REPUBLIC OF TURKEY
FIRAT UNIVERSITY
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

COMPARISON OF IMPORTED AND LOCAL FOR THE DETERMINATION OF ELEMENTS IN RED MEAT IN IRAQ USING XRF TECHNIQUE

MASTER THESIS

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Supervisor: Prof. Dr. Ali ÖLÇÜCÜ

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DECLARATION

I declare that the Master Thesis entitled “Comparison of Imported and Local For The Determination of Elements in Red Meat in Iraq Using XRF Technique” is my own research and prepared by myself, and hereby certify that unless stated, all work contained within this thesis is my own independent research and It is being submitted for the Degree of Master of Science (in analytical chemistry) at the Firat University, and has not been submitted for the award of any other degree at any institution.

DEDICATION

This thesis is dedicated to my beloved family, and I would like to thank them for their understanding, moral supports, encouragements, prayers, patience and all kinds of support. It is also dedicated to my faithful friends.

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Sincerely

MOUSA RASHID ALİ

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ABSTRACT

Red meat is one of the most needed and necessary foods in the world. For this reason, it has a very important commercial and social value. Meat consumption, physiological effects, pleasant taste, aroma and health due to many benefits continues to increase day by day.

This study was to determine the concentrations of some macro, mineral and trace elements in five different red meat specimens produced in northern Iraq (Arbil) and imported from Australia, Ukraine, Paraguay, Moldova to northern Iraq. The red meat samples were characterized using X-ray fluorescence (XRF) spectrophotometer with Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Cd, Sb, Hg and Pb. The red meat samples were assayed in the solid state.

According to the results obtained, the quantities of the elements in the red meat samples imported and Northern Irakta were compared.

Statistical analysis of the results was performed using the SPSS program. A significant ($P < 0.05$) difference was observed between the quantities of some of the assigned elements.

Key Words: Red meat, Trace Element, Determinatio, X-Ray Fluorescence (XRF)

ÖZET

Irak‘ta Üretilen ve İthal Edilen Kırmızı Etlerdeki Bazı Elementlerin XRF Tekniği Kullanılarak Tayin Edilmesi ve Karşılaştırılması

Kırmızı et dünyada en çok ihtiyaç duyulan ve gerekli gıdalardan birisidir . Bu nedenle, oldukça önemli bir ticari ve toplumsal değer taşımaktadır. Et tüketimi, fizyolojik etkileri, hoş tadı, aroması ve sağlık açısından birçok yararı nedeniyle her geçen gün artmaya devam etmektedir.

Bu çalışma, Kuzey Irak bölgesinde(Erbil) üretilen ve Avustralya, Ukrayna, Paraguay, Moldova’dan Kuzey Irak’a ithal edilen beş farklı kırmızı et örneklerin de, bazı büyük, mineral ve eser elementlerin konsantrasyonlarının belirlenmesiydi. Kırmızı et örneklerindeki Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Cd, Sb, Hg ve Pb X-Işını Floresans (XRF) spektrofotometresi kullanılarak tayin edildi. Kırmızı et örnekleri katı halde kullanılarak tayin işlemleri gerçekleştirildi.

Elde edilen sonuçlara göre, ithal edilen ve Kuzey Irakta üretilen kırmızı et örneklerinddeki elementlerin miktarları karşılaştırıldı.

Sonuçların istatistiksel analizi, SPSS proğramı kullanılarak geçekleştirildi. Tayin edilen bazı elementlerin miktarları arasında önemli($P<0.05$)bir fark olduğu gözlendi.

Anahtar Kelimeler: Kırmızı et, Eser Element, Tayin Etmek, X-Işını Floresans (XRF)

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LIST OF SYMBOLS AND ABBREVIATIONS

Instrumental

AAS : Atomic absorption spectroscopy

ETAAS : Electrothermal atomic absorption spectroscopy

FAAS : Flame atomic absorption spectroscopy

GFAAS : Graphite furnace atomic absorption spectroscopy

ICP-AES : Inductively coupled plasma atomic emission spectrometry

ICP-MS : Inductively coupled plasma mass spectrometry

ICP-OES : Inductively coupled plasma optical emission spectrometry

INAA : Instrumental neutron activation analysis

HR-CS : High Resolution-Continuum Source

XRF : X-Ray Fluorescence

Measurements

g : Gram

Kg : Kilogram

L : liter

mg : Milligram

Min : Minute

Sec : second

mL : Millilitre

µg : Microgram

℃ : Celsius

mΩ : Milliohm

nm : Nanometre

ppm : Parts per million

SD : Standard deviation

% : Percentage

Chemistry

As	: Arsenic
Cd	: Cadmium
Cr	: Chromium
Co	: Cobalt
Cu	: Copper
Fe	: Iron
Hg	: Mercury
Mn	: Manganese
Ni	: Nickel
Pb	: Lead
Sb	: antimony
Se	: Selenium
Zn	: Zinc

1. INTRODUCTION

1.1. Literature Review

Meat is one of main products which used by human and contingent upon it to getting of animal protein, particularly the fundamental amino acids, preferably human utilization of red meat to white [1].

Red meat chiefly come from cows (calves), sheep and goats, but it is acknowledged exorbitant in the eastern countries due to the absence of natural pastures and climbing focus feed prices, particularly in Iraq, so imported meat of both sorts of red and white are not welcome due to shopper trustiness of the source, quality and the states of storage and storage process plays an essential part to save the meat for along time a while particularly by solidify of a wide methods utilized to saving the animal products, particularly meat and that the save by freeze supports the quality of the product and its dietary value [2]. Figure 1.2, Figure 1.3.

Figure 1.1. Erbil map

Figure 1.2. Fresh red meat

Figure 1.3. Freeze red meat

Despite the fact the freeze is the most excellent way but its freezing before finishing the stiffness flinging phase lead to the lower meat softness and fibers stiffness during blending and therefore impact the quality and palatable of the meat and this prompts the negative influence of the purchaser side. Due to import different sorts for meat into tje country without knowledge of the quality and condition of

storage, this consider could have been guided for evaluate a part of the chemical, physical properties and evaluated physically by taste and compare it with the local red meat, and also conducted the questionnaire form to discover the consumer (client) and the problems in the consumption of red meat, which might be the first time that questionnaire problem issues in the meat accomplished for Iraq set up will figure out of the issues confronted Eventually Tom's perusing the purchaser in order decide of the problems faced by consumer in order to find replies to these problems [3]. Table 1.1.

Table 1.1. Ranges of mass fraction of elements found in most food stuff

Term	Mass Fraction	Mass Fraction (%)
Major	1–1000 g/kg	0.1–100
Minor	10–1000 mg/kg	0.001–0.1
Trace	0.01–10 mg/kg	0.000001–0.001
Ultratrace	10 μg/kg	0.000001

1.2. Determination of Essential and Toxic Metals in Meats by Spectrophotometric Method

The metals would discovered in all living organisms wherever the place they assume assortment of parts. Metals for example, such that Fe, Cu, Mg, Co, Zn need aid vital for the human body, however chronic metabolic disturbances might happen because of those insufficiency or abundance of these metals have been determined by Chowdhury et al. [4].

It is important in keeping those levels about these metals clinched alongside their correct ranges to looking after legitimate metabolic works for human body. It might be carried out toward taking chose foods for everyday eating methodologies starting with a rundown which could provide for data over those metal substances for diverse foodstuffs.

2. Non-essential elements for example, such that Pb, Cd, Cr, Ni Furthermore, as are recognized should be lethal and their available in the body be able to reason profound biochemical Furthermore neurological varies in the body.

3-The origins of poisonous metals in the surroundings need are the fossil fuels, mining industries, waste disposals with metropolitan sewage. Farming and Forestry also contribute the metal substance in the environment because of the utilization about fertilizer, pesticide, and herbicides. Likewise an outcome for Ecological contamination, the impurities may enter food sequence. We are taking food for living. Therefore the main course of entrance the body through the diet. Animal meats would devoured generally citizens of Bangladesh since they hold proteins, amino acids, minerals and vitamins. It is very necessary, as vital on recognize the toxic metal content in the foods we need aid devouring commonplace. The purpose of this work is to approximation the levels of poisonous metals for example, Pb, Cd, As, Cr and Ni, In addition vital metals for example, Fe, Cu, Mg, co and Zn, in these foods were investigated by Chowdhury et al.[4]. Table 1.2.

Table 1.2. Elements commonly monitored in differentfood samples

Elements	**Range**	**Primary Purpose**
Aluminum	Trace	Toxicity
Arsenic	Trace/ultratrace	Toxicity
Boron	Trace	Nutrition
Cadmium	Trace/ultratrace	Toxicity
Calcium	Major/minor	Nutrition
Chromium	Trace/ultratrace	Nutrition/toxicity
Copper	Minor/trace	Nutrition
Fluorine	Trace	Nutrition/toxicity
Iodine	Trace	Nutrition/toxicity
Iron	Minor/trace	Nutrition
Lead	Trace/ultratrace	Toxicity
Magnesium	Minor/trace	Nutrition
Manganese	Minor/trace	Nutrition
Mercury	Trace/ultratrace	Toxicity
Molybdenum	Trace/ultratrace	Nutrition
Nickel	Trace/ultratrace	Toxicity
Phosphorus	Major/minor	Nutrition
Potassium	Major/minor	Nutrition
Selenium	Trace/ultratrace	Nutrition/toxicity
Sodium	Major/minor	Nutrition
Tin	Minor/trace	Toxicity
Zinc	Minor/trace	Nutrition

1.3. A Study in Minerals Concentrations in Red Meat

The meat is a food material, which is composed of basically proteins, fat and some significant essential elements. Meat will be important to Growth and support of good wellbeing. Pollution is traded with creatures through quick presentation, debased water and items grew once flooded sewerage water and modern effluents. Another vital explanation behind causing sullying of meat is the testimony of toxins from vehicle spread and from the dirty butcher spots. It will be basic on set up keeping finding out about Different poisons in the meat. The businessperson offers most of the meat in the open market and very way side. The tainted nourishment and water are inceptions of ailment to human body. In the midst of various contaminant in the earth, overwhelming metals are straightforwardly associated with heath disorders in human. Despite the fact dat, it is dubious to characterize trace metal in to vital major and noxious gatherings, yet it will be awesome known truth dat a significant metal gets the chance to be poisonous at adequately high admissions were explored by Sabir, Khan, and Hayat [5].

Lead may enter the air all through mining, purifying, refining, fabricating techniques and by the use for lead containing item. Lead admission complex happens beginning with those usage for whisky, organic product juices, sustenance stored in lead lined compartments, beauty care products, cigarettes and engine vehicle fumes [6]. Excess lead may bring about genuine damage of the mind, kidneys, sensory system and red platelets. Energetic children, infants and embryos would particularly vulnerable to lead harm. Us condition insurance Agency (EPA) says dat lead may make embroiled in causing leukemia [7]. High centralization of copper oxide may impact from welding operation. The rust of copper containing composites to pipe fittings may put in quantifiable sum about copper in to the water. Copper substance of ordinary individual grown-up is 50-120 mg, At more than 15 mg reasons queasiness, retching, looseness of the bowels and intestinal hurt. Copper inadequacy results in iron deficiency and the inborn lack of ability discharge copper bringing about amassing and wilsons, s infection. Ecological grouping of nickel is enhanced by nickel creating and preparing industry undertaking. Vehicles deplete a broad sum from nickel which is gotten from oil. Cigarette smoking auto could assemble the took in nickel to the degree dat 4 µg for each pack from Cigarette.

By far most of the mn noticeable all around in light of the flaring from fossil fuels.The point while one is exhibited of the bigger sum for Mn, it reasons "Manganese psychosis" a psychological maladjustment depicted by uncontrolled giggling, happiness, lack of caution, sexual fervor copied by impotency. Zinc is important for typical working of cell including protein combination, sugar digestion, cell Growth and cell division[8].

Tan again, regardless of whether Zn centralization in air is more than 15 mg/m, 3 "metal smoke fever" can come about; which reasons fever, gloom, discomfort, hack, retching, salivation and migraine. Cadmium restores Zn, in numerous compounds. Therefore, higher total of Zn is expected to defeat toxic TEMPeffects for cadmium [9].

Press deficiency is found in the premenopausal woman. As opposed to premenopausal women, grown-up men if not use press supplements, since high tissue level for press relate for extended danger about myocardial dead tissue [10]. High or low level of Mg reasons significant issues including kidney frustration and heart issues. Vast measure of calcium is in charge of thirst, expanded volume of pee, muscle weariness, poor mental fixation and organizing of kidney stones [8].

1.4. Nutrient complex of red meat

Red meat contains high organic protein and huge micronutrients that would required for awesome health wellbeing forever life . It additionally have a scope of fats, including imperative omega-3 polyunsaturated fats. Current examinations require indicated that there has been a huge pattern a huge pattern to less fatty cuts for meat more than two decades [3]. Same time the dietary creation will differ kind of as expressed by breed, nourishing regimen, season and meat cut, when in doubt by and large red meat has a low fat substance, is reasonable in cholesterol and rich in protein and huge numbers critical vitamins and minerals [11].

1.5. Comparison of the composition of red meat and vegetarian protein sources

The Australian guide should wellbeing consuming prescribes a healthy diet incorporate 1-2 serves for every day of meat alternately reciprocals for example, eggs, nuts or legumes [12]. On the other hand, the vegetarian alternative which are utilized as

protein sources have very dissimilar dietary profiles to red meat as show in, Table 6, which compares the percentage of a mature person gentleman every day prerequisite given by 100g of food. Lean beef and lamb would exceptional protein sources than all the selections excluding cheese, and are mostly lower in sodium. The meats would higher in zinc and niacin than all the substitutes and furthermore higher in omega-3 fats than vegetable sources; a preferred source of vitamin B6 (excluding for the walnuts); wealthier, selenium (except in contrast with eggs); and would the most excellent source for vitamin B12, that is not present completely starting with the vegetable products . Egg, cheese and nuts would and a significant part higher sources of sum fat than lean beef or lamb. Table 1.3.

Table 1.3. Nutrient composition (per 100g) of lean red meat [4-6]

	Beef	Veal	Lamb	Mutton	Adult Australian RDI
Moisture (g)	73.1	74.8	72.9	73.2	
Protein (g)	23.2	24.8	21.9	21.5	46-64
Fat (g)	2.8	1.5	4.7	4.0	-
Energy (kJ)	498	477	546	514	6.5-15.8MJ
Cholesterol (mg)	50	51	66	66	-
Thiamin (mg)	0.04	0.06	0.12	0.16	1.1-1.2
Riboflavin (mg)	0.18	0.20	0.23	0.25	1.1-1.6
Niacin (mg)	5.0	16.0	5.2	8.0	14-16
Vitamin B6 (mg)	0.52	0.8	0.10	0.8	1.3-1.7
Vitamin B12 (µg)	2.5	1.6	0.96	2.8	2.4
Pantothenic acid (mg)	0.35	1.50	0.74	1.33	4-6
Vitamin A (µg)	<5	<5	8.6	7.8	700-900µg RE*
Beta-carotene (µg)	10	<5	<5	<5	700-900µg RE*
Alpha-tocopherol (mg)	0.63	0.50	0.44	0.20	7-10
Sodium (mg)	51	51	69	71	460-920
Potassium (mg)	363	362	344	365	2800-3800
Calcium (mg)	4.5	6.5	7.2	6.6	1000-1300
Iron (mg)	1.8	1.1	2.0	3.3	8-18
Zinc (mg)	4.6	4.2	4.5	3.9	8-14
Magnesium (mg)	25	26	28	28	310-420
Phosphorus (mg)	215	260	194	290	1000
Copper (mg)	0.12	0.08	0.12	0.22	1.2-1.7
Selenium (µg)	17	<10	14	<10	60-70

*RE = retinol equivalents (= 1 µg retinol or 6 µg or beta-carotene)

1.6. Heavy Metals

The term heavy metals have been generally utilized as a group name for metals and metalloids that have been related with contamination and potential toxicity or ecotoxicity.

Different terminologies have been utilized in the definition of heavy metals. In terms of density; they are referred to as metals with density (specific gravity) bigger than 5 g/cm3 [62,63](Lozet and Mathieu, 1991; Morris, 1992).

In terms of atomic weight; they are metals with high atomic weight (relative atomic mass) (Porteous, 1996; Oxford Dictionary of Sci., 1999)[64,65].

In terms of atomic number; they are metals with atomic number more bigger than 20[66] (Hale and Margham, 1988) or metals with atomic number between 21 (scandium) and 92 (uranium) (Lyman, 1995)[67].

Definition depend on other chemical properties; any metal that reacts readily with dithizne (C6H5N) e.g zinc, copper, lead e.t.c. (Bates and Jackson, 1987)[68].

Definition in terms of toxicity; elements commonly utilized in industry and generally toxic to animals and to aerobic and anaerobic processes, although not everybody is denser or entirely metallic. Includes: As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Zn (Scott and Smith, 1981)[69].

According to Morais *et al.*(2012) [70]said that the heavey metals include in human body such as Lead (Pb), cadmium (Cd), mercury (Hg), and arsenic (As) are broadly scattered in the environment. These elements have no useful impacts in humans, and there is no known homeostasis mechanism for them (Draghici et al., 2010; Vieira et al., 2011)[71,72]. They are usually considered the most poisonous to humans and animals; the adverse human health impacts connected with exposure to them, much toward at low concentrations, are different and include, although are not limited to, neurotoxic and carcinogenic activities (ATSDR, 2003a, 2003b,2007, 2008; Castro-González & Méndez-Armenta, 2008; Jomova & Valko, 2011; Tokar et al.,2011)[73,74,75,76,77,78,79]

2. ANALYTICAL TECHNIQUES FOR TRACE ELEMENT ANALYSIS IN FOOD

2.1. Measurement Techniques

This section recognizes the above most regularly utilized techniques in trace elements analysis. Table 2.1. We ought to argue the advantages and the disadvantages for every method, compare and dissimilarity the ways, evaluate the likeness of the ways, and suggest conceivable causes purposes for regular bias between the techniques [13].

Table 2.1. Some essential attributes of the considered techniques.

	Techniques	Directly measureable analyte			Possible	Expense	Whether Multielemental
Sr. No.		Free ions/elements	Ions/elements in complexes	Total elemental conc.	Difficulties		
1	XRF	✓	×	✓	Background Problem	High	Yes
2	AAS	✓	✓	✓	Matrix Effects, One element at a time	High	No
3	NAA	✓	✓	✓	Requires Nuclear Reactor	Very High	Yes
4	PIXE	✓	×	✓	Background Problem	High	Yes

2.1.1. X-Ray Flourescence (XRF) Technique

X-ray techniques have been utilized broadly to trace element dissection. These have discovered advantageous requisitions in analysis of geological materials, steels, cements, archeological specimens, forensic specimens also ecological specimens . An generally utilized technique in this Web-domain may be X-Ray fluorescence (XRF), which is non destructive and might be used to analyze just for element in the periodic table from Flourine (Z=9) upwards [14]. Newer developments permit the determination for ultra low atomic no. elements including B,C, O and N.

The sensitivity of XRF relies upon the vitality for energy radiation, geometry of the device utilized with the effectiveness of the identifier. The Generally speaking accuracy of the XRF measurement is generally limited by the measurements of the distinguished photons. The limit of identification relies upon sensitivity of the device background level about example matrix being analyzed [15]. The lower limit level of identification is communicated by the relation [16].

$$Lower\ limit\ of\ detection\ (LLD) = \frac{3}{M} \times \sqrt{Rb/Tb}$$

Where, Rb is count number rate at the background, tb may be spent duration of the time went through numbering foundation and M is sensitivity of the spectrometer.

Specimens to be analyzed by XRF might make coal fly ash, vegetation specimen in plant samples, sand, water …..etc, Likewise an illustration in vegetation sample., XRF technique go along with wanted Characteristics like the likelihood should perform analysis straight forwardly on solid sample. It could be applied with Chips/Films about nail Polishes [17].

It is less time consuming, requiring less amount of test sample, having multi element ability with broadly dynamic range [18].

The principle disadvantage of XRF instrumentation, confining more frequent utilization of the technique for environmental purposes its limited sensitivity for a percentage pollutants in Pb and Cd and poorer precision and precision as contrasted with atomic absorption spectroscopic techniques. However, with the coming some advanced

sign piocessing techniques, precision and exactness particularly to ecological specimens are improved drastically [19].

Two configurations of XRF spectrometers are broadly utilized viz. Vitality dispersive X- beam fluorescence (EDXRF) and wavelength dispersive X- beam fluorescence (WDXRF). EDXRF Concerning diagram explanatory device was utilized to monitoring of urban air contamination in Chandigarh. Vaporized specimens were composed on 47mm diameter, 0. 8µm pore size cellulose nitrate filter papers. The elemental concentrations were decided utilizing basic parameter approach [20].

Pb in vaporized specimens from Mexico valley was determining utilizing EDXRF. This technique being continuously fast , dependable and non destructive might have been utilized and compared for atomic absorption spectrometric technology Furthermore good correlation might have been obtained[89].

Heavy metal substance contents in fruits and vegetables from Lublin, Poland were analyzed utilizing EDXRF. The XRF spectrometer by Canberra might have been prepared for Si(Li) identifier and A/D change Canberra 1510 identifier. X ray radiation might have been induced by 109Cd, 55Fe and 241 Am. Quantitative analyses might have been done with AXIL software [22].

Sensitivity of XRF instrument defined as characterized Concerning illustration continuously those net intensity level got for every unit about concentration. For calculating it, the top intensities of the dissect must make measured on confirmed reference materials (erroneously known in popular language standards) of composition similar to that of the unclear specimens to be analyzed. To calculate the sensitivity, the measured intensities must not be corrected for matrix impacts and person must expect a linear relationship between intensity and concentration. The sensitivity for every analyte is calculated from the slope m_i of the calibration line as follows . The general form of the mathematical equation to a straight line is $Y = mX + b$…(1). Whether the calibration line is a plot of the top intensity I_p of the an analyte i as a fuction of the concentration C_i , the mathematical equation (1) gets to be $I_p = m_iC_i + I_b$ where the place the accurate background intensity I_b is provided by the intercept of the calibration line on the Y axis. The slope m_i is then provided by.

$$m_i = \frac{I_p - I_b}{C_i}$$

Where C_i si the concentration of the analyte i in, % or ppm. It is the slope of the calibration line that enables should change measured net intensities into concentrations. [23].

The elemental concentration of Uranium in the specimens composed from ground and canal water for Bathinda region of Punjab state, India have been examined utilizing EDXRF technique. The deposit gotten following drying water sample were analyzed utilizing EDXRF spectrometer comprising for Mo anode X- ray tube prepared by specific absorber as a excitation basis and Si(Li) detector[24].

2.1.2. FAAS

Fire atomic absorption spectrometry works with presenting the specimen into a blaze wherever it is separated into its ingredient particles. Electromagnetic radiation in the UV/Visible and only of the spectrum is coordinated throughout the blaze and is incompletely assimilated in a way feature of the atoms present. FAAS is moderately cheap and specimens to work. It encounters little impedance.

On the other hand, some recalcitrant elements cannot a chance to be resolved with good sensitivity for the reason that fire temperatures are frequently not heated sufficient with induce finish 12nalyzing12n. At very least , this problem issue means that trace levels of B,W, Ta, Zr, As and Sn might not be decided by FAAS. FAAS might be utilized for the dissection about fluid specimens only and generally huge example volumes would are obligatory.

FAAS is also an generally slow method and is most excellent utilized while only single components are should be resolved inside specimen. While a huge number of elements require dimension, other procedures might a chance to be considerably faster.

The presence of interferences, for example, covering peaks staring with meddling species or imperfect atomization of non-analyte species, might give certain positive predisposition on dimension outcomes . In finish atomization of the goal element it may result in a negative predisposition while utilizing these methods. This is exacerbated while there are show matrix affects so as to frequently stifle pointer from a recognized amount of elements inside the samples, as contrasted with the same quantity of elements in calibration to a standard [25]

Characteristic concentration in atomic absorption (sensitivity) is characterized as the concentration of an element (expressed in mg/l) obligatory to produce a signal of 1% assimilation (0.0044 absorbance units).

On condition that dimension is made in the direct working range feature is able to be resolved , by reading the absorbance produced by a known concentration of the element, and solving the following equation: =.

$$Characteristic\ Concentration = \frac{(Conc.of\ Std.\times 0.0044)}{Measured\ Abs.}$$

The feature concentration values for every element during diverse elementary wavelengths are listed in the recorded in the standard section. Knowing the anticipated characteristic's concentration permits the operator with foresee the absorbance scope which will be experimental to a known concentration scope of the element of enthusiasm. The feature concentration confirms esteem is the concentration of element (in mg/l) that will manufacture a sign of roughly 0. 2 absorbance units under optimum conditions at the wavelength recorded. Utilizing the feature concentration check, the worker be able to decide if device parameters are optimized if the device is performing up to specifications.

The identification limit is defined as the concentration of the element which will engender An indicator/noise ratio of 3. Thus, the identification limit acknowledges both the sign amplitude and the baseline noise is the least concentration which be able to be obviously separated from zero. The standard method to setting up identification limits by fire atomic absorption is as follow: two concentrations of the element are prepared, with completely separate volumetric glassware utilized to every to decrease the likelihood of contamination to minimum . The absorbance method of the two are established as explained below.

The lower concentration standard is made nearly 5× those predictable identification limit, and the second standard is made double this concentration. Then afterward creating is measured to be optimum conditions, take a reading for each standard interchangely , ten or more times. A blank reading (solvent only) is made between every standard reading. The chain is: blank, low-concentration standard, blank, high concentration standard; repeatable the chain. Containing gotten the data, make on the calculation as follows:.

The easier amassing standard is made almost 5× the individuals predictable ID number limit, and the second standard is produced twofold this focus. Then subsequently making will be acknowledged will a chance to be ideal conditions, detract a perusing to every standard interchangely , ten alternately more times. A spotless perusing (solvent only) may be made the middle of each standard perusing. The chain is: blank, low-concentration standard, blank, helter skelter fixation standard; rehashed those chain. Holding gotten those data, make on the count as takes after:

1. Average the two blank readings taken directly previously, then following every standard and subtract starting with the standard reading .
2. Calculate the mean and standard deviation for the set for accurateed high-standard readings. Would similar to situated of corrected low standard readings.
3. In those proportion of intends doesn't relate of the proportion of the fixation arranged should inside Factual error, reject those information.
4. In the information pasquinade those ratio-of-the-means test, ascertain the fixation identification cutoff as takes after:

$$\text{Detection Limit} : \frac{Standard\ \ Conc. \times 3\ Std.Dev.}{Mean}$$

The calculation is separately freely for every standard concentration, and identification constraint is the average of the two results . Schedule analytical dimensions at the identification boundary are arduous for the reason that, by definition, noise makes up a huge proportion of the total quantifiable indicator. By definition, the accuracy gotten at identification limit levels is±33% while a 3-standard-deviation criterion is utilized. Consequently, same time it may be workable with recognize analyte concentrations at identification limit starting with zero, for good accuracy it is important to bound schedule explanatory fill in on concentrations higher than the identification limit.

It is critical to recall that trait concentration baseline the size of the absorption signal; the identification limit considers both the indicator amplitude and the baseline noise. Likewise indicated to figure 14, it is could be allowed with same features concentration, but different identification limits. [26].

2.1.3. Neutron Activation Analysis

The expression activation analysis refers to detection and quantitative determination by utilization of radio nuclides engendered from a goal elements. NAA the most frequent variant in which neutrons are utilized to light and must activate the specimens. While dimension is carried out without former chemical division, the way is known as instrumental NAA (INAA).

As a consequence of a nuclear reaction amid of the neutron and the isotope of the element for attention, radio nuclides for characteristics half-lives might make engendered, emitting radiation of changeable energies that might be calculated by a suitableness identifier and are features of the elements from which they were engendered . Requisitions of the NAA technique have been in the analysis of very pristine silicon (where LODs to a few elements might be mass portions of 10 to-15 or below), the trace determination of the elements in biological specimens , and the multi-element dissection about airborne particulate matter [27].

It could be applied to analyze the cancerous tissues, trace elements in human hairs and drinking water. [28][29].

Activation dissection is suiting of the analysis of solid specimens where these might a chance to be irradiated with no disintegration step. Liquid specimens perhaps analyzed in any case pre concentration is regularly necessary former to analysis. Mass portions down of the 10 to -15 levels might be distinguished.

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The identification limit represents to the capacity of a provided for NAA method to decide the least amounts of elements dependably. The identification limits relies on the irradiation, the decompose and the counting conditions. It additionally relies on the interference circumstance including such things as the ambient background, the Compton continuum from higher energy-rays, and in addition any-ray spectrum interferences from such factors as the blank starting with pre-irradiation treatment and from packing materials. The identification limit is frequently calculated utilizing Currie's formula:.

$$DL = 2.71 + 4.65B$$

Wherever: DL is the identification limit B is the base under a gamma-ray crest. This connection is applicable just while the gamma-ray background (counting statistical error) is the main impedance. [30].

Neutron activation analysis sensitivities and precision are rely on the concentration of specific elements with radionuclide parameters (i. E. parent isotope great quantity, neutron cross section, half life, and gamma beam large quantity). Component sensitivities fluctuate from 10-3 to 10-10 grams for every gram of specimens . T**o Calculate Element Concentration using gamma ray counts:** The procedure utilized to calculate concentration (i.e., ppm of element) in the unidentified specimen is to irradiate the unidentified specimens and a comparator standard are known amount of elements of interest together in the reactor. If the unidentified specimens and the comparator standard are both calculated on the similar identifier, after that person wants to accurate the distinction in decompose between the two. Particular case normally decompose 16nalyzin the calculated counts (or activity) for both specimens back of the end for 16nalyzing16n utilizing the half-life of the calculated isotope. The mathematical statement of equation utilized to calculate the mass of an element in the unidentified specimens relative of the comparator standard is:.

$$\frac{A_{sam}}{A_{std}} = \frac{m_{sam}}{m_{std}} \frac{\left(e^{-\lambda T_d}\right)_{sam}}{\left(e^{-\lambda T_d}\right)_{std}}$$

where A=activity of sample (*sam*) and standard (*std*), m=mass of the element, λ=decay constant for the isotope, and T_d=decay time. Whereas performing short irradiations, the irradiation, decompose and counting times are usually set the similar for all specimens and standards such that the time-dependent factors cancel. Consequently the above mathematical equation simplifies into:

$$C_{sam} = C_{std} \frac{W_{std}}{W_{sam}} \frac{A_{sam}}{A_{std}}$$

Where *C*=concentration of the element and *W*=weight of the specimen and standard.[31]

Sensitivities and LODs can change broadly with a portion elements being difficult to recognize in the least. Principle, NAA offers a hearty dissection method giving very exact effects down on ultra-low concentrations. The vast majority sources of systematic and random error (e. G. , interfering nuclear reactions, overlap of spectral lines and dead-time losses) are detectable , as the physical standards of NAA are great seen and explained [32].

Nondestructive neutron activation dissection has demonstrated to be an effective procedure for 17nalyzing trace elements in Soils. More important is the fact that the essential major elements which is universally available soil specimens are obliviously distinguished in percentage concentrations and ppm; and additionally the key elements required with promote the elemental properties of soils for example, such that Al, Fe, Zn and Mn are also found on moderate amounts [33].

Also, since NAA is depend on standards basically dissimilar from the other analytical techniques, it may be inclined on totally distinctive precise biases and is consequently greatly advantageous in examination of reference materials or in evaluating likeness of dimension result. On the other hand, the throughput of NAA methods is low, and method is not cheap.

2.1.4. Proton induced X-Ray Emission Technique (PIXE)

X-ray release might and be prompted by heavy charged particles (particle-induced X-ray emission, PIXE). Calibration is frequently by means of thin-film standards, or by utilizing basic physical parameters in conjunction by an tentatively resolute effectiveness bend. Utilizing this method, LODs of a few of ng/cm2 have been claimed for particulate material on ambient air filters to a range of elements, with repeatabilities of 1% and an precision for 5% [34].

For a provided trace element a with atomic number Z in an provided for matrix B, the identification limit is determined by statistical fluctuation of background and therefore it is defined by:.

$N_A \geq 3 \times \sqrt{N_B}$

Wherever N_A is the total number of counts of a characteristic X-ray peak for a given line i of A, and N_B is the number of background counts included in the full width of half maximum (FWHM) of the feature X-ray crest or the detection limit of A in the matrix B is given in units of parts per million by the following Formula:

$$\frac{n_A}{n_B} = \frac{3 \times \sqrt{N_B} \times 10^6}{\eta_B \times N_P \times \frac{\Omega}{4 \times \prod} \times \varepsilon_f(Z) \times ab(Z) \times \sigma^i_Z}$$

Where n_B is the atomic concentration of the matrix element, n_A is that of the trace element A, N_p is the number of projectiles, Ω is the solid angle subtended by a identifier , and σ^i_Z , ab(Z),ε_f (Z) are, correspondingly, the production cross section of K X-beams for the trace element, absorption of X-beams by windows and others (air, target) and finding efficiency.[35]absorption for x-rays by windows also other (air, target) and the identification effectiveness. [35].

The trace elements in medicinal plants in Manipur had been detected by PIXE technique as it is one of the most powerful technique for its quick multi elemental trace analysis capability and high sensitivity. Some of the common trace elements determined by this technique are K, Ca, Fe, Zn, Sr. etc. [36][37],.

The trace elements in medicinal plants in Manipur required been detected by technique PIXE Likewise it it is one of the practically capable technique to its fast multi element trace dissection ability and high sensitivity. Some of the regular trace elements determined by this technique are K, Ca, Fe, Zn, Sr. etc. [36].

3. MATERIALS AND METHODS

3.1. Sample collection

A total of twenty specimens collected of dissimilar imported frozen and fresh local red meat(cow meat) were arbitrarily collected from different part in animal body in business local markets in Erbil city. Four sources-imported red meat(frozen) and one local fresh red meat. Four imported legally red meat(frozen) from four different countries (Ukraine, Paraguay, Moldova and Australia) and Iraq.

Every group was collected throughout the period of march to may 2017. These parts of red meat are often inspired by the public as differentiate upon their flavor. This test was so planned to confirm the concentration of essential and toxic metal amassing in them.

3.2. Samples preparation

Only 10g ± 0.2 specimens of each part were weighed up utilizing a sensitive balance, put in an oven at 105°C overnight then grounded to be ready for analysis. Must don't have humidity in the sample.

3.3. Sample analysis of elements

The residues of Fe, Mn, Mg, Zn, Ca, and Pb were determined utilizing X-ray fluorescence spectrometer, Skyray 9000, portable XRF tool (XRF). These heavy metals are so well known elements evaluated in most other researchers. The diagnosed period has been restricted to only 100 seconds. The X-ray fluorescence spectrometry, as an instrumental analytical technique is able to decide the elemental composition of solid and liquid specimens from

Minimally prepared specimen size. In addition to, this technique able to be utilized for direct analysis for both solid and fluid materials. The specimens were blasted by the X-ray to stimulate the atoms within the specimen in order that a distinctive feature radiation for particular elements is released.

Energy (wavelength) of these trait radiations does vary element by element. This fact is measured as the bottom line of the qualitative element examination. The force of feature radiation of every element should be quantifiable to its concentration that permits the qualitative analysis. Data were analyzed statically utilizing the ready made statically program, SAS (2002-2003) system to study the means of heavy metals remains in two diverse genesis (Turkish and Brazilian) imported meat parts made from breast, wing and thigh. The Duncan multiple range test (1955) was utilized to contrast the differences between the means.

3.4. Operating Conditions for XRF Instrument

Genius Handheld XRF Spectrometer features rapid non-destructive elemental detection and composition analysis with SDD Detector for accurate detection of any element from Magnesium to Uranium. Performance and accuracy similar to Desktop XRF System joint with convenience and portable size factor of a Handheld XRF. Table 3.1. Genius XRF is suitable for wide range of applications with multiple software options to choose from. As Figure 3.1.

Figure 3.1. XRF

Table 3.1. Technical of **XRF**

Technical Specifications	
Measurable elements:	Magnesium(Mg) to Uranium (U)
Limits of Detection	10 ppm
Analysis Range:	10 ppm-99.999%
Test time	5 second results, average test time 20 seconds, testing can be set by user from 5 to 60 seconds
Battery:	780mAh rechargeable lithium battery-up to 8 hours work time
Energy Resolution	139eV
Detector	SDD
Sample types	Solids, liquids, powders
Light Element testing	with optional Helium charging system
Weight:	1.6 kg

3.5. Calibration curves to identify elements in red meat samples

In this study, 13 key and secondary levels were identified and affected in five red meat samples from five different countries of red meat successfully using the zipper accurately and with acceptable accuracy. To determine the elements in red meat samples we did not prepare the calibration curve for every element by preparing a series of standard solution and measuring only. We have special (cal check coupon) to calibrate XRF. Figure 3.2.

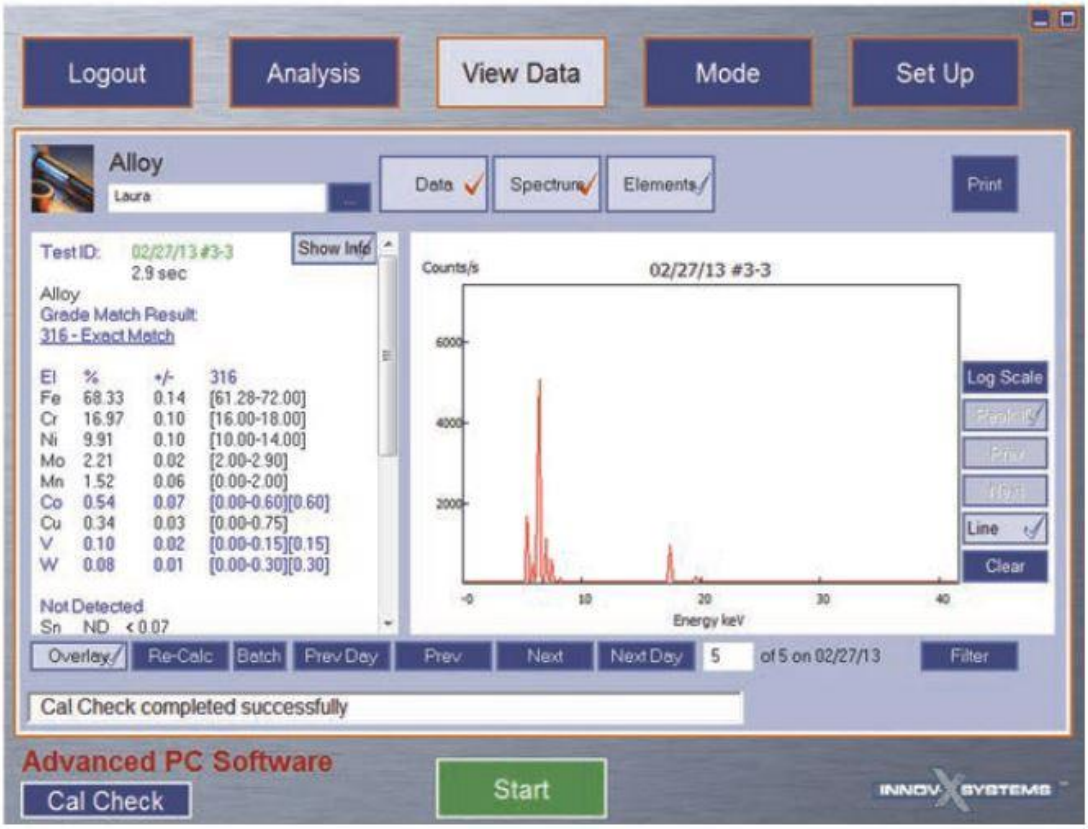

Figure 3.2. XRF -Calibration-Check

3.6. Statistical Analysis

This data of the studying was statistically analyzed using statistical package for social science (SPSS, Version 16), which is a statical package used for statistical analysis. The contained data was expressed as (Mean ±St Dev). Differences in mean values of each element in all five group red meat samples were analyzed by one-way ANOVA and Duncant test and relationships between concentrations of the elements in analyzed red meat were assess by using the Pearson's linear correlation coefficient. The level of P - value ($P < 0.05$) level of significant was considered to be statistically significant.

4. RESULTS AND DISCUSSION

4.1. Concentration of Elements in Analyzed red meat Samples

In this study, concentration of 13 elements (Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Cd, Sb, Hg, and Pb) were determined in red meat samples by X-Ray Fluorescence (XRF). According to the obtained results in this study the measured elements can be classified into three major group, due to their concentration, the first group will be named as macro or essential element because their concentrations are too high in red meat as compared to other elements and include five elements which are (Fe, Zn and Pb), the concentration trend of macro elements were fund to be as follows: Fe > Zn > Pb>As

Red meat is one of the important sources of some micro elements such as Co, Ni, Cu, Se and Hg. The order of mean concentrations of the micro elements in all analyzed red meat samples was found. Table 4.1.

The third and final group of elements determined is trace elements in which red meat samples contain some essential trace elements like Mn, Cr, Cd and Sb which are contain near zero concentration.

Table 4.1. Concentrations (mean ± standard deviation + minimum + maximum) in (mg/kg) of elements in five different red meat samples

		N	Mean	Std. Deviation	Minimum	Maximum
Cr(mg/kg)	Iraq	4	0.0000	0.0000	0	0
	Ukraine	4	0.0000	0.0000	0	0
	Paraguay	4	0.0000	0.0000	0	0
	Moldova	4	0.0000	0.0000	0	0
	Australia	4	0.0000	0.0000	0	0
	Total	20	0.0000	0.0000	0	0
Mn(mg/kg)	Iraq	4	0.0000	0.0000	0	0
	Ukraine	4	0.0000	0.0000	0	0
	Paraguay	4	0.0000	0.0000	0	0
	Moldova	4	0.0000	0.0000	0	0
	Australia	4	0.0000	0.0000	0	0
	Total	20	0.0000	0.0000	0	0
Fe(mg/kg)	Iraq	4	0.1121	0.0063	.1027	.1162
	Ukraine	4	0.1098	0.0022	.1078	.1130
	Paraguay	4	0.1139	0.0041	.1100	.1181
	Moldova	4	0.1129	0.0053	.1076	.1194
	Australia	4	0.1126	0.0026	.1102	.1156
	Total	20	0.1122	0.0042	.1027	.1194
Co(mg/kg)	Iraq	4	1.1128	0.0883	.999	1.183
	Ukraine	4	1.1921	0.1124	1.089	1.347
	Paraguay	4	1.2166	0.0681	1.155	1.287
	Moldova	4	1.1991	0.0406	1.141	1.234
	Australia	4	1.1377	0.0459	1.079	1.189
	Total	20	1.1717	0.0787	.999	1.347
Ni(mg/kg)	Iraq	4	0.0018	0.0037	0	
	Ukraine	4	2.4247	0.4214	2	3
	Paraguay	4	0.2819	0.5638	0	1
	Moldova	4	1.3266	1.8092	0	4
	Australia	4	1.8951	3.2278	0	7
	Total	20	1.1860	1.7721	0	7
Cu(mg/kg)	Iraq	4	1.2295	0.9092	0.000	2.186
	Ukraine	4	5.0958	1.7773	3.171	6.675
	Paraguay	4	0.9481	1.6961	0.000	3.483
	Moldova	4	2.8448	3.3188	0.000	6.269
	Australia	4	1.0426	1.0801	0.000	2.086
	Total	20	2.2321	2.3809	0.000	6.675
Zn(mg/kg)	Iraq	4	469.0896	30.4756	433.0405	497.8603
	Ukraine	4	478.3351	7.5375	467.5414	484.2461
	Paraguay	4	387.4691	85.6690	266.5728	467.2845
	Moldova	4	388.5932	180.7428	144.7723	537.5874
	Australia	4	162.5233	20.5769	136.3054	180.7192
	Total	20	377.2021	142.2048	136.3054	537.5874
As(mg/kg)	Iraq	4	1.8655	0.2428	1.5044	2.0154
	Ukraine	4	2.0629	0.3047	1.8483	2.5062
	Paraguay	4	1.9068	0.2421	1.5955	2.1853
	Moldova	4	1.9310	0.2216	1.7022	2.1232
	Australia	4	1.6683	0.1607	1.5129	1.8935

		N	Mean	Std. Deviation	Minimum	Maximum
	Total	20	1.8869	0.2494	1.5044	2.5062
Se(mg/kg)	Iraq	4	0.2029	0.1349	.1200	.4045
	Ukraine	4	0.1506	0.0239	.1200	.1773
	Paraguay	4	0.2482	0.1127	.1200	.3916
	Moldova	4	0.2806	0.2030	.1200	.5757
	Australia	4	0.1290	0.0181	.1200	.1561
	Total	20	0.2023	0.1223	.1200	.5757
Cd(mg/kg)	Iraq	4	0.0000	0.0000	0	0
	Ukraine	4	0.0000	0.0000	0	0
	Paraguay	4	0.0000	0.0000	0	0
	Moldova	4	0.0000	0.0000	0	0
	Australia	4	0.0117	0.0235	0	
	Total	20	0.0023	0.0105	0	
Sb(mg/kg)	Iraq	4	0.0000	0.0000	0	0
	Ukraine	4	0.0000	0.0000	0	0
	Paraguay	4	0.0000	0.0000	0	0
	Moldova	4	0.0000	0.0000	0	0
	Australia	4	0.0000	0.0000	0	0
	Total	20	0.0000	0.0000	0	0
Hg(mg/kg)	Iraq	4	0.0414	0.0120	.0327	.0590
	Ukraine	4	0.0254	0.0121	.0150	.0366
	Paraguay	4	0.0264	0.0145	.0150	.0454
	Moldova	4	0.0244	0.0125	.0150	.0414
	Australia	4	0.0203	0.0105	.0150	.0360
	Total	20	0.0276	0.0133	.0150	.0590
Pb(mg/kg)	Iraq	4	39.7994	11.9600	30.3731	55.4661
	Ukraine	4	42.8097	14.2434	25.0560	59.7794
	Paraguay	4	41.9980	8.0102	34.8099	51.0876
	Moldova	4	43.6021	5.3318	35.6795	47.2695
	Australia	4	43.5059	8.3927	34.2958	54.6104
	Total	20	42.3430	9.0781	25.0560	59.7794

4.2. Comparison of Elemental Content of red meat Samples

Red meat is an significant basis of minerals in the individual being diet, supplying necessary elements with high availability, especially Fe and Zn. The bioavailability of trace elements from red meat varies from 30 to 45 % for Cu, from 40 to 68 % for Zn, from 55 to 95 % for Mn and from 60 to 70 % for Fe. Iron in meat happens chiefly in its simply available haem form, that is bound with myoglobin and hemoglobin. Its absorption from meat (from 20 to 30 %) is almost twice as high as absorption from plants, even though in the case of plants inspired together with meat, iron absorption be able to even double. Likewise, absorption of zinc from a diet wealthy in animal protein is greater than in the

case of foodstuffs of plant source in Iraq, as in many nations of Middle East, the most red meat is got from cattle breeds utilized for dairy functions and import red meat from other country. This, but, is a diverse population, ranging from normally dairy cows to small inhabitants of native breeds, i.e. those happening in only one state are kept on low-input farms wherever cattle is elevated broadly, i.e. pastured in the summer and fed on-farm fodder in the winter. This kind of production system is a key factor determining the high dietary value of the meat got. It is value emphasizing that the literature have no reports on the mineral concentrations in the meat of Iraqi native livestock breeds. The purpose of the research was to contrast the content of essential with toxic metals in red meat of Iraq, Moldova, Australia, Paraguay and Ukraine.

Those charts shows contain all minerals in analyses and what's different between them: Figure 4.1, Figure 4.2, Figure 4.3, Figure 4.4, Figure 4.5, Figure 4.6, Figure 4.7, Figure 4.8, Figure 4.9, Figure 4.10.

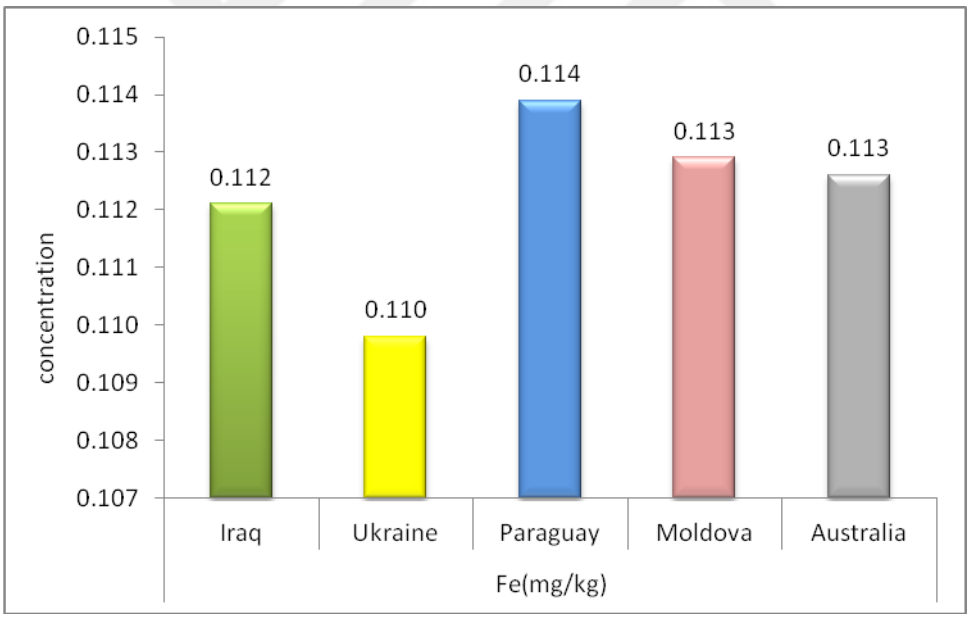

Figure 4.1. Iron levels in different red meat sample.

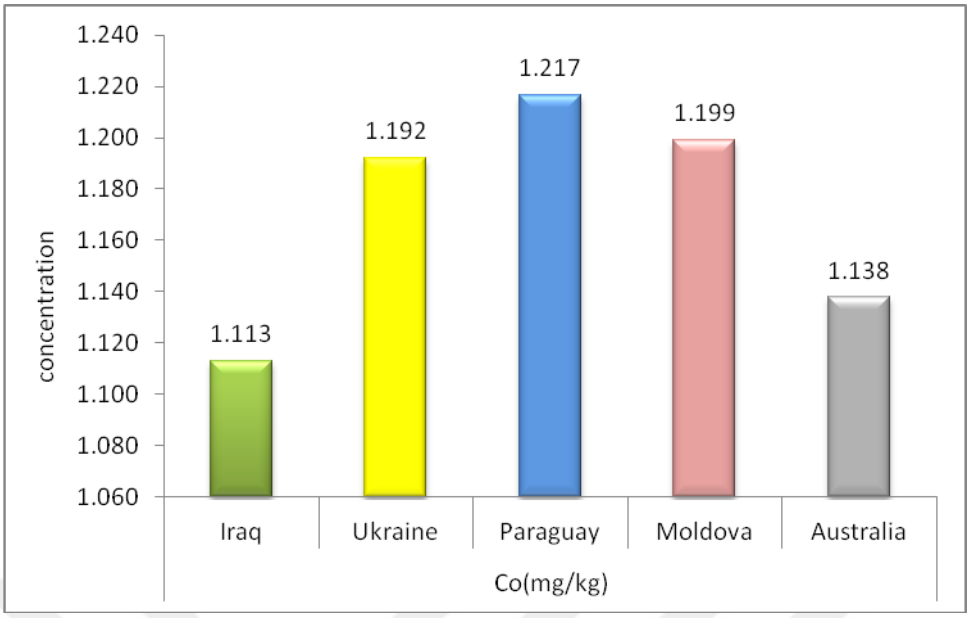

Figure 4.2. Cobalt levels in different red meat sample.

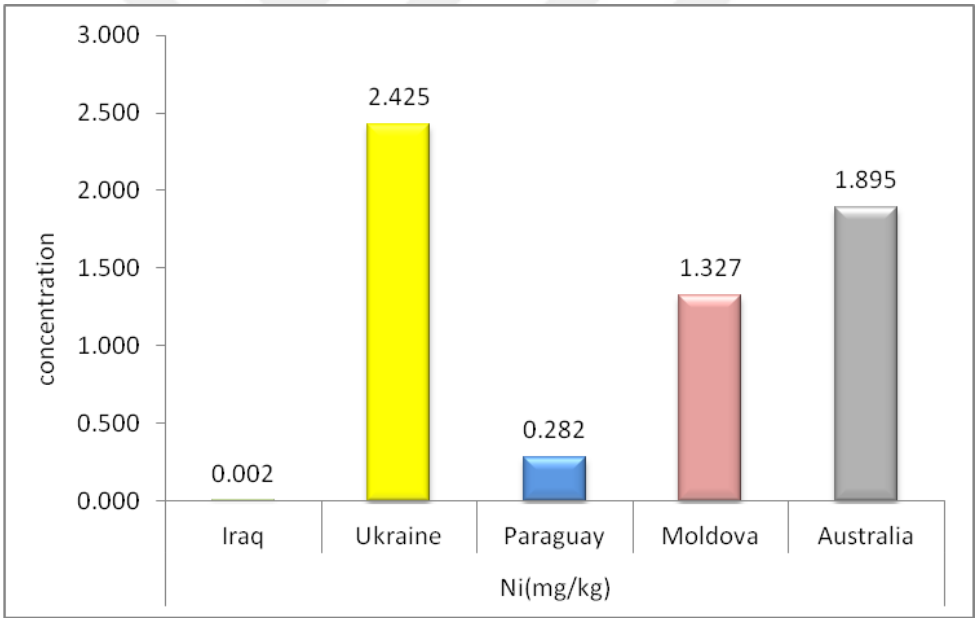

Figure 4.3. Nickel levels in different red meat sample.

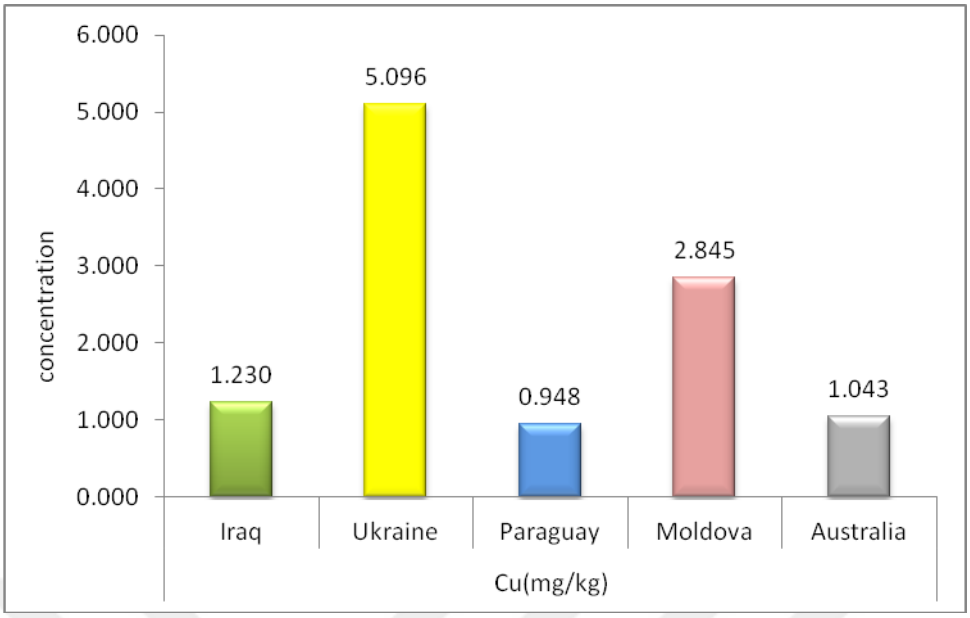

Figure 4.4. Copper levels in different red meat sample.

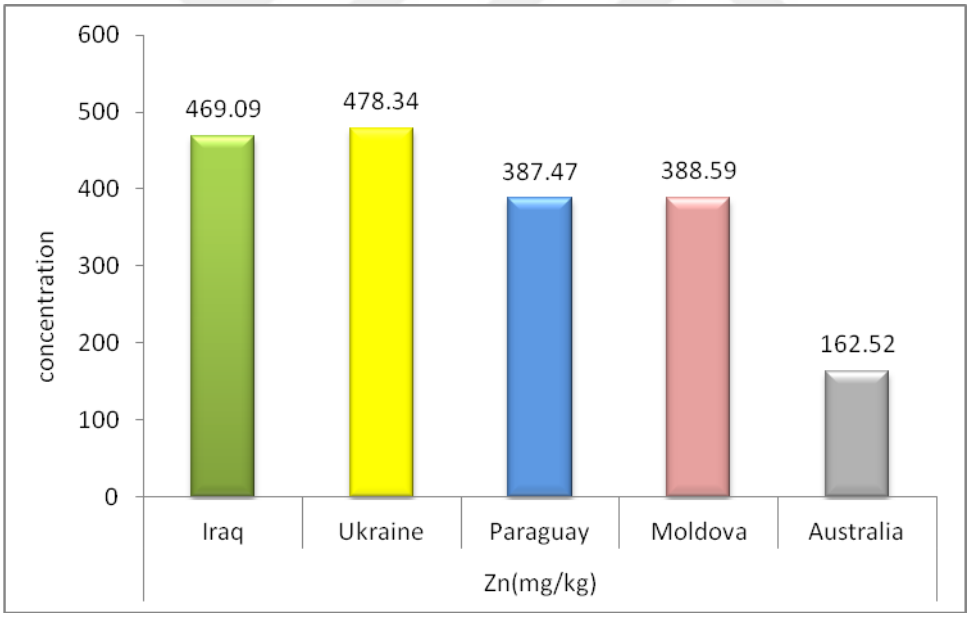

Figure 4.5. Zinc levels in different red meat sample.

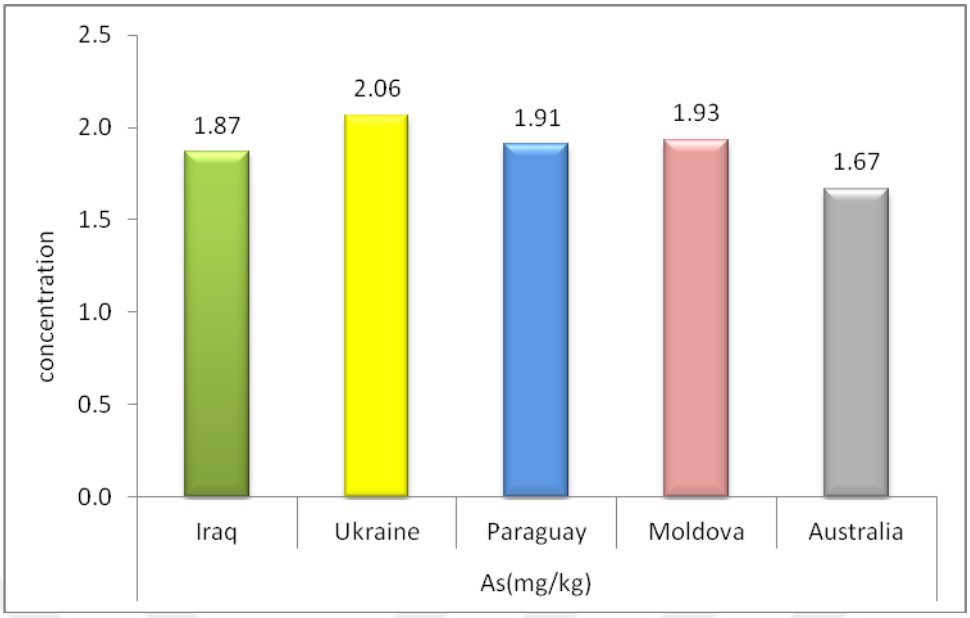

Figure 4.6. Arsenic levels in different red meat sample.

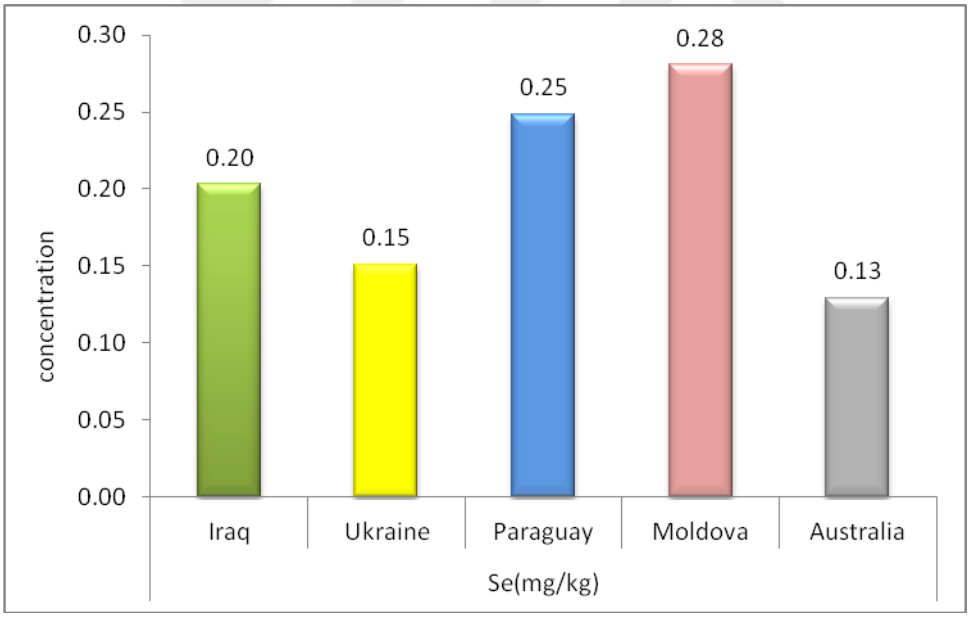

Figure 4.7. Selenium levels in different red meat sample.

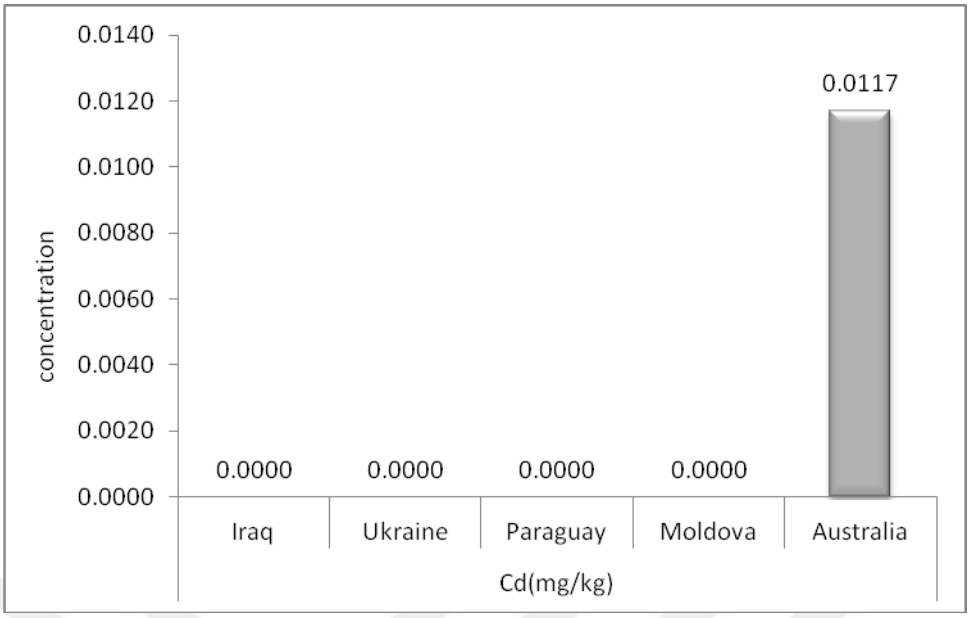

Figure 4.8. Cadmium levels in different red meat sample.

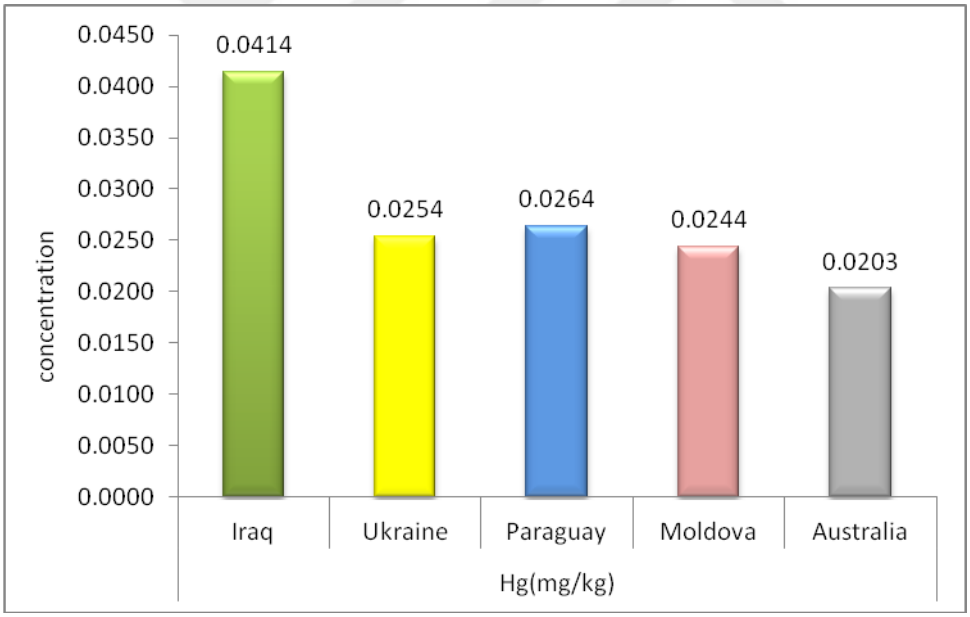

Figure 4.9. Mercury levels in different red meat sample.

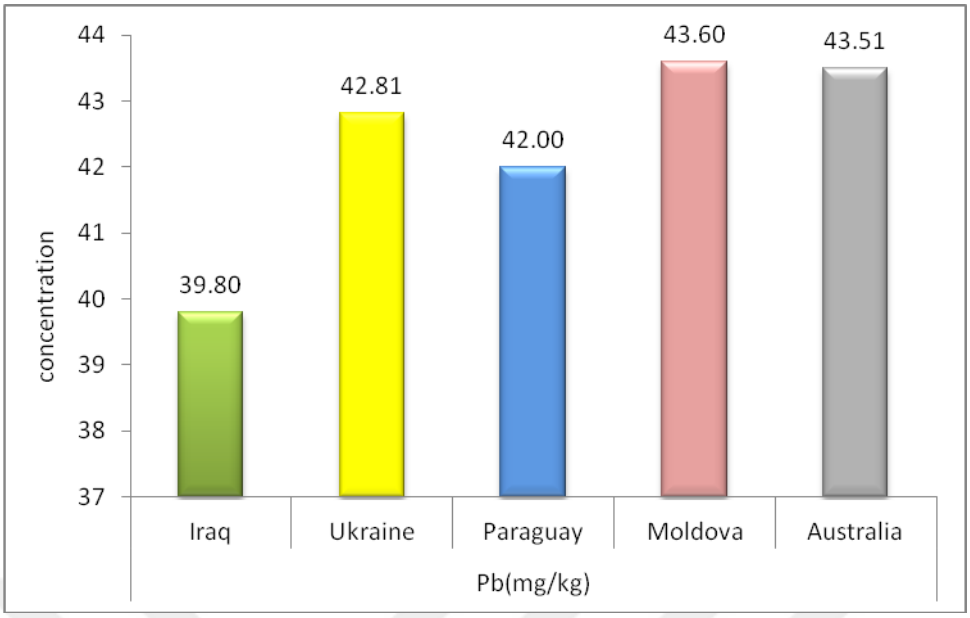

Figure 4.10. Lead levels in different red meat sample.

4.3. Comparison of Elemental Content of red meat Samples with Other Reported Values

In my study I see different range in other study with my study in first table. I talk about four elements (Mn, Cr, Fe and Co) in manganese have different between my study and other test . there is a comparison the results of the present study to other studies have been done on red meat in the world; in general the results that we have in this study showed good result with some of the reported values except for some of the elements in which the results obtained here is slightly lower than previously report values. Table, Table, and Table. shows the comparison between all elements in this study with some other previous studies has been done on red meat in different countries samples.

Concentrations of manganese, chromium, and iron, in red meat samples obtained in present study were higher than the reported values,[38], [39], [40], [41] only in cobalt have lower Concentration. as Table 4.2.

Table 4.2. Comparison of the concentration of micro elements (Mn, Cr, Fe, and Co) in red meat samples in my present analytic study with other analytical studies on red meat samples

Elements	Concentration (mg/kg)	Reference
Mn	**0.00-0.00**	**Present study**
	<0.1	[38], [39], [40], [41]
Cr	**0.00---0.00**	**Present study**
	0.049---0.03	[42], [43]
Fe	**0.1139-0.1098**	**Present study**
	0.18—0.20	[44], [45]
Co	**1.1991---1.1377**	**Present study**
	0.190---0.132	[46], [47], [48], [49], [50]

Amount of zinc (Zn), nickel (Ni), copper (Cu), arsenic (As) found in red meat samples in present study as showed in Table were in different agreements with the values reported previously, while concentration of obtained in present study were slightly higher and some of the lower values as table 4.3. [42], [43], [44], [45], [46], [47], [48], [49]

Table 4.3. Comparison of the concentration of micro elements (Zn, Ni, Cu, and As) in red meat samples in my present analysis study with other analysis studies on red meat samples

Elements	Concentration (mg/kg)	Reference
Zn	**462.08---162.52**	**Present study**
	46.00—45.55	[51], [52], [53]
Ni	**2,42---0.28**	**Present study**
	101.7---19.7	[54], [55], [56], [57], [58]
Cu	**5,09---0.94**	**Present study**
	2.2--1.2	[51], [52], [53]
As	**2.06---1.93**	**Present study**
	82.6---1.3	[54], [55], [56], [57], [58]

Concentrations of selenium (Se), lead (Pb) in the present study, were higher than the other report. Amount of cadmium (Cd), Mercury (Hg) found in red meat samples in present study as showed in Table were fewer values than other reported previously, while concentration of Stibium (Sb) in present study was zero like other reports. As Table4.4. [50], [51], [52], [53], [54], [55], [56], [57], [58], [59], [60], [61]

Table 4.4. Comparison of the concentration of micro elements (Se, Cd, Sb, Hg, and Pb) in red meat samples in my present analysis study with other analysis studies on red meat samples

Elements	Concentration (mg/kg)	Reference
Se	**0.2806—0.1290**	**Present study**
	0.17—0.14	[51], [52], [53]
Cd	**0.0117---0.0023**	**Present study**
	1.2---0.6	[54], [55], [56], [57], [58]
Sb	**0.00---0.00**	**Present study**
	0.00—0.00	[51], [52], [53]
Hg	**0.0414—0.0264**	**Present study**
	1.0---0.9	[59], [60], [61]
Pb	**43.60—39.79**	**Present study**
	18.1---7.6	[54], [55], [56], [57], [58]

4.4. Statistical Analysis on the Result.

4.4.1. One Way Variance Analysis (ANOVA)

The obtained results were analyzed by one_way analysis of variance(ANOVA), and Duncan test to show the elements which have large variations and significant and nonsignificant differences in their concentration levels in different red meat samples. And the results showed that there are significant and nonsignificant differences were observed for different red meat samples. Table 4.5.

For other elements, a significant difference is observed between the concentrations of only one or two red meat with other samples. ANOVA results for macro, micro, and trace elements are shown in Table 4.5, respectively, difference matching letters in each column of the tables means significant difference according to Duncan test.

Table 4.5. Concentration (mg/kg) and standard deviation value of thirteen elements in red meat samples, different matching letters in a column mean significant differences according to Duncan test (P<0.05)

		Sum of Squares	df	Mean Square	F	Sig.
Cr(mg/kg)	Between Groups	0.000	4	0.000		
	Within Groups	0.000	15	0.000		
	Total	0.000	19			
Mn(mg/kg)	Between Groups	0.000	4	0.000		
	Within Groups	0.000	15	0.000		
	Total	0.000	19			
Fe(mg/kg)	Between Groups	0.000	4	0.000	0.483	0.748
	Within Groups	0.000	15	0.000		(NS)
	Total	0.000	19			
Co(mg/kg)	Between Groups	0.031	4	0.008	1.354	0.296
	Within Groups	0.086	15	0.006		(NS)
	Total	0.118	19			
Ni(mg/kg)	Between Groups	17.107	4	4.277	1.507	0.250
	Within Groups	42.561	15	2.837		(NS)
	Total	59.668	19			
Cu(mg/kg)	Between Groups	50.579	4	12.645	3.320	0.039
	Within Groups	57.130	15	3.809		(S)
	Total	107.709	19			
Zn(mg/kg)	Between Groups	259973.344	4	64993.336	7.846	0.001
	Within Groups	124248.426	15	8283.228		(HS)
	Total	384221.770	19			
As(mg/kg)	Between Groups	0.326	4	0.082	1.429	0.272
	Within Groups	0.856	15	0.057		(NS)
	Total	1.182	19			
Se(mg/kg)	Between Groups	0.065	4	0.016	1.114	0.386
	Within Groups	0.219	15	0.015		(NS)
	Total	0.284	19			
Cd(mg/kg)	Between Groups	0.000	4	0.000	1.000	0.438
	Within Groups	0.002	15	0.000		(NS)
	Total	0.002	19			
Sb(mg/kg)	Between Groups	0.000	4	0.000		
	Within Groups	0.000	15	0.000		
	Total	0.000	19			
Hg(mg/kg)	Between Groups	0.001	4	0.000	1.705	0.201
	Within Groups	0.002	15	0.000		(NS)
	Total	0.003	19			
Pb(mg/kg)	Between Groups	38.978	4	9.744	0.096	0.982
	Within Groups	1526.838	15	101.789		(NS)
	Total	1565.816	19			

4.4.2. Correlation between Elements in red meat between Iraq and other four countries.

To determine a correlation between concentrations of elements in red meat samples, Dunnett t-tests treat one group as a control and compare all groups against it coefficient

were assessed. this table (Table 4.6) shows us the difference between Iraq and other countries, most of them nonsignificant, and in tow elements show us significant (Ukraine, Iraq) in Cu and (Australia, Iraq) in Zn but in all other elements nonsignificant between Iraq and another four countries

Table 4.6. Dunnett t-tests treat one group as a control, and compare all others groups against it.

Dunnett t (2-sided)[a]					
Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.
Fe(mg/kg)	Ukraine	Iraq	-.0023000	0.0031	0.870
	Paraguay	Iraq	.0018000	0.0031	0.939
	Moldova	Iraq	.0008500	0.0031	0.996
	Australia	Iraq	.0004750	0.0031	1.000
Co(mg/kg)	Ukraine	Iraq	.079300	0.0537	0.413
	Paraguay	Iraq	.103750	0.0537	0.208
	Moldova	Iraq	.086225	0.0537	0.344
	Australia	Iraq	.024850	0.0537	0.971
Ni(mg/kg)	Ukraine	Iraq	2.423	1.1910	0.175
	Paraguay	Iraq	.280	1.1910	0.998
	Moldova	Iraq	1.325	1.1910	0.642
	Australia	Iraq	1.893	1.1910	0.353
Cu(mg/kg)	Ukraine	Iraq	3.866300*	1.3800	0.043
	Paraguay	Iraq	-.281400	1.3800	0.999
	Moldova	Iraq	1.615325	1.3800	0.603
	Australia	Iraq	-.186850	1.3800	1.000
Zn(mg/kg)	Ukraine	Iraq	9.2455250	64.3554	1.000
	Paraguay	Iraq	-81.6204500	64.3554	0.540
	Moldova	Iraq	-80.4964250	64.3554	0.551
	Australia	Iraq	-306.5662500-*	64.3554	0.001
As(mg/kg)	Ukraine	Iraq	.1974750	0.1689	0.604
	Paraguay	Iraq	.0413500	0.1689	0.997
	Moldova	Iraq	.0655500	0.1689	0.985
	Australia	Iraq	-.1971250	0.1689	0.606
Se(mg/kg)	Ukraine	Iraq	-.0522750	0.0854	0.927
	Paraguay	Iraq	.0453000	0.0854	0.954
	Moldova	Iraq	.0776500	0.0854	0.774
	Australia	Iraq	-.0738750	0.0854	0.801
Cd(mg/kg)	Ukraine	Iraq	0.000	0.0070	1.000
	Paraguay	Iraq	0.000	0.0070	1.000
	Moldova	Iraq	0.000	0.0070	1.000
	Australia	Iraq	.012	0.0070	0.357
Hg(mg/kg)	Ukraine	Iraq	-.0160000	0.0088	0.247
	Paraguay	Iraq	-.0150500	0.0088	0.292
	Moldova	Iraq	-.0170500	0.0088	0.203
	Australia	Iraq	-.0211750	0.0088	0.089
Pb(mg/kg)	Ukraine	Iraq	3.0102750	7.1340	0.979
	Paraguay	Iraq	2.1986000	7.1340	0.993
	Moldova	Iraq	3.8027000	7.1340	0.953
	Australia	Iraq	3.7065500	7.1340	0.957
*. The mean difference is significant at the 0.05 level.					
a. Dunnett t-tests treat one group as a control, and compare all other groups against it.					

4.5. Conclusion

Trace elements are basic for growth, development, creation, and proliferation. They are fundamental to the working on various parts of the safe framework. In this manner, they add to keeping up legitimate wellbeing and immunity.They are imperative for the working of various compounds and proteins which are associated with numerous physiological and biochemical procedures. These Physio-biochemical procedures are identified with development, generation, and proliferation. Thus, trace elements influence both the growth and generation, execution of creatures.

Meat is one of main products which used by human and contingent upon it to getting of animal protein, particularly the fundamental amino acids, preferably human utilization of red meat.

Red meat chiefly come from cows (calves), sheep and goats, but it is acknowledged exorbitant in the eastern countries due to the absence of natural pastures and climbing focus feed prices, particularly in Iraq.

so imported meat of both sorts of red and white are not welcome due to shopper trustiness of the source, quality and the states of storage and storage process plays an essential part to save the meat for along time a while particularly by solidify of a wide methods utilized to saving the animal products, particularly meat and that the save by freeze supports the quality of the product and its dietary value

Trace elements are characterized by their great low fixations in the body, for example, under 50 mg of iron for every kg of tissue. A basic capacity of trace elements is that they go about as an activator and part of numerous compounds. Moreover, they are available in proteins and do a few assignments in the hormonal framework. Accordingly, essential capacities, for example, the proliferation of dairy bovines depend on a considerable measure on the supply of trace elements.

Meat is one of the major food daily used for eating people,In this experiment, the researcher has collected the import meats formally in different borders come to the Erbil province from international country when compared to the local animal meats also the researcher choose 13 elements randomly style these elements consists of the 13 elements in different countries include:

(Cr . Mn , Fe . Co . Ni . Cu .Zn . As . Se . Cd .Sb . Hg and Pb)(Iraq- Ukraine- Paraguay- Moldova-and Australia) also of this experiment have difference between countries and Iraq –Erbil city by XRF instruments have done the test, however, the researchers say have less used XRF instruments for the test when compare to the ICP and AAS instruments with different types, also these differences come back to the feed of animal place and types of food.

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APPENDIX

Recommended daily intake of vitamins and minerals

Humans need a certain daily intake of food supplements. This page summarizes recommended daily intakes by various health experts and agencies in order to provide an overview of recommended daily allowances of all vitamins and minerals.

Table 1: Recommended daily intakes of various food supplements

Vitamins	Recommended daily intake	Vitamins informational pages	Over dosage (mg or µg/d)
Biotin (B-complex)	30 µg	Biotin in food and as a supplement	No information found
Folate (B-complex)	400 µg	Folate in food and as a supplement	Doses larger than 400 µg may cause anaemia and may mask symptoms of a vitamin B12 deficiency
Vitamin A	600 µg	Vitamin A in food and as a supplement	Extremely high doses (>9000 mg) can cause dry, scaly skin, fatigue, nausea, loss of appetite, bone and joint pains and headaches
Vitamin B1 (thiamin)	1,4 mg	Vitamin B1 in food and as a supplement	No toxic TEMPeffects resulting from high doses has been observed
Vitamin B2 (riboflavin)	1,6 mg	Vitamin B2 in food and as a supplement	Doses higher TEMPthan 200 mg may cause urine colour alteration
Vitamin B3 (niacin)	18 mg	Vitamin B3 in food and as a supplement	Doses larger TEMPthan 150 mg may cause problems ranging from facial flushing to liver disease
Vitamin B5 (patotanic acid)	6 mg	Vitamin B5 in food and as a supplement	Dose should not exceed 1200 mg; dis may cause nausea and heartburn
Vitamin B6 (pyridoxine)	2 mg	Vitamin B6 in food and as a supplement	Doses larger than 100 mg may cause numbness and tingling in hands and feet
Vitamin B12 (cobalamine)	6 µg	Vitamin B12 in food and as a supplement	Doses larger than 3000 µg may cause eye conditions
Vitamin C (ascorbic acid)	75 mg	Vitamin C in food and as a supplement	No impacts of over dose have been proven so far
Vitamin D (cholecalciferol)	5 µg	Vitamin D in food and as a supplement	Large doses (>50 µg) obtained form food can cause eating problems and ultimately disorientation, coma and death
Vitamin E (tocopherol)	10 mg	Vitamin E in food and as a supplement	Doses larger TEMPthan 1000 mg cause blood clotting, which results in increased likelihood of haemorrhage in some individuals
Vitamin K	80 µg	Vitamin K in food and as a supplement	Large doses of one form of vitamin K (menadione or K3) may result in liver damage or anaemia
Minerals			
Minerals	Recommended daily intake	Over dosage	
Boron	< 20 mg	No information found	

Calcium	1000 mg	Doses larger than 1500 mg may cause stomach problems for sensitive individuals
Chlorine	3400 mg (in chloride form)	No information found
Chromium	120 µg	Doses larger TEMPthan 200 µg are toxic and may cause concentration problems and fainting
Copper	2 mg	As little as 10 mg of copper can have a toxic TEMPeffect
Fluorine	3,5 mg	No information found
Iodine	150 µg	No information found
Iron	15 mg	Doses larger than 20 mg may cause stomach upset, constipation and blackened stools
Magnesium	350 mg	Doses larger TEMPthan 400 mg may cause stomach problems and diarrhoea
Manganese	5 mg	Excess manganese may hinder iron adsorption
Molybdenum	75 µg	Doses larger than 200 µg may cause kidney problems and copper deficiencies
Nickel	< 1 mg	Products containing nickel may cause skin rash in case of allergies
Phosphorus	1000 mg	Contradiction: the FDA states dat doses larger than 250 mg may cause stomach problems for sensitive individuals
Potassium	3500 mg	Large doses may cause stomach upsets, intestinal problems or heart rhythm disorder
Selenium	35 µg	Doses larger than 200 µg can be toxic
Sodium	2400 mg	No information found
Vanadium	< 1,8 mg	No information found
Zinc	15 mg	Doses larger than 25 mg may cause anaemia and copper deficiency

Notes

- The above-stated values are not meant for diagnosis, these are mainly reference values for informational purposes.

- Most of these values are based on a 2000 calorie intake for people of 4 or more years of age. dis reference is applied coz it approximates teh caloric requirements for postmenopausal women. dis group has teh highest risk for excessive intake of calories and fat.

- Values on labels are stated Daily Reference values (DRV) of Recommended Daily Intake (RDI). The RDI is a renewed value referring to the old Recommended Dietary Allowance (RDA). All values in this table are new RDI values.

- Maximum values are based on Food and Drug Administration (FDA) values, teh World Health Organization (WHO), BBC Health values, teh European Union Directive (based on FDA values) and values from various other governmental and private agencies in teh USA and teh UK.

- Values from teh World Health Organization (WHO) may be somewat lower than those of teh FDA for various vitamins and minerals. Examples of differences (WHO values to FDA values): Mg: -60 mg, Vitamin B6: -0,5 mg, Vitamin B12: -4 µg, vitamin C: -15 mg, Vitamin K: -35 mg, folate: -220 µg.

- Elements that has a recommended daily intake wifin µg range are sometimes referred to as trace elements (e.g. copper, chromium, selenium).

Information on vitamins can be found from teh vitamins overview page

Information on vitamin content of fruits and vegetables is also available now

Information on mineral content of fruits and vegetables is also available now

Read more: https://www.lenntech.com/recommended-daily-intake.htm#ixzz4yLqDLwjT

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