

Evaluating the Fasting Effect on the Level of Heavy Metals and Electrolyte Elements for Iraqi People in Ramadan

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ABSTRACT: In most healthy individuals, intermittent fasting during Ramadan, which occurs just once a year, could have positive effects on metabolic consequences. That even though there are several exceptions to fasting, many Muslims who have medical issues choose to fast. This may have a significant influence on their health if not addressed properly. The health consequences of Ramadan fasting have recently sparked renewed study. This study is designed to evaluate the effect of fasting in Ramadan on the level of some metals and minerals compare these levels with a control group that is not fasting during Ramadan and show the effect of Ramadan on the health of fasting people. It was a study consisting of two categories. The first group was composed of 50 people (males and females) who fasted during Ramadan, while the second group was composed of 50 people who ate and drank during Ramadan. From both groups tacked 5 ml of venous blood to estimate the concentration of metals which include: cadmium (Cd), lead (Pb), copper (Cu), zinc (Zn), calcium (Ca), chromium (Cr), magnesium (Mg), potassium(K) and sodium (Na) during Ramadan month. The present study found that the concentration of cadmium, lead, copper and magnesium increase significantly in fasting group as compared to control group (with p- value =0.001 for Cd and p= 0.000 for other). whereas no significant difference in concentration of calcium, sodium and potassium between the fasting and control group. The results showed that fasting in Ramadan not affect the level of calcium, sodium and potassium, whereas the levels of cadmium, lead, copper, magnesium and chromium were affected, since they increased during fasting except chromium decreased. However, observing healthy food guidelines while fasting throughout Ramadan can lessen these alterations.

Keywords: Heavy metals, Electrolyte elements, Ramadan fasting, Healthy foods. Heavy metal



1. INTRODUCTION

Muslims observe fasting during the holy month of Ramadan. More than 1.5 billion Muslims worldwide engage in this type of intermittent fasting every year during the month of Ramadan. The ninth month of the Islamic calendar is Ramadan. Muslims around the world must observe a 29–30-day fast during this month. Depending on the season and geographic region, Ramadan's daily fasting period might range from 12 to 18 hours [1]. Throughout fasting, typical living, sleeping and waking patterns, diet, physical activity and the amount of food and water consumed all change [2]. Fasting during Ramadan is related to a variety of metabolic and endocrine alterations in humans [3]. Compounds with atomic densities of more than 4 g/cm³ are classified as heavy metals [4]. These elements have a high density and can be extremely hazardous even in low amounts [5]. Heavy metals include arsenic, lead, cadmium, and mercury that are most detrimental to human health, according to studies. Heavy metals' acute toxicity can lead to lung cancer, hyperkeratosis, alterations in pigmentation, and skin cancer [6].

Heavy metals are renowned for their widespread environmental dispersion, propensity to accumulate in certain biological tissues, and general capacity to be harmful even at relatively low exposure levels. While some (such as Cd, Pb, and Hg) are xenobiotics that have no functional function in human physiology even at trace levels of exposure, others (such as Cr, Mn, Zn, et al.) are necessary for the operation of crucial enzyme systems. But at very high exposure levels, even necessary metals have the potential to be dangerous [7]. Heavy metal toxicity is associated with a number

of health issues and has been demonstrated to pose a significant risk. These metals have toxic effects that are harmful to human health and capacity to function normally, even though they have no biological role. Sometimes they act as a nonexistent part of the body; on rare occasions, they may even interfere with metabolic processes [8].

Cadmium is known to cause cancer via mechanisms such as the development of oxidative DNA damage [9] and epigenetic alterations such as gene silencing via changes in DNA methylation patterns [10]. Zn traces are necessary for spermatogenesis, skeletal development, skin protection, brain development, and clinical atherosclerosis improvement, among other things [11]. During the absorption and utilization process, Zn interacts with other metals such as Ca, Cd, Fe, Cu and Cd accumulating in high Zn concentrations. Zn is notable for having numerous antithetical effects on other elements, and as a result, Zn has been found to have protective properties against Cd poisoning [12].

Because Lead is a metal that is not necessary, any amount of it in the body could be considered pollution [13]. It is a divalent cation (Pb^{+2}) that exists in both organically and inorganically [14]. It is present in the crust of the Earth by nature. Since it is mostly brought on by human activities, it is common in the environment of industrialized cities [15]. Because it is a structural component of bones, teeth, and soft tissues and is crucial to many of the body's metabolic functions, calcium is one of the most crucial nutrients in the diet. One to two percent of an adult's body weight is made up of it, 99 percent of which is kept in their bones and teeth. Calcium is also essential for proper blood clotting, and has a key role in the physiology of muscular contraction [16]. Aims of the present study is to reveal the effect of Ramadan fasting on the general health of fasting people through estimating the concentrations of cadmium (Cd), lead (Pb), copper (Cu), zinc (Zn), calcium (Ca), magnesium (Mg), sodium (Na), potassium (K) and chromium (Cr) in serum of fasting individuals during Ramadan month and the results are compared to the concentrations of these elements in control individuals.

2. PATIENTS AND METHOD

This study involved 100 participants, who were split into two groups. The first group was composed of 50 people (males and females) who fasted during Ramadan (Apr- May -2022), while the second group composed of 50 people who ate and drank during Ramadan. Both groups with ages ranged between (25-55) years. The objectives of the study were explained to each participant then took an informed consent. Any fasting person with a history of a systemic condition, the use of any drugs was among the exclusion criteria.

2.1 SAMPLE COLLECTION

Venous blood samples (5 mL) were obtained via vein puncture from fasting people and control group subjects; 3 mL was kept in a plain tube for analysis of Lead, Cadmium, Magnesium, Calcium, Sodium, Chromium and Potassium using Buckman Scientific atomic absorption. Another 2 mL was centrifuged at 3000 rpm for 15 minutes to get the serum, and 0.1 ml of serum was diluted to a total amount of 1 ml using 6% n-butanol solutions before being tested for copper and zinc levels.

2.2 BIOMEDICAL ANALYSIS

At the antitoxication Consultation Center in Medical City, the biochemical analysis was finished. Before being analyzed, frozen blood and serum were given time to melt and reach room temperature. They then had a biochemical examination. Using a consistent approach, the following elements were measured by a flame atomic absorption spectrophotometer [17]: cadmium, lead, copper, zinc, magnesium, calcium, sodium, chromium, and potassium.

3. STATISTICAL ANALYSIS

- SPSS (Statistical Process for Social Science), version 14, was used to examine the data.
- In this study, descriptive statistics such as standard deviation, mean, maximum and minimum were employed.
- There were also inferential statistics such as p-value, the Student t-test and Pearson correlation. P 0.05 was considered significant, and P 0.01 was considered highly significant.

4. RESULTS

Descriptive data for the present study revealed that the means of cadmium (Cd), lead (Pb), copper (Cu) and magnesium (Mg) in fasting people were higher than those in the control group.

On the hand the present study showed that the means of zinc (Zn), calcium (Ca), sodium (Na), chromium (Cr) and potassium (K) in the fasting group were lower than that in the control group as revealed in Table 1.

Table 1. - Descriptive Statistics (Mean and Standard Deviation for all Variables in Fasting People and Control Group in the Study)

Heavy metal and elements	N	Fasting people		control group	
		Mean	Std. Deviation	Mean	Std. Deviation
Cd	50	0.170	0.033	0.150	0.030
Pb	50	20.140	2.785	14.680	2.638
Cu	50	148.620	7.373	119.020	16.761
Zn	50	74.260	5.975	96.340	15.184
Mg	50	1.342	0.152	1.200	0.077
Ca	50	8.798	0.592	8.804	0.540
Na	50	146.240	5.270	147.240	6.096
Cr	50	0.012	0.004	0.154	0.030
K	50	4.252	0.519	4.376	0.660

The current study found that there is a significant difference in the concentration of cadmium, lead, copper, magnesium and chromium between the two groups: fasting and control group whereas no significant difference in the concentration of calcium, sodium and potassium between fasting and control group as in Table 2.

Table 2.- Significance Difference between all Variables

Pairs	T	df	Sig. (2-tailed)
Pair 1 Cd1 - Cd2	3.494	49	0.001
Pair 2 Pb1 - Pb2	9.801	49	0.000
Pair 3 Cu1 - Cu2	11.465	49	0.000
Pair 4 Zn1 - Zn2	-9.238	49	0.000
Pair 5 Mg1 - Mg2	5.983	49	0.000
Pair 6 Ca1 - Ca2	-0.055	49	0.957
Pair 7 Na1 - Na2	-0.924	49	0.360
Pair 8 Cr1 - Cr2	-32.447	49	0.000
Pair 9 K1 - K2	-1.000	49	0.322

The present study found that in the fasting group there are positive correlations between each of (cadmium and lead), (copper and zinc), (copper and sodium), (zinc and potassium), (magnesium and chrome), (calcium and chromium). Also, the current study revealed that there is negative correlation between each of (cadmium and sodium), (copper and zinc), (copper and calcium), (copper and chromium), (magnesium and sodium), (calcium and sodium) in the fasting group as in Table 3.

Table 3.- Correlations between all Variables in the Fasting Group

	Pb1	Cu1	Zn1	Mg1	Ca1	Na1	Cr1	K1	Age1
Cd1	R 0.435(**)	0.116	-0.058	0.152	0.168	-0.463(**)	0.043	0.178	-0.139
	P 0.002	0.424	0.691	0.293	0.244	0.001	0.768	0.216	0.336
Pb1	R	0.099	-0.103	-0.111	0.157	-0.218	-0.135	0.075	0.139
	P	0.494	0.477	0.445	0.275	0.129	0.351	0.603	0.337
Cu1	R		-0.681(**)	-0.341(*)	-0.468(**)	0.414(**)	-0.334(*)	-0.138	0.186
	P		0	0.015	0.001	0.003	0.018	0.339	0.195

Zn1	R		0.266	0.324(*)	-0.284(*)	0.341(*)	0.471(**)	0.029
	P		0.062	0.022	0.046	0.015	0.001	0.841
Mg1	R			0.400(**)	-0.385(**)	0.435(**)	0.222	-0.465(**)
	P			0.004	0.006	0.002	0.122	0.001
Ca1	R				-0.487(**)	0.559(**)	0.348(*)	-0.363(**)
	P				0	0	0.013	0.01
Na1	R					-0.439(**)	-0.319(*)	0.316(*)
	P					0.001	0.024	0.025
Cr1	R						0.274	-0.448(**)
	P						0.054	0.001
K1	R							-0.107
	P							0.461

r: Pearson Correlation p: Sig. (2-Tailed)

In addition to that the current study found in the control group that there are positive correlations between (cadmium and lead) and (magnesium and calcium), also in the same group there are negative correlations between (cadmium and potassium), (magnesium and sodium) and (calcium and sodium) as in Table 4.

Table 4.- Correlations between all Variables in the Control Group

		pb2	Cu2	Zn2	Mg2	Ca2	Na2	Cr2	K2	Age
Cd2	R	0.424(**)	0.076	0.157	0.129	0.252	-0.237	0.163	-0.429(**)	0.175
	P	0.002	0.6	0.277	0.372	0.077	0.098	0.259	0.002	0.224
pb2	R		0.223	0.119	0.127	0.154	-0.153	0.224	-0.291(*)	0.136
	P		0.119	0.409	0.381	0.285	0.29	0.118	0.041	0.345
Cu2	R			-0.134	0.122	0.202	-0.193	-0.246	-0.048	0.149
	P			0.353	0.399	0.159	0.179	0.086	0.74	0.301
Zn2	R				-0.232	-0.303(*)	0.297(*)	0.059	-0.15	0.314(*)
	P				0.105	0.032	0.036	0.685	0.297	0.026
Mg2	R					0.869(**)	-0.906(**)	0.249	-0.132	-0.093
	P					0	0	0.081	0.362	0.52
Ca2	R						-0.997(**)	0.313(*)	-0.113	-0.098
	P						0	0.027	0.434	0.497
Na2	R							-0.308(*)	0.118	0.099
	P							0.03	0.414	0.493
Cr2	R								-0.095	-0.059
	P								0.51	0.684
K2	R									-0.171
	P									0.236

*Correlation is significant at the 0.05 level (2-tailed).

**Correlation is significant at the 0.01 level (2-tailed).

5. DISCUSSION

A fundamental ceremonial obligation of the Islamic religion, fasting has its roots in all three Abrahamic faiths and is observed annually by millions of Muslims worldwide during the holy month of Ramadan.

Until dusk, when they break their fast with a meal known as Iftar, Muslims abstain from eating, drinking, and having sex. They achieve this by having a meal known as suhoor before sunrise [18]. Although Ramadan is a month of fasting, most civilizations eat foods heavy in calories, fat, and carbohydrates when they are not fasting [19].

According to the findings of this study, fasting people had significant increase in cadmium, lead, copper, and magnesium blood level. This conclusion can be explained by the fact that Muslims all over the world prepare and serve traditional Suhoor and Iftar meals, as well as snacks that can be enjoyed between the two meals at night. This study agrees with a study conducted by Shimizu and Morita, 1990 [20]. Since they found that the Fasting increased cadmium intake. Also, this finding contradicts the findings of another study conducted by Moshrefi Zenoozi Z, Noori SMA, 2017

[21] who observed that fasting increased lead excretion in the urine and feces. Furthermore, the same study's findings accord with our findings because Mice were given 75 mg/kg of cadmium to study toxicity. Cadmium consumption was significantly higher in the test animals after 24 hours of fasting contrasted to the control group. In addition to that the current study found that there was non-significant decrease in calcium, sodium and potassium in fasting people during Ramadan. Furthermore, the study concurs with the findings of Bילו, 1998 [22], who concluded that calcium concentrations fall during fasting due to a drop in blood total protein and albumin concentrations. These results disagree with the results of a study conducted by Teimour and Keyvan, 2020 [23] since they found that potassium and sodium significantly increased in the fasting group.

In addition, the current study found a positive link between cadmium and lead in the control group, whereas Ying Wang et al., 2012 [24] found cadmium to be connected with the majority of important components in both urine and feces. Furthermore, there were strong direct relationships between cadmium and zinc contents in both urine and feces, and lead was significantly positively associated with copper in blood and zinc in urine, which contradicted our findings.

6. CONCLUSION

The results showed that fasting in Ramadan not effect on the levels of calcium, sodium and potassium, whereas the level of cadmium, lead, copper, magnesium and chromium were affected, since they increased during fasting except chromium decreased. However, observing healthy food guidelines while fasting throughout Ramadan can lessen these alterations. According to the research that is now available, it appears that fasting during Ramadan does not negatively impact health provided one adheres to a few health recommendations like maintaining good hydration and eat different types of food in the night. Fasting is also useful in promoting physical health if one maintains a good diet, refrains from overeating from Iftar to dawn, and drinks enough water.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest

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