can be expelled from the meat by the use of force, and measures the amount of water released under the measurement conditions. Free drip refers to the amount of water that is lost by the meat without the use of force other than capillary forces (gravity). About 88 to 95% of the water in the muscle is held intracellular within the space between actin and myosin filaments. However, only 5 to 12% of water in the muscle is located between the myofibrils (Offer and Knight, 1988). Factors such as pH, sarcomere length, ionic strength, osmotic pressure, and development of rigor mortis influence the WHC by altering the cellular and extracellular components (Northcutt et al., 1994; Offer and Knight, 1988). Abd-Elhamid *et al.* (1994) concluded that, the percentage of muscular fat deposition was increased in broiler chicks fed GA3.Tenderness, juiciness, firmness, and appearance of meat improve as the content of water in the muscle increases, leading to an improvement in quality value.

It may be concluded that GA3 and AO treatments were associated with high dressed carcass, protein, best sensory traits and less fat deposition which matches with the consumer's desire and health.

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تأثير حمض الجبريلك ومضادات الاكسدة على جودة الذبائح و اللحم فى أرانب النيوزلندي الابيض.

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أجريت هذه الدراسة بغرض دراسة تأثير التعرض لحمض الجيريلك ومضادات الاكسدة (فيتامين هـ والسلينيوم)علي صفات الذبيحة, التركيب الكيماوي للحوم لأرانب النيوزلندي. بعد الفطام , تم تربية كل ارانب التجربة فى بطاريات ثم قسمت إلي أربعة مجاميع (مقارنة , 3 معاملات), تم تقديم الماء للمجموعة الأولى دون اى اضافات واعتبرت كمجموعة مقارنة , إما المعاملة الأولى والثانية والثالثة فتم اضافة 75 ملليجرام حمض الجبريلك/1لتر ماء, 1 مللى مضاد اكسدة/1 لتر ماء, و ومخلوط من حمض الجبريلك و مضاد الاكسدة بنفس التركيز على التوالى خلال فترة التسمين (20 إسبوع). أظهرت النتائج المتحصل عليها أن اضافة حمض الجبريلك و مضاد الاكسدة فى الماء للأرانب النامية كان ذو تأثير معنوي (مستوى معنوية 5%) على كلا من نسب التصافي، طول الذبيحة، درجة التسمين ، الكبد, البروتين, الكالسيوم, الحديد باللحم , وايضا وزاد كلا من الطراوة , العصيرية ، القوام و درجة حموضة اللحم. وان كان التأثير غير معنوي على نسب القلب, الكلية, دهن الذبيحة ونسبة اللحم:العظام, نسبتى الرطوبة والدهن, ودرجات التذوق, الرائحة, الطعم و قدرة اللحم على الاحتفاظ بالماء.بينما كان محتوي اللحم من الصوديوم فى المجاميع المعاملة اقل معنويا عن مجموعة المقارنة. بصفة عامه نستخلص انه يمكن استخدام حمض الجبريلك مع أو بدون مضادات الاكسدة للأرانب النامية وتأثيره الفعال و الغير ضار على جودة اللحوم التى تتماشى مع صحة وذوق المستهلك.