



# Chemical Analysis of some Essential Trace Elements in Hen's Eggs: A Comparative Study

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Hen's egg is an inexpensive but very nutritious component within the human diet. It is one of the few foods that are used widely worldwide and are healthy and safe for consumers.

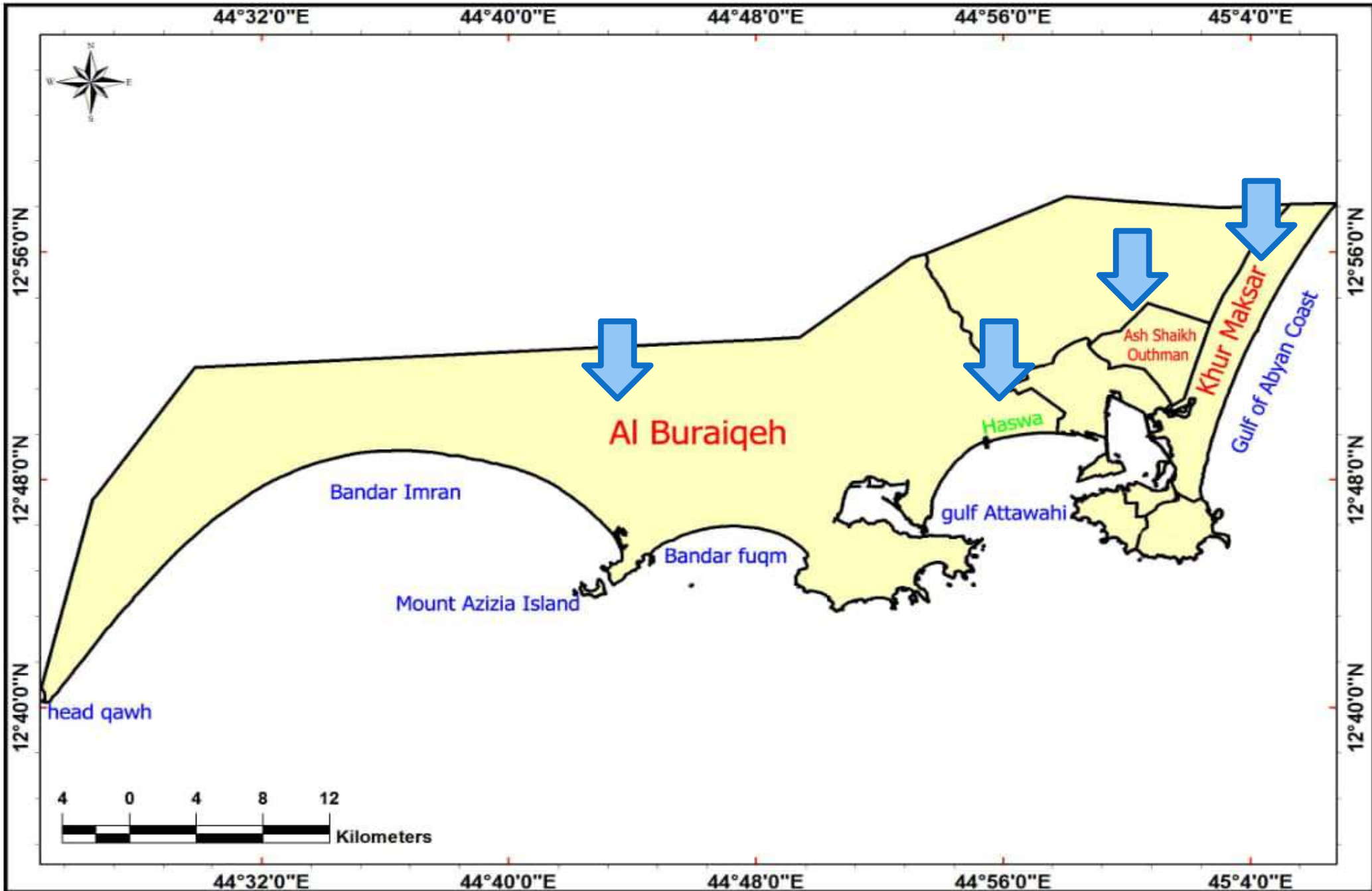
The aim of our study is focused on determining the levels of the concentrations of some essential elements in three kinds of the hen eggs (i.e. home, street and market hen eggs) were collected from four regions at Aden city including Al-Buraiqeh, Al-Hiswah, Khormaksar and Shaikh Othman at Yemen.

The concentrations of Cr, Mn, Fe, Co, Cu, Zn, Se and Mo elements were measured using the Inductively Coupled Plasma-Optical Emission Spectrometer (ICP-OES) technique.

The concentrations of elements in hen's eggs were in part per million (ppm) units .

The regular national checking of hen's eggs producing and the quality of environment and hen's feeds should be taken into account with the intention of protection public health.

# The Study Area





Hen's eggs are an excellent source of high-quality protein and they give a balanced distribution of minerals and vitamins, particularly vitamins E, A, B12, B2, and folate [7]. Hen's eggs are considered as one of nature's highly-nutritious for human health and economical food items in human daily diet, especially that of the children [8].





**This study will be useful in determining the potential risks from the toxic effects of heavy metals and to make recommendations for future implementations by the local health regulatory authorities.**





# Practical Part



# Samples Collection



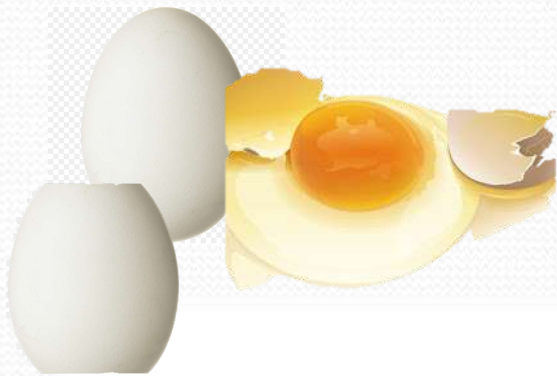
Hen's eggs samples were randomly collected in 2017-2018 from the houses and the markets at four regions of Aden city including Al-Buraiqeh, Al-Hiswah, Khormaksar, and Shaikh Othman.

Egg samples were transferred into plastic bags and kept at refrigerated temperature to the laboratory where saved cold until analyzed.



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# Samples Analysis



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# Samples Analysis



The egg samples were prepared for elemental analysis and the procedure was repeated three times on the different part of the samples. The concentrations of the 8 elements: Cr, Mn, Fe, Co, Cu, Zn Se and Mo in the studied egg samples were analyzed by using Inductively Coupled Plasma hyphenated to Optical Emission Spectrometry (ICP-OES) Model Thermo Scientific iCAP 6000 Series, USA at Central Processing Facility Laboratory of Masila Petroleum Exploration and Production Company, Hadramout – Yemen and the standard method was followed as mentioned in [12].



# Results & Discussion

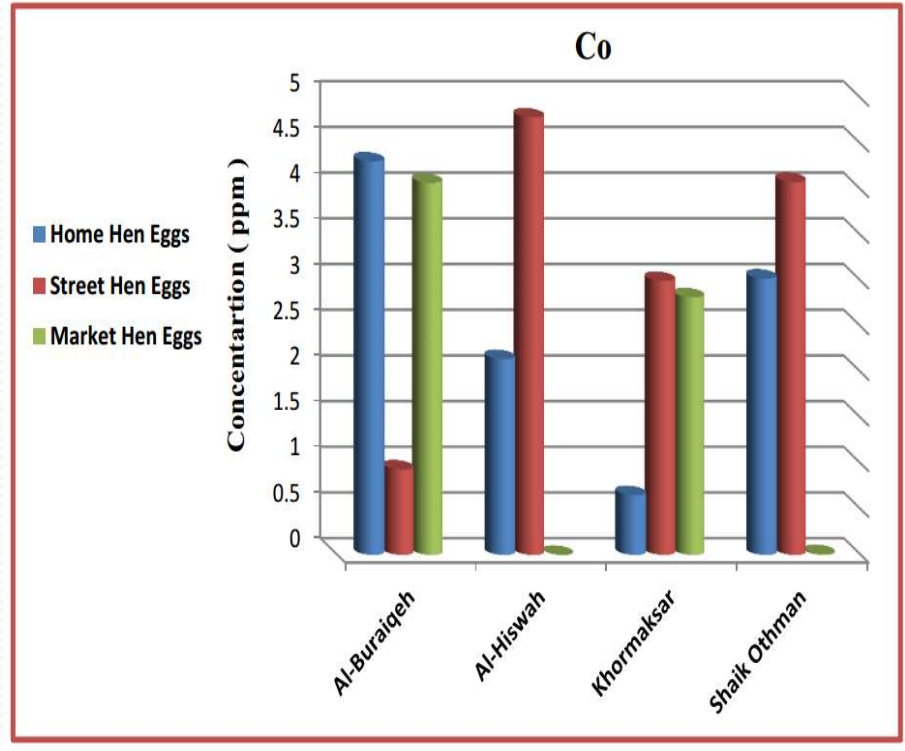
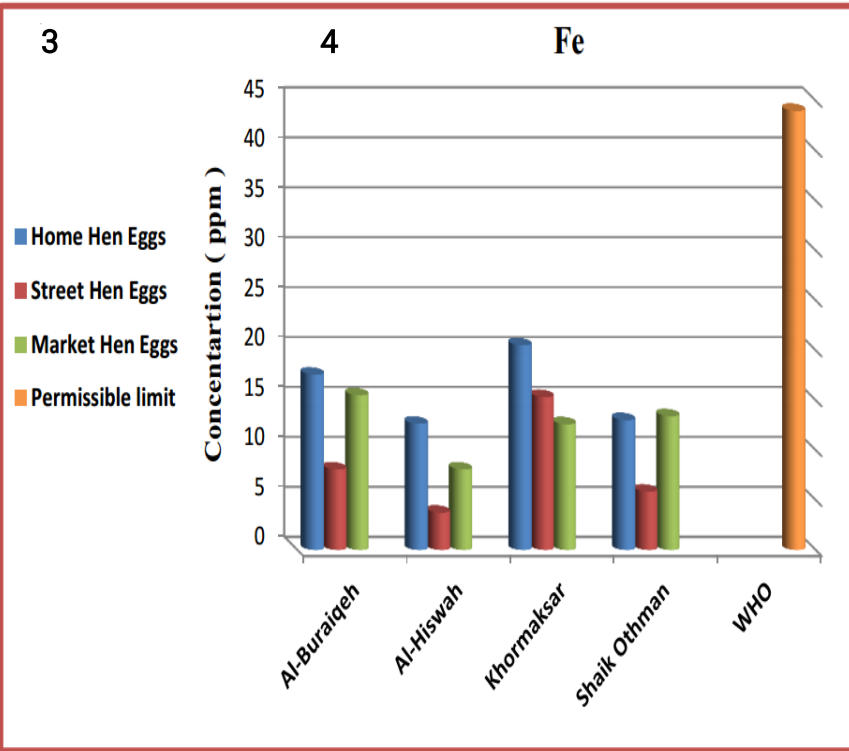
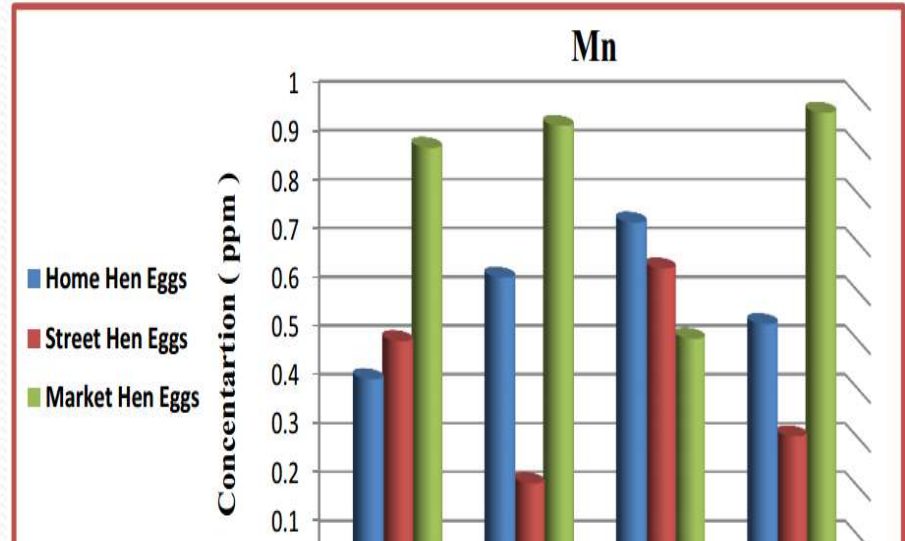
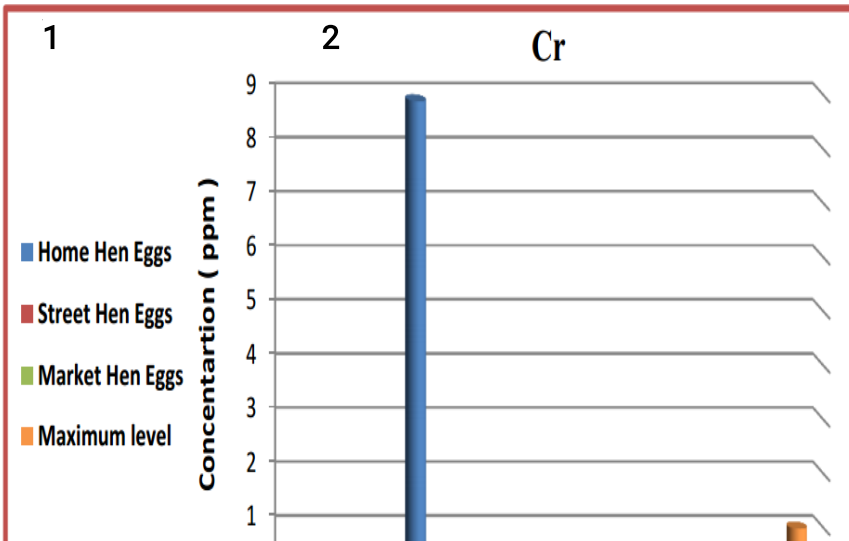
Parameters	Al-Buraiqeh	Al-Hiswah	Khormaksar	Shaik Othman	Mean±SD
<b>Cr</b>					
Home Hen Eggs	ND**	8.903±0.420	0.139±0.032	0.105±0.031	2.287±0.422
Street Hen Eggs	ND	ND	0.070±0.021	ND	0.017±0.021
Market Hen Eggs	0.069±0.002	0.308±0.008	0.029±0.004	0.106±0.043	0.128±0.044
L.S.D*** for types	0.023				
<b>Mn</b>					
Home Hen Eggs	0.430±0.002	0.638±0.001	0.751±0.002	0.543±0.002	0.590±0.004
Street Hen Eggs	0.508±0.010	0.217±0.002	0.657±0.010	0.313±0.004	0.424±0.014
Market Hen Eggs	0.904±0.008	0.949±0.001	0.513±0.004	0.976±0.001	0.835±0.009
L.S.D for types	0.004				
<b>Fe</b>					
Home Hen Eggs	17.58±0.06	12.66±0.02	20.52±0.19	13.02±0.02	15.95±0.201
Street Hen Eggs	8.074±0.104	3.749±0.040	15.33±0.29	5.858±0.159	8.254±0.349
Market Hen Eggs	15.50±0.03	8.069±0.060	12.61±0.03	13.41±0.01	12.395±0.074
L.S.D for types	0.102				
<b>Co</b>					
Home Hen Eggs	4.309±0.103	2.145±0.126	0.655±0.012	3.027±0.046	2.534±0.169
Street Hen Eggs	0.937±0.055	4.795±0.265	3.000±0.000	4.084±0.099	3.204±0.288
Market Hen Eggs	4.075±0.058	ND	2.821±0.139	0.010±0.001	1.726±0.151
L.S.D for types	0.092				

Parameters	Al-Buraiqeh	Al-Hiswah	Khormaksar	Shaik Othman	Mean±SD
<b>Cu</b>					
Home Hen Eggs	0.621±0.011	0.504±0.006	1.115±0.017	0.731±0.001	0.743±0.021
Street Hen Eggs	0.455±0.014	0.363±0.004	0.388±0.012	0.251±0.002	0.364±0.019
Market Hen Eggs	0.927±0.008	2.528±0.029	0.474±0.007	1.476±0.023	1.351±0.038
L.S.D for types	0.011				
<b>Zn</b>					
Home Hen Eggs	14.85±0.25	11.78±0.38	48.07±0.06	28.92±0.14	25.91±0.479
Street Hen Eggs	16.26±0.21	18.22±0.29	15.18±0.17	10.26±0.05	14.98±0.399
Market Hen Eggs	22.92±0.25	19.73±0.25	21.71±0.50	22.54±0.05	21.73±0.614
L.S.D for types	0.21				
<b>Se</b>					
Home Hen Eggs	55.00±0.01	ND	21.01±0.02	12.15±0.25	22.04±0.063
Street Hen Eggs	24.21±0.26	21.96±0.15	21.91±0.16	32.12±0.11	25.05±0.357
Market Hen Eggs	26.00±0.01	17.12±0.11	36.15±0.79	47.22±0.47	31.62±0.926
L.S.D for types	0.25				
<b>Mo</b>					
Home Hen Eggs	ND	ND	5.923±0.059	2.208±0.008	2.033±0.059
Street Hen Eggs	3.323±0.293	4.033±0.057	ND	ND	1.839±0.298
Market Hen Eggs	ND	ND	ND	ND	ND
L.S.D for types	0.072				

\*ppm±SD: Concentration in part per million unit± standard deviation

\*\* ND: Not detected (< 0.001 ppm)

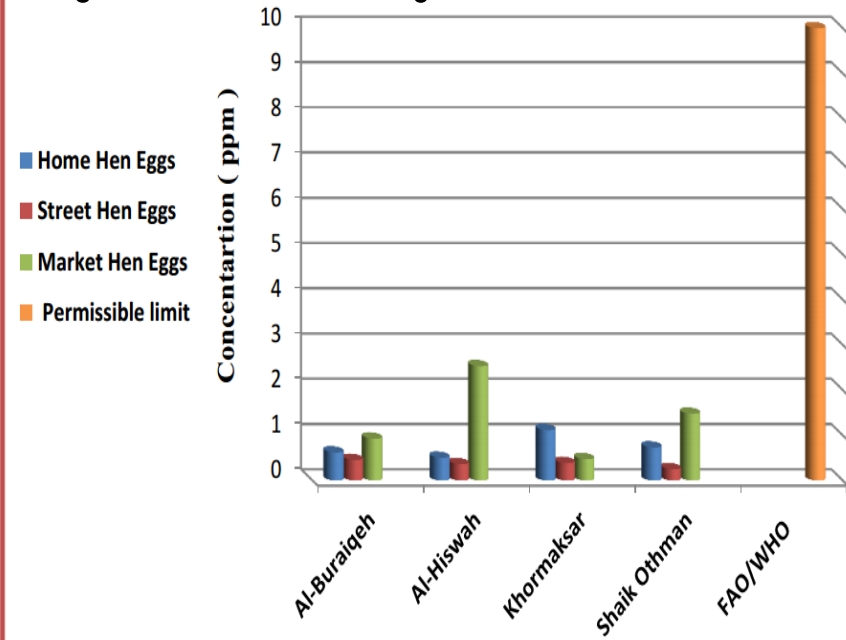
\*\*\* L.S.D: Least significant difference of mean values for whole eggs types at (P<0.05)



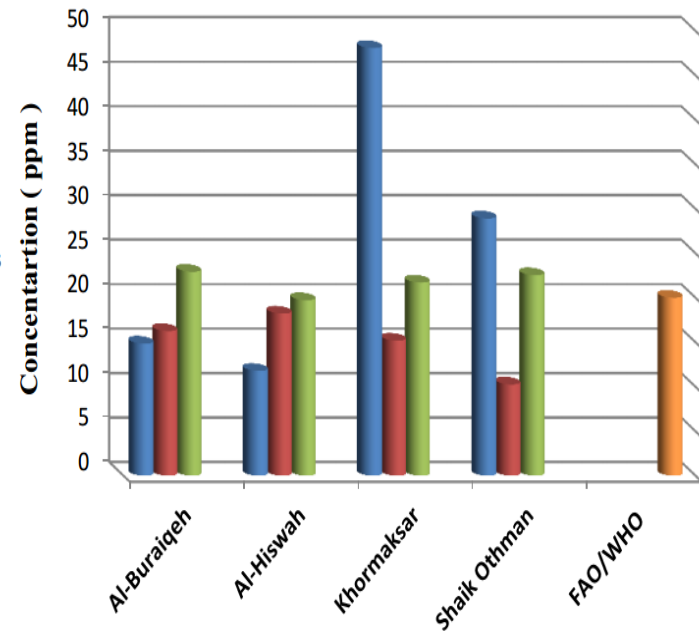
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Cu



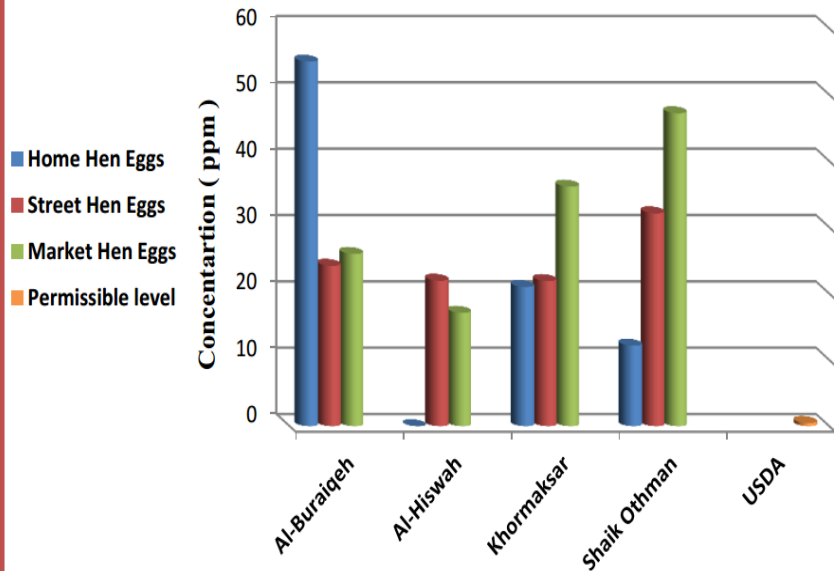
Zn



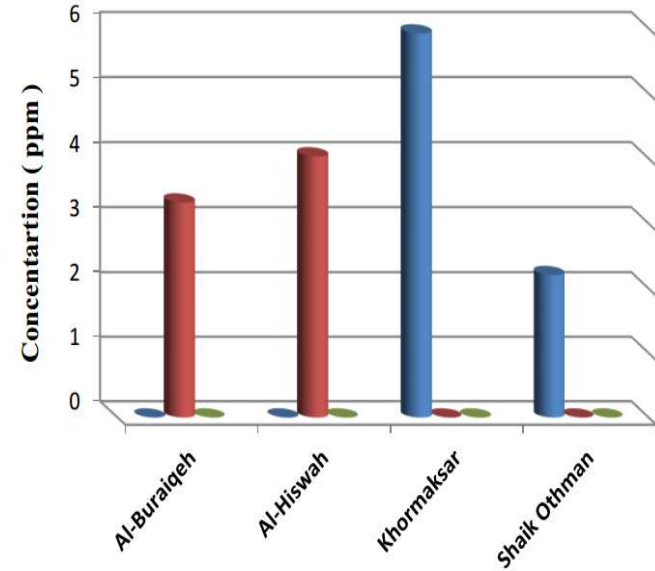
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Se



Mo



❑ The mean concentrations (ppm) of elements in hen's eggs were in the range

0.029–8.90 for Cr,

0.217–0.976 for Mn,

3.749–20.52 for Fe,

0.010–4.795 for Co,

0.251–2.528 for Cu,

10.26–48.07 for Zn,

12.15–55.00 for Se

and

2.208–5.923 for Mo

**Conclusion**







Recent study presents that the level of several essential elements in hen's eggs can be measured by ICP-OES technique and the concentrations range vary significantly among the locations and types.





The bioaccumulation of metals in hen's eggs can be influenced by different factors such as metal concentration, hen's feed, exposure time, and environmental conditions. However, hen's eggs consumption can be used as a biomarker for monitoring the human health and the environment pollutants.





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