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SOME PRODUCTIVE ASPECTS RELATED TO WATER POLLUTION OF BROILER CHICKS

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ABSTRACT

Two hundred and ten one day old Arbor Acres chicks were obtained and divided into seven treatments, each of 30 chicks. Chicks of each treatment were subdivided into three replicates, 10 chicks each . The experiment was extended up to seven weeks of age.

Three sources of heavy metals: Lead (Pb), Cadmium (Cd) and Arsenic (As) were used in forms of chlorides. Two levels of each element were applied to meet three -fold and six -fold of their high concentration allowed in tap water as measured and reported by Egyptian Ministry of Health and Population.

Polluted water by lead , cadmium and arsenic at both levels caused decreased body weight and feed intake of chicks at 4 and 6 weeks of age. While there were no effects of these metals on feed conversion.

Birds consumed the highest level of $Pbcl_2$ by level 300 ppm presented the lowest ($P<0.05$) values of water consumption during the whole experimental period compared with other treatments and control Obtained results indicated that the heavy metal consumption increase linearly with advantage of age and increasing the level of contamination. The linear decrease in serum total lipids; and increases of triglycerides, GOT and GPT in blood serum were observed by increasing the pollution level.

INTRODUCTION

Water is involved in every aspect of poultry metabolism. It plays important roles in regulating body temperature, digesting food, and eliminating body wastes. At normal temperatures, poultry consume at least twice as much water as feed. A safe and adequate supply of water is therefore essential for efficient poultry production. Poultry production in Egypt has became one of the biggest agricultural industries and its improvement is one of the main objectives of both private and govemmental sectors. One of the most important environmental issues today is the ground water contamination. Water contamination with heavy metals and volatile organic compounds (VOC) has been reported in many countries (Kido *et al.*, 1989). Heavy metals and VOC emitted by industries, traffic, municipal wastes, and hazardous wastes sites (HWS) have resulted in a steady rise in contamination of ground water (Yang *et al.*, 1989). Human and Animal exposure due to occupational or environmental contamination is rarely limited to a single chemical.

Recently, Abaza and El-Sebai (1998) indicated that the addition of lead alone to the diet of broiler chicks by levels of 300 and 500 ppm resulted in toxicity, as evidenced by a continuous significant inhibition of growth. Many investigators reported that the supplementation of cadmium to ration of birds caused decrease in growth rate (Hill *et al.*, 1963; Supplee, 1963; Weber and Reid, 1971; Fox *et al.*, 1973and Fathi *et al.*,1999)

Zein El-Dein *et al.*, (2000) indicated that feeding broilers on diet contained 40, 80, 120 ppm Cd (as cadmium sulfate) significantly reduced ($P<0.001$) the body weight at all levels of dietary Cd.

Excessively high or low concentrations of other chemicals can produce recognizable symptoms. Excessive amounts may cause liver damage, detrimental to broiler performance and economic loss thereafter.

The chemicals such as lead, Cadmium and arsenic are used in this study because these chemicals are frequently found contaminating ground water. This experiment was carried out to evaluate some productive aspects related to water pollution in broiler chicks.

MATERIALS AND METHODS

A total of two hundred and ten one day old Arbor Acres chicks were obtained and divided into seven treatments, each of 30 chicks. Chicks of each treatment were subdivided into three replicates, each of 10. The experiment was extended up to seven weeks of age. Chicks of each replicate were housed in a cage with slatted floor of iron. The diameters of the cage were 70 × 70 × 75 cm for length, width, and height, respectively. All cages were kept inside one room of 8 ×3 floor area and 2.5 m. height. There were two windows covered with wire gauze. Room's ceiling was made from wooden logs. This study was carried out during winter.

The experimental period was divided into two feeding phases (starter: from 0 - 3 weeks of age) and grower (from 4 -6 weeks of age). The basal diets were of 23.07% and 20.02% crude protein; and were of 2926.6 and 3074.8 Kcal ME/kg diet for the starter and the grower diet, respectively. Practical diets were formulated to meet the nutritional requirements of the broiler chicks (NRC, 1994).

Treated water was available all the time during the experiment, and daylight and artificial light were applied to maintain 23 hrs light per day during all the experimental period.

Three sources of heavy metals: Lead (Pb), Cadmium (Cd) and Arsenic (As) were used in forms of chlorides. Two levels of each elements were applied to meet three - fold and six - fold of their high concentration allowed in tap water as measured and reported by Egyptian Ministry of Health and Population.

Tap water was used as a control and it has contained: 0.05 mg Pb, 0.005 mg Cd and 0.05 As / L. Which make 50, 5 and 50 ppm for Pb, Cd and As, respectively. Then the experimental treatments were as follows: Treatment 1: Control (tap water); Treatment 2: Tap water + 150 PPM ($PbCl_2$); Treatment 3: Tap water + 300 PPM ($PbCl_2$); Treatment 4: Tap water + 15 PPM ($CdCl_2$); Treatment 5: Tap water + 30 PPM ($CdCl_2$); Treatment 6: Tap water + 150 PPM ($AsCl_2$) and Treatment 7: Tap water + 300 PPM ($AsCl_2$).

Productive Performance:

Body weight was recorded at 2 , 3 and 6 weeks of age. Feed intake was measured weekly for each replicate and these data was suppressed to each three weeks period. Then feed conversion (feed / gain) was calculated for each replicate within each period. Water consumption as well as heavy metal consumption were calculated. The first as CC/ bird per week and the second by known the exact amount of drinking water and the concentration of the metal in each treatment. Dead chicks during the experiment were weighed at the day of death. Data on growth and feed intake of the chicks could therefore be adjusted for mortality occurred in each replicate by knowing the feed intake of the replicate and individual weight of the dead chicks.

Blood Sampling

Blood samples were collected from five chicks chosen randomly within each treatment at six weeks of age. Samples of about 3 ml of blood were withdrawn from the brachial vein into collecting tube and immediately centrifuged at 3000 rpm for 15 minutes. Blood serum was then obtained and stored at -20 °C until analysis. Obtained blood serum were subjected to determine: total lipids (Frings *et al.*, 1972) triglycerides (Biggs *et al.*, 1975). Serum glutamic oxaloacetic (GOT) and pyruvic transaminase (GPT) were determined according to Reitman and Frankel (1957).

Data collected were transferred for statistical analysis by the analysis of variance with the General Linear Model (GLM) procedure of the Analytical Software. 1958. Eldridge Ave, St. Poul. MN, 55108, USA. As described by (Snedecor and Cochran, 1980). All statements of significance are based on the 0.05 level of probability. Significance difference among means were separated using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Exposure of broiler chicks to contaminated (Lead, cadmium and arsenic) drinking water and its effect on body weight, feed consumption; feed conversion, water consumption, heavy metal consumption and mortality rate are presented as follows.

1- Productive Performance:

1-1: Body Weight (gm):

Results presented in Table (1) showed that the effect of water pollution on body weight of broiler chicks at 2,4 and 6 weeks of age was not significant.

Polluted water by lead ($PbCl2$) at a level of 150 ppm decreased body weight of chicks at 4 and 6 weeks of age by 44 and 110 gm, respectively. The respective decreases in body weight due to addition lead by a level of 300 ppm were 73gm and 206gm. These results indicated that body weight of broiler tend to be reduced as the level of lead increased. In agreement with these results, Jacob *et al.* (1989) reported that when chicks given lead acetate via gelatin capsules placed in esophagus with a dose of 5mg/kg body weight per day from 42 weeks of age, chickens maintained constant body weights and no statistical differences were detected between control group and lead treated group of both sexes.

Table 1. Means ± (SE) of body weight (gm) as affected by drinking polluted water.

Treatments	Age in weeks		
	2	4	6
Control	177.2±2.05	1080±29.22	1876±46.22
$Pbcl_2$ (150p.p.m)	177.1±0.54	1036±26.41	1765±20.18
$Pbcl_2$ (300p.p.m)	174.3±1.15	1017±33.20	1669±11.06
$Cdcl_2$ (15p.p.m)	176.2±0.88	1046±5.29	1825±53.98
$Cdcl_2$ (30p.p.m)	175.1±1.76	1021±26.82	1749±58.79
$Ascl_2$ (150p.p.m)	173.1±0.57	1059±5.9	1807±16.03
$Ascl_2$ (300p.p.m)	174.2±1.00	1030±22.25	1800±65.74

Means in the same column with no common superscripts differ significantly ($P<0.05$).

Data in Table (1) showed that body weight of chicks received cadmium with a level of 15 ppm was decreased by 34 and 80 gm at 4 and 6 weeks of age, respectively. The respective reduce in body weight due to addition a level of 30 ppm cadmium was 59 and 126 gm, respectively. These results indicated that body weight of broiler chicks decreased by water polluted by cadmium at a level of 15 ppm or 30 ppm. Garlish and Hill (1986) found that body weight of turkey pollutes fed on starting ration supplemented with levels of cadmium (137, 274 and 542μg/kg basal diets as CdSO4) was not affected by the highest amount of cadmium.

Results in Table (1) showed that water polluted by arsenic with a level of 150 ppm or 300 ppm caused slightly decreases in body weight at 4 and 6 weeks of age. Vodel *et al.* (1997) reported that drinking water contain a mixture of arsenic, benzene, cadmium, lead and trichloroethylene at low concentrations (0.85, 01.30, 5.0,6.7 and 0.56 ppm and high concentrations (8.6, 13, 50, 67 and 5.6 ppm) decreased body weight in broiler chicks.

1-2: Feed intake:

The effect of experimental treatments on feed intake is presented in Table (2). The data revealed that adding heavy metals (Lead, cadmium, and arsenic) reduced significantly ($P<0.05$) feed intake from 4 to 6 weeks of age and from 2 to 6 weeks of age compared with the control groups.

The present results indicated that water polluted by high levels of lead, cadmium and arsenic (300 ppm, 30 ppm and 300 ppm) decreased feed intake of chickens during 4-6 and 2-6 weeks of age compared with the low levels of the previous heavy metals (150 ppm, 15 ppm, 150 ppm) or control group.

Water polluted by lead (PbCl2) at level of 150 ppm decreased feed intake of chicks during 4-6 and 2-6 weeks of age by 165gm and 300gm, respectively. The respective decreases in feed intake due to addition lead by a level of 300 ppm were 202 and 345 gm. Wittman *et al.* (1994a,b) reported that the addition of lead (Pb) by 600 mg/kg diet (as lead acetate) to ration of broilers from 1 to 21 days old resulted in significantly decreased in feed intake. Vodel *et al.* (1997) reported that drinking water contain a mixture of arsenic, benzene, cadmium, lead and trichloroethylene at low concentrations (0.85,1.3,5,6.7 and 0.56 ppm) and high concentrations (8.6,13,50,67 and 5.6 ppm) decreased feed intake in broiler chicks.

Table 2. Means ± (SE) of feed intake (gm / bird) as affected by drinking polluted water.

Treatments	Age in weeks		
	2-4	4-6	2-6
Control	1849.2±61.87	$1891.5±60.91^{b}$	$3904.4 ±115.2^{a}$
$Pbcl_2$ (150p.p.m)	1848.5 ±40.25	$1726.3±80.39^{bc}$	$3604.3±80.51^{b}$
$Pbcl_2$ (300p.p.m	1731.2 ±51.87	$1689.1 ±74.58^{c}$	$3559.1±84.33^{b}$
$Cdcl_2$ (15p.p.m)	1813.2 ±62.84	$1848.1±78.39^{b}$	$3714.2±89.51^{ab}$
$Cdcl_2$ (30p.p.m)	1818.4 ±73.18	$1924.4 ±83.01^{a}$	$3773.1±70.66^{ab}$
$Ascl_2$ (150p.p.m)	1846.1 ±83.22	$1940.2 ±98.55^{a}$	$3887.02 ±118.9^{a}$
$Ascl_2$ (300p.p.m)	1837.1 ±82.64	$1825.2±93.01^{bc}$	$3708.1±97.66^{ab}$

Means in the same column with no common superscripts differ significantly ($P<0.05$).

Data in Table (2) showed that feed intake of chicks received cadmium with a level of 15 ppm was decreased by 130 gm during 2-6 weeks of age. However, feed intake of chicks received cadmium with a level of 30 ppm was decreased by 43 gm and 190 gm during 4-6 and 2-6 respectively. Sell (1975) reported that the addition of 60 ppm cadmium to ration of laying hens reduced feed consumption beginning on day 6 of experiment. Also, Hermayer *et al.* (1977) found that feed intake reduced in laying hens when fed on diet containing cadmium levels of 40, 32 or even 8 ppm.

Results in Table (2) showed that water polluted by arsenic at level of 150 or 300 ppm slightly decreased feed intake during 2-6 weeks of age. These results agreed with those reported by Vodel *et al.* (1997) they reported that drinking water contain mixture of arsenic, benzene, cadmium, lead and trichloroethylen at low concentrations (0.85,1.3,6.7 and 0.56 ppm) and high concentrations (8.5,13, 50, 67 and 5.6 ppm) decreased feed intake in broiler chicks.

1-3: Feed Conversion:

Results presented in Table (3) showed the effect of water pollution on feed conversion of broiler chicks during (2-4), (4-6) and (2-6) weeks of age. Water polluted by lead ($Pbcl_2$) at a level of 150 ppm or 300 ppm did not effect feed conversion of broiler chicks. Bakalli *et al.* (1995) fed broiler chicks from hatching to 42 days of age on lead dietary levels (0.1,0.5 or 1.0 mg/kg feed) as lead sulfate and found that 1.0 mg lead /kg caused a significant increase in feed conversion ratio.

Water polluted by cadmium ($cdcl_2$) at a level of 15 or 30 ppm did not affect feed conversion of broiler chicks. These results disagree with Shih *et* *al.* (1997) and Chiou, *et al.*,(1997) . They reported that diet-containing 50mg/kg reduced feed conversion ($P<0.05$) of Taiwan chickens at 5-8 and 9-13 weeks of age.

Results presented in Table (3) showed that water polluted by arsenic with a level of 150 or 300 ppm had no effect on feed conversion of broiler chicks. These results disagree with those obtained by (Jeng *et al.*, 1997) . They indicated that feeding of 3 nitro 4-gydroxy phenyle arsenic acid to laying hens by level 22.5mg per pound improved feed efficiency. Also, feed was utilized more efficiently by turkeys receiving 3-nitro 4-hydroxy phenyle arsenic acid than by their controls (Chiou, *et al.*,1997)

Table 3. Means ± (SE) of feed conversion (feed gm /gain gm) as affected by drinking polluted water.

Treatments	Age in weeks		
	2-4	4-6	2-6
Control	2.04±0.57	2.38±0.60	2.30±0.52
$Pbcl_2$ (150p.p.m)	2.15±0.18	2.37±0.15	2.27±0.09
$Pbcl_2$ (300p.p.m)	2.05±0.01	2.59±0.02	2.38±0.05
$Cdcl_2$ (15p.p.m)	2.14±0.08	2.54±0.07	2.36±0.01
$Cdcl_2$ (30p.p.m)	2.09±0.08	2.47±0.15	2.29±0.00
$Ascl_2$ (150p.p.m)	2.15±0.08	2.52±0.14	2.39±0.09
$_2$ (300p.p.m)	2.07±0.04	2.44±0.01	2.22±0.01

Means in the same column with no common superscripts differ significantly ($P<0.06$).

1-4:Water Consumption:

water consumption data are reported in Table (4). Water consumption data implies that, birds received drinking water contaminated with some heavy metals such as lead, cadmium or arsenic showe^r a depression ($P<0.05$) in water consumption than control group during the periods (4 to 6 and 2 to 6 weeks of age). However, no significant differences were detected during 2 to 4 weeks of age.

1-5: Heavy metal consumption

Data presented in Table (5) showed the amount of heavy metal consumption. Chicks which received water polluted by lead with level 150 mg consumed 495 mg during (2-4) weeks and 639 mg during (4-6) weeks and 941 mg during (2-6) weeks. Chicks which received water polluted by lead with level 300 ppm consumed 960 mg during (2-4) weeks and 1143 mg during (4-6) weeks and 1731 mg during (2-6) weeks. Birds consumed $Pbcl_2$ by level 300 ppm presented the lowest ($P<0.05$) values of water consumption during all experimental periods compared with other treatments and control. The significant linear decrease in water consumption that corresponded to concentration of chemical mixture in drinking water could be due to that the volume of water consumption is related directly to the amount of feed consumed (Pagliuca *et al.*, 1990).

Vodel *et al.* (1997) reported that drinking water contain a mixture of arsenic, benzene, cadmium lead and trichloroethylene at low concentrations

(0.85, 1.3,5,6.7 and 0.56 ppm) and high concentrations (8.6,13,50,67 and 5.6 ppm) decreased water consumption in broiler chicks. Birds consumed $cdcl_2$ by level 15 or 30 ppm decreased water consumption than control. Chicks consumed Arsenic by level 150 or 300 ppm decreased water consumption than control.

Table 4. Means ± (SE) of water consumption (CC / Bird) as affected by drinking polluted water.

Treatments	Age in weeks		
	2-4	4-6	2-6
Control	3303.1±60.78	4767.4±309.4^{a}	6752.4±315.6^{a}
$Pbcl_2$ (150p.p.m)	3301.01±51.80	4257.3±35.90^{bc}	6275.3±27.02^{bc}
$Pbcl_2$ (300p.p.m)	3201.3±87.94	3809.02±95.00^{d}	5770.2±108.9^{d}
$Cdcl_2$ (15p.p.m)	3276.2±15.30	4383.1±6.69^{bc}	6402.1±6.43^{abc}
$Cdcl_2$ (30p.p.m)	3153.1±30.51	4095.03±42.34^{cd}	6070.1±40.05^{cd}
$Ascl_2$ (150p.p.m)	3247.2±14.86	4478.1±10.69^{ab}	6473.2±22.39^{ab}
$Ascl_2$ (300p.p.m)	3139.4±21.55	4247.4±8.0^{bc}	6211.1±16.17^{bc}

Means in the same column with no common superscripts differ significantly (P<0.05).

Chicks which received water polluted by cadmium with level 15 ppm consumed 49 mg during (2-4) weeks and 66 mg during (4-6) weeks and 96 mg during (2-6) weeks. Chicks, which received water polluted by cadmium level 30 mg, consumed 94 mg during (2-4) and 123 mg during (4-6) and 182 mg during (2-6) weeks.

Chicks which received water polluted by arsenic with level 150 mg consumed about 487 mg during (2-4) and 671 ppm during (4-6) and 971 mg during (2-6) weeks Chicks which received water polluted by arsenic with level 300 mg consumed 942 mg during (2-4) and 1274 mg during (4-6) and 1863 mg during (2-6) weeks.

Obtained results indicated that the heavy metal consumption increase linearly with advantage of age and increasing the level of contamination.

Table 5. Means ± (SE) of heavy metal consumption (mg/ bird) as affected by drinking polluted water.

Treatments	Age in weeks		
	2-4	4-6	2-6
$Pbcl_2$ (150p.p.m)	495.15 ±12.8	639.45 ±3.59^{b}	941.25 ±2.7^{b}
$Pbcl_2$ (300p.p.m)	960.3 ±18.79	1143.3 ±9.50^{a}	1731.2 ±4.89^{a}
$Cdcl_2$ (15p.p.m)	49.14 ±15.30	66.47 ±6.92^{d}	96.03 ±6.43^{c}
$Cdcl_2$ (30p.p.m)	94.49 ±13.51	123.05 ±4.23^{c}	182.1 ±4.05^{c}
$Ascl_2$ (150p.p.m)	487.05 ±14.86	671.3 ±10.69^{b}	971.35 ±2.23^{b}
$Ascl_2$ (300p.p.m)	942.3 ±21.55	1274.1 ±8.00^{a}	1863.3 ±3.16^{a}

Means in the same column with no common superscripts differ significantly (P<0.05).

1-6: Mortality rate

Data reported in Table (6) showed the effect of water pollution on mortality rate of broiler chicks during (2- 4), (4 – 6) and (2 – 6) weeks was not significant.

Water polluted by lead (Pbcl2) at levels of 150 ppm and 300 ppm increased Mortality than control in agreement with these results, Damron et.al. (1969) reported that the pollution of feed by 1000 ppm caused more mortality when compared with control. Also, Bafundo et.al., (1984) found that the levels of pb 1100 and 3300 mg /Kg was toxic to the growing chicks.

Data in Table (6) showed that mortality of chicks received cadmium with a level 30 ppm increased mortality than control and anther treatments during (4-6) and (2-6) weeks In agreement with these results. Pritzl et at (1974) showed that mortality increased with an increase in dietary cd in the ration and all of the birds on the 800 and 1000 ppm cadmium levels died before the 20 days period.

Results in Table (6) showed that mortality of chicks received arsenic with level 150 ppm and 300 ppm increased mortality rate than the control during (4-6) and (2-6) weeks.

Table 6. Means ± (SE) of mortality rate as affected by drinking polluted water.

Treatments	Age in weeks		
	2-4	4-6	2-6
Control	-	-	-
$Pbcl_2$ (150p.p.m)	3.3 ±0.03	0.0 ±0.00	6.7 ±0.02
$Pbcl_2$ (300p.p.m)	6.5+ 0.01	20.0±0.02	20.0±0.02
$Cdcl_2$ (15p.p.m)	3.3 ±0.03	3.3 ±0.03	3.3 ±0.03
$Cdcl_2$ (30p.p.m)	3.3±0.23	23.0±0.21	23.0±0.21
$Ascl_2$ (150p.p.m)	-	-	-
$Ascl_2$ (300p.p.m)	3.3±0.23	16.7±0.016	16.7±0.02

Means in the same column with no common superscripts differ significantly (P<0.05).

Jeng *et al.*, (1997) observed that arsonilic acid had no detrimental effects on adult hen performance when added at 20 and 180 grams per ton to breeder ration. Mortality and incidence of leg disorders were low with no significant differences between the groups when arsenic acid added to ration of white Plymouth Rock chickens (Fathi *et al.*,1999)

2- Blood Serum Constituents: Serum total lipids, triglycerides, glutamic oxaloacetate (GOT) and pyruvic transaminases (GPT).

Values of serum total lipids, triglycerides, glutamic oxaloacetate (GOT) and pyruvic transaminase (GPT) are shown in Table 7. Generally, it is clearly noticeable that there are linear decrease in serum total lipids and linear increase of serum triglycerides, GOT and GPT by increasing the pollution level. However, supplementing the broiler drinking water with lead 300 ppm or cadmium 30 ppm or arsenic 300 ppm decreased significantly (p<0.05) serum total lipids compared to the values recorded from the control chicks. Cadmium 30 ppm or arsenic 300ppm and lead administered disturbed the lipid metabolism. The results are in accordance with Abaza and El-Sebai (1996) they found that serum triglycrides significantly elevated in birds, which received 50 ppm cadmium, compared with control group. Also the same authors (1998) reported that serum triglycerides significantly higher in birds which received 500 ppm lead compared with control group. This might be the metabolic disturbance occurred caused enzymatic disorder and not complete pathway of the lipids and fatty acid. That means that those heavy metals inhibit the fat metabolism.

Results of serum glutamic oxaloacetic (GOT) and pyruvic transaminase (GPT) indicated that liver enzymes (GOT and GPT) were significantly increased for chickens received lead 300 ppm or cadmium 30 ppm or arsenic 300 ppm in drinking water than the control. These results agree with Gain *et al.*, (1983). They found that the high levels of cd led to increase in serum GPT. Fathi *et al.*, (1999) reported that level of GPT significantly higher in birds received dietary cadmium by levels 30 and 60 ppm as lead acetate or dietary lead by levels 200 and 400 ppm compared to control chickens. Also, Zein-El-Dein *et al.*, (2000) indicated that feeding broiler on dietary cd supplementation increase significantly GOT and GPT activities in birds fed diets added 80 and 120 ppm cd compared to control fed group

Table 7. Means ± (SE) of serum total lipids, triglycerides, glutamic oxaloacetic (GOT) and pyruvic transaminase (GPT) as affected by drinking polluted water.

Treatment	Total Lipids (mg/ dl)	Trigly-cerides (mg/dl)	GOT (U/l)	GPT (U/l)
Control	308.6±4.5 ^{a}	5.5±0.04 ^{b}	89.4±2.5 ^{c}	12.7±1.2 ^{c}
$Pbcl_2$ (150p.pm)	278.6±3.1 ^{b}	4.8±0.04 ^{b}	96.5±2.9 ^{b}	18.9±1.8 ^{b}
$Pbcl_2$ (300p.pm)	228.3±2.2 ^{c}	6.9±0.07 ^{a}	113.4±3.1 ^{a}	23.7±2.1 ^{a}
$Cdcl_2$ (15p.pm)	286.5±3.3 ^{b}	5.2±0.05 ^{b}	103.7±3.2 ^{b}	16.6±1.7 ^{b}
$Cdcl_2$ (30p.pm)	219.5±2.6 ^{c}	6.6±0.06 ^{a}	127.4±3.6 ^{a}	21.8±2.3 ^{a}
$Ascl_2$ (150p.pm)	277.5±3.8 ^{b}	4.9±0.03 ^{b}	99.8±2.9 ^{b}	17.6±1.9 ^{b}
$Ascl_2$ (300 p.pm)	209.3±2.4 ^{c}	6.4±0.07 ^{a}	126.3±3.6 ^{a}	23.3±2.6 ^{a}

Means in the same column with no common superscripts differ significantly ($P<0.05$).

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بعض النواحي الإنتاجية المتعلقة بتلوث ماء الشرب لبداري التسـمين

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أجريت هذه الدراسة بهدف دراسة وتقييم بعض الصفات الإنتاجية المرتبطة بتلوث المياه المستخدمة فى الشرب لكتاكيت التسمين . استخدم فى هذه الدراسة عدد مائتان و عشر كتكوت عمر يوم (اربو ايكرز) حيث قسمت الكتاكيت إلى سبعة معاملات كل معاملة اشتملت على ثلاث مكررات . كل مكرر بها عشر كتاكيت .قسمت فترة التجربة إلى مرحلتين غذائيتين.

فى هذه التجربة تم استخدام ثلاثة عناصر معدنية ثقيلة وهى الرصاص والكادميوم والزرنيخ واستخدمت كلها فى صورة كلور يد . تم عمل مستويين من كل عنصر المستوى المنخفض ويساوى ٣ أضعاف كمية العنصر الموجود فى المياه العادية والمسموح بها من وزارة الصحة ، المستوى الثاني ويساوى ٦ أضعاف كمية العنصر الموجود فى المياه العادية والمسموح بها من وزارة الصحة

تم استخدم ماء الصنبور فى المعاملة رقم ١ للمقارنة ويحتوى ماء الصنبور على ٠,٠٥ ملليجرام رصاص و ٠,٠٠٥ ملليجرام كادميوم و ٠,٠٥ ملليجرام زرنيخ .

أظهرت النتائج أن تلوث المياه بالرصاص و الكادميوم و الزرنيخ أدى إلى انخفاض في وزن الجسم عند عمر ٤ ، ٦ أسابيع.

أوضحت هذه النتائج أن الانخفاض في وزن الجسم تزداد مع زيادة تركيز العنصر فى مياه الشرب .

كما اوضحت النتائج ان الانخفاض فى الوزن المكتسب تزداد مع زيادة تركيز العنصر فى مياة الشرب.

أكدت النتائج أن تلوث المياد بمستويات عالية من الرصاص والكادميوم والزرنيخ (٣٠٠ ، ٣٠ ، ٣٠٠ جزء فى المليون) أدى إلى انخفاض في معدل استهلاك الغذاء لكتاكيت التسمين أثناء الفترة من ٢-٤ أسابيع و٢-٦ أسابيع من العمر بالمقارنة بالمستوى المنخفض (١٥٠ ، ١٥ ، ١٥٠ جزء فى المليون) للعناصر السابقة أو مجموعة المقارنة .

تلوث المياه بكلور يد الرصاص او الكادميوم او الزرنيخ لم يكن له تاثير على معامل التحويل الغذائى.

أظهرت النتائج أن الكتاكيت التي كانت تستهلك مياه ملوثة بكلور يد الرصاص بمستوى ٣٠٠ جزء فى المليون حققت اقل أرقام في استهلاك المياد طوال فترة التجربة بالمقارنة بباقي المعاملات والمعاملة المقارنة .

أكدت النتائج أن معدل استهلاك الأملاح المعدنية الثقيلة يزداد بصورة خطية مع التقدم فى العمر والزيادة فى مستوى العنصر المعدني الثقيل .

أظهرت النتائج انه لم يكن هناك تأثير ملحوظ على معدل النفوق من خلال التجربة بالنسبة للعناصر المستخدمه والمستويات الخاصة بكل عنصر .

لم يكن هناك تأثير ملحوظ على وزن الأعضاء (الكبد – الكلية – الطحال – والبرسا والغدة الثيموثية) لكتاكيت التسمين بالنسبة للعناصر المعدنية الثقيلة والمستويات المستخدمة لها .

– أوضحت النتائج أن هناك انخفاض فى الدهون الكليه وزيادة فى الترای جليسريدات و GOT و GPT مع زيادة مستوى التلوث