



RESEARCH ARTICLE

Occupational Exposures and Associated Health Effects among Dumpsite Workers: A Case Study of Kani Qirzhala Landfill Site, Erbil, Iraq

Tanya S. Salih, Ameena S. M. Juma, Muhsin H. Ubeid

Department of General Biology, Cihan University-Erbil, Kurdistan Region, Iraq

ABSTRACT

Eighty-nine male workers from the landfill site in (Kani Qirzhala), Erbil, Iraq, aged from 12 to 65 years were investigated in this study. Each one had filled out a questionnaire sheet, in addition to their signed consent to take a blood sample from them. Plus, a 7 ml of venous blood samples were collected from them. Total IgE and syphilis antibodies were detected. Thus, CBC was conducted on each sample. The results recorded 92.13% of the workers lived in rural areas, while 7.87% lived in urban areas. Further, there were 58.43% smokers and 41.57% non-smokers. Furthermore, the research sample contained 38.20% single and 61.80% married people. As education illustrated, 37.08% had no schooling, primary school education 40.45%, less than 20% had secondary school education, 2.25% acquired a diploma, and a B.Sc. degree. The serum concentration of total IgE of dumpsite workers revealed a significant increase when compared to the healthy group. None of the workers' sera revealed syphilis antibodies except one case which was positive; however, it shows non-significant differences between both groups. WBC count was soared significantly in dumpsite workers when compared to the healthy individuals, yet, lymphocyte and granulocyte numbers showed non-significant increment, while monocyte numbers showed a statistically insignificant rise in workers as compared to healthy group. The number of RBCs and Hb level of the landfill workers exhibited a substantial increase. Even though, both groups' platelets did not show significant variance. The rise in WBC counts and IgE levels may be due to the exposure of these workers to allergens at the dumpsites as for allergies is the common consequence when exposed to waste and garbage.

Keywords: IgE and allergy, dumpsite workers, complete blood count, syphilis and hematological factors

INTRODUCTION

Wastes management using open landfill sites is considered a primitive practice and an inadequate service that is still used in many parts of the globe, in addition to the absence of efficacy and scientific concepts.

These sites commonly are located at the brinks of towns. Such dumpsites are considered health and environmental hazard,^[1] they will affect and infect not only the contacted workers but they also will influence the communities who live in the surrounding adjacent areas.^[2,3]

As such, those people who work and live in a dirty atmosphere are at risk of illness as of their surroundings. They have a high possibility to be caught by many microbial diseases and exposure to many chemical substances causing them, namely, irritation (allergies) of skin, nose, and eyes, in addition to chest and stomach pains, headaches, and diarrhea.^[4-7] In fact, the study had isolated various of pathological species of bacteria from the site's surroundings; top soils, leachates, and the study group for instance; *Bacillus*, *Staphylococcus*, *Escherichia coli*, *Proteus*, *Streptococcus*,

Klebsiella, *Pseudomonas*, *Citrobacter*, *Bacteroides*, *Clostridium*, and *Serratia*. All these bacteria are known to cause serious respiratory, skin, gastrointestinal, and even central nervous system infections.^[8,9]

Further, dumpsites are known to emit air pollutants, that is, bioaerosols, which are hazardous to those who work in landfill sites and put them at risk of respiratory diseases. Admittedly, cough was the most reported symptom by the investigated literature.^[10] Furthermore, surveys of community

Corresponding Author:

Tanya S. Salih, Department of General Biology, Cihan University-Erbil, Kurdistan Region, Iraq.
E-mail: tanya.salam@cihanuniversity.edu.iq

Received: May 31, 2021

Accepted: July 28, 2021

Published: August 10, 2021

DOI: 10.24086/cuesj.v5n2y2021.pp1-5

Copyright © 2021 Tanya S. Salih, Ameena S. M. Juma, Muhsin H. Ubeid. This is an open-access article distributed under the Creative Commons Attribution License (CC BY-NC-ND 4.0).

health from Africa had documented a vast of well-being issues: Psychological disorders, gastrointestinal problems, respiratory symptoms, skin inflammation besides to nose, and eyes.^[2]

Based on the aforementioned statements, and the scarcity of information, this study is subjected to shed the light on the health status of the local landfill workers. Because of their continuous exposure to toxic materials and allergens, hence, the investigation on the immune status of the mentioned workers was carried out.

RESEARCH METHODS

Location and Groups Selection

From Kani Qirzhala, Erbil, Iraq, dumpsite eighty-nine males were investigated for this study in hand.

Age, gender, and apparently healthy subjects had selected as criteria for healthy group. Figure 1 illustrates the questionnaire that was filled by both groups. In addition, they were subjected to all tests mentioned in the next section.

Sample Collection

To collect 7 ml of venous blood from each worker, a standard clean venipuncture technique was administered by disinfecting the anti-cubital fossa with 70% ethanol and using a disposable hypodermic syringe and 23-gauge needle after tourniquet application. Afterward, 2 ml of venous blood was dispensed; into dipotassium ethylenediaminetetraacetic anticoagulant tube, and evenly stirred, hence, to facilitate the establishment of the hematological criteria (CBC).

The remaining, 5 ml were placed in a plain tube and left aside for 60 min at room temperature for blood to clot. Then, the tubes were in a centrifuge for 10 min. Afterward, tubes cooled at 4°C at 450× g to collect the serum. Later, using a Pasteur pipette, the serum was aspirated and dispensed into 0.5 ml sterile glass tubes and frozen at -20°C.

Antibody Detection

Once they are restored to room temperature, the stored sera were used for the seroprevalence tests. The automated Cobas

E411 immunoassay analyzer facilitated the total IgE and syphilis antibodies detection.

Hematology

The hematology tests were achieved after 1 h of blood samples collection using an automated hematological analyzer coulter machine (Mythic 18 Hematology Analyzer, Orphee, Switzerland) for 20 parameters.

RESULTS

Workers' Data

This research investigated 89 males who were 12–65 years old (no females were found in that site). No significant difference ($P > 0.05$) was found in the age intervals regarding all results. The majority 92.13% lived in rural areas, while urban areas consisted only of 7.87%. Results demonstrated that there were 58.43% smokers and 41.57% non-smokers. Further, it showed that most of them were married 61.80%, and only 38.20% were single. More into this, the education level illustrated, 37.08% had no schooling, primary school education 40.45%, 17.97% had secondary school education, 2.25% acquired a diploma, and a B.Sc. degree [Table 1]; these workers supported their families financially by going into this occupation.

Concentration of Total IgE

Table 2 reveals a high and significant increase the serum concentration of total IgE of the dumpsite workers when compared to the healthy group.

Frequency of Syphilis Antibodies

The results show a non-significant difference between both groups, as none of the collected sera demonstrated the availability of syphilis antibodies except one case was positive [Table 3].

Hematological Parameters

Table 4 and Figure 2 indicate that WBC count increased significantly ($P < 0.01$) in dumpsite workers in comparison

Name: <input type="text"/>		No. <input type="text"/>	
Gender:	<input type="checkbox"/> ♂	<input type="checkbox"/> ♀	
Status	Married <input type="checkbox"/>	Single <input type="checkbox"/>	
Age	<input type="text"/>	Years	
Weight	<input type="text"/>	Kg	
Education	Primary <input type="checkbox"/>	Secondary <input type="checkbox"/>	College <input type="checkbox"/> Non <input type="checkbox"/>
Residence	Rural <input type="checkbox"/>	Urban <input type="checkbox"/>	
Smoker	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Diabetic	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Hypertensive	Yes <input type="checkbox"/>	No <input type="checkbox"/>	
Hypersensitivity Other Diseases	Allergy <input type="checkbox"/>	Asthma <input type="checkbox"/>	Eczema <input type="checkbox"/>
Any Drug Intake Other Notes	<input type="text"/>		

Figure 1: The study's questionnaire sheet to investigate worker's antibodies in the sera, hematological, and other parameters

Table 1: Kani Qirzhala landfill site workers' Information

Characteristics	Frequency	Percent
Live in rural areas	82	92.13
Live in urban areas	7	7.87
Smoker	52	58.43
Non-smoker	37	41.57
Single	34	38.20
Married	55	61.80
Illiterate	33	37.08
Primary school education	36	40.45
Secondary school education	16	17.97
Diploma degree	2	2.25
B.Sc. degree	2	2.25

Table 2: Total IgE concentration in the sera of the dumpsite workers compared with healthy individuals

Immunological characteristics	Gender	Dumpsite workers		Healthy Group		t-test P-value	P-value
		No.	Mean±SE	No.	Mean±SE		
IgE ng/ml	M	89	255.62±51.47	40	98.40±9.04	0.003	H.S.**

$P > 0.05$: Non-significant; $*P < 0.05$: Significant; $**P < 0.01$: Highly significant

Table 3: Syphilis antibodies in the sera of dumpsite workers compared with healthy individuals

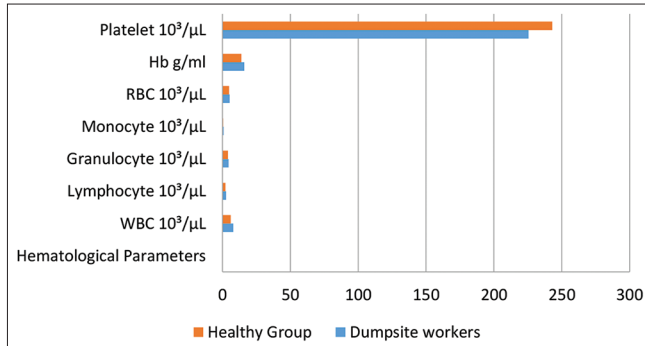
Immunological parameter	Gender	Dumpsite workers		Healthy group		t-test P-value	P-value
		No.	Mean±SE	No.	Mean±SE		
Syphilis ng/ml	M	89	0.313±0.019	40	0.296±0.004	0.399	N.S.

$P > 0.05$: Non-significant; $*P < 0.05$: Significant; $**P < 0.01$: Highly significant

Table 4: Hematological parameters in the sera of dumpsite workers in comparison to healthy individuals

Immunological and hematological parameters	Gender	Dumpsite workers		Healthy group		t-test P-value	P-value
		No.	Mean±SE	No.	Mean±SE		
WBC (10^3 /gL)	M	89	7.97±0.62	40	6.19±0.21	0.009	H.S.**
Lymphocyte (10^3 /gL)	M	89	2.70±0.22	40	2.20±0.14	0.058	N.S.
Granulocyte (10^3 /gL)	M	89	4.51±0.31	40	4.05±0.18	0.209	N.S.
Monocyte (10^3 /^L)	M	89	0.77±0.11	40	0.47±0.04	0.014	S.*
RBC (10^6 /^L)	M	89	5.27±0.07	40	4.95±0.09	0.006	H.S.**
Hb (g/ml)	M	89	16.06±0.24	40	13.86±0.18	0.000	H.S.**
Platelet (10^3 /^L)	M	89	225.49±13.85	40	242.97±4.74	0.235	N.S.

$P > 0.05$: Non-significant; $*P < 0.05$: Significant; $**P < 0.01$: Highly significant

**Figure 2:** Hematological parameters in the sera of dumpsite workers in comparison to healthy individuals

to the healthy individuals, while lymphocyte and granulocyte numbers non-significantly increased ($P > 0.05$), and monocyte number shows a slightly significant rise ($P < 0.05$) in workers as compared to healthy individuals.

The table illustrates also, significant increment in the number of RBC's and Hb level as contrasted to the control group. Further, it signifies no substantial variance among platelet of groups.

DISCUSSION

At present, more than 15 million individuals in economically poor countries endure by retrieving domestic waste. Shockingly, children are a big category among those people. They wade through households' garbage or factories, collecting and selling

materials of recycling context to earn their income.^[11] Many of the enrolled individuals in this current study were children.

Pollution of garbage emissions is one of the reasons for many microbial diseases. A wide variety of diseases and sickness symptoms have been diagnosed in dumpsite workers including cholera, typhoid, malaria, skin diseases gastrointestinal, stomach pain, vomiting, diarrhea, and respiratory allergies. It should be mentioned that none of the individuals included in this study showed any symptoms of diseases, despite the fact that most of them looked malnourished.

Insects and specific mosquitoes can also spread various diseases in the area.^[4-7,12,13] Whereas, the International Solid Waste Association reported a variety of microbial diseases that can be caught from garbage including bacterial, viral, fungal, and parasitic, in addition to various allergic infections.^[14] In general, degraded living conditions have a direct relationship with the immunological status of a person, which makes them more liable to infections.^[15]

Landfill wastes are identified of spreading very high-risk diseases. Moreover, the major types are the medical and biowastes.^[12] In addition, the dumpsite dwellers are likely to inhale poisonous gases, that is, methane, ammonia, carbon monoxide, and hydrogen sulfide. Moreover, many other medical conditions have been diagnosed in these workers including cardiovascular degeneration, disorders such as osteoarthritic changes and intervertebral disc herniation, problems of skin and respiratory system, and altered pulmonary function parameters.^[16]

The research revealed high levels of IgE and WBCs in the dumpsite workers. This could indicate allergic reaction to the substance(s) that these workers exposed to. It is of interest to emphasize on the fact that none of the workers were on any medication, including anti-allergic medications. Allergic reactions associated with hypersensitivity to substances that are characterized by excessive activation of certain white blood cells named as mast cells and basophil granulocyte by IgE.^[17] For instance, hay fever triggers the nose, sneezing, itching, and eyes redness irritation.^[18] Inhaled allergens can generate asthmatic indications, causing the lung's airways to narrow, mucus production, dyspnea, as well as to wheezing and coughing.^[19] Further studies have stated that those who work for long hours in compost are vulnerable to acute and (sub-) chronic non-immune or Type III allergic inflammation.^[20]

In Lebanon, through observation, it was assured the escalation tendency in the acute health symptoms among dumpsite people, such as respiratory, gastrointestinal, constitutional, and dermatological.^[21]

Values of increased WBCs may refer to their involvement in immunological responses as they tend to engage in a descending form of instances resulting in inflammatory and certain sickness conditions, that is, hypersensitivity, immunosuppression, immunomodulation, and autoregression on exposure to allergens or environmental contamination.^[22]

Despite the distinct case of syphilis, which have documented in this research, still it is necessary to it put into consideration. This agrees, where evidence indicated that if threats of biological, chemical, and physical exceeded their limitations, work-related diseases may emerge. Many workers, and even retired persons, have been found to have many illnesses including ulcers, bronchitis, in addition to hypertension, heart diseases, arthritis, and diabetes.^[23] Multitude studies reported that waste collectors risk their health and safety when exposed to significant concentration of biological aerosols,^[20,24-26] namely, respiratory and gastrointestinal complaints,^[6,27-30] infectious diseases such as hepatitis (A, B, and C), and HIV, in addition to syphilis.^[31-33]

It is worthy to mention that there have been some studies in the Kurdistan region regarding the dumpsites. In Sulaymaniyah, poor management and lack of waste treatment have resulted in the severe contamination of soil, water, and air of the surrounding area. Besides, urban waste, oil refineries, and cement plants nearby unload production residues into the city dump. Around 75% of medical waste from local hospitals is also disposed in the same place. Soil and water samples taken in proximity of the landfill showed concentrations of iron (Fe), manganese (Mn), cadmium (Cd), nickel (Ni), cobalt (Co), and chromium (Cr) above permissible levels.^[34] Life on Kani Qirzhala has been described elaborately and how it is a family affair and lives of families depend on this occupation.^[35] The concern about the protection of the environment has largely increased due to the contaminants mainly with anthropogenic origin and has affected and continues to threaten human resources, especially air quality, surface soil, and groundwater in Erbil City where the government is working hard to prevent any health issues, especially with the rapid development of the city.^[36]

CONCLUSION

Municipal landfills areas and the workers establish a major public health hazard to themselves, families, in addition to nearby communities. Because of relationship between dumpsites as a source of income, and the landfill site administration, the workers' health is at risk. Thus, education of these workers on how to protect themselves and their families is essential.

REFERENCES

1. F. P. Sankoh, X. Yan and Q. Tran. Environmental and health impact of solid waste disposal in developing cities: A case study of Granville brook dumpsite, Freetown, Sierra Leone. *Journal of Environmental Protection*, vol. 4, NO. 7, pp. 665-670, 2013.
2. S. Abul. Environmental and health impact of solid waste disposal at Mangwaneni dumpsite in Manzini: Swaziland. *The Journal of Sustainable Development in Africa*, vol. 12, no. 7, pp. 64-78, 2010.
3. N. P. Thanh, Y. Matsui and T. Fujiwara. Assessment of plastic waste generation and its potential recycling of household solid waste in Can Tho City, Vietnam. *Environmental Monitoring and Assessment*, vol. 175, no. 1, pp. 23-35, 2011.
4. H. Issever, H. Gul, M. Erelel, F. Erkan and G. Y. Gungor. Health problems of garbage collectors in Istanbul. *Indoor and Built Environment*, vol. 11, no. 5, pp. 293-301, 2002.
5. P. O. Njoku, J. N. Edokpayi and J. O. Odiyo. Health and environmental risks of residents living close to a landfill: A case study of Thohoyandou Landfill, Limpopo Province, South Africa. *International Journal of Environmental Research and Public Health*, vol. 16, no.12, p. 2125, 2019.
6. M. R. Ray, S. Roychoudhury, G. Mukherjee, S. Roy and T. Lahiri. Respiratory and general health impairments of workers employed in a municipal solid waste disposal at an open landfill site in Delhi. *International Journal of Hygiene and Environmental Health*, vol. 208, no. 4, pp. 255-262, 2005.
7. R. Maheshwari, S. Gupta and K. Das. Impact of landfill waste on health: An overview. *IOSR Journal of Environmental Science, Toxicology and Food Technology*, vol. 1, no.4, pp. 17-23, 2015.
8. F. Oviasogie and D. Agbonlahor. The burden, antibiogram and pathogenicity of bacteria found in municipal waste dumpsites and on waste site workers in Benin City. *The Journal of Medicine and Biomedical Research*, vol. 12, no. 2, pp. 115-130, 2013.
9. F. E. Oviasogie, C. U. Ajuzie and U. G. Ighodaro. Bacterial analysis of soil from waste dumpsite. *Archives of Applied Science Research*, vol. 2, no. 5, pp. 161-167, 2010.
10. G. F. Akpeimeh. *Bioaerosol Emission from MSW Open Dumpsites and The Impact on Exposure and Associated Health Risks*. Leeds, England: University of Leeds, 2019.
11. M. Medina. *Solid Wastes, Poverty and the Environment in Developing Country Cities: Challenges and Opportunities*. WIDER Working Paper, 2010.
12. A. Jorgensen. *Diseases Caused by Improper Waste Disposal*. Geneva: World Health Organization, 2007.
13. A. S. Juma, M. H. Ubeid and T. S. Salih. Anti-toxoplasma, anti-rubella, and anti-cytomegalovirus antibodies in dumpsite workers of Erbil Governorate. *Cihan University-Erbil Scientific Journal*, vol. 3, no. 1, pp. 85-89, 2019.
14. A. Mavropoulos and D. Newman. *Wasted Health The Tragic Case of Dumpsites*. Vienna: International Solid Waste Association, 2015.
15. T. S. Salih, S. S. Haydar, M. H. Ubeid and A. S. Juma. Some immunological and hematological parameters among refugees in Kawergosk Camp-Erbil governorate. *Cihan University- Erbil Scientific Journal*, vol. 3, no. 1, pp. 80-84, 2019.
16. R. R. Tiwari. Occupational health hazards in sewage and sanitary

- workers. *Indian Journal of Occupational and Environmental Medicine*, vol. 12, no. 3, p. 112, 2008.
17. D. Ogundele, V. Olayemi, F. Folaranmi, O. Oludele and A. Oladejo. Haematological, liver function parameters and heavy metal assessment of KWMC workers at roadside and mixed waste dumpsites in Kwara state, Nigeria. *Journal of Applied Sciences and Environmental Management*, vol. 23, no. 7, pp. 1213-1219, 2019.
 18. E. T. Bope and R. E. Rakel. *Conn's Current Therapy*. Philadelphia, PA: WB Saunders, 2002.
 19. D. T. Win. Chemical allergies/chemical sensitivities. *AU Journal of Technologies*, vol. 12, no. 4, pp. 245-250, 2009.
 20. J. Douwes, H. Dubbeld, L. Van Zwieten, I. Wouters, G. Doekes, D. Heederik and P. Steerenberg, work related acute and (sub-) chronic airways inflammation assessed by nasal lavage in compost workers. *The Annals of Agricultural and Environmental Medicine*, vol. 4, no. 1, pp. 149-152, 1997.
 21. R. Z. Morsi, R. Safa, S. F. Baroud, C. N. Fawaz, J. I. Farha, F. El-Jardali and M. Chaaya. The protracted waste crisis and physical health of workers in Beirut: A comparative cross-sectional study. *Environmental Health*, vol. 16, no. 1, p. 39, 2017.
 22. B. Majkowska-Wojciechowska and M. L. Kowalski. Allergens, air pollutants and immune system function in the era of global warming. In: *Air Pollution-monitoring, Modelling, Health and Control Rijeka*. London: InTech, pp. 221-254, 2012.
 23. J. A. Cimino and R. Mamtani. Occupational hazards for New York city sanitation workers. *Environmental Health*, vol. 1, no. 1, pp. 8-12, 1987.
 24. J. Lavoie, C. J. Dunkerley, T. Kosatsky and A. Dufresne. Exposure to aerosolized bacteria and fungi among collectors of commercial, mixed residential, recyclable and compostable waste. *Science of the Total Environment*, vol. 370, no. 1, pp. 23-28, 2006.
 25. I. M. Wouters, S. Spaan, J. Douwes, G. Doekes and D. Heederik. Overview of personal occupational exposure levels to inhalable dust, endotoxin, P (1[^]3)-glucan and fungal extracellular polysaccharides in the waste management chain. *Annals of Occupational Hygiene*, vol. 50, no. 1, pp. 39-53, 2006.
 26. S. Widmeier, A. Bernard, A. Tschopp, S. Jeggli, X. Dumont, S. Hilfiker, A. Oppliger and P. Hotz. Surfactant protein A, exposure to endotoxin, and asthma in garbage collectors and in wastewater workers. *Inhalation Toxicology*, vol. 19, no. 4, pp. 351-360, 2007.
 27. C. Y. Yang, W. T. Chang, H. Y. Chuang, S. S. Tsai, T. N. Wu and F. C. Sung. Adverse health effects among household waste collectors in Taiwan. *Environmental Research*, vol. 85, no. 3, pp. 195-199, 2001.
 28. K. Kheldal, A. Halstensen, J. Thorn, W. Eduard and T. Halstensen. Airway inflammation in waste handlers exposed to bioaerosols assessed by induced sputum. *European Respiratory Journal*, vol. 21, no. 4, pp. 641-645, 2003.
 29. G. de Meer, D. Heederik and I. M. Wouters. Change in airway responsiveness over a workweek in organic waste loaders. *International Archives of Occupational and Environmental Health*, vol. 80, no. 7, pp. 649-652, 2007.
 30. M. R. Ray, S. Roychoudhury, S. Mukherjee S, S. Siddique, M. Banerjee, A. B. Akolkar, B. Sengupta and T. Lahiri. Airway inflammation and upregulation of P2 Mac-1 integrin expression on circulating leukocytes of female Ragpickers in India. *Journal of Occupational Health*, vol. 51, no. 3, 2009, pp. 232-238.
 31. G. Dounias and G. Rachiotis. Prevalence of hepatitis A virus infection among municipal solid-waste workers. *International Journal of Clinical Practice*, vol. 60, no. 11, 2006, pp. 1432-1436.
 32. M. A. Rozman, I. S. Alves, M. A. Porto, P. O. Gomes, N. M. Ribeiro, L. A. Nogueira, M. M. Caseiro, V. A. da Silva, E. Massad and M. N. Burattini. HIV and related infections in a sample of recyclable waste collectors of Brazil. *International Journal of STD and AIDS*. vol. 18, no. 9, 2007, pp. 653-654.
 33. P. Luksamijarulkul, D. Sujirarat and P. Charupoonphol. Risk behaviors, occupational risk and seroprevalence of hepatitis B and A infection among public cleansing workers of Bangkok Metropolis. *Hepatitis Monthly*, vol. 8, no. 1, pp. 35-40, 2008.
 34. A. Tinti. Available from: <https://www.ejAtlas.org/conflict/dump-site-in-sulaymaniyah-kurdistan-region-of-iraq>. [Last accessed 2021 May 20].
 35. E. Fitt. *Life on the Kani Qirzhala Landfill Site in Iraq*, 2017. Available from: <https://www.recyclingwasteworld.co.uk/in-depth-article/life-on-the-kani-qirzhala-landfill-site-in-iraq/164658>. [Last accessed 2021 May 20].
 36. S. Q. Gardi. *Environmental Impact Assessment of Erbil Dumpsite Area West of Erbil City-Iraqi Kurdistan Region*, 2018 Available from: https://www.researchgate.net/publication/324262622environmentalimpactassessmentof_erbil_dumpsite_area_-_west_of_erbil_city-iraqi_kurdistan_region. [Last accessed 2021 April 01].