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ACCUMULATION OF HEAVY METALS UPTAKE IN BALADY BREAD PRODUCED FROM WHEAT CULTIVATED ON FISH PONDS DURING THE WINTER SEASON

Nahla M. M. Hassan[1]; A. F. Fath El - Bab[2] and Noha M. Mohamed[3]

[1] Food Technology Research Institute, Agric. Res. Center, Cairo, Egypt,

[2] Central Laboratory for Aquaculture Research at Abbassa, Agriculture Research Center

[3] Regional center for food and feed, Agriculture Research Center

ABSTRACT

This study aimed to study the effect of exploitation of fish ponds in the cultivation of wheat during the winter season on uptake heavy metal accumulation in balady bread prepared from produced wheat. Six earthen ponds (4200 m²) were used in this study for Nile tilapia (*Oreochromis niloticus*) and wheat was cultured in these ponds for increase the overall yield per feddan. Fish were exposed to three treatments as follow: The first treatment fish were fed on artificial feed 25% crude protein only, in the second treatment fish were fed on artificial feed 25% crude protein with inorganic fertilization and in the third treatment fish were fed on artificial feed 25% crude protein with organic fertilization. Some Heavy metals (HMs) which may caused hazard effects on human health (Hg, As, Fe, Cu, Ni, Pb, Zn, Mn and Cd) were measured in water irrigation, soil, wheat grains and bread. The obtained result to revealed that the highest significant increase in all parameters resulted in organic fertilization. Heavy metals Cd, As and Hg concentrations were exceeded than the permissible limits in water. The concentrations of heavy metals lower than the safe limits at soil (expect Hg, As) , in wheat flour and bread. Health risk index (HRI) of Hg and As can reach to hazard level in bread and can affect on human being health. It was suggested to pay more attention on the potential added threat of HMs to the health of country inhabitants through consumption of wheat cultivated in fish ponds.

Keywords: fish ponds, heavy metals, winter wheat, balady bread

INTRODUCTION

Pond sediment would be a valuable resource for agriculture as an alternative organic supplement, but long-term use may require the cessation of the excavated sediment as agricultural landfill in order to restrict heavy metal contamination through it.

Crops-fish culture can actually increase crops yields (up to 10% in some cases) while providing farmers with an important source of protein and extra income. A perfect design is relatively inexpensive and of low-risk to fish farming in crop fields, and farmers generally follow this procedure. Alternative fish culture demonstrated a perfect design for gaining maximum outputs of land, water and manpower (Stefan, 2004).

The quality of bread, pastries and other products depends primarily on the quality of the flour as basic ingredient that is the quality of the wheat variety as basic raw material (Nan *et al*., 2002).

The polluted air and soil by undesirable some heavy metals due to chemicals that transfer into the soil then crops. The waste water are used for crop irrigation increased the contaminated risk of heavy metals (Shou-Chen *et al*., 2015).

The environmental pollution problems originated from accumulation some heavy metals such as As, Cd, , Pb, Mn, Hg and Ni in plant and soil from natural and artificial sources. These heavy metal accumulation increased at critical levels in living organisms from contaminated environment. The most toxic trace elements for living organisms – all belonging to the heavy metal (Abrahams, 2002).

In wheat, trace metal elements concentrations in plant parts follow a pattern with the concentration in roots > leaves > stems > grain. Thus, the potential hazard from metals is apparently reduced if only the grains are harvested and used as a food source (Topbaş *et al*., 1998).

El-Sheikh, (2003) and Tantawy, (2004) observed that, irrigation the soil with different water qualities led to an insignificant different on the available content of most trace undesirable some heavy metals (Co, Ni, Pb and Cd). They also observed that, the content of these trace metals was decreased with the increase of soil depth. Also Tantawy, (2004) found that, the irrigation water quality, soil properties and soil depth effect on the soil of Pb content.

Wheat cultivation in ponds during the winter period, taking into account feeding O. niloticus on artificial feed containing 25% crude protein with organic fertilization lead to increase the weights of fish, as well as increase the yield of wheat product from fish ponds in addition to that he was best in terms of economic efficiency compared to other treatments (Ahmed *et al.,* 2014).

Therefore, the aim of this study was to ascertain the forms of heavy metals in fish pond sediment and how the forms are linked to the wheat yield, the heavy metal uptake by wheat plants, and the health risks after consumption.

MATERIALS AND METHODS

Materials

Nile tilapia (Oreochromis niloticus) was obtained from private farm at Tollumbat No. 7 in Riyad City, Kafr El-Sheikh governorate, Egypt). Wheat kernels was obtained from field crops Research Institute, A.R.C. Egypt. Artificial feed containing 25% protein, and poultry manure were purchased from private sector. Urea and triple super-phosphate were purchased from Agricultural evident at Giza. The main source of water that from the agricultural drainage water chanel from El- Gharbia governorate, Egypt.

Methods:

Experimental design:

Fish was exposed to three feeding treatments containing artificial feed contain 25% crude protein but differ in the other portion of feeding which contained separately organic (manure) or inorganic fertilization (urea and triple super phosphate) for 22 weeks for fish culture of private farm mainly (Tollumbat No. 7 in Riyad City, Kafr El-Sheikh governorate, Egypt). Fertilization was conducted weekly by broadcasting of poultry manure (50 kg/ fd) or 2kg urea mixed with 8kg/feddan of triple super-phosphate dissolving in water and splashed all over the experimental ponds water as organic and inorganic fertilization, respectively. At the beginning of October, fish was harvested and wheat seeds were planted at 3 rd week of November without fertilization.

Mill 0f wheat grains

All samples of whole wheat grains were milled in a via laboratory mill (1400, Perten) to obtain whole wheat flour. While wheat flour 82% extraction obtained by Brabander mill.

Analysis of heavy metals

Concentrations of Cd, Cu, Pb, Zn, Ni, Mn, Fe, As and Hg in the filtrate of digested soil, water, wheat grain and bread samples (made from 82% extraction) were determined by using an atomic absorption spectrophotometer (Model 2380, Perkin Elmer, Inc., Norwalk, CT, USA). The instrument was fitted with specific lamp of particular metal and calibrated using manually prepared standard solution of respective heavy metals as well as drift blanks. Standard stock solution of 1000 ppm for every metal was obtained from Merck. These solutions were diluted for desired concentrations to calibrate the instrument. (A. O. A. C., 2012)

Preparation of balady bread

Balady bread prepared described by Mohamed *et al.,* (1996).

Enrichment Factor (EF)

To examine the translocation of heavy metals from the soil to the edible portion of bread and to show the difference in metal concentrations between the soil and bread, the enrichment factor (EF) was calculated by using the formula given by Buat-Menard and Chesselet (1979):

$$\mathbf{EF} = \frac{\textbf{Concentration of metal in bread}}{\textbf{Concentration of metal in soil}}$$

The Daily Intake of Metals (DIM) through bread consumption

The Daily Intake of Metals (DIM) through bread consumption was determined by the following equation.

$$\mathrm{DIM} = \frac{C\ X\ D\ I\ Bread}{B.W.}$$

Where:

C = Metal concentration in bread (mg / kg)

DI_{Bread} = Average Daily Intake of Bread (g /day)

Bread: weight of bread 130g on fresh (moisture 27%)
Bread on dry weight 178g
B.W. = Body Weight (Kg). In this study, body weight was determined as 74Kg / person/day, while, as used in previous studies (Ge, 1992 and Wang *et al.,* 2005).

Health risk index (HRI)

The health risk index (HRI) for the locals through the consumption of contaminated bread was assessed based on the food chain and the reference oral dose (RFD) for each metal. Oral reference doses were 0.3, 1 $\times 10^{-1}$, and 4×10^{-2} mg kg^{-1} day^{-1} for Zn, Cd, and Cu, respectively and 0.02, and 0.004 mg kg^{-1} day^{-1} for Ni, and Pb respectively. Reference dose (Cui *et al.,* 2004). US-EPA 2002 estimated exposure is obtained by dividing daily intake of heavy oral metals by their safe limits. The HRI <1 means the exposed population is assumed to be safe according to (USEPA, 2002).

$$\mathrm{HRI} = \frac{DIM}{RFD}$$

Bio concentration factor (BCF)

Concentrations of Hg, As, Cu, Ni, Pb, Zn, Co, Mn, Fe and Cd in wheat grain, Factor (BCF) are exhibited in equation. BCF is a common parameter often used in the study of environmental contaminations (Sipter *et al*., 2008). BCF is the ratio of concentration of HM in wheat grain and that in soil according to the following equation: BCF = Cp/Cs

Where, Cp is the concentration of HM in wheat grain; Cs is the Concentration of HM in soil.

Statistical analysis

The data were statistically analyzed by the least significant differences value (L.S.D.) of 0.05 levels probability procedure of Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

Nile tilapia harvesting:

The obtained results indicate that feeding of alternative culture method for *O. niloticus* fish ponds with wheat in earthen ponds after fish harvesting *O. niloticus* fed on diets containing 25% crude protein with poultry litter resulted in best economic efficiency compared to the other treatments.

Effect of fertilization on crop growth, yield and grain quality

Table (1), shows the qualitative parameters of wheat grains .From these results, the highest significant increase in all parameters of produced grains was obtained in organic fertilization for fish ponds. These results are in accordance with these obtained by Bassel *et al*., (2001), who found that bio-fertilizer significant increases in plant, No. of spiks /m^{2}, No. of grains/spike, 100 grains weight and grains straw yield kg/fd.

Table1:Effect fish ponds artificial feed, organic and inorganic fertilization for on wheat yield and its parameters

Trail	T1	T2	T3
No. of till/m^2	289.68±8.12[c]	334.52±8.12[a]	324.34±8.12[b]
No. of spiks/m^2	282.96±7.59[b]	303.99±7.59[a]	305.29±7.59[a]
Spike length(cm)	9.38±0.73[b]	12.32±0.73[a]	11.52±0.73[ab]
100 grains weight	4.01±0.41[b]	4.69±.41[a]	4.57±0.41[a]
No. of grains/spike	48.11±1.16[b]	62.9±1.16[a]	61.68±1.16[a]
No. of grains/m^2	13613.21±12.7[b]	19120.97±56.3[a]	18830.29±56.37[a]
Weight of grains/m^2	54.59±30.06[b]	89.68±12.71[a]	86.05±12.71[a]
Grains yield Kg/Fadden	2292.74±30.06[b]	3766.45±30.06[a]	3614.29±30.06[a]
Straw yield kg/Fadden	2637.00±20.2[b]	2749.00±29.56[a]	2712.00±29.56[a]
Prices of grain yield	6603.08 L.E	10847.37 L.E	10409.14 L.E
Prices of straw yield	817.47 L.E	852.19 L.E	840.72 L.E
Total income	7420.55 L.E	11699.56 L.E	11249.86 L.E

T1: fish were fed on artificial feed, T2: fish were fed on artificial feed and organic fertilization, T3: fish were fed on artificial feed and Inorganic fertilization

Table (1) based on results obtained in this study and on the economical evaluation, it could be concluded that, wheat can planted in the fish ponds during the winter season, taking into account feeding *Oreochromis niloticus* on artificial feeding contain 25% crude protein in addition to organic fertilization using chicken manure also add organic fertilization to increase the weights of fish as well as increasing wheat crop of fish ponds, in addition to that it was the best in terms of economic efficiency compared with other treatments (Ahmed *et al.,* 2014).

Heavy metals content in soil and drainage irrigation water

Metal concentrations in irrigation water are illustrated in Table (2). The concentrations of heavy metals in the irrigation water was 0.035 ppm for Cd, 0.346 for Cu, 0.342 for Zn, 0.0475for Ni, 0.25 for As, 0.537 for Mn and 0.60 for Hg(mg/l). Among all the heavy metals, Cd, As and Hg concentration exceeded the permissible limit set by FAO (1985). Heavy metals in the drainage irrigation water are associated with small scale industries such as coloring, electroplating, metal surface treatments, fabric printing, and battery, releasing Cd, Cu, Pb, Zn, Ni and other heavy metals into water channels, which are accessed for irrigation.

Results in Table (2) showed that the lower concentrations of heavy metals in the three soils expect Hg. The irrigation water may be due to dilution of heavy metals in the water medium, but the continuous application of these treated and untreated wastewater for irrigation resulted in an accumulation of heavy metals into the soil.

The agricultural drainage water containing pesticides and fertilizers and effluents of industrial activities and runoffs in addition to sewage effluents supply the water with bodies and sediment with huge quantities of inorganic anions and heavy metals (ECDG, 2002). The most anthropogenic sources of metals are industrial, petroleum contamination and sewage disposal (Santos *et al.,* 2005).

Table (2): Heavy metals (mg/kg) content in soil and drainage irrigation water

Samples	Cu	Ni	Pb	Cd	Hg*	As	Fe	Zn	Mn
T1	62.44 ± 0.11[a]	56.55 ±3.2[a]	16.26 ±0.52[b]	2.15 ±0.12[b]	123.83 ±9.02	97.56 ±2.66[b]	609.50 ±17.81[a]	96.75 ±.43[a]	348.13 ±9.02[a]
T2	61.17 ±0..19[a]	50.68 ±0.72[b]	18.29 ±0.23[a]	2.6 ±0.21[a]	128.0 ±3.29	145.96± 12.49[a]	553.88 ±16.30[b]	93.31 ±.75[b]	282.31 ±8.91[ab]
T3	56.55 ± 2.10[b]	52.70 ±3.35[ab]	13.96 ±1.08[c]	2.33 ±0.15[b]	114.26 ±5.96	120.46± 10.29[ab]	572.42 ±2.64[ab]	90.05 ±.87[c]	227.07 ±19.79[c]
USA*	750	210	150	20	17	--	--	1400	--
UK*	135	75	300	3	--	--	--	300	--
EU*	50 -140	30 -75	50 -300	1 -3	16 -25	--	--	150 -300	--
Drainage irrigation water (mg/L)									
Water irrigation	0.346	0.0475	0.00	0.035	0.605	0.25	0.78	0.342	0.537
NSDQ- *Pak	2	0.02	0.05	0.01	--	--	--	5	0.5
US *irrigation	0.2	0.2	5.0	0.01	0.1	0.1	5.0	2	0.2

T1: fish were fed on artificial feed, T2: fish were fed on artificial feed and organic fertilization, T3: fish were fed on artificial feed and Inorganic fertilization
***Nan et al., (2002)**

Elevated levels of heavy metals in irrigation water led to significantly higher concentrations of heavy metals in the soil as compared to those obtained from clean water irrigated site (Table 2). The heavy metal concentrations of EU standard (European Union, 2002) at soil were recorded in Table (2). The lower concentrations of heavy metals than the safe limits at soil may be due to the continuous removal of heavy metals by the cereals grown in this area and also due to leaching of heavy metals into the deeper layer of the soil. The main sources of contamination were sewage water irrigation as reported by Singh *et al*., (2004). Among the sources of irrigation, in sewage irrigation treatments there was improvement in soil heavy metal content like Cu, Fe and Mn which are known as essential plant growth micronutrients. Legume crop irrigated with sewage water absorbed significantly higher amount of essential micronutrients (*Liu et al.,* 2012). But other toxic heavy metals like, Ni, Pb, and Cd did not accumulate in soil significantly under sewage irrigation. Heavy metals' accumulation was known to increase in plants due to sewage irrigation but extent of accumulation varies among varieties and crops depending on concentration of heavy metals in effluent and frequency of application.

Concentration and Bio Concentration heavy metals in wheat grain

Food and Agriculture Organization (FAO, 2013) records that 65 % of wheat is used as food, 17 % is used as animal feed and 12 % is used as industrial inputs including biofuel**.** Concentrations of heavy metals in wheat grain are exhibited in Table (3). The highest level of content of Hg in wheat grain was related to that in soil and exceed recommended by (WHO 1993).

Table (3): Concentration and Bio-concentration factor (BCF) of heavy metals mg/kg in wheat grain.

Samples of wheat grains	Heavy metals in wheat grains (ppm)								
	Hg	**As**	**Cd**	**Pb**	**Ni**	**Fe**	**Cu**	**Zn**	**Mn**
T1	0.93[a]	0.097[b]	0.13[a]	0.16	0.77[c]	61.63[a]	6.56[a]	18.53[a]	56.28[c]
T2	0.74[b]	0.11[b]	0.14[a]	0.052	0.79[a]	53.86[b]	6.23[b]	17.88[b]	42.52[b]
T3	0.52[c]	0.18[a]	0.095[b]	0.00	0.74[b]	51.45[b]	5.92[a]	16.13[c]	38.36[a]
Control	0.002	0.02	0.00	0.00	0.15[c]	39.45[c]	4.35[c]	15.22[c]	16.18[c]
FAO/WHO	0.1	0.1	0.2	0.3	0.67	425.5	73.3	99.4	500
Bio-concentration factor (BCF)									
T1	0.00751	0.0009	0.060	0.010	0.014	0.101	0.105	0.191	0.162
T2	0.00578	0.0008	0.054	0.003	0.016	0.097	0.102	0.192	0.151
T3	0.0045	0.0001	0.041	0.00	0.014	0.069	0.105	0.179	0.239

T1: fish were fed on artificial feed, T2: fish were fed on artificial feed and organic fertilization, T3: fish were fed on artificial feed and Inorganic fertilization

Drainage water irrigation did not increase the heavy metals in wheat grains over other sources of irrigation but had increased the Ni in wheat (Table 3). The Pb concentration in grains was not influenced by sources of irrigation, soil and fertilizer levels and also their interactions being immobile at any concentration in soil. Drainage water also did not increase the Cd accumulation in plant. Inorganic fertilizers contain significantly higher amount of available form of heavy metals which also has been evident by higher amount of extractability of available heavy metals (Cd and Pb).

The highest concentration of BCF in Mn and Zn from soil to wheat grain (0.239) and (0.192) mg/kg. This result is consistent with that of Wang *et al*., (2005) who stated that the highest value of BCF in Zn for vegetables and fish. It is worth maintaining that BCF of HMs of wheat grains significantly lower than the soil. This result strongly agreed with the shower of Gigliotti *et al*., (1996), who reported As and Pb are less mobile in corn plants. Variations of Hg and Ni concentrations in wheat grains were considerably less than those in soil, which in the line with these of Liu *et al*., (2005a) who suggested that HMs in grain may be affected by such pollution environmental factors as emissions from print works and electroplating plants.

Heavy metal uptake accumulation in bread

Bread is an important diet cereal products provide as much as 50-90% of total caloric and protein intakes. Table (4) showed the effects of extraction rate (82%) on the levels of HM content. Wheat plants may be contaminated by trace metals and transferred to bread. The embryo, bran and the aleuronic layer of wheat are rich in minerals and metals than the endosperm. Aleuronic layer contained about 61% of all minerals in grain (Hoseney, 1994).

It is obvious that milling process reduced the levels of the trace metals mentioned above considerably. Although such reduction are depending on the stages and type of flours produced. Wet wheat (first stage of milling) reduced the level of HM. This is not surprising, since the first stages of milling include cleaning and removing the dust, weed seed, stones and then washing with water (Khaniki *et al*., 2005) which resulted wheat flour (82%) contains less amount of HM than the wheat grains. All of breads showed the high content of Cd, Hg and Ni (Table 4). Hg content was lower in breads than in wheat grains but the highest content of Hg was observed in bread due to (bread from wheat cultivated in fish were fed on artificial feed). This is mainly due to the facts that the flour HM in food (Gholam *et al*., 2005) and the levels of the trace heavy metals mentioned found in three types of soil.

Table (4): Heavy metal uptake accumulation in bread

Samples of bread	Hg	As	Cd	Pb	Ni	Fe	Cu	Zn	Mn
T1	0.65[a]	0.063[a]	0.036[b]	0.014[b]	0.62[a]	38.82[a]	4.97[a]	17.82[a]	25.56[a]
T2	0.44[b]	0.080[b]	0.101[a]	0.032[a]	0.65[a]	29.58[b]	4.15[b]	16.67[b]	20.56[b]
T3	0.34[c]	0.125[c]	0.002[c]	0.00	0.47[b]	24.36[c]	3.29[c]	12.95[c]	19.65[b]
Control	0.00	0.001	0.00	0.00	0.12	27.59	3.56	14.33	15.66

T: bread from wheat cultivated in: T1: fish were fed on artificial feed, T2: fish were fed on artificial feed and organic fertilization, T3: fish were fed on artificial feed and Inorganic fertilization

Enrichment factor (EF) of heavy metals in bread

Lower values of enrichment factor (EF) showed in (Table 5).The lower heavy metals in bread due to poor retention of metals in soil and/or more translocation in plants and bread .Within the Enrichment factor of heavy metals depends upon bioavailability of metals, which in turn depends upon its concentration in the soil, their chemical forms, difference in uptake capability and growth rate of different plant species (Tinker, 1981). The higher uptake of heavy metals in leafy vegetables than cereal may be due to higher transpiration rate to maintain the growth and moisture content of these plants (Tani and Barrington, 2005).

Table 5: Enrichment factor of heavy metals in bread

Heavy metals	Samples of bread		
	T1	**T2**	**T3**
Cu	0.0795964	0.06784	0.058179
Ni	0.010964	0.012826	0.008918
Pb	0.00086	0.017499	0000
Cd	0.016744	0.037828	0.0008584
Hg*	0.00508	0.003438	0.002976
As	0.000646	0.000548	0.00099
Fe	0.06369	0.053405	0.042556
Zn	0.184167	0.1786518	0.143889
Mn	0.073428	0.0728277	0.122521

T: bread from wheat cultivated in: T1: fish were fed on artificial feed, T2: fish were fed on artificial feed and organic fertilization, T3: fish were fed on artificial feed and Inorganic fertilization

Daily intake of heavy metals in bread (DIM)

From Table (6) it could be concluded that HMs consumed due to the bread in urban was less than rural. Hussien *et al.,* (2013) reported that 4.3

and 3.6 bread as staple food were consumed by an average in city and urban respectively per inhabitant (74kg for person). The results of Hu *et al.,* (2004) wheat grain reported that around 30% of the staple food in the diet of inhabitants in Jiangsu province. However, there is need to estimate dietary daily intake of other element (DIM) which are essential to human beings taking into account all the food and vegetable consumption in the context of intake limits of Cu, Fe, Zn, and Mn in adults that range from 1.2 to 3.0 mg, 10.0 to 50.0 mg, 5.0 to 22.0 mg and 2.0 to 20.0 mg, respectively (WHO 1993).

The tolerable weekly Pb intake limit recommended by the FAO/WHO for adults is 25 Ag/ kg body weight (Ostapczuk *et al.,* 1987), which corresponds to 3.57 Ag Pb/kg body weight /day. The Cd intake of 10 Ag/day through the consumption of vegetables, fish, and crops is also less than the tolerable daily dietary intake limit (57–71 Ag/day) of FAO/WHO (Ostapczuk *et al.,* 1987). Recommended daily dietary intake of Cu and Zn for adults is 6.5 and 33 mg, respectively (Raghunath *et al.,* 1999). Among all the heavy metals studied, vegetables HMs in grain may be affected by such environmental factors as emissions from print works and electroplating plants (Liu *et al.,* 2005b).

(Table 6) Daily intake of heavy metal by bread in rural and urban

Samples of bread	Heavy metals								
	Hg	As	Cd	Pb	Ni	Fe	Cu	Zn	Mn
Rural									
T1	6.7223	0.6514	0.3722	0.1448	6.4108	401.399	51.3898	184.2588	264.2904
T2	4.549	0.8272	1.0443	0.3309	6.721	305.8572	42.911	172.3678	212.5904
T3	3.512	1.293	0.0207	0.000	4.8598	251.8824	34.0186	133.903	202.2504
Control	0.000	0.010	0.000	0.000	1.2408	285.2806	36.8104	148.1722	161.9244
Urban									
T1	5.629	0.54558	0.31176	0.12124	5.3693	336.1812	43.0402	154.3212	221.3496
T2	3.8104	0.6928	0.87466	0.27712	5.629	256.1628	35.939	144.3622	178.049
T3	2.9444	1.0825	0.01732	0.000	4.04.07	210.9576	28.4914	112.147	170.169
Control	0.000	0.01	0.000	0.000	1.0392	238.9294	30.8296	124.0978	136.6156

T: bread from wheat cultivated in: T1: fish were fed on artificial feed, T2: fish were fed on artificial feed and organic fertilization, T3: fish were fed on artificial feed and Inorganic fertilization

Health risk index (HRI) of heavy metals intake of bread

Several methods have been proposed to estimate the potential health risks of pollutants, divided mainly into carcinogenic and the observed or predicted exposure concentrations are compared with thresholds for adverse effects or the toxicant reference value (TRV) as determined by dose–effect relationships (Solomon *et al.,* 1996).

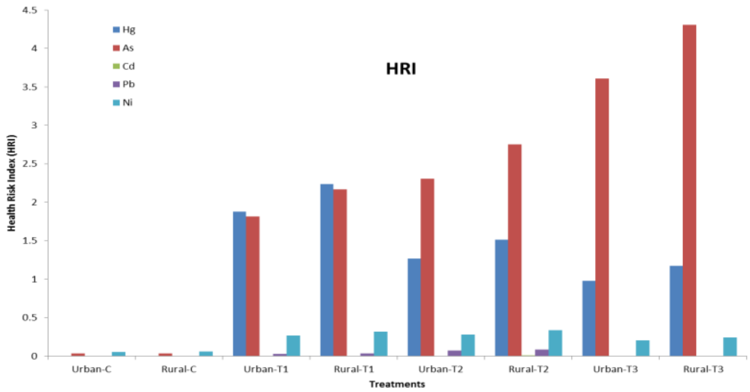

Fig (1): Health risk index (HRI) of heavy metals via intake of bread in Rural and Urban

The value of (HRI) for individual metal are shown in Fig (1). For different exposure populations, HRI of individual HM were be all below 1, except Hg and As which means that the daily intake of individual element through the consumption of bread would be unlikely to cause adverse health effects for inhabitants. The Results of HRI in wheat grain was much lower than that in fish or vegetables studied by others (Chien *et al*., 2002; Wang *et al*., 2005; Zheng *et al*., 2007). It can also be concluded from Fig (1) that HRI of individual element for children is higher than that for adults either in city or country, which is coincidence with these of previous studies (Nadal *et al*., 2004; Zheng *et al*., 2007). Consequences of HRI for every metal for different exposure populations were in the same order of: country children, country adults, urban children and urban adults. There was a big discrepancy of HRI among different HMs.

Medium-risk Hg and As (1-10) in the high-risk zone for bread (Solomon *et al.,* 1996). Use of fish pond increased the major micronutrients such as Zn and Cu in wheat grain. The HRIs of heavy metals also suggested that heavy metal concentration in grain was the highest in bread from wheat cultivated in fish ponds fed on 25% artificial feed.

Correlation coefficients

In fact, there were statistically significant correlations of total concentrations of HMs in wheat and bread samples Table (7). The concentrations of Cu, Pb, Mn and Zn in wheat and bread varieties were highly correlated with available soil extraction. Zn, Cd, Cr, Cu, Ni and Zn in were positively correlated with available extraction (*R*2 > 0.9) (Chary *et al.,* 2008)

Table7: Correlation coefficients (r) between heavy metal concentrations in wheat and produced bread.

Heavy metals	Samples	
	Wheat	Bread
Cu	0.826**	0.779*
Ni	-0.074	0.062
Pb	0.933**	0.0922**
Cd	0.275	0.645
Hg*	0.357	0.229
As	0.022	0.287
Fe	0.630	0.582
Zn	0.899**	0.896**
Mn	0.917**	0.671**

**** Correlation is significant at the 0.01 level (2 tailed)**
*** Correlation is significant at the 0.05 level (1 tailed)**

El-Sheikh (2003) and Tantawy (2004) observed that, irrigation with different water qualities led to an insignificant variation on the available contents of most trace elements (Co, Ni, Pb and Cd). They also observed that, the content of these trace elements were decreased with the increase of soil depth. Tantawy (2004) added that, the soil content of Pb depended on irrigation water quality, soil properties and soil depth.

CONCLUSIONS

It has been of economic importance from many aspects, most of all in view of food supply to the population as well as for the strategic planning. Each citizen in the Egypt consumers in average 750 g of bread daily. Considering that bread is consumed on daily basis, the emphasis should be put on its healthy production. If there are undesirable matters in bread, there is a risk of jeopardizing people’s health. This may be prevented by way of constant quality control. Finally, it can be concluded that the application of fish ponds can be used as an organic supplement for resource recovery to soils, which did not necessarily cause short-term problems to the wheat crop.

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تراكم امتصاص العناصر الثقيلة فى الخبز البلدى الناتج من القمح المنزرع فى الاحواض السمكية فى الشتاء

نهلة محمد محمود حسن [١] ، احمد فاروق فتح الباب[٢] و نهى محمود محمد[٣]
[١] معهد بحوث تكنولوجيا الاغذية – مركز البحوث الزراعية – الجيزة – مصر
[٢] المعمل المركزي لبحوث الثروة السمكية – مركز البحوث الزراعية – الجيزة – مصر
[٣]المركز الاقليمى للاغذية والاعلاف - مركز البحوث الزراعية – الجيزة – مصر

تم اجراء هذه الدراسة لدراسة تاثير استغلال الاحواض السمكية فى زراعة القمح فى الموسم الشتوى على امتصاص وتراكم العناصر الثقيلة فى الخبز البلدى المنتج من القمح.

وقد اجريت هذه الدراسة فى ستة مزارع سمكية بمساحة (٤٢٠٠م٢) باسماك البلطى النيلى وزراعة القمح فى هذه المزارع لزيادة الانتاج الكلى لكل فدان. وقد عوملت اسماك البلطى النيلى بثلاث معاملات هى: تم تغذية الاسماك فى المعاملة الاولى على الاعلاف الصناعية ٢٥% بروتين خام فقط وتم تغذية الاسماك فى المعاملة الثانية على العلف الصناعى ٢٥% من البروتين الخام بالاضافة الى التسميد الغير عضوى والمعاملة الثالثة للاسماك تم تغذيتها على الاعلاف الصناعية ٢٥% بروتين خام مع التسميد العضوى .

وتم تقدير تركيز العناصر الثقيلة لما تسببه من مخاطر على صحة الانسان مثل الزئبق و الزرنيخ والحديد والنحاس والنيكل والرصاص والزنك والكادميوم والمنجنيز فى القمح والتربة ومياه الرى والخبز الناتج من القمح المزروع فى هذه الاحواض. وقد لخصت النتائج الاتى: زياده معنوية فى كل قياسات التسميد العضوى وقد زاد تركيز عناصر الكادميوم والزرنيخ والزئبق عن النسبة المسموح بها فى مياه الرى. وكان تركيز العناصر الثقيلة فى التربة و القمح والخبز البلدى اقل من النسب المسموح بها ماعدا الزئبق والزرنيخ . وقد وصلت دليل مخاطر الصحة (HRI) بالنسبة لعنصر الزئبق والزرنيخ لدرجة الخطورة فى الخبز مما يكون له اثر ضار على صحة الانسان. ونوصى بالاهتمام بتحليل العناصر الثقيلة الضارة فى القمح المزروع فى المزارع السمكية قبل تداوله للحفاظ على صحة الانسان.