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Nephropathy Effects of 2,3,7,8-Tetrachlorodibenzo-P-Dioxin (TCDD) Toxicity In Ova Injected Chicken

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Abstract

Eggs are importance in human feeding, it is inexpensive and complex source of food with highly biological value, The aims of this study to investigate the evaluation toxicity of pollution of biological tissue characterized by 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) toxicity in kidney chickens.Chiken eggs are attractive bioindicater of pollution. Sixty chiken eggs fertile suplier from local market of Baghdad province from Alzafaranya city, these eggs were divided equally and randomly into three equal group: 1st group injected into aircell with 0.2 μg/ kg corn oil at day 4 , 2nd group injected in aircell at day 4 with 0.1μg/ kg TCDD dissolve in corn oil, 3rd group group injected in aircell at day 4 with 0.2μg/ kg TCDD dissolve in corn oil. The eggs incubated for 21 days. Biochemical assay (Creatinine and Urea) concentration and pathological examination were observed on chicken at days 15 and 30. Biochemical assay of kidney function found significant increased $P<0.05$ in serum urea concentration & creatinine concentration at days 15 & 30, with highly increased in dose 0.2 μg/ kg at day 30. Pathological lesion characterized by chest and abdominal edema, hydronephrosis with severe tubular and glomeruli damage, in addition of destruction with extensive hemorrhage & lymphocytic infiltration.

Keyword: 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), ova chicken, nephropathy, urea & creatinine.

INTRODUCTION

Chiken eggs are assumed to be profetional bio-indicators of environmental pollution like dioxins contamination and for human health risk, so the low intake may cause highly levels in eggs (Anastasia *et al.*, 2020), chicken eggs like liver and adipose tissue have congener profile (Chang *et al.*, 1989). Eggs are a highly nutritions food vital vitamine, rich minerals, saturated and unsaturated fatty acid which play asignificant role in maintaining health(Molnar & Osi, 2020).

The comman term dioxin is often used for a number of lipophilic chemical compound (polychlorinated dibenzofurans- PCDFs), (poly chlorinated dibenzo- para dioxins- PCDDs) including certain dioxin-like polychlorinated biphenyls- PCBPs with similar toxic properties, whoever the denomination of dioxin is given to 2,3,7,8- tetrachloro- dibenzo- para-dioxin(TCDD) and presence as environmental pollution (Stantaon *et al.*, 2001), present in herbicides contamination, papar bleaching, volcanic activities, cigarette smoke, forest fire etc.

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Human are exposed to dioxins via food contaminatin mostly fish, diary products, milk and eggs.(BMU, 2013 & UNEP, 2013)

Eggs from laying hen's housed outdoors are sensitive indicator to dioxin contamination in soil, also be a relevant pathway in human (Digangi & Petrlik, 2005; Weber *et al.*, 2015). TCDD exposure caused adverse health outcome mostly hypothyroidism, infertility, birthdefect, neurobehavioural disorder, immune system deficiency, nephropathy and kidney cancer.(Smith & Lopero, 2001; Baan *et al.*, 2009 & Mannetje, 2012).

MATERIALS AND METHODS

Experimental eggs and chickens:

In Baghdad province in Iraq from Alzaafarania city near Diyala river where is highly percent of pollution, 60 fertile eggs from local market were supplier the fertile eggs were artificially incubated at $37C^{o}$ and 55% relative humidity in incubator (model 21) humidaire for 21 day.

Chemicals:

Stoek solution P> 99% of 2,3,7,8- tetrachloro-dibenzo-para-dioxin(TCDD) were supplier from Sigma chemical company (St. Louis,Mo.) and dissolved freshly in corn- oil.

Eggs injection procedure:

Sixty (60) fertile chicken eggs (ova) were divided randomaly and equally into three group: 1^{st} group (C) control group contain 20 ova ingected 0.2µg/ kg corn oil in the aircell at day 4 of incubation (Sanderson & Bellward, 1995), 2^{nd} group contain 20 fertile eggs were injected 0.1µg /kg TCDD after dissolved freshly in corn oil in the aircell at day 4 ,while 3^{rd} group contain 20 fertile eggs injected 0.2 µg /kg TCDD in the aircell after dissolved freshly in corn oil.

These perinatal time were chosen to recorded the pathological lesion which may accur due to TCDD toxicity during embryogensis of fetus in the kidney (Scanes *et al.*, 1987). Aftr 21 days of incubator chicken were housed in hatcheng trays on the floor of incubator of the same humidity and temparture used for fertile eggs. The experiment were located in the animal house resources/ Science and Technology which located in Al- Zaafarania city, Baghdad, Iraq.

After 21 days the hatched chicken were euthanized with Co_2 for 45 sec. for all groups in average 10 chicks at days 15 and 10 chicks at days 30 of the experiment.

Blood collection:

Blood were colleded from newly hatched chicken at days 15 and 30 from all groups by cardiac puncture after chest cavity opening by euthanized with CO2 for 45 sec., then the blood centrifuged at 3000g, $4C^{0}$ for 20 min., under $-20C^{0}$ plasma was stored.

Biochemical assay:

a) Blood urea concentration assay (mL/dL):

Enzymatic and colorimetric method based on the specific action of urea which hydrolyse urea in ammonium ion carbon dioxide complex, this coloration proportional to urea concentration and measured at 600nm.(Fawcett & Scott, 1960)

b) Serum creatinine concentration assay (mg/dL):

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Creatinine under alkaline condition react with picrate ions forming reddish complex. The formation rate of the complex is measured through the increases of absorbance in apre-fixed interval of time is proportional to the concentration of creatinine in the sample.

Creatinine + picric acid $\frac{PH>12}{37C}$ red addition complex.

Calculation test (A1+A2) / Standard (A1+A2).

Standard concentration: 2 mg/dl. (Henry *et al.*, 1974)

Pathological examination:

After blood collection as above, the abdominal cavity were carfully cut, kidneys were carefully excised for detect any abnormal lesion, size, color, density and adhesion, etc. then and according to (Bancroft & Gamble, 2008), kidney samples >1cm^3 were immersed in Bouin's solution and embedding in paraffin section, then stained by hematexylin & eosin stain and examined by light microscope.

Statistical analysis:

All the grouped data were statistically read by SPSS program, Version 17 software (2010).Testing methods including one way ANOVA for comparisons among groups. P values of less than <0.05 were considered statistical significance. All data were expressed as means ± standard error (SE) (Leech *et al.*, 2011; Bassim *et al.*, 2020 and Humadi *et al.*, 2021).

RESULTS

Biochemical assay:

The table (1) showed significant increase (P<0.05) in serum urea concentration (ml/dL) in 3rd compared with control group.

Table (1):Chicken serum urea concentration (ml/dL) in study groups.

Groups	15 days	30 days
Control (1st group)	9.6 b	9.1b
TCDD 0.1 µg /kg (2nd group)	13.2 ab	13.7 ab
TCDD 0.2 µg /kg (3rd group)	19.2 a	19.4 a

n:10 with P<0.05.

Also the table (2) showed significant increase (P<0.05) in serum creatinine concentration (mg/dL) in 3rd group compared with control group.

Table(2): Chicken serum creatinine concentration (mg/dL) in study groups.

Groups	15 days	30 days
Control (1st group)	0.96 b	0.97 b
TCDD 0.1 µg /kg (2nd group)	1.95 ab	1.98 ab
TCDD 0.2 µg /kg (3rd group)	2.7 a	3.1 a

n:10 with P<0.05.

Pathological examination:

At day 15 and 30 no importand pathological changes were observed in chicken kidney control (1st group), while severe abdominal and chest sac edema covered the internal organ showed in both 2nd and 3rd groups (0.1 and 0.2) µg/kg TCDD respectively at (15 and 30) day with sever hydronephrosis. At 15 days, kidneys of chicken in both treated groups showed dilation of proximal convoluted tubules epithelium lining , some area swelling and granular

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(severe acute cellular swelling), other are sloughing and desquamated cells in lumen with atrophied tubules, moderated mononuclear cells monocytes infiltration. fig(1 and 2).

Other section of kidney consist atrophy of proximal convoluted tubules with sever interstitial lymphocytes infiltration and densety amorphous eosinophilic (colloid) cast in tubules. fig(3).

In newly hatched chicken treated with (0.1µg /kg TCDD) kidney at days 30, recorded absences of most glormeruli capsule, distended and width congested blood vesels, colonized most of tubuler epithelial cells fig(4). Extensive hemorrhage contain the cortex area causing tubular and glomerular atrophy with interstitial edema. fig(5). Folicular like hemorrhagic area causing atrophy in tubules and glormeruli with amyloid like material. fig(6). Balloning distended blood vesels, congested with blood with multiple tubular colloid hyaline cast degeneration and sever lmphocytic cuffing around blood vesels with cells damage and necrosis in cortical layer fig(7).

At days 30, kidneys of the hatched chicken treated with 0.1 µg/kg TCDD group showed necrotic all of glomeruli and tubules , all tubules degenerated with stare–shape like (hydropic degeneration) due to enlargement and swelling of tubular epithelial cells in lumen with colonized epithelial cells and glomeruli atrophy. fig(8). Extensive interstitial of hemorrhage causing damage and destrution of cortex layer. fig(9,10,11).

Group of 0.2 µg /kg TCDD at day 30 observed sever damage and necrosis of tubules with different degree of tubules colloid cast and congested blood vesels. Fig(12,13,14), Kidney at fig(15 and 16) showed severe damage due to extensive hemorrhage & interstitial infiltration of mononuclear calls causing cortex atrophy.

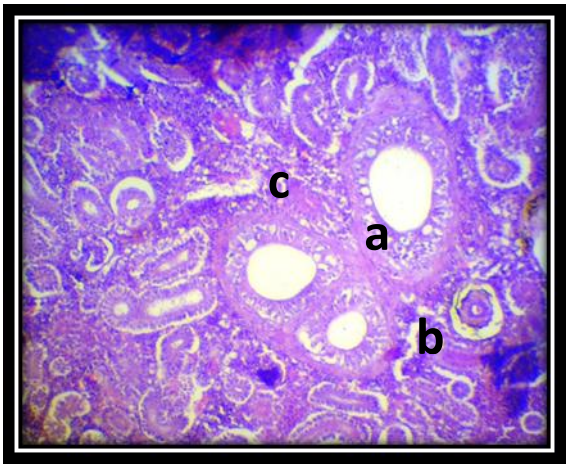

Figure (1): Kidney of newly hatched chicken treated by 0.1 µg /kg TCDD at days 15 showed:a) dilation of proximal conulted tubules epithelium lining b) sloughing & desqumation of epithelial cell in lumen c) atrophied tubules.

(X20 H&E)

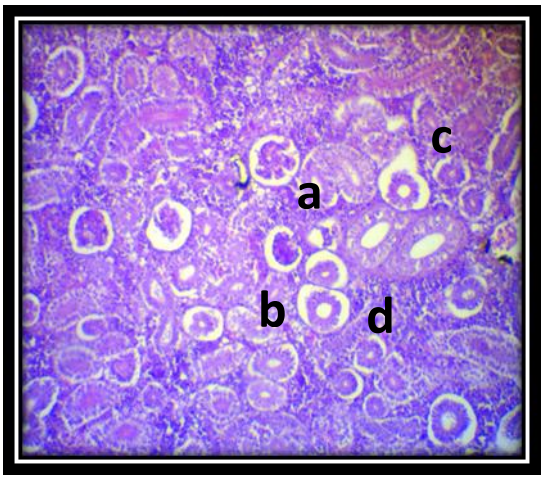

Figure (2): Kidney of newly hatched chicken treated by 0.1 µg /kg TCDD at days 15 showed:a) dilation of proximal conulted tubules epithelium lining b) sloughing & desqumation of epithelial cell in lumen c) atrophied tubules d) interstitial infiltration of lymphocytes (X20 H&E).

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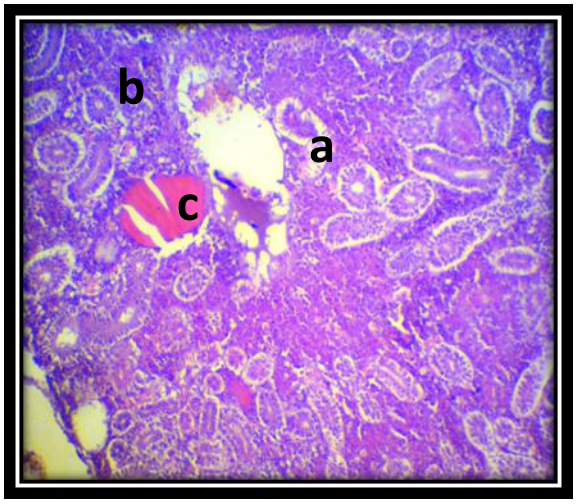

Figure (3): Kidney of newly hatched chicken treated by 0.1 µg /kg TCDD at days 15 showed:a) sloughing epithelium lining cell in lumen b) severe lymphocytic infiltration in interstitial layer c) amorphous eosinophilic colloid cast in tubules (X20 H&E).

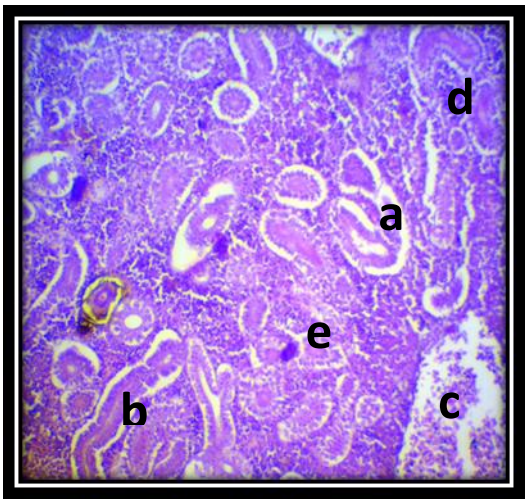

Figure (4): Kidney of newly hatched chicken treated by 0.1 µg /kg TCDD at days 30 showed:a) tubular epithelial cells sloughing b) closed irregular proximal conulted tubules c) distended & width congested B.V. d) abscences of corpsules e) colonized of tubules epithelium (X20 H&E).

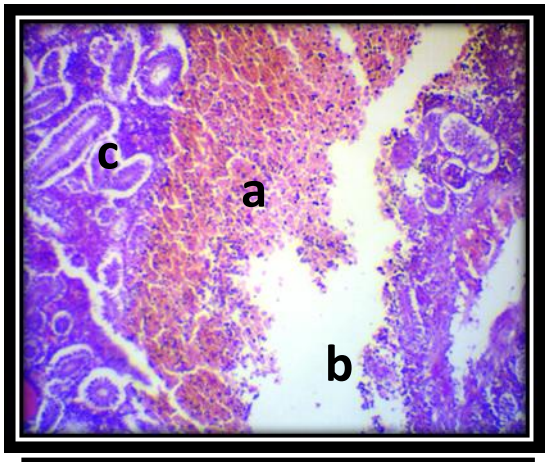

Figure (5): Kidney of newly hatched chicken treated by 0.1 µg /kg TCDD at days 30 showed:a) extensive interstitial hemorrhage b) edema c) tubular acute cellular swelling.

(X20 H&E).

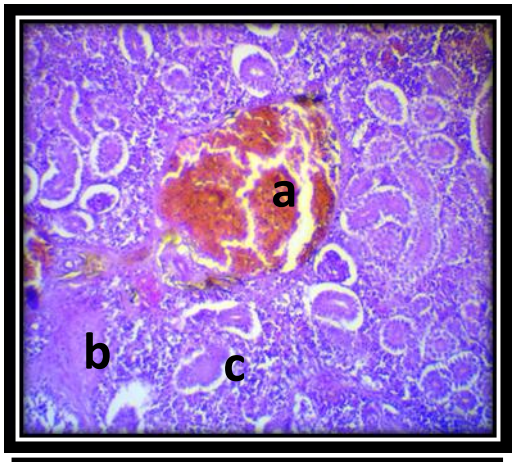

Figure (6): Kidney of newly hatched chicken treated by 0.1 µg /kg TCDD at days 30 showed:a) follicular like hemorrhage b) amyloid like materials c) acute cellular swelling.

(X20 H&E)

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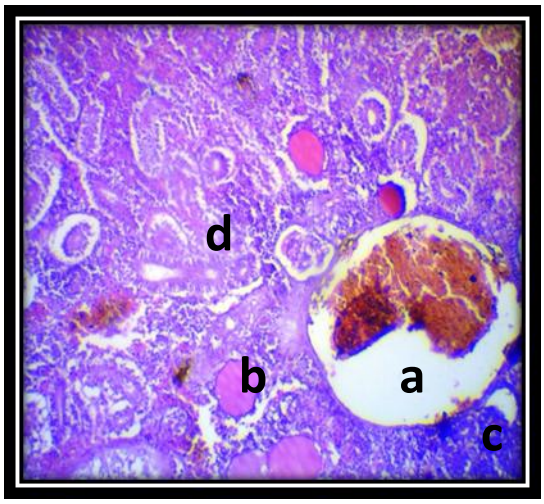

Figure (7): Kidney of newly hatched chicken treated by 0.1 µg /kg TCDD at days 30 showed:a) ballooning distended B.V. & congested b) tubular colloid hyaline degeneration cast c) cuffing of lymphocyte around B.V. d) necrosis

(X20 H&E)

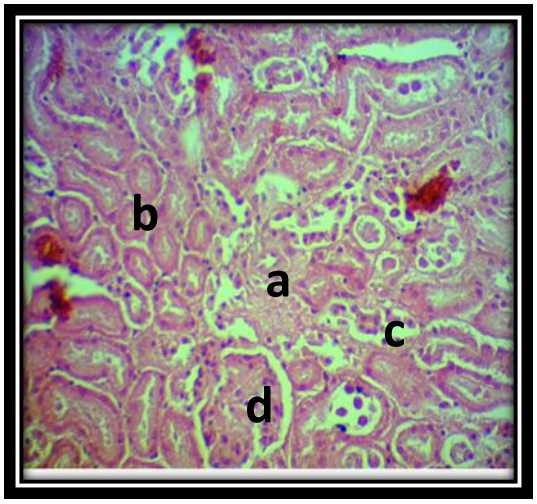

Figure (8): Kidney of newly hatched chicken treated by 0.1 µg /kg TCDD at days 30 showed:a) necrosis of glomeruli & tubules b) star shaped degenerated tubules (hydropic degeneration) c) colonized of tubular epithelium d) glomeruli atrophy.

(X20 H&E)

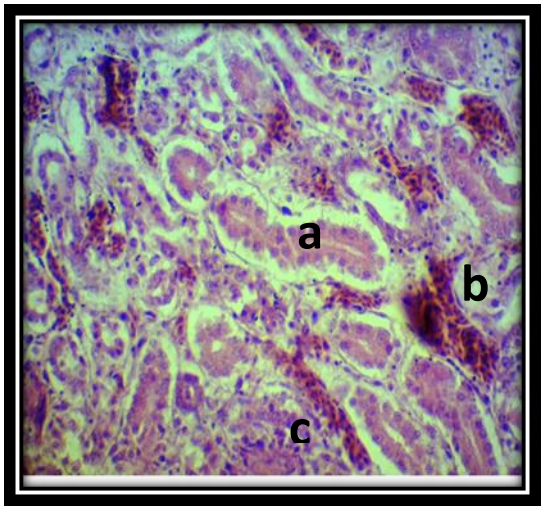

Figure (9): Kidney of newly hatched chicken treated by 0.1 µg /kg TCDD at days 30 showed:a) acute cellular swelling of tubules b) severe interstitial hemorrhage c) infiltration of lymphocytic cells.

(X40 H&E)

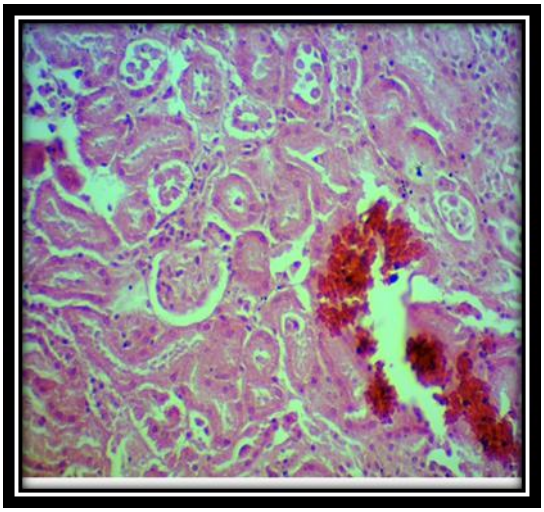

Figure (10): Kidney of newly hatched chicken treated by 0.1 µg /kg TCDD at days 30 showed damage of cortical area by extensive hemorrhage with mild lymphocytic infiltration.

(X40 H&E)

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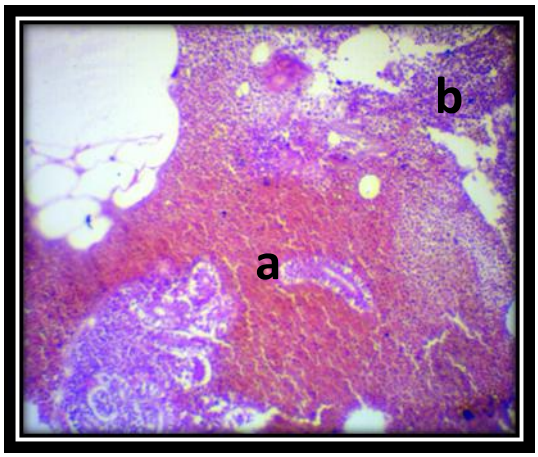


Figure (11): Kidney of newly hatched chicken treated by 0.1 µg /kg TCDD at days 30 showed:a) damage of cortical area by extensive hemorrhage with atrophy of glomeruli & tubules b) severe interstitial lymphocytic infiltration.

(X20 H&E)

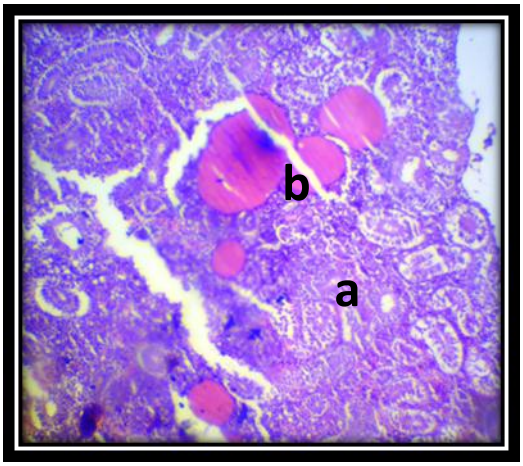
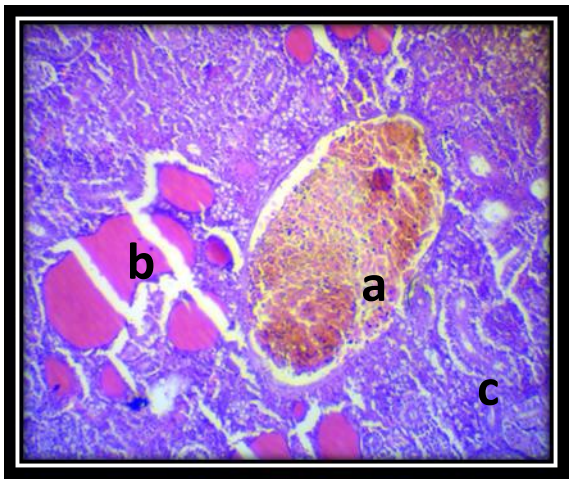


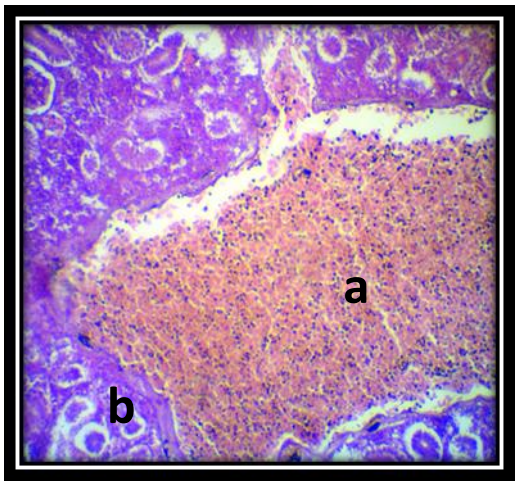
Figure (12): Kidney of newly hatched chicken treated by 0.2 µg /kg TCDD at days 30 showed:a) damage of tubules b) colloid tubular cast.

(X20 H&E)



chicken treated by 0.2 µg /kg TCDD at days 30 showed:a) severe dilated congested B.V. b) colloid tubular cast c) mild lymphocytic infiltration.

(X40 H&E)



hatched chicken treated by 0.2 µg /kg TCDD at days 30 showed:a) severe dilated congested B.V. b) swelling of tubules.

(X40 H&E)

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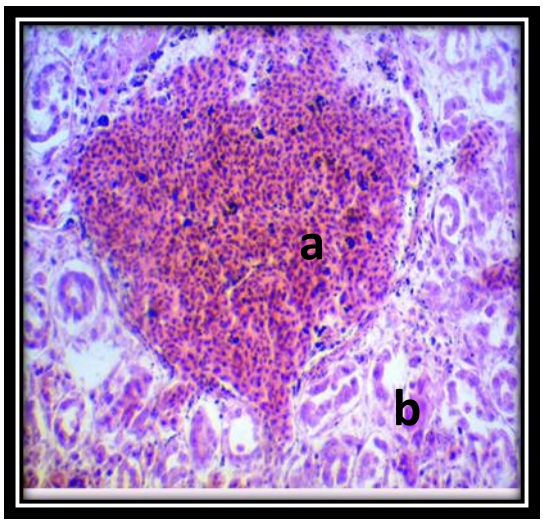

Figure (15): Kidney of newly hatched chicken treated by 0.2 µg /kg TCDD at days 30 showed:a) severe interstitial hemorrhage surrounded by fibrous connective tissue b) damage & necrosis of tubules.

(X40 H&E)

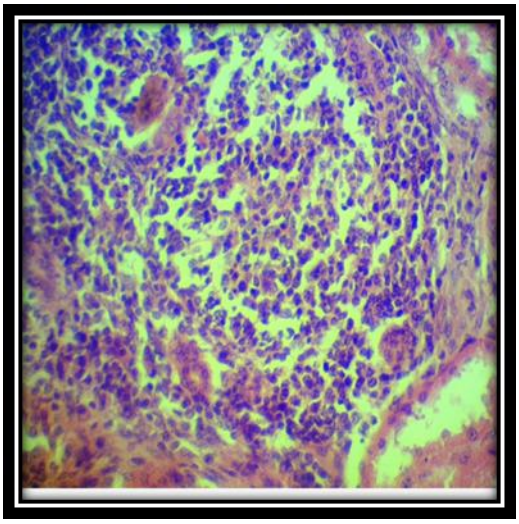

Figure (16): Kidney of newly hatched chicken treated by 0.2 µg /kg TCDD at days 30 showed interstitial infiltration of lymphocytes surrounded by fibrous connective tissue.

(X40 H&E)

DISCUSSION

Kidney function recorded significant increased in blood urea and creatinine concentration at (0.1 and 0.2) µg/kg TCDD specially at day 30, insufficiency of renal function occur due to distrubance in $Na^{+}K^{+}$ pump of nephrone due to epithelial cell detachment from tubules and destruction of renal parenchyma, dioxin enter the body in the food that chicken eat then enter circulatory system to adipose tissne and liver cells (Birkner *et al.*, 2008).

In liver TCDD ties to protein aryl- hydrocarbon (Ah- receptor) then tie to secondary protein. Ah- receptor- nuclear translocation.(Ah- rnt), this protein convers protein- dioxin complex in cell nucleus, in nucleus ties to strand turn on and turn off causing multiple disease like nephropathy, cancer, immunosuppression & hydronephrosis (Silbergeld & Gasiewicz, 1989; Greenfact, 2012 and Lali, 2018).

In human hydronephrosis is found in 1.5-3.3% of all outepsies and 1-5% of pregnancies on antenatal ultrasonography, the major of hydronephrosie is anatomical obstruction of urinary tract from kidney to bladder via the ureter causing increase retrograde hydrostatic pressure causing destruction of kidney paranchyma and hydronephrosis (Lee *et al.*, 2006; Frokiaer & Zeidel, 2011 and Yamacake & Nguyen, 2013), Chick edema which present in the chest and abdominal cavity due to toxicity of TCDD which called mysterious disease (Hites, 2011).

Pathological change characterized by acute cellular swelling in proximal convoluted tubules with damage of tubules and glomeruli at day 15 with dose (0.1 and 0.2 µg/kg) TCDD and increased the damage at day 30 at dose 0.2µg/kg by sever hemorrhage and massive

lymphocytic infiltration, these results are in agree with (Humadi, 2019) who showed dilated tubules, enlargment of glomruli with glomeruli tuft, tubular proteinaceous material and granuloma after exposured to toxic materials (Acrylonitrile).

The study of (Courtney & Moore, 1971) found that TCDD when given in pregnant murins (rat and mice) causes abnormalities in kindney like hydronephrosis in fetus at dose (1-3)µg/kg on GD10 or from GD10- GD13 and reduction in kidney size, dilation of renal calyces, loss of renal papilla which cause ureteric ooclusion & the lumen anatomically obstruct due to hyperplasia induced by TCDD, then leading to renal paranchyma damage and necrosis (Abbott *et al.*, 1987 and Nishimura *et al.*, 2006), So these results agree with (Humadi *et al.*, 2021) who showed pathological changes charaterized by present of multiple granuloma with giant cells and calcification at days 90 indicated that TCDD cause liver damage depending on dose and period of exposure and early indicator to liver cancer special with present of pleomorphism irregular epithelioid granuloma.

TCDD administration measured the antibody immunoreactivity against CYPIA and activation of Ah-r dependend gene on outerzone of the medulla which caus the tissue damage (Fujiwara *et al.*, 2008).

The present of inflammatory cells mostly lymphoceytes due to that TCDD enhance inflammatory process by increased proinflammatory interleukins and generation of free radical which cause destructive change in tissue (Calkosinski *et al.*, 2014), these results are in agree with (Humadi, 2019) who showed histopathological changes in kidney tissue exposed to toxic material (Acrylonitrile) including the inflammatory cells infiltrating were also appeard mainly mononuclear cells, lymphocytes and neutrophils, these changes resulting in increased the susceptibility to toxicity and infection. dilated tubules, enlargment of glomruli with glomeruli tuft, tubular proteinaceous material and granuloma

CONCLUSSION

Overall the results of this study consistently showed that chicken exposed to TCDD in ova injection at early incubation period causing kidney damage and destruction.

REFERENCES

[1]. Abbott, BD.; Birnbaum, LS. and Pratt, RM. (1987). TCDD-Induced hyperplasia of the ureteral epithelium produces hydronephrosis in murine fetuses.35(3): 329-334. https://doi.org/10.1002/tera.1420350307.

[2]. Anas, A. Humadi; Samer, I,; Bushra, I. and Ali, I. (2021). Toxicopathological And Biochemical Impacts Of 2,3,7,8 Tetrachlorodibenzo-P-Dioxin (TCDD) On Liver Of Albino Male Rats. Int. J. of Pharma. Res. 13(1): 2536-43.

[3]. Anastasia, D.; Andrey A. and Efim S. (2020). Free-range chicken eggs as a bioindicator of dioxin contamination in Vietnam, including long-term Agent Orange impact, Emerging Contaminants. 6: 114-23. https://doi.org/10.1016/j.emcon.2020.02.003.

[4]. Baan, R.; Grosse, Y.; Straif, K.; Secretan, B.; El Ghissassi, F.; Bouvard, V.; Benbrahim-Tallaa, L.; Guha, N.; Freeman, C.; Galichet, L. and Cogliano, V. (2009). International Agency for Research on Cancer Monograph Working Group. A review of

human carcinogens,Part F: chemical agents and related occupations. Lancet Oncol. 10(12): 1143-4. doi: 10.1016/s1470-2045(09)70358-4. PMID: 19998521.

[5]. Bancroft, J.D. and Gamble, M.(2008). Theory and Practice of histological techniques. Elsevier health sciences.

[6]. Bassim, MJ.; Anas, A.H. and Bushra, I.(2020). Pathological potential effects of Alpha-Lipoic acid in preventing cataract Diabetic retinopathy in albino male mice. Annals of Tropical Medicine & Public Health. 23 (9).

[7]. Birkner, E.; Grucka-Mamczar, E.; Kasperczyk, S.; Kasperczyk, A.; Stawiarska-Pieta, B.; Zalejska-Fiolka, J. and Birkner, B. (2008). The influence of fluoride ions upon selected enzymes of protein metabolism in blood plasma of rabbits with hypercholesterolemia. Biol Trace Elem Res. 124(2):118-28. doi: 10.1007/s12011-008-8129-4. Epub 2008 May 28. PMID: 18506400.

[8]. BMU(Federal Ministry for the Environment, Nature Conservation and Nuclear Safety) (2013): Umweltschutz – Standbein der Lebensmittelsicherheit (Dioxin- und PCB-Einträge vermeiden). Herausgegeben vom Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, 2013. http://www.bmub.bund.de

[9]. Całkosiński, I.; Rosińczuk-Tonderys, J.; Bazan, J.; Dobrzyński, M.; Bronowicka-Szydełko, A. and Dzierzba, K. (2014). Influence of dioxin intoxication on the human system and possibilities of limiting its negative effects on the environment and living organisms. Ann Agric Environ Med. 21(3):518-24. doi: 10.5604/12321966.1120594. PMID: 25292121.

[10]. Chang, R.; Hayward, D.; Goldman, L.; Harnly, M.; Flattery, J. and Stephens, R. (1989). Foraging fram animals as biomonitors for dioxin contamination. Chemosphere. 19 (1–6): 481-86. https://doi.org/10.1016/0045-6535(89)90355-X.

[11]. Courtney, K.D. and Moore, JA. (1971). Teratology studies with 2,4,5-trichlorophenoxyacetic acid and 2,3,7,8-tetrachlorodibenzo-P-dioxin, Toxicology and Applied Pharmacology, 20(3): 396-403, https://doi.org/10.1016/0041-008X(71)90282-1.

[12]. Digangi, J. and Petrlik, J. (2005). The Egg Report - Contamination of chicken eggs from 17 countries by dioxins, PCBs and hexachlorobenzene. Available at: http://english.arnika.org/publications/the-egg-report.

[13]. FAWCETT, JK. and SCOTT, JE. (1960). A rapid and precise method for the determination of urea. J. Clin. Pathol. 13(2):156-59. doi: 10.1136/jcp.13.2.156. PMID: 13821779; PMCID: PMC480024.

[14]. Frøkiær, J. and Zeidel, M.L. (2011). Urinary tract obstruction. In The kidney, 9th ed.; Taal, M.W., Chertow, G.M., Marsden, P.A., Skorecki, K., Yu, A.S.L., Brenner, B.M., Eds.; Elsevier Saunders: Philadelphia, PA, USA, 1: 1383–410.

[15]. Fujiwara, K.; Yamada, T.; Mishima, K.; Imura, H. and Sugahara, T. (2008). Morphological and immunohistochemical studies on cleft palates induced by 2,3,7,8-tetrachlorodibenzo-p-dioxin in mice. Congenital Anomalies 48: 68–73.doi:10.1111/j.1741-4520.2008.00181.x.

[16]. GreenFacts. (2012). Scientific Facts on Dioxins. https://www.greenfacts.org/en/dioxins/

[17]. Henry, RJ.; Canon, DC. and Winkelman, JW. (1974). Clinical Chemistry: Principles and Technics, 2nd Ed, Harper and Row Publishers.

[18]. Hites, RA. (2011). Dioxins: An Overview and History. Environ. Sci. Technol. 45(1): 16–20. https://doi.org/10.1021/es1013664

[19]. Humadi, A.A.(2019). Evaluation of toxicopathological effects of Acrylonitrile in albino male rats treated with alpha lipoic acid. Degree of doctor of philosophy of science in Veterinary Medicine/ Pathology/ College of Veterinary Medicine/ University of Baghdad, Iraq.

[20]. Humadi, A.A.; Sabeeh, S.I.; Al-Kaisei, B.I. and Al-Ezzy,A.I.(2021). Toxicopathological And Biochemical Impacts Of 2,3,7,8 Tetrachlorodibenzo-P-Dioxin (TCDD) On Liver Of Albino Male Rats. Inter. J. of Pharm. Res. 13(1): 2536-43.

[21]. Lali Z. (2018). Release of Dioxins from Solid Waste Burning and its Impacts on Urban Human Population- A Review. J Pollut Eff Cont 6: 215. doi: 10.4172/2375-4397.1000215

[22]. Lee, RS.; Cendron, M.; Kinnamon, DD. and Nguyen, HT. (2006). Antenatal hydronephrosis as a predictor of postnatal outcome: a meta-analysis. Pediatrics. 118(2):586-93. doi: 10.1542/peds.2006-0120. PMID: 16882811.

[23]. Leech, N. L.; Barrett, K. C.; and Morgan, G. A. (2011). IBM SPSS For Intermediate statistics.4th ed. Taylor and Francis Group. LLC.USA.

[24]. Mannetje, A.; Coakley, J.; Mueller, JF.; Harden, F.; Toms, LM. and Douwes, J. (2012). Partitioning of persistent organic pollutants (POPs) between human serum and breast milk: a literature review. Chemosphere. 89(8):911-8. doi: 10.1016/j.chemosphere.2012.06.049. PMID: 22868196.

[25]. Molnár, S. and Osi L. (2020). Sustainability and Quality Aspects of Different Table Egg Production Systems: A Literature Review Sustainability. 12: 7884. doi:10.3390/su12197884.

[26]. Nishimura, N.; Yonemoto, J.; Nishimura, H. and Tohyama, C. (2006). Localization of cytochrome P450 1A1 in a specific region of hydronephrotic kidney of rat neonates lactationally exposed to 2,3,7,8-tetrachlorodibenzo-p-dioxin. Toxicology. 227(1-2):117-26. doi: 10.1016/j.tox.2006.07.020. Epub 2006 Jul 31. PMID: 16959395.

[27]. Sanderson, JT. and Bellward, GD. (1995). Hepatic microsomal ethoxyresorufin O-deethylase-inducing potency in ovo and cytosolic Ah receptor binding affinity of 2,3,7,8-tetrachlorodibenzo-p-dioxin: comparison of four avian species. Toxicol Appl Pharmacol. 132(1):131-45.doi: 10.1006/taap.1995.1094. PMID: 7747276.

[28]. Scanes, CG.; Hart, LE.; Decuypere, E. and Kuhn, ER. (1987). Endocrinology of the avian embryo: an overview. J Exp Zool Suppl. 1:253-64. PMID: 3298531.

[29]. Silbergeld, EK. and Gasiewicz, TA. (1989). Dioxins and the Ah receptor. Am. J. Ind. Med. 16(4):455-74. doi: 10.1002/ajim.4700160411. PMID: 2558567.

[30]. Smith, AH. and Lopipero, P. (2001). Evaluation of the Toxicity of Dioxins and Dioxin-like PCBs: a Health Risk Appraisal for the New Zealand Population. Wellington: Ministry for the Environment.

[31]. Stanton, BJ.; El-Sabeawy, F.; Fang, X.; Enan, E. and Lasley, BL. (2001). Interaction of estrogen and 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in immature male

chickens (Gallus domesticus). Comp Biochem Physiol C Toxicol Pharmacol. 129(1): 35-47. doi: 10.1016/s1532-0456(01)00178-8.PMID: 11369299.

[32]. United Nations Environment Program(UNEP, 2013). Toolkit for Identification and Quantification of Releases of Dioxins, Furans and Other Unintentional Persistent Organic Pollutants (POP) A Guide to theunder the Stockholm Convention.

[33]. Weber, R.; Watson, A.; Petrlik, J.; Winski, A.; Schwedler, O.; Baitinger, C. and Behnisch, P. (2015). High levels of PCDD/F, PBDD/F and PCB in eggs around pollution sources demonstrates the need to review standards. Organohalogen Compounds. 77: 615-18.

[34]. Yamaçake, KG. and Nguyen, HT. (2013). Current management of antenatal hydronephrosis. Pediatr. Nephrol. 28(2):237-43. doi: 10.1007/s00467-012-2240-7. Epub 2012 Jul 27. PMID: 22836304.