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# INVESTIGATION OF EFFECT OF FRYING AND SOAK IN CITRIC ACID AND TH EN FRYING ON THE CHANGES OF SOME HEAVY METALS IN SHEEP'S LIVER

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## ABSTRACT

Heavy metals in drinking water and food can have adverse effects on human health, including the effe cts of limb loss, cancer, nervous system disorders of the immune system is impaired and in extreme ca ses can cause life-threatening. The liver, in addition to having high nutritional properties as one of the major organs in the body, treatment of animals, can be a variety of contaminants including heavy met al pollution. In this regard, this study examined the effect of frying on the concentration of the heavy metals Pb, Cd, Fe per kilogram of lamb's liver. Experimental results indicate that the relationship betw een heavy metals Pb and Cd antagonism exists, IE the, an increase in one of these metals, other metals can be reduced, probably due to the heavy metals cadmium, Pb and heavy metal increases in the fryin g in this study because it is. Due to the benefits of the element iron fry for two minutes and soak in cit ric acid and then frying the raw liver increase.Keywords: Sheep's liver, Heavy metals, Frying, Citric a cid.

## INTRODUCTION

Sheep liver contains large amounts of vitamins A, D, C, $B_{12}$ is. The liver is rich in folic acid and Fe. Nearly double that of sheep liver, beef liver, but slow digestion property. After using lamb's liver gets better. Higher liver protein, but lower i n fat than red meat. Liver iron is red meat, but th ree times more cholesterol than red meat **(Arma n, 2013)**. For this reason, the sheep liver is a good source of nutrition that the past is a sp ecial place in our diet. The liver, in addition to having high nutritional properties because livestock is one of the major organs in the b ody treatment, may contain a variety of cont aminants including heavy metal pollution, w hich in different ways (water, fodder and inh aled air) enters the trap body and accumulat e in the liver **(Akan *et al*., 2010)**. Metal and nonmetal abnormal amounts enter the body i f they are causing significant problems **(Spi erenburg *et al*., 1988)**. Some metals are ben

eficial and others are harmful to our health **(Selinus *et al*., 2005)**. Heavy metals are thos e chemical elements according to their densi ty is greater than 5 g/cm³. These elements in clude the central part of the periodic table of elements and transition metals and oxide or sulfide may be released. Unlike most heavy metals, organic compounds and other conta minants in environmental degradation is not the most stable form. Heavy metals in drinki ng water and food can have adverse effects on human health, including the effects of li mb loss, cancer, nervous system dysfunction in the immune system is impaired, and in e xtreme cases can cause life-threatening **(Rez van and Hashemi-nejad, 2013)**. Routes of entry into the body of heavy metals in mam mals typically through contaminated air in i ndustrial areas after a rain water and dirt are the mini. The heavy metal poisoning caused by drug use, including Fe, mg, Al or Be are. In discussing the health of humans metals s uch as Pb, Hg, Cu, Cd, Ni, Cr and etc., exce pt heavy metals that many of these elements and their compounds in terms of their adver se effects and except harmful toxins hazardo us environments pose around. The toxins in the air we breathe, drinking water, building materials, kitchen appliances and even cloth es are. One of the most fundamental issues r egarding the lack of metabolized of heavy m etals in the body. In fact, after entering the b ody of heavy metals from the body and no o ther tissues such as fat, muscles, bones and j oints will be deposited accumulate. This is c ausing the illnesses and complications in the **body (Vassen, 1985)**. **Rudy (2008)** study o f various sheep organs, including the liver a nd the relationship between aging and the ac cumulation of heavy metal animals did. Lev els of Cd, Pb and Hg in the liver of sheep in the part of Poland in the years 2002 to 2006 were studied, that the amount of Cd 0.109, 0 .116, 0.180, 0.221, 0.294 mg/kg and Pb 0.07 1, 0.076, 0.115, 0.141, 0.188 mg/kg of Fe 0. 001, 0.001, 0.002, 0.006, 0.001 were reporte d. **Akan *et al* (2010)**, heavy metals such as Pb, Cd, Fe and some other elements in some animals such as sheep examined. **Stoev *et a l*., (2003)** in a study of Cd in mammals 70-3 00 µg/kg was reported. Consumption of raw or half-cooked liver is the most common ro ute of human infection with various parasite s and diseases the liver should be fully cook ed. In this regard, this study examined the ef fect of frying on the concentration of the hea vy metals Pb, Cd, Fe in sheep's liver.

## MATERIALS AND METHODS

### Sample Preparation and Frying

The sheep’s liver was kept in cold iced boxe s and transported to the laboratory within 2h. On arrival at the laboratory, fresh liver was washed with tap water several times to remo ve blood and slime. Samples were filleted an d cut into (2×2cm) pieces and then the livers pieces were divided into five groups. The fi

rst group was raw sampled. The second grou p was fried samples for 10 min in 180˚ C an d sunflower oil was used as the medium for pan-frying. The third, fourth and fifth group were raw samples which lemon juice (as a ci tric acid resource) was added to them for (2, 5, 7) min, then were washed with tap water f or several times to remove citric acid then w ere fried (190˚C, 10 min). The samples were homogenized in stainless-steel meat mincer and a blender and each group was analyzed i n the same way **(Figure 1)**.

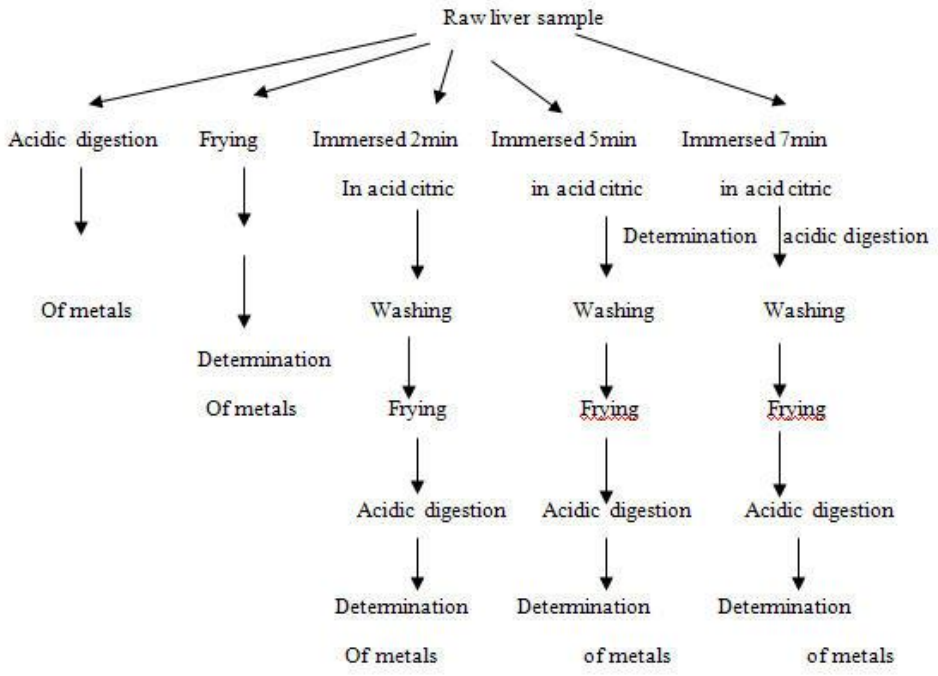


**Figure 1: Flow diagram of procedure**

**Digestion Procedures**

A sample (1.5 gr) of the homogenized sampl e was placed in a 50 ml digestion tube, and 5 ml of concentrated $HNO_3$were added where necessary, then the sample was heated slowl y to dissolve, the solution was filtered with Whatman NO.42 filter paper and made up to volume with distilled water. A blank digest was carried out in the same way. All metals were determined against queues standards.

**Analytic Procedure**

Determination of all metal concentration wa s carried out by inductively coupled plasma atomic spectrometry (ICP-AES). Following the absorption lines were used: Cd 226.502, Fe 259. 940, Pb 220.353. Metal concentratio ns were calculated in ppm dry weight. The i nstrument detection limit was 0.1ng. From t his point forward, all metal concentrations a re expressed as µg/gr dry weight.

**The Population**

The population of cells is taken from the sla ughterhouse Tehran after sample preparatio n according to the above methods. In this re gard, the treatments are defined as follows:

T1: Raw liver

T2: Raw liver fried

T3: Raw liver was immersed for two minute

s in citric acid and then fried

T4: Raw liver for five minutes and then im mersed in citric acid-fried

T5: Raw liver seven minutes in citric acid di pped and then fried

T6: Liquid oil

T7: Lemon juice

**Statistical Analysis**

Analysis of variance was used to evaluate th e analysis data, and significant differences a mong means were determined by one way a nalysis of variance (ANOVA) and Duncan's multiple range test (p=0.05) ($SPSS_{V18}$).

**RESULT**

Cd levels in raw liver (treatment 1) the amo unt 0.295 ppm and Raw liver fried (treatmen t 2) showed little 0.429 ppm. Raw liver was fried when the difference between -0.134 to indicate that thedifference is statistically sig nificant **(Table 1)**. Therefore increase the a mount of cadmium in the raw liver frying is. The amount of Cd in the liver, fried raw, ra w liver in comparison with two minutes and then fried and dipped in citric acid (treatmen t 3) and Raw liver treated five minutes and s even minutes in citric acid dipped and then f ried (treatments 4 and 5), respectively, a diff erence of 0.033, 0.034 and 0.033 respectivel y, the difference is not statistically significa nt and that means that when two, five and se ven minutes in citric acid and then fried live r is only slightly reduced levels of Cd (Figur e 1). Raw liver treatments (treatment 1) and vegetable oil (treatment 6) were 0.29, there i s a significant difference and this indicates t hat the amount of Cd in the liquid oil is very small compared with the raw liver and the p ossibility of Cd in the liver and cause errors in testing liquid oil samples absent **(Figure 1)**. Raw liver treatments and lemon juice tre atment (treatment 7), no difference was foun d equal to 0.24, which is significantly differ ent and this indicates that the amount of Cd found in lemon juice is very small in compa rison with the raw liver. And

the possibility of lemon juice Cd in liver sam ples and the error at trial absent **(Figure 1)**.

**The Pb**

The amount of Pb in raw liver (treatment 1) the amount 1.850 ppm and Raw liver fried (t reatment 2) showed little 1.733 ppm. When the liver was fried raw, the metal showed a decrease of about 0.117 is not statistically si gnificantly different (Table 2). So fried the r aw liver caused a slight decrease in the amo unt of Pb in it. The amount of Pb in crude li ver fried with raw liver for two minutes and then fried and dipped in citric acid (treatmen t 3) difference equal to -0.407 to be revealed , which is a statistically significant differenc e (Table 2). When the two minutes and then fried liver with citric acid to increase the am ount of metallic Pb. The amount of Pb in cru de liver fried with raw liver for five minutes and then immersed in citric acid fried differ ence equal to -0.23 to indicate that the differ

ence is statistically significant (treatment 4). When the five minutes and then fried liver a re placed in citric acid, increases the amount of metallic Pb **(Figure 2)**. The amount of P b in crude liver fried with raw liver seven m inutes in citric acid dipped and then fried (tr eatment 5) difference equal to -0.203 to sho w that the difference is significant. When th e seven minutes and then fried liver are plac ed in citric acid, increases the amount of me tallic Pb **(Figure 2)**. Between treatment 1 (r aw liver) and treatment 10 (oil) showed a dif ference of 1.824, which is a significant diffe rence this indicates that the amount of Pb in liquid oil is very small compared with the ra w liver **(Figure 2)**. And the liquid oil likely Pb to liver samples and the error in testing t here. Raw and treatment bitter lemon juice d ifference between treatments was observed t hat a significant difference is equal to 1.653 and indicated that the amount of Pb found in lemon juice is very small compared with th e raw liver **(Figure 2)**. And likely Pb to erro rs in the lemon juice and liver samples teste d there.

**The Fe Concentration**

Raw liver in the treatment of Fe content in t he 279.20 ppm and Raw liver fried treatmen t showed little 317.36 ppm. When was fried raw liver Fe levels increase about -38.16 Th ere is a statistically significant difference **(T able 3)**. So frying increases the amount of F e in the liver raw, raw liver in comparison w ith the two-minute difference in citric acid d ipped and then fried for -0.63 revealed the d ifference is not statistically significant **(Tabl e 3)**. When the two minutes and then fried li ver are placed in the citric acid causes a slig ht increase in the amount of metallic Fe. Fe i n the body increases the body's resistance to disease, contributing to the growth of the bo dy, prevents fatigue in the body and is essen tial for energy production in the body. The e nergy the body needs to convert sugar, prote in and fat to ATP. And when the body cann ot use ATP production requires the presence of Fe, production of Catalase: Catalase is a n enzyme that also rotates the body of free r adicals (oxygen atoms) to collect **(Jarup, 20 13)**. Test results indicate a beneficial effect of Fe overload and frying for two minutes a nd then soak in citric acid-fried lamb's liver. The amount of iron in the treatment of raw l iver fried in comparison with raw liver for fi ve minutes and then fried and dipped in citri c acid showed a difference of 5.35, The diff erence is not statistically significant. When t he five minutes and then fried liver are place d in the citric acid causes a slight decrease i n the amount of metallic Fe **(Figure 3)**. The amount of Fe in the liver, fried raw, raw live r incomparison with seven minute citric acid dipped and then fried in a division of 14.71 showed, when the seven minutes and then fr ied liver are placed in citric acid reduces the amount of metallicFe **(Figure 3)**. The liver

treatment difference between raw and treate d liquid oil is equal to 278.3 showed a signif icant difference this indicates that the amou nt of Fe in the liquid oil is very small compa red with the raw liver **(Figure 3)**. And the possibility of liquid Fe in the liver samples, and the error in testing there. Raw and the tr eated bitter lemon difference between treat ments was observed that a significant differe nce is equal to 267.6 this indicates that the a mount of Fe in the lemon juice is very small compared with the raw liver. And the possi bility of Fe from the liver and causing lemo n juice samples tested, there is no error **(Fig ure 3)**.

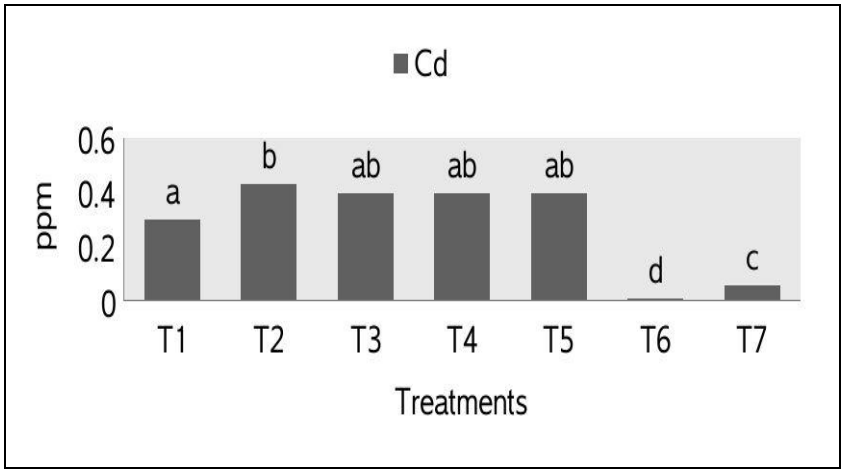


**Figure 1: The amount of Cd in all treatments**

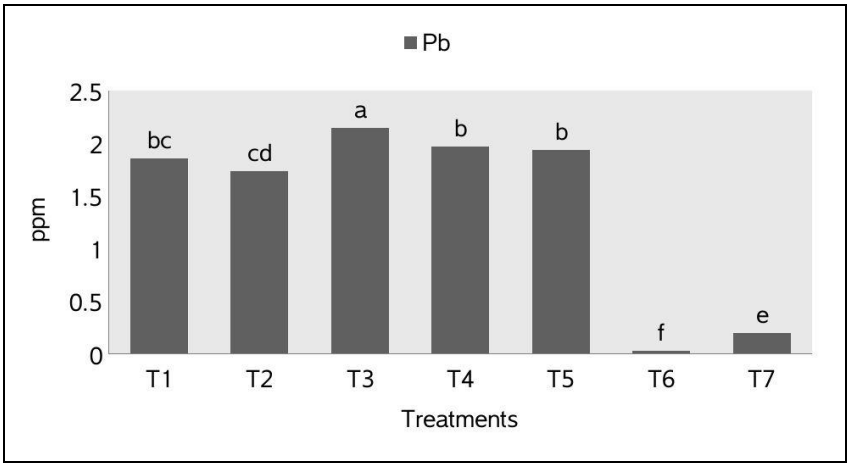


**Figure 2: Heavy metal concentrations Pb in treatment**

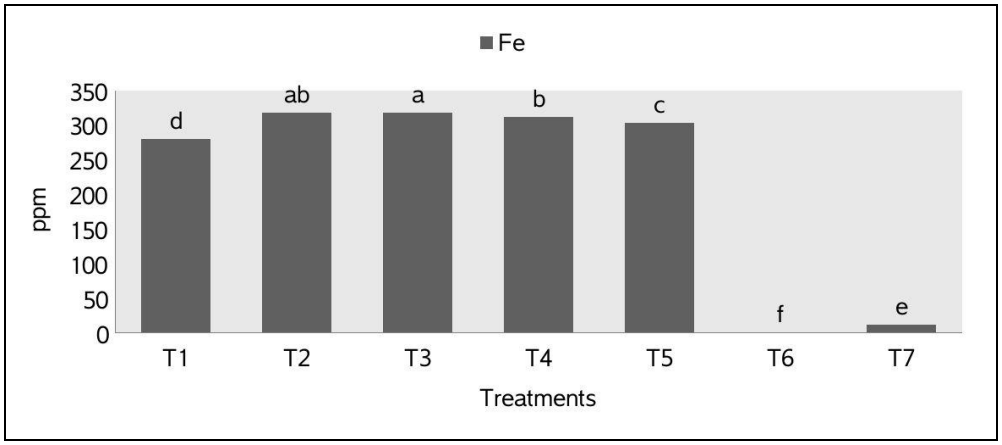


**Figure 3: The amount of Fe in the treatment**

**DISCUSSION**

Given the amount of Cd allowed standard ac ross Europe Union **(EU Commission, 2001)** , Germany **(Kreuzer *et al*., 1998)**, Slovak R epublic **(Kottferova and Korenekova, 199 5)** and Northern Europe **(Abou-Arab, 2001)** The 0.5 µg/g has been determined accordin g to the results of the tests that were done fr ying Raw liver in 0.429 ppm the permitted l evel of Cd in the liver of sheep is lower. Sev eral studies on the measurement of Cd comp ared with its allowance has been made. **Far mer and Farmer (2000)**, Cd and Pb levels i n sheep liver studied in three regions of Kaz akhstan and Standard MAC (maximum allo wable concentration) were compared. Conce ntrations of Cd and Pb in Ulanskiy, 0.17 and 1.16 kg in the Tavricheskiy, both small amo unts and in Tarbagatayskiy, 0.27 and 0.96 m g/kg were reported. **Rudy (2008)**, a study of some heavy metals on various sheep organs , including the liver, it did. Levels of Cd, lea d and mercury in the liver of sheep in the pa rt of Poland were examined, the amount of Cd 0.109, 0.116, 0.180, 0.221, 0.294 mg/kg and Pb 0.071, 0.076, 0.115, 0.141, 0.188 mg /kg and Fe 0.001, 0.001, 0.002, 0.006, 0.001 were reported. The Committee approved le gislation limit Cd in the liver of sheep 0.5 m g/kg and the maximum allowable Pb in shee p liver 0.1 mg/kg and the maximum authoriz ed under 0.001 mg/kg of mercury is announ ced, the average value of Cd and Pb in the li ver of the sheep was within range, however, excessive amounts of Hg were reported. The results fry lamb liver Pb level was slightly r educed. The plunge in crude liver citric acid and then frying the Pb content was increase d. Pb is a bluish-white metallic element that is highly toxic. The element has a metallic l uster, highly malleable and ductile, low con ductivity and high resistance to corrosion **(N riago *et al*., 2009)**. The maximum amount o f Pb in the liver and then in the gills and the n accumulates in the kidney and ovary creat ures, but fortunately retained the lowest in muscle organisms (Farmer and Farmer., 200 0). The amount of Pb in raw liver test values

in 1.850 ppm fried livers showed little 1.73 3 ppm. When the liver was red raw, the met al showed a decrease of about 0.117. The all owable level of Pb in Europe and Northern Europe 0.5 µg/g **(EU Commission, 1997; A bou-Arab, 2001)**, Slovakia 1 **(Kottferova a nd Korenekova, 1995)** and the UK 2 (UK Ministry of agriculture Fisheries and Food, 1998) have been determined. The amount of Pb used in the experiments was lower than Standard English. In the context of the heav y metal Pb in sheep liver, several studies ha ve been done. **Husain *et al*., (1996)**, the am ount of Cd and Pb in liver of sheep in Kuwa it as part of their review and how to arrange it 0.125 and 0.044 µg/g dry weight, respecti vely. Liu (2003) levels of Pb in liver of shee p on the part of China to measure the extent of 0.72 µg/g dry weight, respectively. The p resent study showed that the 1.8503 mg/kg o f lead in liver investigates the values obtaine d in the investigation **Akan (2010)** shows a l arger amount. But in contrast to research **Sw aile *et al*., (2009)**, the Pb content in the sam ples tested in the present study showed a lo wer rate. Of the micronutrient Fe for blood i n the body. Its deficiency can cause major di sturbances in different parts of the body. Fe deficiency is the most common nutritional p roblems in developing countries and the mo st common cause of nutritional anemia in ch ildren and women of childbearing age is by creating smaller and reduces the amount of hemoglobin in red blood cells decreases can be physical or psychological **(Jarup, 2013)**. However, increased accumulation Fe in the body can increase the risk of heart attacks a nd cancer (esophagus, and gallbladder), the studies at Harvard University indicates that most of the Fe in meat is the cause of this co ndition, the cause of which is unknown **(Sm ith *et al*., 2006; Jarup, 2013)**. **Akan *et al*., ( 2010)**, heavy metals such as Pb, Cd, Fe and some other elements in some animals such a s sheep examined. The amount of heavy met als in liver and kidney of cattle and beef catt le had the lowest rate was the highest. Pb le vels in sheep liver 0.25 µg/g, Cd levels 0.22 µg/g and Fe levels 2.13 µg/g was reported. I n this experiment the amount of Fe in the liv er and frying for two minutes soak in citric a cid and frying 317.36 and 317.99 ppm, resp ectively, increased. The usefulness of Fe in t he body due to the two treatments are chose n. **Tuzen (2003)** also test the levels of Cd an d Pb and Fe in the form of fish in the Black Sea in Turkey respectively 0.48 to 0.09 and 0.85 to 0.22 and 32.40 to 9.52 µg/g dry weig ht reported.

**CONCLUSIONS**

Studies, researchers showed that a correlatio n exists between the different metals in fish. Several studies showed that this association may be synergistic effects (increase of the metal), or antagonism (reduction of metal) h as **(Jezierska and Witeska, 2001)**. The rela

tionship between heavy metals lead and Cd antagonism exists **(Golmohamadi, 2003)**, t he increase of one of these metals, other met als can be reduced, probably due to the heav y metals Cd, Pb and heavy metal increase in the fry in this study because it is. Due to the benefits of the element Fe frying for two mi nutes and soak in citric acid and then frying the raw liver increases.

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