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EFFECT OF SPRAYING HATCHING EGGS BY DIFFERENT LEVELS OF VINEGAR ON EMBRYOLOGICAL DEVELOPMENT, HATCHABILITY AND PHYSIOLOGICAL PERFORMANCE OF DANDARWI CHICKS

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ABSTRACT: The aim of this experiment was to evaluate the effects of spraying fertile eggs of Dandarawi chicken local strain with natural white vinegar solution (NWVS) on embryonic development, physiological parameters, hatchability, post-hatch chick growth and bacterial quantity on eggshell surface. Four hundred and fifty hatching eggs of Dandarawi chicken local strain were randomly distributed into five groups of 90 eggs each. Eggs of the 1st group were served as a control (non–treated eggs). The 2nd group was sprayed with water as a vehicle (positive control). Eggs of the 3rd, 4th and 5th groups were sprayed with three concentrations of vinegar: 1.25, 2.5 and 5%, respectively.

Results showed that embryo weight, embryonic and shank lengths as well as, chick body weight, chick and shank lengths and hatchability tended to be Significantly higher ($P<0.05$) in eggs treated with natural white vinegar solution when compared with control eggs. While albumen weight ratio, egg shell thickness, egg weight loss ratio at 18th day of development, embryonic mortality and hatch time were significantly ($P<0.05$) decreased in eggs sprayed with natural white vinegar solution when compared with control eggs. Blood constituents: RBCs, Hb and PCV%, plasma total protein, albumin, total lipids, P, Ca and T4, GH hormones were significantly increased ($p<0.05$), while plasma cholesterol and glucose were decreased. There was no effect on WBCs count compared to control. Internal organs of chicks at hatch and growth performance of chicks at 14th days of age recorded significant higher values and improved feed conversion in response to spraying with natural white vinegar solution but yolk residual of chicks at hatch was less than control group. The use of natural white vinegar solution had significant influence on TBC and T. StaPhly. C.on egg shell surface either at one week or after two weeks of incubation compared to control groups.

These results indicated that spraying fertile eggs of chicken (pre-incubation) with natural white vinegar solution as natural disinfectants is a good way to improve embryonic development, blood constituents, hormones, hatchability and performance of chicks.

Keywords: white vinegar - chicken eggs - embryonic development - blood constituents

INTRODUCTION

It is well documented that chicken fertile eggs are infected by numerous micro organisms before and after lying. Bacteria, can move into the egg from an infected hen reproductive tract or penetrate through the egg shell when, the egg is contaminated with fecal material (Harry, 1963; Board et al., 1964 and Williams et al., 1968). In general, microbial contamination of hatching eggs causes poor hatchability and unsatisfied performance of the chick. Fumigation, UV light, spray application and washing with convenient sanitizers are the common applied practices for egg sanitation (Adler et al. 1979; Arhienbuwa et al. 1980; Kuhl, 1989; Proudfoot et al., 1985; Sacco et al., 1989; Whistler and Sheldon, 1989). An effective hatchery sanitation program is necessary to achieve a high hatchability percent and ensure the production of good quality chicks. Formaldehyde fumigation is the most common and considered an effective anti-microbial agent, however, it is a toxic chemical, and can severely damage the dormant embryo if the fumigation is carried out improperly (Cadirci, 1997). In addition, formaldehyde is a harmful and irritant for the eyes and nose and has a lingering noxious odor (Whistler and Sheldon, 1989). Most importantly, recent actions taken by the protection agency regulate the use of such these chemicals under the low on the control of toxic substances act due to its suspected carcinogenicity (Chemical and engineering news, 1984). Recent studies showed that organic acids such as acetic acid are used primarily to control mold, inhibit the growth of pathogenic bacteria in the gastrointestinal tract, modify pH levels and accelerate growth of beneficial bacteria and thus improve feed utilization (Adams, 1999, Watarai and Tana, 2005, Hudha et al. 2010 and Cooksley, 2011). Furthermore, organic acids have potent bacteriostatic agent effects and have been used as Salmonella control agents in feed and water supplies for poultry (Ricke, 2003). Manwar et al. (2012), Found improved feed conversion, significant increase in body weight gain, and reduced the cost of broiler feeding. Therefore, the aim of this study was to evaluate the practical applicability of spraying hatching eggs by different levels of vinegar as an organic acid on the physiological changes in the embryos, hatchability and post hatch chicks.

MATERIALS AND METHODS

The present study was conducted at the Poultry Experimental Station, Faculty of Agriculture, New Valley University, Egypt.

Solutions preparation

Natural white vinegar 5% was purchased from local market and considered as a stock solution in this experiment. Fifty ml from the previous solution was diluted with the same amount of distilled water to prepare 2.5% of vinegar. A 1.25% natural white vinegar solution (NWVS) was prepared by mixing 75mL of water and 25mL of vinegar (5%).

Experimental eggs:

Four hundred and fifty fertile eggs were obtained from breeder hens Dandarawi chicken local strain and randomly distributed into five groups of 90 eggs each. Eggs of the 1st group were served as a control group (non–treated eggs). The 2nd group was sprayed with water as a vehicle (positive control). The 3rd, 4th and 5th groups were sprayed with three concentrations of vinegar: 1.25, 2.5 and 5%, respectively. The prepared solutions were sprayed on the egg surfaces, using a

hand sprayer. After applications, eggs were dried at 22°C for 10 minutes. A total of 30 eggs from each study group was numbered and weighed at the beginning and on day 18th of incubation to determine egg weight loss percent. Infertile eggs and eggs containing dead embryos were eliminated from the calculation.

Incubation Management: Eggs were incubated at temperature of 37.5°C and 65% relative humidity until day 18th of incubation then; eggs were transferred to the hatcher during the last three days.

Bacteriological Examination: Four eggs from each group were taken for bacteriological measurements at 7th and 14th days of incubation. Each egg was placed immediately in sterile bag containing 10 ml of sterile phosphate buffered saline (PBS) with 7.2 pH. Egg washing technique was carried out to recover the shell-associated bacteria for estimating the total viable bacterial count (TBC) and total Staphylococcus count (TSC) spp. by using plate counting agar (PCA); (Conda lab., Spain) and Baired Parker agar (BPA) (Lab M, UK), respectively. Serial dilutions were made in PBS and then were cultivated into sterile Petri plates (Gentry and Quarles, 1972; Jones et al., 2002). The plates were incubated at 37°C for 24 hours and at the end of incubation, the plates were removed and colonies were counted and multiplied by the dilution factor. Colonies were measured as cfu/egg (Özelik, 1992).

Total bacterial count: Total bacterial count was carried out on plate counting agar according to standard methods of BAM. (2005).

Total Staphylococcus count: Dilutions made for TBC were pour-plated on Baired Parker agar (BPA) (Lab M, UK). Typical colonies were counted after 24 hours of incubation at 37°C. Suspected Staphylococcus spp colonies were confirmed by coagulates activity and confirmed by other biochemical reactions.

Traits measured:

The ratios of embryo weight, albumen weight were estimated in relation to the egg weight. Shell thickness (mm), embryonic and shank lengths at 14th and 18th day of incubation were recorded. Also, egg weight loss at 18th day of development was considered. Chick and shank lengths and body weight were measured. The percentages of residual yolk sac, liver, gizzard, heart and intestine were weighed and calculated as percentage to the live body weight of hatched chick.

At hatch, blood samples were randomly collected from six chicks per treatment. A part of the fresh blood was used to examine and count; red blood cells (RBCs $10^6/mm^3$), hemoglobin (Hb g/dl), packed cells volume (PCV %), white blood cells (WBCs $10^3/mm^3$) and differential counts. The other part from samples was centrifugated for 15 minutes at 3000 rpm and stored at (– 20 C^o) for further analysis. Plasma hormones such as thyroxin (T4 ng/ml) and growth hormone (GH ng/ml) were studied. In addition, some biochemical parameters total protein (g/dl), total lipids (mg/dl), cholesterol (mg/dl), glucose (mg/dl), phosphorus (P mg/100ml) and calcium (Ca mg/100ml) were determined by enzyme immunoassay using commercial kits.

Hatch parameters: During the last few hours before hatching (between 468 and 492 hour of incubation), eggs were transferred and checked every eight hours and hatched chicks were recorded. After the end of incubation, chicks were

removed from each hatch basket and weighted. Un-hatched eggs were examined the embryonic mortality and scientific hatchability of fertile eggs was calculated. Hatch time was monitored after the hatch of first chick.

Chick Performance: At the day of hatch, 21 chicks per group (7chicks/pen) were raised to evaluate their performance for 14 days. Chicks were individually weighted. Chicks were kept (3 pens/group) in different pens with 7 chicks. Grower diet (2,800 kcal of ME / kg and 19 % CP) was provided ad-libitum (Table 1). At the end of 14^{th} days, all chicks were individually weighed. Body weight at 1^{St} day (BW1) and 14^{th} day (BW14) were recorded to calculate the body weight gain (BWG). Feed intake (FI) was reported for each replicate and thereby feed conversion ratio (FCR) as g feed/g BWG was calculated.

Statistical Analysis: Data obtained from this study were statistically analyzed using one-way ANOVA. Differences among groups were evaluated according to procedure out lined by Gomez and Gomez (1983). Significant of differences between means was defined at 5% level compared using the Duncan's multiple range test (Duncan, 1955).

RESULTS

The embryo weight percentage and shank sprayed with 2.5% (NWVS) had the highest values of at days 14^{th} and 18^{th} of incubation and at hatch. Significant ($P<0.05$) increase in the albumin consumption consequently the embryo weight was observed on day 18^{th} compared to day 14^{th} of development for treated groups (NWVS). On the other hand, there was a significant decrease ($p< 0.05$) in albumin at 14^{th} and 18^{th} days of incubation (Table 2). The lowest percentage of albumin was found in eggs sprayed with 2.5% (NWVS), followed by 5% then 1.25%, respectively, compared to the control group.

Egg weight loss from 0 to 18 days of embryonic development, is presented in Table 2. Results showed that egg loss rates varied significantly ($P< 0.05$) between 9.71 and 11.76% among all groups. The egg weight losses of all natural white vinegar solution treatment groups were significantly lower ($P<0.05$) than the untreated groups.

No significant differences were found in egg shell thickness (mm) among treated and not treated eggs at the 14^{th} day of incubation. However, there was a significant decrease ($p<0.05$) in the 18^{th} day of incubation in eggs sprayed with (NWVS) Table 2.

The effect of natural white vinegar solution on the length of incubation period is presented in Table (3). Results showed that eggs treated with NWVS had shorter incubation periods than non-treated eggs. Chicken's eggs sprayed with 1.25, 2.5 and 5 %, vinegar recorded shorter periods (502.7, 498 and 501 hours) respectively compared to water sprayed (503.6 hours), and control group (504.3) hours.

Hatchability

The percentage of hatchability had significantly increased for all treated groups by spraying with natural white vinegar solution compared to untreated groups (Table 3). The highest percentage was observed in eggs sprayed by 2.5% natural white vinegar solution compared with the lowest one in control. Spraying fertile eggs with either 2.5 or 5% natural white vinegar solution resulted in increased hatchability of fertile eggs by 11.13 and 10.9 % of the control value, respectively. Consequently, embryonic mortality was significantly different between groups treated with natural

lengths by 14^{th} and 18^{th} days of incubation period, as well a

white vinegar solution than that of untreated eggs (Table 3), lowest mortality was estimated in eggs sprayed by 2.5 and 5% natural white vinegar solution compared to the untreated groups.

Blood constituents:

Results in Table (4) showed significant ($P<0.05$) increase in the hematological parameters, total protein, total lipids and hormones, in addition to some minerals such as phosphorus and calcium levels of chicks hatched from eggs sprayed by NWVS as compared to the control and water sprayed groups. Spraying fertile eggs with either 2.5 or 5% NWVS led to an increase in RBCs by 12.42 and 8.87 %, Hb by 26.15 and 17.25 %, PCV% by 20.35 and 9.55 %, total protein by 15.5 and 12.01%, total lipids by 6.65 and 5.36 %, growth hormone by 42.68 and 29.26 % and T4 by 10.63 and 7.13 %, Phosphorus by 9.9 and 6.75 %, calcium level by 13.41 and 10.78 %, of the control value, respectively. There was non-significant difference in counts of different white blood cells (%) in hatched chicks as in Table (4). While cholesterol and glucose were significantly ($P< 0.05$) decreased for all treated groups compared to the untreated groups.

Internal Organs Weight

Relative weights of liver, gizzard, heart and intestine of Dandarawi chicks are presented in Table (5). Liver, gizzard, heart and intestine relative weight for chicks hatched from eggs sprayed by 2.5 and 5% NWVS were higher than those of eggs sprayed with water or control group. Furthermore; the relative weight of residual yolk for chicks hatched from eggs sprayed by 2.5 and 5% NWVS was lower than control group.

Growth performance

The averages of body weight, body weight gain, feed intake and feed conversion of chicks of Dandarawi chicks are presented in Table (6). The statistical analysis showed that the averages of body weight, body weight gain and feed intake for chicks hatched from eggs treated with NWVS were significantly higher ($P<0.05$) than those for eggs sprayed with water or control groups. Also, results showed an improvement in feed conversion rate. Spraying fertile eggs with either 2.5 or 5% natural white vinegar solution led to an increase in body weight by 9.04 and 6.71 %, body weight gain by 15.91 and 11.7%, feed intake by 3.21 and 2.01 %, of the control group, respectively.

Microbiological study

Natural white vinegar solution had significant influence on TBC and TSC compared to control group after one and two weeks of incubation (Table 7). The best significant results of TBC and TSC after one week of incubation was observed for eggs sprayed with 2.5 % natural white vinegar solution as it decreased from 33.0×10^3 cfu/egg, 3.86×10^3 cfu/egg for control to about (20.56×10^3 cfu /egg, 2.44×10^3 cfu /egg) for treated group, respectively. Similar trend of decreasing TBC and staphylococcus count (TSC) was observed for spraying eggs by natural white vinegar solution after two week of incubation. Total bacterial count on eggshell surface was increased in control untreated group from 33.0×10^3 cfu /egg at one week of incubation to 49.04×10^3 cfu/egg after two week of incubation. However, mode of action of natural white vinegar solution products is less clear.

DISCUSSION

It is well known that vinegar has a light acidic effect; accordingly it reduces the pH concentration in the crop .As a result, vinegar is capable to destroy any ingested microbe and bad bacteria. Moreover, hat vinegar, decreased the internal worms in chickens, In addition to these properties, vinegar is rich in vitamins, minerals and trace elements such as potassium which are beneficial to birds and animals. Therefore, vinegar has been used for chicken for many years since it has many health benefits and supports the immune system. It is particularly excellent at times of stress which can cause birds to be infected when the immunity is decreases. It is observed great difference in the health of flock and therefore it is recommend to all chicken breeders.

Our results showed an improvement in the percentage of embryo weight, and other related measurements at incubation days 14th and 18th, also the weight of the chick at hatch was significantly higher for eggs treated with natural white vinegar solution (Tables 2 and 3). These improvements may be due to the enhancement health status of embryos, as a result of treatment with natural white vinegar solution. Kirchgessner and Roth (1988) reported that acidification with various weak organic acids such as vinegar improve digestibility of protein and of P, Ca, Mg and Zn and acts as substrates in the intermediary metabolism and reduces the colonization of pathogens and the production of toxic metabolites. An organic acid such as acetic acid has been used in diets because of their positive effect on health and bird growth. The use of organic acids has become more acceptable to feed manufacturers, poultry producers and consumers, and there is growing interest in replacing them with antibiotics as promoters of growth (Callsen, 1999). In addition, Kishi et al .(1999) reported that dietary vinegar enhanced the absorption of intestinal calcium by improving the solubility of calcium and the nutritional effect of acetic acid found in vinegar. Angel et al. (2005), Yang et al. (2008) and Pirgozliev et al. (2008) noted that beneficial effects of dietary supplements such as organic acids on protein utilization and energy in poultry.

During the incubation period, embryo development and growth depends completely on the egg components (albumin, yolk and egg shell). In this study, a significant increase in the consumption of albumin and embryo body weight were observed at days 14^{th} and 18^{th} of development especially in the treated eggs with vinegar (Table 2). The same trend was found in the chicks after hatch which reflect the beneficial effects of organic acids on protein utilization, (Angel et al., 2005 ; Yang et al., 2008 and Pirgozliev et al., 2008).

Egg weight losses of all (NWVS) treatment groups were significantly lower ($P<0.05$) than untreated groups. This might be explained by a reduction in water loss through the pores of the eggs shell after natural white vinegar solution treatment. Egg weight loss is an important parameter for incubation it is used to estimate the exchange of vital gas and is associated with embryo metabolism and development rates (Paganelli et al., 1978; Rahn et al., 1979, Rahn and Ar, 1980 and Burton and Tullet, 1983).

The loss of egg weight due to the treatment of eggs with vinegar as disinfectants is reasonable because antiseptics may affect the cuticle layers and the porosity of the shell. This point of

view was confirmed by Brake and Sheldon (1990) who noted that any change or removal of the cuticle by antiseptics may have a significant impact on egg weight loss and hatchability. Soliman et al. (1994) found that egg weight loss was 11.3% until 15 days of incubation of hatched quail eggs.

Eggs treated with (NWVS) was similar in shell thickness (mm) compared to the untreated group at day 14^{th} of development then significantly decreased in the 18^{th} day of incubation (Table 2). This difference could be explained by the interaction between vinegar solution and the egg shell which changes its properties, and cause a thinner eggshell. As such, (NWVS) supplemental increases Ca and P digestion.

Fertilized eggs treated with vinegar solution showed shorter ($P < 0.05$) hatching time than non-treated eggs (Table 4). Hatch time is an important indicator for chick distribution in the hatcher and it is preferred to abridge the staying of chicks in the hatcher to avoid chick dehydration (Shahein et al., 2014). These results are in accordance with those already reported by Mona, 2011; Fouad and Abdel-Hafez, 2017 and Fouad et al., 2018, who reported that the shortest range of hatch time was observed for the chicks produced from eggs treated with natural disinfectants.

Hatchability of fertile eggs

Spraying fertile eggs with either 2.5 or 5% (NWVS) resulted in increased hatchability by 11.13 and 10.9 % of the control value, respectively. On the other hand embryonic mortality was significantly different between groups treated with such organic acid (Table 3). Hatchability may be improved due to decreasing the embryonic mortality, where (NWVS) may be considered as an anti-stress agent. Kadim et al. (2008). Fouad et al, (2018) reported that spraying Japanese quail eggs with natural disinfectants (pre-incubation) is a good way to improve embryonic development, hatchability.

Blood constituents:

Results in Tables (4) showed significant ($P<0.05$) increase of hematological parameters, total protein, total lipids and hormones beside phosphorus and calcium level for chicks of groups sprayed with (NWVS) compared with those for control and water sprayed groups. No significant differences among different WBC (%) in hatched chicks were observed. On the same time, while cholesterol and glucose were significantly decreased for all treated groups compared to the untreated groups. Recent studies showed that organic acids dominate the reduction of serum cholesterol and the abdominal fat of broiler chickens (Yusrizal and Chen, 2003 and Gaggia et al., 2010). Rouzbeh et al., 2016 reported that Plasma calcium was higher in the supplemented treatments by organic acid. Fouad et al,. (2018) and Yalçın et al., (2013) were proposed that, the decrease in blood WBC might be due to the reduction of the pathogenic bacterial load in the intestine with application of spraying eggs with natural disinfectants (pre-incubation) for controlling microbial load on eggshell surface of quail eggs during the incubation periods .

Internal organs Size

Relative weights of liver, gizzard, heart and intestine for hatched chicks are presented in Table (5). These organs had higher relative weights for chicks hatched from eggs treated with (NWVS) than those of control groups. Yolk residual relative weights from the same treatments were lower than control group. Our

results agreed with those of Ashayerizadeh et al., 2011 and Rouzbeh et al., 2016.

Growth performance

Growth performance (body weight, body weight gain, feed intake and feed conversion) of chicks are presented in Table (6). These parameters which resulted from sprayed with (NWVS) were higher ($P<0.05$) than those of the non sprayed group and there was an improvement in feed conversion rate. The improvement in growth performance may be due to the higher levels of T4 and GH hormones that had positive correlation with chick embryonic body weight LU ET AL (2007). In addition, that thyroid hormones appear to be critically important in maintaining normal growth and development during chick embryogenesis. McNabb (2000) and Reyns et al., (2003) suggesting that thyroxine is important for stimulating a variety of developmental and metabolic processes necessary for successful hatching. The developmental profile of plasma levels of T4 and GH hormones in embryos and hatched broiler chicks indicates that a close relationship exists between circulating levels of metabolic hormones and known developmental events LU ET AL (2007). In addition, the thyroid hormones regulate heat production during the incubation of chick eggs McNabb, (2000).

Dibner and Buttin (2002) reported that organic acids have effects beyond those antibiotics, which increased pancreatic secretion, include low pH digestion and nutritional consequences on the gastrointestinal mucosa. Huda et al., (2010) noted that acetic acid supplements in drinking water have improved growth, feed conversion. Acetic acid is an organic acid used primarily to control mold and reduce the growth of bacteria in feed, but it can inhibit the growth of microorganisms in the gastrointestinal tract, adjust pH levels and improve feed utilization (Cooksley, 2011). Mahbuba et al., (2014) reported that significantly increase ($P<0.05$) in body weight gain, body weight, better feed conversion, crypt depth of (duodenum, jejunum and ileum) and Villi height and Lactobacillus content when added acetic acid. Rouzbeh et al., 2016 reported that supplementation of organic acid improved body weight gain, feed conversion rate, final body weight.

Microbiological study

Results showed significant influence on TBC and TSC as compared to the control group after one and two weeks of incubation (Table 7). These results are in agreement with various researchers (Izat et al., 1990; Thompson and Hinton, 1997; Luckstadt, 2007) Many organic acids are used that are particularly effective against species such as Campylobacter E. coli and Salmonella. Fouad et al., (2018) found that spraying Japanese quail eggs with natural disinfectants (pre-incubation) is a good way to lowering the bacterial contamination of eggshell surface of quail eggs. However, the mode of action of vinegar solution products is still less clear.

CONCLUSION

Using natural white vinegar solution (2.5%) as natural substances for spraying fertile eggs of Dandarawi chicken may be a good way to improve embryonic development, blood constituents, hormones, hatchability, chick performance of hatching chicks and lowering the bacterial contamination of eggshell surface of Dandarawi chicken eggs.

Table (1): Composition and calculated analysis of the experimental diet through the growing period

Ingredients	**(%)**
Yellow corn	59.84
Soya bean 44%	24.20
Wheat bran	8.20
Corn gluten 66%	4.00
Di. Ca. phosphate.	1.53
Limestone	1.52
Salt	0.37
Premix**	0.30
L Methionine	0.04
Total	100.00
Calculated values (%)	
Crude protein ME,	19.0
Kcal/kg Crude fiber	2800
Ether extract Calcium	4.12
Available Phosphorus	3.05
Lysine	0.995
Methionine	0.447
Methionine + Cysteine	0.949

** Composition of premix in 3 kg is : Vit E 10,000 mg, Vit K3 1,000 mg, Vit A 10,000,000 IU, Vit B1 1,000 mg, Vit B2 4,000 mg, Vit B6 1,500 mg, Vit B12 10 mg; Niacin 20,000 mg; Vit D3 2,000,000; Folic acid 1,000 mg, Pantotenic acid 10,000 mg, Choline chloride500, 000 mg, Biotin 50 mg, Cu 3,000 mg, Fe 30,000 mg; Iodine 300 mg, Mn 40,000 mg, Zn 45,000 mg, Selenium 100 mg.

Table (2): Effect of spraying Dandarawi eggs by natural white vinegar solution on percentages of embryonic weight , albumen weight and egg shell thickness, embryonic length at 14th or 18th days of incubation and egg weight loss (0-18d)

Traits / Treatments	Initial egg weight	Embryo weight % (14d)	Albumin weight % (14d)	Egg shell thickness(mm) (14d)	Embryo weight % (18d)	Albumin weight % (18d)	Egg shell thickness (mm) (18d)	Egg weight loss % (18d)
Control	49.79	13.35^{d}	18.62^{a}	36.11	37.36^{d}	6.86^{a}	35.00^{a}	11.76^{a}
Spraying by water	49.78	13.63^{d}	18.24^{a}	36.22	37.55^{d}	6.59^{a}	34.78^{a}	11.73^{a}
Spraying by vinegar (1.25%)	49.75	14.48^{c}	16.14^{b}	35.89	39.20^{c}	5.56^{b}	33.67^{b}	10.56^{b}
Spraying by vinegar (2.5%)	49.90	16.11^{a}	12.78^{d}	35.56	41.18^{a}	3.89^{d}	32.77^{c}	9.10^{d}
Spraying by vinegar (5%)	49.92	15.25^{b}	13.66^{c}	35.78	40.13^{b}	4.62^{c}	33.44b^{c}	9.71^{c}
Pooled SEM	0.061	0.214	0.123	0.259	0.183	0.087	0.273	0.072

Embryonic length (cm)				
Traits	**Body length (14d)**	**Shank length (14d)**	**Body length (18d)**	**Shank length (18d)**
Control	7.90^{c}	0.90^{c}	11.00^{d}	1.70d
Spraying by water	8.03^{c}	1.03^{bc}	11.17^{d}	1.90^{c}
Spraying by vinegar (1.25%)	8.50^{b}	1.03^{bc}	12.60^{c}	2.23^{b}
Spraying by vinegar (2.5%)	8.83^{a}	1.30^{a}	13.27^{a}	2.67^{a}
Spraying by vinegar (5%)	8.53^{b}	1.20^{ab}	12.87^{b}	2.50^{a}
Pooled SEM	0.043	0.048	0.067	0.055

a,b,c,d. Means with the different letters in the same column are significantly different (P≤0.05).

Table(3) : Effect of spraying Dandarawi eggs by natural white vinegar solution on hatched chick body weight , body length , shank length, hatchability , embryonic mortality and hatch time.

Traits	Chick body weight (g)	Chick body length (1d)	Chick shank length (1d)	Hatchability of fertile eggs (%)	Embryonic mortality of fertile eggs (%)	Hatch time (hrs)
Control	32.88^{d}	14.83^{d}	2.63^{c}	78.56^{c}	21.44^{a}	504.33^{a}
Spraying by water	32.98^{d}	14.93^{cd}	2.67^{c}	80.31^{c}	19.69^{a}	503.67^{ab}
Spraying by vinegar (1.25%)	33.84^{c}	15.23^{c}	2.86^{bc}	84.54^{b}	15.46^{b}	502.66^{b}
Spraying by vinegar (2.5%)	35.31a	16.23^{a}	3.33^{a}	87.32^{a}	12.68^{c}	498.00^{d}
Spraying by vinegar (5%)	34.81^{b}	15.83^{b}	3.07^{b}	87.14^{a}	12.86^{c}	501.00^{c}
Pooled SEM	0.115	0.101	0.066	0.603	0.604	0.431

a,b,c,d. Means with the different letters in the same column are significantly different ($P \leq 0.05$).

Table (4): Effect of spraying Dandarawi eggs by natural white vinegar solution on blood constituents and hormones of hatched chicks.

Traits	RBC (10^6/mm^3)	HB (g/dl)	PCV (%)	WBC (10^3/mm^3)	Lymphocytes (%)	Neutrophils (%)	Monocytes (%)	Eosinophils (%)
Control	1.69d	9.56^{d}	23.97^{d}	42.41	47.33	42.67	5.67	4.33
Spraying by water	1.70d	9.81^{d}	24.38^{d}	42.41	47.33	42.66	5.33	4.66
Spraying by vinegar (1.25%)	1.79c	10.76^{c}	25.30^{c}	42.42	47.33	42.33	5.66	4.67
Spraying by vinegar (2.5%)	1.90a	12.06^{a}	28.86^{a}	42.42	47.67	42.33	6.00	4.00
Spraying by vinegar (5%)	1.84b	11.21b	26.27^{b}	42.42	47.33	42.00	6.00	4.67
Pooled SEM	0.004	0.117	0.216	0.004	0.267	0.266	0.199	0.266
	Hormones		**Biochemical blood**					
Traits	**T4 (ng/ml)**	**GH (ng/ml)**	**Total protein (g/dl)**	**Total lipids (mg/dl)**	**Cholesterol (mg/dl)**	**Glucose (mg/dl)**	**P (mg/100ml)**	**Ca (mg/100ml)**
Control	9.40^{d}	0.81^{d}	2.58^{c}	335.33^{c}	170.00^{a}	199.33^{a}	4.44^{c}	10.29^{d}
Spraying by water	9.43^{d}	0.82^{d}	2.66^{c}	343.33^{b}	168.66^{a}	198.00^{a}	4.45^{c}	10.40^{d}
Spraying by vinegar (1.25%)	9.67^{c}	0.91^{c}	2.79^{b}	347.00^{b}	167.00^{a}	190.00^{b}	4.69^{b}	10.77^{c}
Spraying by vinegar (2.5%)	10.40^{a}	1.17^{a}	2.98^{a}	357.67^{a}	145.33^{c}	176.33^{c}	4.88^{a}	11.67^{a}
Spraying by vinegar (5%)	10.07^{b}	1.06^{b}	2.89^{ab}	353.33^{a}	155.67^{b}	188.00^{b}	4.74b	11.40^{b}
Pooled SEM	0.054	0.01	0.023	1.392	0.939	0.699	0.029	0.054

a,b,c,d. Means with the different letters in the same column are significantly different (P≤0.05).

GR .H = Growth hormone, T4 = Thyroxine hormone, P = Phosphorus, Ca = Calcium

Table (5): Effect of spraying Dandarawi eggs by natural white vinegar solution on some relative carcass characters of hatched chicks

Traits	Yolk residual (%)	Liver (%)	Gizzard (%)	Heart (%)	Intestine (%)
Control	19.59^{a}	2.03^{d}	3.53^{c}	0.74^{c}	3.50^{d}
Spraying by water	19.48^{a}	2.05^{d}	3.53^{c}	0.74^{c}	3.51^{d}
Spraying by vinegar (1.25%)	18.93^{b}	2.27^{c}	3.60^{c}	0.76^{c}	3.58^{c}
Spraying by vinegar (2.5%)	15.94^{d}	2.63^{a}	3.88^{a}	0.91^{a}	4.05^{a}
Spraying by vinegar (5%)	16.54^{c}	2.55^{b}	3.75^{b}	0.86^{b}	3.83^{b}
Pooled SEM	0.064	0.015	0.018	0.010	0.016

a,b,c,d. Means with the different letters in the same column are significantly different ($p<0.05$).

Table (6) : Effect of spraying Dandarawi eggs by natural white vinegar solution on post-hatched chicks growth .

Traits	Initial chick weight (g)	Final body weight at 14thd (g)	Body weight gain (g)	Feed intake (g)	Feed conversion (g feed/g W)
Control	33.52	73.66^{d}	40.13^{d}	166.33^{c}	4.14^{a}
Spraying by water	33.67	74.00^{d}	40.32^{d}	167.33^{c}	4.15^{a}
Spraying by vinegar (1.25%)	33.76	75.23^{c}	41.47^{c}	168.33^{bc}	4.05^{b}
Spraying by vinegar (2.5%)	33.79	80.33^{a}	46.53^{a}	171.66^{a}	3.68^{d}
Spraying by vinegar (5%)	33.77	78.61^{b}	44.84^{b}	169.^{66b}	3.78^{c}
Pooled SEM	0.198	0.230	0.167	0.509	0.013

a,b,c,d. Means with the different letters in the same column are significantly different ($P\leq0.05$).

Table (7) : Effect of spraying Dandarawi eggs by natural white vinegar solution on total bacterial and total staphylococcus counts on the eggshell surface (X 10^3 cfu /egg) of 1st and 2nd weeks of incubation.

Traits	T.B.C		T. StaPhly. C.	
	T.B.C. 1st week	T.B.C. 2nd week	T. StaPhly. C. 1st week	T. StaPhly. C. 2nd week
Control	33.09[a]	49.04[a]	3.86[a]	11.05[a]
Spraying by water	33.05[a]	48.94[a]	3.87[a]	10.99[ab]
Spraying by vinegar (1.25%)	32.95[a]	48.22[b]	3.78[a]	10.80[b]
Spraying by vinegar (2.5%)	20.56[c]	19.18[d]	2.44[c]	2.53[d]
Spraying by vinegar (5%)	26.81[b]	25.07[c]	3.19[b]	2.79[c]
Pooled SEM	0.094	0.143	0.027	0.065

a,b,c,d. Means with the different letters in the same column are significantly different (P≤0.05).

T.B.C. =Total bacterial count of quail eggs - T. StaPhly. C.= Total staphylococcus count of quail eggs

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الملخص العربى

تأثير رش بيض التفريخ بمستويات مختلفة من الخل على النمو الجنيني و التفريخ والأداء الفسيولوجي لكتاكيت الدندراوي

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الغرض من هذا البحث هو دراسة تأثير رش بيض التفريخ بمحلول الخل الأبيض الطبيعي على التطور الجنيني، وبعض الصفات الفسيولوجية و معدلات الفقس وأداء الكتاكيت الفافسة وكذلك التلوث البكتيري على سطح قشر البيض. تم تقسيم 450 بيضة تفريخ لدجاج الدندراوى المحلي عشوائيا إلى 5 مجموعات بكلًا منها 90 بيضة. المجموعة الأولى هي المجموعة الكنترول (بيض غير معامل). و المجموعة الثانية تم رش البيض بالماء المقطر(كنترول إيجابى) و تم رش بيض المجموعه الثالثة والرابعة والخامسة بمحلول من الخل الأبيض الطبيعى :(1.25٪ و 2.5٪ و 5٪ على التوالي).

أظهرت النتائج زياده معنوية فى وزن وطول الجنين وطول عظمة الساق للجنين وأيضا وزن الكتاكيت الفافسة وطول الجسم و طول عظمة الساق ، كما زادت نسبه التفريخ من البيض المخصب فى حين أن وزن الألبيومين كنسبة مئوية من وزن البيضة و سمك قشرة البيضة ونسبة الفقد المائى عند عمر 18 يوم من التفريخ ونسبة الاجنة الميتة وقت الفقس قد إنخفض في البيض الذي تم رشة بمحلول الخل الأبيض الطبيعي بالمقارنة مع البيض الغير معامل.

كما تحسنت معنويا صفات الدم: عدد كرات الدم الحمراء والهيموجلوبين ونسبة المكونات الخلوية للدم (الهيماتوكريت) وبروتينات الدم الكلية والألبيومين والدهون الكلية والفسفور والكالسيوم والهرمونات: هرمون الغده الدرقية وهرمون النمو بينما إنخفضت نسبة الكوليسترول و نسبة جلوكوز الدم للكتاكيت الفافسة من البيض المعامل برش محلول الخل الأبيض الطبيعي ولم يكن هناك أي تأثير على عد كرات الدم البيضاء مقارنة بالكنترول .

كما تحسنت نسب الأعضاء الداخلية للكتاكيت الفافسة وتحسنت صفات النمو للكتاكيت (وزن الجسم و وزن الجسم المكتسب ووزن العلف المستهلك ومعدل التحويل الغذائى) عند عمر 14 يوم ،في حين وجد إنخفاض معنوى فى نسبه وزن الصفار المتبقى للكتاكيت الفافسة للبيض المعامل بالمقارنه بالكنترول.

كان لرش البيض بمحلول الخل الأبيض الطبيعي تأثير كبير حيث إنخفض العدد البكتيرى الكلى والعدد الكلى لبكتيريا الاستافيلوكوكس بعد أسبوع و أسبوعين من وضع البيض بالمفرخة0

أشارت نتائج الدراسة إلى أن إستخدام الخل الابيض كمطهر طبيعي في رش بيض الدجاج المخصب هو وسيلة جيدة لتحسين النمو الجنيني ومكونات الدم والهرمونات ونسبة الفقس وأداء الكتاكيت بعد الفقس.