Study the effect of some heavy metals on the morphological and anatomical characteristics of chicken

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Abstract

This study was conducted to determine the effect of cadmium and zinc on the morphological and anatomical characteristics of the chicken. Having been exposed chicken aged for a period of three weeks (28) days to different concentrations of salts of the above elements, dividing the chicken into six groups as well as the control group and by three replicates for each group, each group containing ten individuals. The first and the second groups exposed to (0.1 ppm) and (0.2 ppm) of cadmium nitrate, respectively, while the third and Fourth groups exposed to (0.1 ppm) and (0.2 ppm) of zinc sulfate, respectively, were exposed fifth and sixth groups combination of both cadmium nitrate and zinc sulfate and a concentration (0.1 ppm) and (0.2 ppm), respectively.

Been through this study, calculating the rate of bird weight (g) each week and the weighted increase (g) and daily average feed consumption and feed conversion ratio and the percentage of Mortality.

The results of the current study on the superficial appearance of the symptoms of chicken exposed to the studied was weak year from through comparison year weight with the weight of the control sample, In addition to inactivity and lack of appetite and cyanosis custom and moult or subtraction of plume.

In terms of internal anatomy has been found by the results of the current study, enlargement of the liver, heart and spleen in all concentrations used compared with the control sample, in addition to the weakness of the muscles of the thigh and chest, increasing the viscosity of the blood damage the kidney damage part of the brain.

The results of statistical analysis indicated significance differences distinctions between six groups Chicken meat in the probability level (P<0.05), also showed the results of statistical analysis significantly direction correlated and at the potential level (P<0.05) between the daily average feed consumption and each of the number of exposure days and the heavy metals concentration.

Keywords / Chicken meat, heavy metals, cadmium nitrate, zinc sulfate.

Introduction

Chicken meat is widely consumed worldwide. Meat and meat products are important for human diet because they provide a great part of nutrients (protein, lipids), including the necessary trace elements. Heavy metals from manmade pollution sources are continuously released into aquatic and terrestrial ecosystems and therefore, the concern about the effect of anthropogenic pollution on the ecosystems is growing. Contamination with heavy metals is a serious threat because of their toxicity, bioaccumulation and biomagnifications in the food chain (Demirezen & Uruç, 2006). These pollutants often have direct physiological toxic effects because they are stored or incorporated in tissues, sometimes permanently (Bokori, et al., 1996; Mariam, et al., 2004).

Toxic metal is defined as that metal, which is neither essential nor has beneficial effect, on the contrary, it displays severe toxicological symptoms at low levels and is defined as a metal with a specific weigh more than 5 g/cm3. With
increasing industrialization, more and more metals are entering into the environment. These metals stay permanently because they cannot be degraded in the environment. They enter into the food material and from there they ultimately make their passage into the tissue (Baykov, et al., 1996).

The risk of heavy metal contamination in meat is of great concern for both food safety and human health because of the toxic nature of these metals at relatively minute concentrations (Santhi, et al., 2008; Mahaffey, 1977). Heavy metals enter the environment by human activities such as mining, purification of Zinc, lead and cadmium, steel production, coal burning, burning of wastes, discharges from industrial effluents, excessive use of fertilizer, pesticide application and use of raw sewage waste in farming (Lone, et al., 2008; Okoronkwo, et al., 2005; Jing, et al., 2007).

Cadmium is one of non-essential trace elements which are not vital and is one of the highly toxic contaminants of living up to what it was very low concentrations in the natural environment (Jayaknmar and Paul, 2006). And classifies cadmium items that have no effect my life chemist in the life of organisms and has a high potential for bioaccumulation, and cadmium is found in surface waters is likely existence as dissolved or non-dissolved shape may take shape dissolved many patterns include ions cadmium Cd++ and ions complex organic and diverse inorganic (Svobodova, et al., 1993). There cadmium in nature in the Earth's crust in combination with zinc and increase the high level of dust in the air and in civilized areas may be associated with the emissions from the combustion of fuel (coal) and household waste and car engines (Obasohan, 2008). As a result, for the release of these enormous quantities of cadmium, which up to the aquatic environment and land through hundreds of years as it enters the food chain and cause the length of the Long half-life, it is concentrated in diverse organisms (Gagnon, et al., 2007).

Cadmium emitting into the air from many sources, including burning oil, plastics and paints and batteries of the type cadmium - nickel and motor oil and rubber materials, tires and other sources such as smoke cigarettes and smelters (zinc, lead and copper) and can enter into waterways from waste water and industrial, And the activities Agricultural important sources of cadmium entry into the soil (Hodges, 1977; Buhler, 1972 and Baechle and Wolstein, 1984).

The zinc compounds of pollutants dominant in most industries, as well as in the domestic waste water in rivers or sediment deposits continuing above the old levels of metals in because of the rain and especially in civilized areas related to the transmission and the construction and use of zinc compounds in diverse industries (Ni Shuilleabhin, et al., 2006). The importance of zinc in conversion Carbonic acid H2CO3 to carbon dioxide by the enzyme Carbonic Anhydrase, and zinc is essential in the process of building a protein, as he enters in the composition of the enzyme DNA-RNA Polymerase (Crawford and Bhattachary, 1985).

The zinc from trace elements necessary in the composition and function of enzymes, particularly those that contribute to the metabolic processes cellular diverse (Valee and Auld, 1990), and is zinc of essential elements in the maintenance, installation and function of the cell membrane also has a significant impact on the growth of plants and animals, and is one of the elements of the toxic effects weak or few on the human, but if this increased concentration on the limit be toxic (Lemly, 1999).

The present research aims to study the effect of some heavy metals, a cadmium and zinc on the morphological and anatomical characteristics of chicken meat.
Materials and Methods
This experiment was conducted in the fields of the College of Agriculture / University of Al- Qassim Green for the period from 25/4/2012 and up to 23/5/2012. Chicken meat used for this experiment at 28 days, which previously brought up in the same field, and these chicks bred on a mattress of sawdust 4-5 cm thick under the temperature of 35 ° C and when chicks reached the age of experience had prepared her temperature between 32 - 34 m transfer chicken to a special room divided by ferrous metal cages to 19 cage were fed on fodder ready.

poultry were divided into six groups in addition to the control group and by three replicates for each group and each group containing ten individuals . Feedlots were allocated hanging with a diameter of 45 cm, which was lifted to the top continually to be the level of the back of the bird feeding in order to be free. In terms of water fountains have been used of freehand , the capacity per fountain 5 liters .

poultry groups exposed to different concentrations of salts of heavy metals, a cadmium nitrate and zinc sulfate soluble in water and previously prepared . The first and the second groups exposed to (0.1 ppm) and (0.2 ppm) of cadmium nitrate , respectively, while the third and Fourth groups exposed to (0.1 ppm) and (0.2 ppm) of zinc sulfate, respectively, were exposed fifth and sixth groups combination of both cadmium nitrate and zinc sulfate and a concentration (0.1 ppm) and (0.2 ppm), respectively.

After exposing the groups Chicken meat used in the experiment to salts of heavy metals monitored on a regular, daily basis to see phenotypic , behavioral and anatomical changes obtained from exposure . The weight average bird (g) was calculated , the weight increase (g) , daily average feed consumption , feed conversion ratio and the percentage of depreciation depending on Al-Zubaidi, 1986.

Were slaughtered chicken meat used in the experiment and make in the process of scalding and plucking and then cutting poultry and isolating parts for examination, and then was Anatomy of chicks murdered in the days (28, 42 and 56) were observed changes macroscopic the same phenotypic characteristics for Chicken in addition to changes macroscopic seen in anatomy characteristics.

Statistical analysis
All data were expressed as means ±SD . least significant difference (LSD) was used for mean separation . The significant level was set at the probability level of P<0.05.

Results Discussion
Table (1) show rate body weight (g) and increase Gravimetric (g) and average daily feed intake and feed conversion ratio and percentage of Mortality for the six groups of Chicken meat used in the experiment and the exposed to different concentrations of heavy metals salts and days 28, 42 and 56 . Table (2) displays compared the relative weights of the parts of the carcass after 56 days after the end of the experiment and exposed to concentrations of heavy metals used in the experiment.

The current study showed fluctuation clear in the rate of weight bird to chicken meat exhibition to heavy elements compared a sample of control , especially when exposed to concentration cadmium nitrate (0.2 ppm) and then exposed to concentration (0.2 ppm) from a mixture of cadmium nitrate zinc sulfate , and to a lesser degree exposed to concentration (0.1 ppm) for cadmium nitrate . The others of the concentrations used from heavy elements was also an impact on the rate of weight bird , but lesser degree, in addition to fluctuation clear also the increase Gravimetric , and this has been demonstrated in the results of statistical analysis that showed
significant differences clear and at a level probability (P<0.05) between six groups of Chicken meat with average weight of the bird and with the weight increase when compared to a control sample, and you can see the table (2) that demonstrates the obvious differences in the relative weights of the carcass parts. This may be due to the many toxic effects of cadmium on living organisms which hinders the development and growth through several mechanisms that stop the absorption of cadmium ions and disrupts the function of the liver and break down the skeleton in addition to that cause pathological changes in some tissues and organs (Cicik and Engin, 2005). In addition to the damage in the digest ability and an increase in the cellular secretion of the digestive tract and cadmium associated always with mining calcium and this is important in the metabolism of calcium and is considered the major mechanical for toxicity of cadmium (Hwang and Yang, 1997) also cadmium works to disrupt ion exchange changer so recipes permeability of the cell membrane (Bougnegneau and Gilles, 1979), and the cadmium impact of a change in the needs of glucose levels in the serum and Glycogen in the liver through its effect on the events of liver enzymes, which have an impact in the metabolism of carbohydrates through the process Glycolysis and Gluconeogenesis (Levesque, et.al., 2002) has caused exposure of this component of the human food to a disease itia - itia in Japan through water contaminated with cadmium used in rice irrigation in the region has caused this element bone softening (Ademoroti, 1996). In particular, cadmium works in addition to the general effects influence the protein molecules, especially enzymes where to have a high affinity for the link with amino acids of the protein, which leads to change in the composition of the enzyme and then lead to inhibition of function (Kovarova, et.al., 2009).

Cadmium is toxic to virtually every system in the animal body. It is almost absent in the human body at birth, however accumulates with age. Cadmium accumulated in the kidney and liver over long time have been reported by McLaughlin, et al. (1999) that cadmium interacts with a number of minerals mainly Zn, Fe, Cu and Se due to chemical similarities and competition for binding stage. It is also reported that Cd can affect Ca, P and bone metabolism in both industrial and people exposed to Cd in general environment (Jarup, et al., 1998). And Doganoc (1996) found higher levels of cadmium and zinc in the livers and kidneys of the chickens, which exceeded the official tolerance levels.

The main source of metals in chicken arises from contamination of poultry feed and drinking water. Meat is a food material, which is composed of mainly protein, fat and some important essential elements. It is essential for growth and maintenance of good health. Contamination is transferred to animals through direct sewage water and industrial effluent. Contamination of meat can also be caused by vehicle emission and from dirty slaughter places. In the current study showed that the daily average feed consumption was increase an increase the number of exposure days and increase the heavy metals concentration, were significance differences distinctions between six groups Chicken meat in the probability level (P<0.05), also showed the results of statistical analysis significantly direction correlated and at the potential level (P<0.05) between the daily average feed consumption and each of the number of exposure days and the heavy metals concentration. It that the higher concentration of heavy element and increased the number of days of exposure results were clear on Chicken Meat.

The results showed that the percentage of mortality Chicken meat used in the experiment was different depending on the type heavy metals concentration and number of days of exposure where the increases with the number of days of exposure and increase the metal concentration and this is evident from the results of statistical
analysis that showed the existence of a direct correlation at probability (P<0.05) between the mortality percentage and each of the heavy metal concentration and the number of days.

In terms of phenotypic macroscopic changes on Chicken meat exhibition to salts of heavy metals studied it was General weak and the lack of weight and especially groups exposed to cadmium nitrate concentration (0.2 ppm) and exposed to a mixture of cadmium nitrate and zinc sulfate concentrate (0.2 ppm) by comparing General weight and the relative weights of carcass parts with control sample. In addition to inactivity and lack of appetite and carcass cyanosis custom and moult or subtraction of plume.

In terms of internal anatomy has been found by the results of the current study, enlargement of the liver, heart and spleen in all concentrations used compared with the control sample, in addition to the weakness of the muscles of the thigh and chest, increasing the viscosity of the blood damage the kidney damage part of the brain.

And there are a lot of researchers who study the impact are some heavy metals on the chicken meat, including Stef and Gergen, 2012 The contents of essential metals (Fe, Mn, Zn and Cu) in chicken meats are different, depending mainly on the type of meat. So Fe is the predominant metal in liver and Zn is the predominant metal in legs and breast chicken meat. The addition of metal salts in the feed influences accumulations of all metals in the liver, legs and breast chicken meat with specific difference to the type of metal and meat. And the Iwegbue et.al., 2008 found The concentrations of iron, manganese, copper, zinc were below the permissible limits while those of cadmium, nickel, chromium and lead in some samples were at levels above the permissible limits. The body burden with these elements is very dependent on the concentration of the various elements in major sources of animal protein chicken meat the frequency of consumption of these foods and the rate of detoxification in the human body.

References


Table (1) rate body weight (g) and increase Gravimetric (g) and average daily feed intake and feed conversion ratio and percentage of Mortality for the six groups of Chicken meat exposed to different concentrations of heavy metals salts and 28 , 42 and 56 days

<table>
<thead>
<tr>
<th>Heavy metal concentration</th>
<th>Exposed Days</th>
<th>rate of bird weight (gm)</th>
<th>weighted increase (gm)</th>
<th>daily average feed consumption</th>
<th>feed conversion ratio</th>
<th>percentage of Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>CdNO3 (0.1 ppm)</td>
<td>28</td>
<td>600 ± 10</td>
<td>200 ± 7</td>
<td>45.16 ± 2.84</td>
<td>0.4516 ± 0.024</td>
<td>10 %</td>
</tr>
<tr>
<td></td>
<td>42</td>
<td>850 ± 31</td>
<td>350 ± 10</td>
<td>61.904 ± 1.541</td>
<td>0.495 ± 0.096</td>
<td>30 %</td>
</tr>
<tr>
<td></td>
<td>56</td>
<td>1130 ± 72</td>
<td>280 ± 13</td>
<td>58.707 ± 1.547</td>
<td>0.419 ± 0.014</td>
<td>30 %</td>
</tr>
<tr>
<td>CdNO3 (0.2 ppm)</td>
<td>28</td>
<td>565 ± 24</td>
<td>175 ± 12</td>
<td>38.273 ± 3.681</td>
<td>0.437 ± 0.027</td>
<td>20 %</td>
</tr>
<tr>
<td></td>
<td>42</td>
<td>623 ± 21</td>
<td>135 ± 6</td>
<td>43.571 ± 2.456</td>
<td>1.483 ± 0.171</td>
<td>30 %</td>
</tr>
<tr>
<td></td>
<td>56</td>
<td>700 ± 51</td>
<td>77 ± 4</td>
<td>50 ± 2.461</td>
<td>1.299 ± 0.193</td>
<td>40 %</td>
</tr>
<tr>
<td>ZnSO4 (0.1 ppm)</td>
<td>28</td>
<td>597 ± 17</td>
<td>207 ± 14</td>
<td>30.357 ± 0.579</td>
<td>0.293 ± 0.057</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>42</td>
<td>940 ± 15</td>
<td>343 ± 15</td>
<td>52.222 ± 1.251</td>
<td>0.304 ± 0.092</td>
<td>10 %</td>
</tr>
<tr>
<td></td>
<td>56</td>
<td>1250 ± 26</td>
<td>310 ± 7</td>
<td>56.875 ± 0.569</td>
<td>0.367 ± 0.083</td>
<td>20 %</td>
</tr>
<tr>
<td>ZnSO4 (0.2 ppm)</td>
<td>28</td>
<td>579 ± 21</td>
<td>184 ± 8</td>
<td>41.969 ± 2.045</td>
<td>0.456 ± 0.025</td>
<td>10 %</td>
</tr>
<tr>
<td></td>
<td>42</td>
<td>810 ± 25</td>
<td>231 ± 10</td>
<td>47.556 ± 0.173</td>
<td>0.412 ± 0.041</td>
<td>10 %</td>
</tr>
<tr>
<td></td>
<td>56</td>
<td>1100 ± 36</td>
<td>290 ± 17</td>
<td>62.428 ± 1.492</td>
<td>0.431 ± 0.036</td>
<td>30 %</td>
</tr>
<tr>
<td>CdNO3 &amp; ZnSO4 (0.1 ppm)</td>
<td>28</td>
<td>581 ± 18</td>
<td>181 ± 3</td>
<td>47 ± 2.047</td>
<td>0.519 ± 0.046</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>42</td>
<td>930 ± 1</td>
<td>349 ± 11</td>
<td>51.871 ± 0.572</td>
<td>0.297 ± 0.017</td>
<td>10 %</td>
</tr>
<tr>
<td></td>
<td>56</td>
<td>1150 ± 20</td>
<td>220 ± 5</td>
<td>66.428 ± 1.519</td>
<td>0.604 ± 0.051</td>
<td>30 %</td>
</tr>
<tr>
<td>CdNO3 &amp; ZnSO4 (0.2 ppm)</td>
<td>28</td>
<td>571 ± 14</td>
<td>178 ± 3</td>
<td>53.571 ± 1.284</td>
<td>0.602 ± 0.026</td>
<td>20 %</td>
</tr>
<tr>
<td></td>
<td>42</td>
<td>670 ± 10</td>
<td>99 ± 7</td>
<td>49.039 ± 0.924</td>
<td>0.991 ± 0.74</td>
<td>20 %</td>
</tr>
<tr>
<td></td>
<td>56</td>
<td>800 ± 10</td>
<td>130 ± 6</td>
<td>71.5 ± 1.749</td>
<td>1.1 ± 0.183</td>
<td>40 %</td>
</tr>
<tr>
<td>Control</td>
<td>28</td>
<td>610 ± 15</td>
<td>210 ± 9</td>
<td>32.5 ± 2.418</td>
<td>0.309 ± 0.091</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>42</td>
<td>1100 ± 56</td>
<td>490 ± 10</td>
<td>33.821 ± 0.861</td>
<td>0.138 ± 0.84</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>56</td>
<td>1500 ± 73</td>
<td>400 ± 4</td>
<td>35.25 ± 2.735</td>
<td>0.176 ± 0.31</td>
<td>-</td>
</tr>
</tbody>
</table>
Table (2) displays the relative weights of the parts of the carcass after 56 days after the end of the experiment and exposed to concentrations of heavy metals.

<table>
<thead>
<tr>
<th>Chicken meat groups</th>
<th>Thighs Weight (gm)</th>
<th>Wings Weight (gm)</th>
<th>Back Weight (gm)</th>
<th>Chest Weight (gm)</th>
<th>Heart Weight (gm)</th>
<th>Spleen Weight (gm)</th>
<th>Neck Weight (gm)</th>
<th>Liver Weight (gm)</th>
<th>Gizzard and true stomach Weight (gm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CdNO3 (0.1 ppm)</td>
<td>187</td>
<td>93</td>
<td>109</td>
<td>225</td>
<td>8</td>
<td>1</td>
<td>38</td>
<td>34</td>
<td>21</td>
</tr>
<tr>
<td>CdNO3 (0.2 ppm)</td>
<td>106</td>
<td>74</td>
<td>84</td>
<td>122</td>
<td>9</td>
<td>2</td>
<td>27</td>
<td>32</td>
<td>13</td>
</tr>
<tr>
<td>ZnSO4 (0.1 ppm)</td>
<td>274</td>
<td>105</td>
<td>122</td>
<td>322</td>
<td>7</td>
<td>4</td>
<td>50</td>
<td>37</td>
<td>38</td>
</tr>
<tr>
<td>ZnSO4 (0.2 ppm)</td>
<td>232</td>
<td>100</td>
<td>134</td>
<td>241</td>
<td>7</td>
<td>0.5</td>
<td>52</td>
<td>26</td>
<td>33</td>
</tr>
<tr>
<td>CdNO3 &amp; ZnSO4 (0.1 ppm)</td>
<td>317</td>
<td>130</td>
<td>143</td>
<td>185</td>
<td>10</td>
<td>4</td>
<td>21</td>
<td>34</td>
<td>34</td>
</tr>
<tr>
<td>CdNO3 &amp; ZnSO4 (0.2 ppm)</td>
<td>174</td>
<td>83</td>
<td>113</td>
<td>204</td>
<td>11</td>
<td>5</td>
<td>29</td>
<td>42</td>
<td>28</td>
</tr>
<tr>
<td>Control</td>
<td>237</td>
<td>120</td>
<td>143</td>
<td>296</td>
<td>7</td>
<td>1</td>
<td>57</td>
<td>32</td>
<td>46</td>
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</table>