Pak. j. life soc. Sci. (2024), 22(1): 3513-3524 E-ISSN: 2221-7630;P-ISSN: 1727-4915

Pakistan Journal of Life and Social Sciences
www.pjlss.edu.pk

https://doi.org/10.57239/PJLSS-2024-22.1.00256

RESEARCH ARTICLE

Effect of Water Pollutant Rivers on Biochemical and Physiological Parameters in Local Geese in two Regions AL-Qurnah and Shatt-AL-Arab In Basrah Governorate

Arwa H. M. AL-Saeed [1], Muna H. AL-Saeed[2]

[1]Department of Chemistry, College of Science , University of Basrah, Basrah, Iraq
[2]Department of Physiology, Pharmacology and Biochemistry, College of Veterinary Medicine , University of Basrah, Basrah, Iraq.

ARTICLE INFO

Received: Apr 24, 2024

Accepted: Jun 27, 2024

Keywords

Pollutant
Local Geese
Stress

***Corresponding Author:**

……

ABSTRACT

Pollutants play a key role in the development and distribution of aquatic creatures, and hormonal and haematological measures are the most widely used stress indicators for gauging the health of local geese. In this work, some physical and chemical parameters were estimated from 2 regions in Basrah province, from region of Al-Qurnah and the other region Shatt-AL-Arab district. An attempt has been made to investigate the stressors pollutant impact on haematological [Differential leucocyte count (DLC), White Blood Cell count (WBC), Haemoglobin (Hb), Red Blood cell count (RBCs) and Packed Cell Volume (PCV)] and hormonal (Estrogen,Progestron and Cortisol) and biochemical (glucose and profile of lipid) parameters of local geese. Physical and chemical variables were shown to significantly reduce RBC, Hb, PCV, and WBC counts when exposed to natural stresses. When inspected under a microscope, DLC showed a decrease in lymphocytes, monocytes, eosinophils, and basophils, and a rise in hetrophils and thrombocytes. A significant rise in levels of glucose and cortisol were estimated with ($P \leq 0.05$). Also, local Geeses showed significant reduce in Hct, Hb and TEC under 6.05 mg/l of the phosphate, contrary to RBC-dependent parameters (RBC, Hb, and PCV). There was a notable rise in both glucose and cortisol levels and an increase in DLC and TLC, with rises in eosinophils, lymphocytes and monocytes and decreases in thrombocytes, basophils and hetrophils. Generally, local Geeses affected than regarded histopathological, biochemical and haematological examinations..

INTRODUCTION

The term "stress" is often used to characterize a variety of physiological responses, including those that occur in reaction to external stimuli. When an organism is exposed to an external stimulus that disrupts its internal hormonal balance—called homeostasis [1] the organism is said to be under stress.A variety of abiotic variables can cause stress in Geeses, an essential constituent of the aquatic ecosystem and a significant item for human food (proteins, 16–23%). Additionally, stress can cause Geeses to reallocate energy within its system, disrupting its usual physiological equilibrium or homeostasis.

Changes in the surrounding environment (such as the water's temperature, pH, or oxygen levels)

[2-3]. Heavy metals and xenobiotics, which enter water systems via the industrial, household, and agricultural discharge system, are also considered severe contaminants that function as a major cause of stress to Geeses[4]. In addition to putting Geeseses under a great deal of stress, the combination of natural and artificial stressors disrupts their homeostatic process [5]. Geese have been shown to react to chemical and other stressor levels much below those detectable by terrestrial mammals [6]. Because their physiological equilibrium is so intrinsically linked to and dependent on the water in their habitat, geese are more vulnerable to stress than many other animals. Because of the close link between bodily fluids in the gills and the surrounding water, water and ion homeostasis are disrupted under stressful situations. Primary and secondary physiological reactions have been identified in Geeses in response to environmental stresses. Catecholamine release from chromaffin tissue [7-8] and the hypothalamic-pituitary-interrenal (HPI) axis activation resulting in the corticosteroid hormones secretion into circulation are examples of first reactions involving the early neuroendocrines[9-11].Cellular responses, immune function, hydromineral balance, acid-base status, respiration and alterations to metabolic processes, are all examples of secondary responses [12-13]. As a result, researchers are currently looking at the impact of environmental stresses on the blood and hormone levels of local geese.

Diseases in Geeses can occur and progress when sublethal amounts of toxic substances are present in freshwater ecosystems. It has been hypothesized that Geeses' metabolic profile and a number of their physiological systems (including their blood, reproduction, and osmoregulation) are impaired due to persistent stress alone. In light of the foregoing, recent studies have been done to determine how inorganic pollutants such phosphore, Ca, CL, and Mg have affected the haematological, biochemical, and hormonal characteristics of local Geeses.

2.MATERIALS AND METHODS

2.1Areas of the study:

The water samples were obtained from 2 regions (fig. 1), one of them (St. 1) situated at AL-Quranahrevier northwest of Basrah governorateand other region east region (Shatt-AL-Arab of Basrah governorate.

2.2Experimental grouping

A total of 24 female samples related to local geese (***Ansercygnoidesdomesticus***). Water temperature measured by using thermometer. Other Marine Science Centre -Basrah University.

Geese samples were obtained from two region R1 and R2 respectively, and transferred alive in clean river water. Geeseswere brought to the Biochemistry, Pharmacology and Physiology laboratory in Veterinary Medicine College, Basrah University.

The Geese were released at least for two to three hours for adaptation and Geeses were handled slightly to evade stress, and sacrificed. After the completion of blood withdrawal, weights were measured.

Blood samples were used in measured for:

Geeses had their hearts punctured to obtain blood samples for analysis of several haematological parameters, including granulocyte count, count of white blood cell, count of red blood cell and count of platelet as well as cortisol and glucose levels. An enhanced Neubauer haemocytometer[15] was used to count RBCs and WBCs. Methodology based on [16] was used to tally DLC. Sahli haemometer was used to calculate Hb [17]. The centrifugation technique was used to calculate PCV [18]. Blood was drawn into plastic Eppendrof tubes for the measurement of glucose and cortisol. Plasma was detached from whole blood using centrifugation, and the cortisol, estradiol, and progesterone

concentrations were estimated utilizing an ELISA Kit in accordance with [19]'s protocol. Estimates for glucose and lipid profile were made using the approach described in [20].

2.3Statistical Analysis

Analysis of the gathered data was carried out [21]. The statistical significance of the observed deviation from the mean was determined utilizing one-way analysis of variance (ANOVA) in SPSS.

3.RESULTSANDDISCUSSION

3.1The environmental factors:

Station 2 had lower concentrations of hydrogen ions compared to station 1 and had higher temperatures, salinities, electrical *conductivity*, and turbidities than station 1 (table 1). This was just one example of how the environmental analysis revealed differences between the two stations' measurements of physical and chemical factors. Table 2 shows that compared to measurements taken in region 1, all chemical parameters were significantly higher in region 2. All human, industrial, and agricultural uses in the Basrah province rely on water from the Shatt al-Arab. The waters of the Shatt al-Arab are influenced by those of the Tigris and Euphrates [38] . The hydrological, chemical and physical characteristics of the water entering the Shatt al-Arab are affected by a number of factors, including the rain amount, recharge of groundwater and conditions of storage above the river basin, and the salt front and tidal energy coming from the Arabian Gulf [39] .

Water's physical and chemical qualities are the most crucial in determining its suitability for human, agricultural, and industrial consumption [40]. Periodic evaluation of these characteristics provides a clear picture of the stability or decline of well water [39] . Water temperature has a significant impact on the sensitivity of living organisms to toxic substances as well as the solubility and, therefore, the toxicity of some chemical materials in systems of water [41] . This has implications for a wide range of biological processes, including reproduction, feeding, migration, metabolism, activity, and toxicity. The mean temperatures at stations 1 and 2 in the current investigation ranged from 20.5 to 23.1 degrees Fahrenheit, as shown in table (1).

When evaluating quality of water, turbidity, which is the measure of organic and inorganic suspended particles, is commonly used [42] . When turbidity prevents light from penetrating the water column, it can stunt the development of phytoplankton and macrophytes. Lower river flow and more pollution may explain why the St.2 had higher turbidity than the st.1 in this research. The measured concentrations in st.2 were higher than the maximum amount allowed in WHO-recommended [43] drinking water.

It is a well-known truth that the escalating cost of living in the United States has a direct correlation to the rising cost of living in other countries. The United States is no exception to this trend. This result was agreed with [44] , which states that an increase in salinity occurs when freshwater flow is reduced due to the intrusion of a marine salt wedge front from the Arabian Gulf. Since the Shatt al-Arab River and the rise in the water level of the Arabian Gulf due to natural causes and human activities are likely to be the main causes, we can conclude that the al-hababah river has higher salinity values than the tanks water at station 1. The diversion of the Karun River into Iran has reduced the effectiveness of the natural barrier provided by the Shatt al-Arab River against the penetration of the marine salt wedge front from the Arabian Gulf.

Water's acidity or alkalinity, as measured by the pH scale, is a key factor in determining how well it serves various functions. Table (1)'s results showed a clear decline in pH values between St. 2 (7.1) and St. 1[7.8]. The high levels of phosphate, carbonate, and bicarbonate in the water make it suitable for regulatory purposes [44] , and the present research agrees with others on aquatic ecosystems in Southern Iraq that have suggested a pH range of 6.5 to 8.5 [39-45] .

Station 2 has much higher EC values (5.84) compared to station 1 (2.72) because EC assesses the amount of total solids or amount of total dissolved ions in water. A lower total dissolved salts (TDS) content in st.1. (174) compared to st.2 (37370). Tables 1 and 2 illustrate that hardness rises with increasing concentrations of dissolved contaminants and salinity including associated ions (such as Mg^{+2}, Ca^{+2}, Cl^{-} and PO_4). Variations and decreases in water flow and increases in soluble salts from the Arabian Gulf are indicated by these metrics [44-46] .

This proves the deterioration of water quality and its invalidity for human uses,

especially drinking, and demonstrates that the Al-Hababah River station was subjected to a high level of nutrient contamination as a result of multiple pollution activities. These activities included the discharge of domestic waste, industrial waste, and agricultural waste. Basrah province had to find alternative sources to meet its needs, which meant paying higher prices or resorting to more expensive methods of desalinization, as evidenced by studies [39 , 45 , 47 , 48 , and 49] .

Table (1): The mean of some physical parameters at areas of study

Site	Region 1 River of AL-Quranah	Region 1 AL-Quranah Water house	Region 2 River of Shatt AL-Arab	Region 2 Shatt AL-Arab Water house
EC ms/Cm	1.96	1.85	16.97	14.82
pH	8.01	7.95	7.8	7.77
PO_4 mg/L	0.057	0.043	0.068	0.000
Ca mg/L	80	96	264	240
Cl mg/L	639	568	5858	5148
TDS	1257	1187	10861	9485

Table (2): Impact of environmental stresses on Weight of Geese in two regions

Groups	R.1		R.2	
Parameters	Geese in River of AL-Quranah	Geese in AL-Quranah Water house	Geese in Shatt AL-Arab Water house	Geese in River of Shatt AL-Arab
Weight(g)	3000±10.15 a	3250±15.75 A	2900±12.69 b	3000±21.59 a

Mean±SD. N=6 , small letters denote differences between groups, P≤0.05 vs. unstressed, N=number of Goose.

Effect of Environmental Stresses on Weight of GeeseHaematological factors on local Gooses:

Table 2 shows that the length and weight of Geeses in the Al-Hababah River (st. 2) are significantly lower than those of Geeses in region (1) with ($P \leq 0.05$). Results in table (3) revealed that RBC counts, Hb values, PCV% values, and WBC counts all decreased significantly ($P \leq 0.05$) in Geeses caught from st. 2 compared to st. 1. There was a decline in all four kinds of white blood cells (basophils, eosinophils, monocytes and lymphocytes) in the differential leucocyte counts. In contrast, both hetrophil and thrombocyte counts increased.

The physiological reaction of Geeses to changes in their external environment can be better understood by a haematological study of these birds. The blood of geese has been the subject of research [21-23] Physiological dysfunction in Geeses's body is reflected in changes to the blood's composition, making the blood a sensitive stress indicator. Since blood is used to carry substances between cells and inside cells, it frequently comes into touch with many different tissues and organs, putting the physiological processes of the Geeses in jeopardy [23].

Table (3): Impact of environmental factors on Haematological Factors in two regions

Groups / Parameters	R.1		R.2	
	Goose in River of Shatt AL-Arab	Goose in Shatt AL-Arab Water house	Goose in AL-Quranah Water house	Gooses in River of AL-Quranah
Monocyte%	7.9±0.012b	9.2±0.34b	14.1±0.1a	15.3±0.22a
Lymphocyte %	31.6±0.16b	33.3±0.81b	42.8±0.16a	40.2±0.02a
Basophiles%	0.1±0.47b	0.3±0.015b	3.4±0.39a	2.5±0.25a
Eosinophiles %	0.2±0.01b	0.2±0.03b	3.1±0.36a	3.2±0.29 a
Neutrophiles%	56.8±0.12a	55.8±0.37a	35.3±0.20 b	39.11±0.61b
PCV%	30.0±0.22b	33.0±0.13b	41.2±0.13a	41.3±0.16a
Hb (mg\dl)	5.1±0.24b	6.2±0.14b	8.9±0.37a	9.6±0.23a
WBC (×103 /cmm)	10.47±0.28b	11.01±0.21b	13.02±0.11a	13.23±0.27a
RBC (×106 / cmm)	2.32±0.057b	2.47±0.12b	4.79±0.18a	4.83±0.15a

Mean±SD N=6, Small letters denote differences between groups, P≤0.05 vs. st1. N=number of geese

Effect of Environmental Stresses on Glucose and Hormonal Parameters in Local Geese of Two Regions

Table 4 shows that when comparing Geeses collected from R 1 and R 2, the estrogen and progesterone levels were significantly (P≤0.05) lesser, whereas the values of cortisol and glucose were significantly (P≤ 0.05) higher.

Glucocorticoid steroid hormones have a crucial role in regulating homeostatic activities including metabolism and osmoregulation, and they also have the ability to alter immunological systems. Many scientists consider it a "rule of thumb" that Geeseses under stressful conditions show a plasmatic rise in cortisol levels since stress has been shown to raise plasma cortisol, an essential glucocorticoid [26-27] . Furthermore, cortisol stimulates the production of catecholamines from chromaffin cells, which further stimulates glycogenolysis and modulates circulatory and respiratory function [28] . All of this works to boost glucose levels, allowing the Geeses to generate more power in the event of an emergency [30,14] . Thyroxine (T4) is a prohormone formed mostly via the thyroid gland. It is converted into triiodothyronine, the physiologically active form, by type I and type II monodeiodinases in tissues [31-32] . Thyroid research is primarily focused on elucidating the regulatory mechanisms that govern TH hormonogenesis and TH tissue metabolism. Mechanisms for maintaining systemic levels of T3 depend on the intricate coordination of the TH receptor group [33] , deiodinases [34] , transport complex of carrier proteins that allow TH entrance into cells via the plasmodium lateral membrane, and other proteins [35 - 37] . The release of T3 into the extracellular fluid after T4 conversion makes this possible [38,39] .

Table (4): Impact of Environmental parameters on Glucose, Lipid Profile and Hormonal Parameters in Local Geese of Two Regions

Group	R.1		R.2	
Parameters	Geesein River of AL-Quranah	Geese in AL-Quranah Water toilet	Geese in River Shaat-AL-Arab	Geese in AL-Quranah Water oilet
Glucose(mg/dl)	94.09± 2.04 b	100± 20.21b	150± 18.08a	134±11.01a
Cortisol(ng/ml)	6.47±0.016 b	4.47±0.016 b	11.96±0.012a	8.25±0.011 a
HDL(mg/dl)	20.32±0.32 b	29.10±5.64 a	15.09±4.99 b	18.01±5.76 b
Progestron(ng/ml)	11.08 ± 4.72a	10.29± 4.72a	7.40±1.60b	5.61±0.38b

T-CH(mg/dl)	289.94±7.33a	242.51±5.89b	320.06±22.39a	278.04±16.06a
Triglyceride(mg/dl)	221.93±6.99b	203.02±11.78b	260.34±17.94a	190.53±14.68b
Estrogen(ng/ml)	3.78±0.011a	4.62±0.031a	1.42±0.015b	2.40±0.021b
LDL(mg/dl)	119.96±12.2	100.72±9.30	170.24±25.46a	99.62±14.29
VLDL(mg/dl)	30.57±4.29	22.30±5.52	66.49±8.45	49.07±12.8

Mean±SD , N=6, Small letters denote differences between groups,P≤0.05 vs. st.1. N=number of geese.

3.2Histological Examination:

-Liver:

Hepatocytes in the livers of local geese from the river Al-Quran showed evidence of significant fatty infiltration. The hepatocytic cytoplasm had comparatively larger lipid droplets than those seen in the local geese of the river Shatt-AL-arab. In isolated instances, the tubules of glands did not have clear borders because the membranes of the cells were compromised. The liver of the R1 group of local geese looks quite similar to the liver of the R2 group of local geese under a light microscope. Hepatic steatosis was not present in the euthanized birds. The liver cells, or hepatocytes, were tiny and showed no symptoms of enlargement. Congestion restricted to a single hepatocyte. histopathological alterations may be induced by xenobiotics (such as heavy metals/pesticides) due to their fast binding to blood proteins. Similar to mammals, geese rely on glucocorticoids to control a plethora of mechanisms that allow them to react to and withstand stress [23]

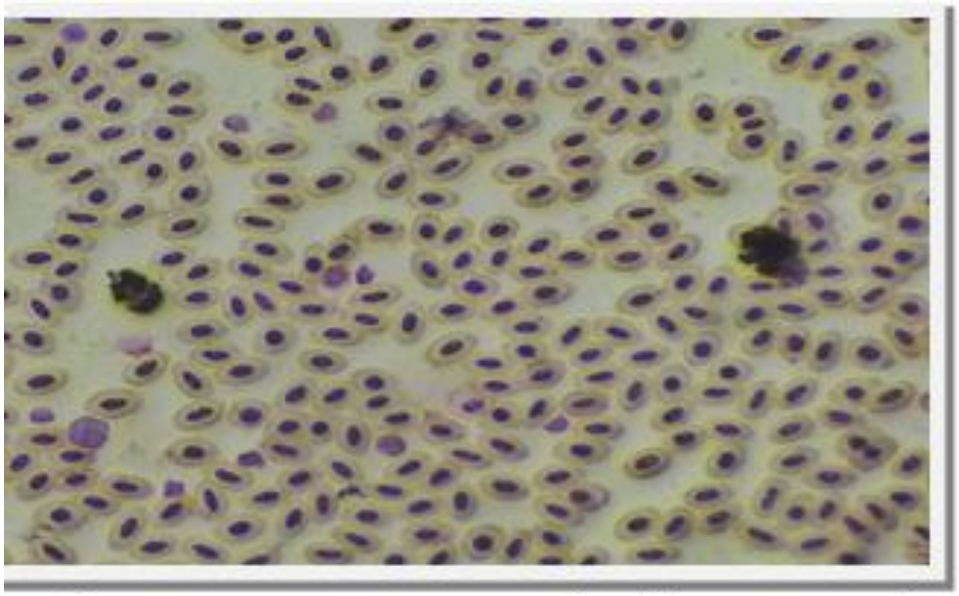

Fig.(3): Blood smear of local geese in region1(AL-Qurana)

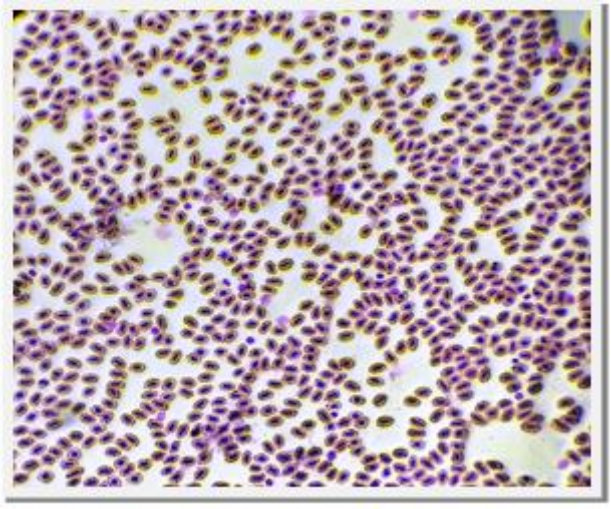

Fig. (4): Blood smear of local geese in region2 (Shatt-AL-arab)

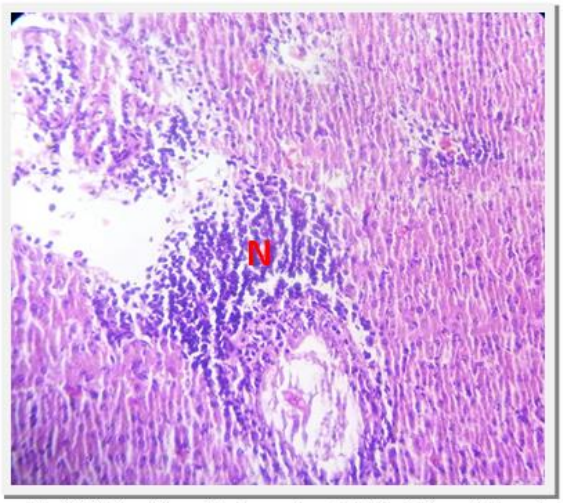

Fig. (5): Section of liver of local geese in region2 (Shatt-AL-arab. Showed necrosis in hepatocyte(N)

Acknowledgement

I'd like to express my gratitude to everyone who assisted me in completing this research in such a fantastic manner.

Conflict of Interest

Authors declare no conflict of interest.

6. REFERENCES

[**1]** Rahi , K.A. ; Al-Madhhachi,A.T. ; AL-Hussaini,S.N.Assessment of Surface Water Resources of Eastern Iraq.Hydrology . 2019 ,6,57.https: // **doi.org/10.3390/hydrology6030057**

[2] Hassan,A.A. ; Dawood,A.S. ; AL-Mansori,N.J.Assessment of WaterQuality of Shatt Al-Basrah Canal using Water Pollution Index.Int.J.Eng.Technol. 2018 .7, 757-762. DOI:10.14419/ijet.v7i4.19.27994

[3] Al-Lami , A.M.A. ; Abbas,Z.R. and Alshammary , A,G.Study of Water Pollution Problem in Basra city of Iraq: a case study . Plant Archives .2020 . 20 (1) : 2274-2276 .

[4] Al-Kazaeh ,D.K.K.Chemical and Physical properties of common water in area and evaluation degree for Irrigation in Basra / Iraq . Journal of Basra Research (Scientific) .2014 .40(2b) : 18: 26-44

[5] Abdulnabi,Z.A. ; Altememi,M.K. ; Hassan,W.f. ; Kassaf Al-Khuzaie, D.K. and Saleh ,S.M.Assessing of Some Toxic Heavy Metals Levels and Using Geo Accumulation Index in Sediment of Shatt Al-Arab and the Iraqi Marine Region . Baghdad Science Journal . 2019.16(2): 323-331.

[6] Al-Asadi,S.A. The future of freshwater in shatt al-arab river (southern Iraq) .Journal of Geography and Geology . 2017 .9(2) : 24-38. DOI:10.5539/jgg.v9n2p24

[7] Moyel,M.S. and Hussain,N.A. Water Quality assessment of the Shatt al -Arab River , Southern Iraq . Journal of Coastal Life Medicine .2015 .3(6):459-465. DOI:10.12980/JCLM.3.2015J5-26

[8] Potasznik , A. and Szymczyk,S. Magnesium and Calcium concentrations in the surface water and bottom deposits of a river -lake system . Journal of Elementology.2015 . 20(3): 677-692. DOI: 10.5601/jelem.2015.20.1.788

[9] Stress and Geeses (Pickering A. D., ed.. Academic Press, London and New York.

[10] Al-Asadi,S.A. ; Al Hawash,A.B. ; AlKhlifa,N.H.A. and Ghalib,H.B. Factors affecting the Level of Toxic Metals in the Shatt Al-Arab River ,Southern Iraq, Earth Systems and Environment. 2019 . 1-13. doi.org/10.1007/s41748-019-00096-y

[11] Hamdan,A.N. Variation effect of discharge on total dissolved salts in Shatt Al-Arab River .2015. The 2nd International Conference of Building , Construction and Environmental Engineering (BCEE 2-2015): 135-142.

[12] Al-Nasrawi,a.K. ; Fuentes ,I. and Al-Shammari , D. Changes in Mesopotamian Wetlands: Investigations Using Diverse Remote Sensing Datasets .Wetlands. 2021. 41(7), 1-17. DOI:10.1007/s13157-021-01490-x

[13] Al-Khafaf,A .A. ; Al-Ziyadi, H.A. ; Al-Fartousi. Kh.K.Al-Rafidain Center for Dialogue, Beirut editional Lebanon, Editional 1 Beirut, Lebanon, 2019, p.13.

[15] Dethloff, G.M.; Schlenk, D.; Khan, S. and Bailey, H.C.. The effects of copper on blood and biochemical parameters of rainbow trout (Oncorhynchus mykiss. *Arch. Environ. Contam. Toxicol*.,1999 . 36: 415- 423. DOI: 10.1007/PL00006614

[16] Maule, A.G. and Schreck, C.B.. Changes in the number of leucocytes in immune organs of juvenile coho after acute stress or cortisol treatment. J. Aquatic Animal Health,1990 . 2: 298-304. doi.org/10.1577/1548-8667(1990)002<0298:CINOLI>2.3.CO;2

[17] Tort, L.;Padros, F.; Rotllant, J. and Crespo, S.. Winter syndrome in the gilthead sea bream Sparus aurata. Immunological and Histopathological features.Geeses and Shellfish immunol.,1998. 8: 37-47. DOI:10.1006/FSIM.1997.0120

[18] Cravo, A., Pereira, C., Gomes, T., Cardoso, C., Serafim, A., Almeida, C., ...& Norberto, R. 583. A multibiomarker approach in the clam Ruditapesdecussatus to assess the impact of 19 pollution in the Ria Formosa lagoon, South Coast of Portugal. Marine environmental research,2012. 75, 23-34. DOI:10.1016 / j.marenvres.2011.09.012

[19] Damásio, J., Fernández-Sanjuan, M., Sánchez-Avila, J., Lacorte, S., Prat, N., Rieradevall, M., 587 ... & Barata, C.. Multi-biochemical responses of benthic macroinvertebrate species as a complementary tool to diagnose the cause of community impairment in polluted rivers. Water research,2011. 45(12), 3599-3613.DOI: 10.1016/j.watres.2011.04.006

[20] Depledge, M. H. and Fossi, M. C.. The role of biomarkers in environmental assessment (2). Invertebrates. Ecotoxicology,1994. 3(3), 161-172. doi: 10.1007/BF00117081.

[21] Devaux, A., Bony, S., Plenet, S., Sagnes, P., Segura, S., Suaire, R. and Olivier, J. M.. Field evidence of reproduction impairment through sperm DNA damage in theGeesesnase (Chondrostoma nasus) in anthropized hydrosystems. Aquatic Toxicology,2015. 169, 113-122. doi: 10.1016/j.aquatox.2015.10.013. Epub

[22] Barton, B.A.; Ribas, L.; Acerete, L. and Tort, L. Effects of chronic confinement on physiological responses of the juvenile gilthead sea bream, Sparus aurata L. to acute handling. *Aquaculture Res*.,2005. 36: 172-179. DOI: 10.1111/j.1365-2109.2004.01202.x

[23] Begg, K. and Pankhurst, N.W.. Endocrine and metabolic responses to stress in a laboratory population of the tropical damselfish Acanthochromispolyacanthus. *J.Geeses Biol*.,2004. 64: 133–145. DOI: 10.1111/j.1095-8649.2004.00290.x

[27] Sachar, A.. Studies on effect of organic and inorganic pollutants on haematology, blood biochemistry and immune organs in some Geeseses of Jammu region. University of Jammu.2011. Ph. D Thesis.

[28] Santhakumara, M.; Balaji, M. and Amudu, K.. Adaptive changes in respiratory movements of an air breathingGeeses, Anabas testudineus exposed to organophosphate pesticide, monocroptophos. *Eco. Env. Conserv.*2000.6(1): 67-69.

[29] Munch, A.; Guryre, P.M. and Holbrook, N.J.. Physiological functions of glucocorticoids in stress and their relation to pharmacological actions. *Endocr. Rev.*, 1984. 5(1): 25-44. doi: 10.1210/edrv-5-1-25.

[30] Singh, B.P. and Tandon, P.K.. Effect of river pollution on haematological parameters ofGeeses, Wallago attu. *Res. Environ. Life Sci*.,2009. 2(4): 211-214.

[31] Stein-Behrens, B.A. and Sapolsky, R.M.. Stress, glucocorticoids, and aging. Aging,1992. 4: 197-210. DOI: 10.1007/BF03324092

[32] Tavares-Dias, M. and Barcellos, J.F.M.. Peripheral blood cells of the armoredcatfishHoplosternum littorale Hancock, 1828: a morphological and cytochemical study. *Braz. J. Morphol. Sci*.,2005. 22: 215 - 220.

[33] Torres, P.; Tort, L.; Planas, J. and Flos, R.. Effects of confinement stress and additional zinc treatment on some blood parameters in the dogdish (Scyliorhinusconicula. Comp. Biochem. Physiol.,1984. 83C: 89-92. doi.org/10.1016/0742-8413(86)90017-4

[34] Vosyliene, M.Z. and Kazlauskiene, N.. Alterations in Geeses health state parameters after exposure to different stressors. Acta ZoologicaHydrobiologica,1999. 9(2): 1392-1657.

[35] Vosyliene, M.Z., Kazlauskiene, N. and Svecevicius, G.. Effect of heavy metal model mixture on biological parameters of rainbow trout Oncorhynchus mykiss. Environ. Sci. Pollut. Res. 2003.10: 103–107. DOI:10.1065/espr2002.02.109

[36] Wedemeyer, G.A., Barton, B.A. and McLeay, D.J.. Stress and acclimation In: Schreck, C.B., Moyle, P.B. Eds. Methods for Geeses Biology. AmericanGeeseseries Society, Bathesda, MD.,1990. 451-489. doi.org/10.47886/9780913235584

[37] Wendelaar Bonga, S.E.. The stress response in Geeses. *Physiol.Rev*., 1997. 77: 591- 625.

[38] MoyelM.S.. Assessment of water quality of the Shatt Al-Arab River, using multivariate statistical technique. Meso. Environ. J.,2014. 1: (1):39-46.

[39] Ludwig,S.C. ; Kapetanopoulos,K. ; Kotrschal,K. ; wascher,C.A.F.Effects of mate separation in female and social isolation in male free-living Greylag geese on behavioural and physiological measures .Behavioural processes. 2017 ; 138: 134-141. DOI: 10.1016/j.beproc.2017.03.002

[40] Zhou,H.J.; Kong,L.L. ; Zhu,L.X. ; Hu,X.Y. ; Busye,J. and Song,Z.G. Effects of cold stress on growth erformance,serumbiochemistry,intestinal barrier molecules and denosinemonophosphate-activated protein kinase in broilers. im.2021.15: 1-7. DOI: 10.1016/j.animal.2020.100138

[41] Sahin,N.; Hayirli,A. ; Orhan,C. ; Tuzcu,M. Akdemir,F.; omorowski,J.R.andSahin,K.Effects of the supplemental chromium form on performance and oxidative stress in broilers exposed to heat stress.Poult.Sci.2017.96:4317-4324.

[42] Jahantigh,M. ; Zamani-Ahmadmahmudi,M. Hematology and serum biochemistry values in graylag geese in southeast Iran.Comarative Clinical Pathology .2016 : 25 : 671-675. DOI:10.1007/s00580-016-2273-6

[43] World Health Organization. Guidelines for drinking-water quality,2017. 4th edition, incorporating the 1st addendum. 631 pp.

[44] Moyel M. S. and Aboud Hussain N. Water quality assessment of the Shatt al-Arab River, Southern Iraq. J. Coast. Life Med.; 2015. 3(6): 459-465. DOI: 10.12980/JCLM.3.2015J5-26

[45] Al HejujeM.M.K..Application of water quality and pollution indices to evaluate the water and sediments status of Shatt al-Arab River [dissertation]. Basrah: University of Basrah; 2014. p. 293.

[46] Al Maliky J.H.A.. "Analysis of water quality and the impact of the salt wedge from the Arabian Gulf on the Shatt Al-Arab River," Iraq. MSc. Thesis, Queensland Univ.,2012. pp.81,.

[47] Hamadmi,H. ; Khan,A. A. ; Mirr, M.S. Pampori, Z.A. ; Hussain, I. ; Banday,M.T.Physiological and Haemato-Biochemical profiling of domestic geese of Kashmir. Applied Biological Research. 2014. 16: 66-71.

[48] Al-Asadi,S.A. The future of fresh water inshatt al-arab river(southern Iraq) .Journal of Geography and Geology.2017. 9(2):24-38. DOI:10.5539/jgg.v9n2p24

[49] Yaseen B. R., Al Asaady K. A., Kazem A. A., Chaichan M. T. Environmental Impacts of Salt Tide in Shatt Al-Arab-Basra/Iraq. IOSR-JESTFT, 2016. 10: 1 (2): 35-43. DOI:10.9790 / 2402-10123543