J. Agric. Sci. Mansoura Univ., 33 (9): 6577 - 6586, 2008

EFFECTS OF GROUND AND POTABLE WATER UTILIZED IN WHEAT CONDITIONING PROCESS ON ASH AND SOME HEAVY METALS CONTENT OF RESULTED FLOUR

Al-Bardeny, A.E.*; A. S. Barakat and A. S. Ibrahim****
*** North Cairo Flour Mills Co. Cairo, Egypt**
**** Food Technology Research Institute, Agric. Res. Center, Giza, Egypt**

ABSTRACT

The processes of wheat conditioning involve adjustment of the average moisture content of the wheat and distribution the moisture throughout each wheat grain by adding the required amount of water, to reach moisture content of wheat to15.5% in soft wheat and 17.5% in hard wheat. Some mills use wells of groundwater directly in conditioning wheat instead of potable water, to decrease milling cost, without considering its content of heavy metals. The objective of the present study is to study ash, Mn, Fe, Zn, Cu and Pb content of wheat flour, i.e., wholemeal, 82% and 72% extraction, produced from some Cairo province mills which use ground or potable water in wheat conditioning process, and comparing it with control sample and Egyptian Organization for Standardization of wheat.

The results revealed that ash content of wheat flour 82% and 72% produced from conditioned wheat with groundwater were 1.14% and 0.56%, respectively. Whereas Egyptian Standers(ES, 2005) permit a limit for ash content of wheat flour 82% and 72%to be less than 1.1% and 0.56%, respectively. Increment percent than control of Mn, Fe and Cu content of wheat flour 82% produced from conditioned wheat with groundwater reached to114%, 207% and 147%, respectively. Increment percent than control of Mn, Fe and Cu content of wheat flour 72% produced from conditioned wheat with groundwater reached to 140% to Mn, 169% to Fe, 145% to Zn and 300% to Cu and Pb.

Consumption of Balady bread produced from wheat flour 82% of conditioned wheat with this water increases the daily intake of this metals more than the Recommended Dietary Allowances(RDA).

These metals can be classified as potentially toxic(Pb) and very harmful even at low concentration when ingested over a long time period. Other elements are essential for human life at low concentration (Mn, Fe, Zn and Cu) however, they can also be toxic at high concentrations. The regulations of the Egyptian Standers neglected to permit limits for minerals or heavy metals content of wheat flour.

INTRODUCTION

High levels of lead, copper, iron and heptachlor were found by 0.35, 0.15, 2.7 and 0.03 mg/ 100 g in wheat flour sample (72% extraction) resulted from a mill located in Cairo province. The mill was uses groundwater in wheat conditioning process. The used groundwater also was found with high content of these heavy metals and heptachlor (Anon, 2005). The possibility that the high heavy metals content of groundwater used in wheat conditioning process increased heavy metals content of resulted flour was studied in this paper.

The processes of wheat conditioning involve adjustment of the average moisture content of the wheat and distribution the moisture throughout each wheat grain by adding the required amount of water. The objectives in wheat conditioning are primarily to improve the physical state of the grain for milling, and sometimes to improve the baking quality of the milled flour. The optimum moisture content of wheat varies from15.5% in soft wheat to 17.5% in hard wheat(Kent, 1970).

Industrialization has improved general technology as well as quality of life but has also resulted in an increase in metal concentrations in water (Tarley, *et al.*, 2001). These metals can be classified as potentially toxic (aluminium, arsenic, cadmium, lead, mercury, etc.), probably essential (nickel, vanadium, cobalt) and essential (copper, zinc, selenium) (Mun˜oz-Olivas and Ca´mara, 2001). Toxic elements can be very harmful even at low concentration when ingested over a long time period. Other elements are essential for human life at low concentration, however, they can also be toxic at high concentrations (Oehlenschläger, 2002 and Ray, 1994). The side effects of these elements on human health have been widely studied (Lall, 1995; Linder and Hazegh-Azam, 1996 and Mun˜oz-Olivas and Ca´mara, 2001)

Presence of contaminants in natural freshwater continues to be one of the most important environmental issues in many areas of the world, particularly in developing countries, where several communities are far away from potable water supply (WHO, 1993, 1996). Low-income communities, which rely on untreated surface water and groundwater supplies for domestic and agricultural uses are the most exposed to the impact of poor water quality. (Ongley and Booty, 1999). Many of the earth's major rivers and groundwater supplies are either overexploited or polluted due to population growth, agricultural activities, urbanization and industrialization (Godwin, *et.*, *al.*, 2007). Groundwater flows through sediments, metals such as iron and manganese are dissolved and may later be found in high concentration in the water. Industrial discharge, urban activities, agriculture, groundwater pumpage, and disposal of waste all can affect groundwater quality. Contaminants from leaking fuel tanks of fuel or toxic chemical spills may enter the groundwater and contaminate the aquifer. Pesticides and fertilizers applied to lawns and crops can accumulate and migrate to the groundwater (Waller, 1982 and Bergstrom, 2004).

Some mills use wells of groundwater directly in conditioning wheat instead of potable water without any analysis or treatment. However, there are no sufficient studies about heavy metals content of wheat flour. The objective of the present research is to study the effects of groundwater utilization in wheat conditioning process on ash and some heavy metals contents of wheat flour, i.e., wholemeal, 82% and 72% in comparison with potable water.

MATERIALS AND METHODS

Control samples:

Sample of clean and unconditioned wheat grain was pulled from a pioneer company has many cylinders mills. The sample was conditioned with distilled water to rise moisture content to 16% in the laboratory. Conditioned sample was milled in laboratory mill to produce control of wholemeal. Another portion of wholemeal wheat flour was sieved using sieves No.50 and 60 to produce control of wheat flour 82% extraction and Control of 72%extraction, respectively.

Mills samples:

Samples of wholemeal wheat flour, wheat flour 82% and 72% extractions were obtained from the company mills which divided as using ground or potable water in the wheat conditioning process as shown in Table N0.(1).

Table (1): Types of examined flour according to the sources of used water in wheat conditioning process:-

Mills No.	Types of conditioning water	Types of examined flour:		
		wholemeal	82% extraction	72% extraction
1	Ground	+	+	-
2	Ground	+	+	-
3	Potable	+	+	-
4	Potable	+	+	-
5	Ground	-	-	+
6	Potable	-	-	+

Ash and minerals analysis:

Samples were analyzed for ash according to the method recommended by AOAC (1995). Mn, Fe, Zn, Cu, and Pb were determined after dissolving the dry ash of samples in HCl IN using an atomic absorption spectrophotometer (Perkin-Elmer Instrument, Model 23865) according to Anon (1971).

Increment percent(%) = Mill x / Control x × 100

X : ash or heavy metals content.

RESULTS AND DISCUSSION

Ash and heavy metals content of wholemeal wheat flour produced from conditioned wheat with ground or potable water:-

Table (2) shows the ash and heavy metals content of the wholemeal produced from conditioned wheat with ground or potable water and its averages. The results revealed that using of ground or potable water in wheat conditioning process increased the average of ash and heavy metals content of produced wholemeal compared with control sample. Also, the averages of ash, Mn, Fe, and Cu content of the wholemeal produced from conditioned wheat with groundwater were higher than the control or the wholemeal produced from conditioned wheat with potable water. The results revealed also that Sample of mill No.(1) recorded the highest Mn and Cu content and the increment percents to control were 114 and 428%, respectively. Also, sample of mill No. (2) recorded the highest ash and Fe content and the increment percent to control was 114 and 344%, respectively. Zn and Pb content of mills samples which use ground or potable water in wheat conditioning process were higher than control, and the averages of increments to control were similar, although the sample of mill No.(3) recorded the highest Zn content and the increment percents to control was 118%. It can be noticed also that control wholemeal was in accordance with that reported by the National Nutrition Institute (NNI), (2006) in the ash, Fe and Cu and exceeded it in Zn. Also, wholemeal of the conditioned wheat with potable water was in accordance with that reported by NNI (2006) in Zn and Cu and exceeded it in the average of ash and Fe. Tangkongchitr *et al.*, (1981.a) reported that wholemeal contained 4.1 mg Zn /100 g.

Ash, Fe, Zn and Cu content of wholemeal for the conditioned wheat with groundwater exceeded that reported by the NNI (2006). Furthermore, NNI (2006) did not pay any attention to Mn. or Pb. The regulations of the Egyptian Organization for Standardization and Quality Control (ES, 2005) permits a limit of ash content for wheat wholemeal to be less than 2.4%, and did not permit limits for minerals or heavy metals content. Ash content of control and wholemeal for the conditioned wheat with ground or potable water were below the permitted levels of ES (2005).

Ash and heavy metals content of wheat flour (82% extraction) produced from conditioned wheat with ground or potable water:-

Table (3) shows the ash and heavy metals content of the wheat flour (82% extraction) produced from conditioned wheat with ground or potable water and its averages. The results illustrate that the averages of ash heavy metals contents of wheat flour (82% extraction) produce from conditioned wheat with groundwater or potable water were higher than control sample.

Also, except Zn, the average of ash and heavy metals content of mills samples which use groundwater in wheat conditioning process were higher than mills samples which use potable water. In contrast, using of potable water in wheat conditioning process increased the average of Zn content of produced wheat flour (82% extraction) from conditioned wheat with potable water was higher than that conditioned with groundwater. Sample of mill No.(2) which groundwater was used in wheat conditioning process recorded the highest ash and Fe content and the increment percents to control were 154% and 253%, respectively.

Sample of mill No.(1) which groundwater was used in wheat conditioning process recorded the highest Cu content and the increment percent to control was 150%. Sample of mill No.(3) which potable water was used in wheat conditioning process recorded the highest Zn content and the increment percent to control was 145%. It can be noticed also that ash, Fe and Cu content of control wheat flour (82% extraction) accorded with that reported by the NNI (2006) and exceeded it in Zn. Also, the average of ash, Fe, Zn and Cu content of mills samples which groundwater were used in wheat conditioning process exceeded that reported by the NNI (2006). Also, the average of ash, and Zn content of mills samples which potable water were used in wheat conditioning process exceeded that reported by the NNI (2006) and accorded with it in Fe and Cu. The average of Pb content of mills samples which ground or potable water were used in wheat conditioning process were higher than control, and the averages of increments to control were similar. The regulations of the ES (2005) permit a limit for ash content of wheat flour (82% extraction) to be less than 1 %, neglected to permit limits for minerals or heavy metals content.

Table(2): Ash and heavy metals (mg/100g) content of wholemeal wheat flour produced from conditioned wheat with ground or potable water:-

Samples	Ash (%)	Increment to control (%)	Heavy metals content									
			Mn	Increment to control (%)	Fe	Increment to control (%)	Zn	Increment to control (%)	Cu	Increment to control (%)	Pb	Increment to control (%)
Control	1.6	100	2.73	100	2.42	100	3.21	100	0.14	100	0.06	100
Mill No.1	1.77	110	3.82	140	4.56	188	3.69	115	0.60	428	0.06	100
Mill No 2	1.83	114	3.01	110	8.33	344	3.64	113	0.52	371	0.07	116
Average1+2	1.73	112	3.41	125	6.45	266	3.67	114	0.56	400	0.065	108
Mill No 3	1.73	108	3.05	111	2.43	100	3.80	118	0.14	100	0.06	100
Mill No 4	1.73	108	3.07	112	2.56	105	3.52	109	0.16	114	0.07	116
Average3+4	1.73	108	3.06	112	2.49	103	3.66	114	0.15	107	0.065	108
NNI(2006)	1.82	100	nd	nd	3.52	145	3.29	102	0.37	264	nd	nd
ES (2005)**	2.4	150	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

* National Nutrition Institute (2006).

** Egyptian Organization for Standardization and Quality Control(2005).

Table(3): Ash and heavy metals (mg/100g) content of wheat flour (82% extraction) produced from conditioned wheat with ground or potable water:-

Samples	Ash (%)	Increment to control (%)	Heavy metals content									
			Mn	Increment to control (%)	Fe	Increment to control (%)	Zn	Increment to control (%)	Cu	Increment to control (%)	Pb	Increment to control (%)
Control	0.87	100	1.25	100	1.92	100	2.03	100	0.24	100	0.06	100
Mill No.1	0.94	108	1.77	116	3.10	161	2.03	100	0.36	150	0.06	100
Mill No 2	1.34	154	1.69	111	4.86	253	2.17	106	0.35	145	0.07	116
Average1+2	1.14	131	1.73	114	3.98	207	2.10	103	0.355	147	0.065	18
Mill No 3	1.09	125	1.77	116	2.22	115	2.96	145	0.28	116	0.07	116
Mill No 4	1.04	119	1.52	100	2.00	104	2.22	104	0.24	100	0.06	100
Average3+4	1.06	122	1.65	108	2.11	109	2.45	124	0.26	108	0.065	108
NNI(2006)*	1.00	115	nd	nd	2.60	135	1.82	-110	0.30	125	nd	nd
Es(2005)**	1	115	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

* National Nutrition Institute (2006).

** Egyptian Organization for Standardization and Quality Control(2005).

Ash content of control sample was in accordance with the permit of ES (2005) Both ash content of wheat flour (82% extraction) and average of wheat flour (82% extraction) for the conditioned wheat with ground or potable water were higher than the ash content which permitted by the ES (2005). Also, The average of ash content of wheat flour (82% extraction) produced from conditioned wheat with groundwater was more higher than the permitted levels. by the ES (2005).

Daily intake(DI) of heavy metals from Balady bread produced from conditioned wheat with ground or potable water:-

Ibraheem and Youssef (2004) mentioned that the average of Balady bread consumption in Egypt is 2.6 loaves/ person/ day comes from 260 g. of wheat flour 82% extraction. Then, consumption of 2.6 loaves of Balady bread will increase the DI and the DI to the Recommended dietary allowances (RDA) of heavy metals by 2.6-folds. National Research Council (1989) estimated the RDA means of Mn, Fe, Zn and Cu with 3.5, 12, 15 and 2.25mg/ day for adults, respectively

Table (4) shows Daily intake(DI) and the percent of DI to Recommended Dietary Allowances(DI/ RDA) of Mn, Fe, Zn and Cu based on the daily consumption of wheat flour 82%- Balady bread produced from conditioned wheat with ground or potable water. The results revealed that consumption of 2.6 Balady bread loaves per day produced from wheat conditioned with ground or potable water flour increased DI and DI/ RDA of all heavy metals. Also, DI and DI/ RDA of Mn overreached the means of RDA and the increment caused by groundwater was higher than that caused by potable water. Normandin and Hazell, (2002) reported that exposure to Mn may lead to accumulation of Mn in the basal ganglia of the brain, where it may have its toxic effects lead to neurotoxicity (also known as manganism). Manganism was characterized by neuropsychiatric symptoms and extrapyramidal dysfunction, such as hypokinesia, rigidity, and tremor often resemble Parkinson's disease (Erikson *et al.*, 2004).

The results in Table(4) revealed also that, usage of groundwater in conditioning process increased DI and DI/RDA of Fe more than potable water. The increment percent of the mill sample No. 2 overreached the mean of RDA. Elizabeth, Lund *et al.*, (2001) reported that there is an increasing evidence that chronic exposure to high level of dietary iron may be a risk factor for colorectal cancer and cardiovascular diseases (Duk - Hee *et al.*, 2005).

The results in Table(4) revealed also that, usage of groundwater in conditioning process caused similar increments with potable water in DI and DI/RDA of Zn, but the increments were higher in Cu. Oehlenschläger (2002) reported that Zn and Cu are essential for human life at low concentration, however, they can also be toxic at high concentration. Also, Magdalena *et al.*, (2005) found that mild copper excess in humans induced a transient, mild, but significant elevation of liver aminotransferases.

Ash and heavy metals content of wheat flour (72% extraction) produced from conditioned wheat with ground or potable water:-

Table(5) shows ash and heavy metals content of wheat flour (72%) produced from conditioned wheat with ground or potable water.

Table (4): Daily intake(DI) of heavy metals from Balady bread produced from conditioned wheat with ground or potable water:

Samples	Heavy metals											
	Mn			Fe			Zn			Cu		
	Content (mg/100g)	DI (mg/day)	DI/RDA [a] (%)	Content (mg/100g)	DI (mg/day)	DI/RDA [b] (%)	Content (mg/100g)	DI (mg/day)	DI/RDA [c] (%)	Content (mg/100g)	DI (mg/day)	DI/RDA [d] (%)
Control	1.25	3.25	92.8	1.92	4.99	41.5	2.03	5.28	35.2	0.24	0.62	27.6
Mill No.1	1.77	4.60	131.5	3.10	8.06	67.2	2.03	5.28	35.2	0.36	0.94	41.8
Mill No 2	1.69	4.39	125.4	4.86	12.63	105.3	2.17	5.64	37.1	0.35	0.91	40.4
Average1+2	1.73	4.50	128.5	3.98	10.35	86.3	2.10	5.46	36.4	0.355	0.92	40.9
Mill No 3	1.77	4.60	131.5	2.22	5.77	48.1	2.96	7.70	51.3	0.28	0.73	32.4
Mill No 4	1.52	3.95	112.8	2.00	5.20	43.3	2.22	5.77	38.5	0.24	0.62	27.6
Average3+4	1.65	4.29	122.5	2.11	5.47	45.6	2.45	5.54	36.9	0.26	0.68	30.2

[a] RDA of Mn is 3.5 mg/ day (National Research Council,1989).
[b] RDA of Fe is 12 mg/ day (National Research Council,1989).
[c] RDA of Zn is 15 mg/ day (National Research Council,1989).
[d] RDA of Cu is 2.25 mg/ day (National Research Council,1989).

Table (5): Ash and heavy metals (mg/100g) content of wheat flour (72% extraction) produced from conditioned wheat with ground or potable water:-

Samples	Ash (%)	Increment to control (%)	Heavy metals content									
			Mn	Increment to control (%)	Fe	Increment to control (%)	Zn	Increment to control (%)	Cu	Increment to control (%)	Pb	Increment to control (%)
Control	0.40	100	0.55	100	0.65	100	0.84	100	0.11	100	0.06	100
Mill No.5	0.66	165	0.77	140	1.10	169	1.22	145	0.33	300	0.18	300
Mill No 6	0.46	115	0.61	111	0.65	100	0.87	103	0.11	100	0.07	116
NNI(2006)*	0.5	125	nd	nd	0.85	130	1.50	178	0.13	118	nd	nd
ES (2005)**	0.56	140	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

* National Nutrition Institute (2006).
** Egyptian Organization for Standardization and Quality Control(2005).

The results revealed that using of ground or potable water in wheat conditioning process increased the ash content of produced wheat flour (72%) compared with control sample and the increment percents to control were 165% and 115%, respectively. Also, using of groundwater in wheat conditioning process increased Mn, Zn and Pb content of produced wheat flour (72%) more than control or potable water. The increment percents to control were 140, 145 and 300%, respectively. Pb metal can be classified as potentially a toxic and very harmful even at low concentration when ingested over a long time period (Celik and Oehlenschläger, 2007).

The results obvious also that, Fe and Pb content of produced wheat flour (72% extraction) from conditioned wheat with groundwater was higher than control or that produced from conditioned wheat with potable water. The increment percents to control were 169% and 300%, respectively. Fe and Cu content of wheat flour (72%) produced from conditioned wheat with potable water recorded no increment percent compared with control sample. Ash, Fe and Cu content of mill sample which groundwater was used in wheat conditioning process exceeded that reported by the NNI (2006). In contrast, the average of ash, Fe, Zn and Cu content of mills samples which potable water were used in wheat conditioning process recorded an accordance with that reported by the NNI (2006). The ES (2005) permit a limit for ash content of wheat flour (72% extraction) to be less than 0.56 %, but it did not provide the maximum minerals or heavy metals content. Both ash content of control wheat flour (72% extraction) and wheat flour (72% extraction) produced from conditioned wheat with potable water or which reported by the NNI, (2006) were accorded with that provided by the ES (2005). In contrast, ash content of wheat flour (72% extraction) produced from conditioned wheat with groundwater was higher than which permitted by the ES (2005).

Conclusion

The results obtained from this study showed that wheat flour in Egyptian market had generally much higher Of heavy metals concentrations than that are allowed by health authorities. The levels may be reduced by a better selection of the water sources including an analysis for toxic trace elements prior to usage this source of water. This study showed also that potable water may be a legal and safe source of the water used in wheat conditioning process. This study also showed that a more comprehensive survey should be carried out in heavy metals content of wheat flour and water used in wheat conditioning processes. Mills that were use groundwater in wheat conditioning process changed to potable water as soon as these results carried out.

REFERENCES

A.O.A.C.(1995).Association of Official Analysis Chemicals. Arlington, Virginia , USA.

Anon (1971). Analytical Methods of the Association of Official Analytical Chemists. Arlington, Virginia , USA.

Anon (2005). Heavy metals, pesticides and aflatoxins detections of flour samples (72% extraction) from local market. Un- publication data.

Bergstrom, L. (2004). The impact of food production on soils and groundwater resources. J. Food Sci., 69 (9): R 181-R184.

Celik, U. and Oehlenschläger, J. (2007). High content of cadmium, lead, zinc and copper in popular fishery products sold in Turkish supermarkets. Food Control 18, 258-261.

Duk-Hee, L., Arson, R. and David, R. (2005). Iron, Zinc and alcohol consumption and mortality from cardiovascular disease: the Iowa woman's health study. American J. Clinical Nutrition. 81 (4): 787-791.

Egyptian Organization for Standardization and Quality Control (2005). Wheat flour with its different extractions and methods of analysis and testing, ES No. 1251-1/2005.

Elizabeth, K. Lund, Suzan, J. Fairweather-Tait, Gabrielle, S. Wharf and Ian, T. Johnson (2001). Chronic exposure to high levels of dietary iron fortification increases lipid peroxidation in the mucosa of the rat large intestine. . J Nutrition, 131, 2928-2931.

Erikson, K., Dobson, A. and Dorman, D., (2004). Manganese exposure and induced oxidative stess in the rat brain. J. Sci. Total Environ. 334, 409–416.

Godwin, A., Kirpal, S., Steven, B. and Serge, K. (2007). Exploratory multivariate modeling and prediction of the physico-chemical properties of surface water and groundwater. J. Hydrology, 336: 115–124.

Ibraheem, N. and Youssef, I. (2004). The loss of cereal especially wheat. Symposium of cereal crops in Egypt, today and future. Syndicate of Agriculture professions in El Beheira province (in Arabic), pp 19-28.

Kent, N. (1970). Technology of cereals with special reference of wheat. Oxford, Pergamon Press, 115.

Lall, P. (1995). Macro and trace elements in fish and shellfish. Fish and fishery products, pp187-213.

Linder, C. and Hazegh-Azam, M. (1996). Copper biochemistry and molecular biology. American J. of Clinical Nutrtion,63, 797-811.

Magdalena, A., Manuel, O. Fernando, P., Marco, A., Mauricio, G. and Ricardo, G. (2005). Supplementing cooper at the upper level of the adult dietary recommended intake induces detectable but transient changes in healthy adults. J. Nutrition. 135: 2367-2371.

Mun˜oz-Olivas, R., and Ca´mara, C. (2001). Speciation related to human health. In trace element speciation for environment, food and health (pp. 331–353). The Royal Society of Chemistry.

National Nutrition Institute (2006). Food Composition Tables for Egypt. Cairo, Egypt. Second edition.

National Research Council (1989). Recommended dietary allowances,10th Ed. National Academic Press, Washington, DC.

Normandin, L. and Hazell, A.S., (2002). Manganese neurotoxicity: an update of mechanisms. J. Metabol. Brain Dis. 17, 375–387.

Oehlenschläger, J. (2002). Identifying heavy metals in fish. In H. A. Bremmer (Ed.), safety and quality issues in fish processing (pp. 95-113). Woodhead Publishing Limited and CRC Press LLC.

Ongley, E.D. and Booty, W. (1999). Pollution remediation planning in developing countries: conventional modeling versus knowledge based prediction. Water International 21, 31–38.

Ray, S. (1994).Analysis of contaminants in edible aquatic resources. VCH Publishers, Inc.91–113.

Tangkongchitr, V., Seib, P. and Hoseney, R. (1981.a). Phytic acid, I. determination of thee forms of phosphorus in flour, dough and bread. Cereal Chem., 58 (3): 226.

Tarley, C. ,Coltro, W., Matsushita, M., and Souza, N. (2001).Characteristic levels of some heavy metals from Brazilian canned sardines (Sardinella brasiliensis). Journal of Food Composition and Analysis, 14, 611–617.

Waller, G.(1982). Groundwater and the rural homeowner, Pamphlet, U.S. Geological Survey.

World Health Organization, (1993). Guidelines for Drinking Water Quality, vol. 1. Recommendations. Second Ed., WHO, Geneva.

World Health Organization, (1996). Guidelines for Drinking Water Quality, vol. 2. Health criteria and other supporting information. Second Ed, WHO, Geneva.

تأثير استخدام الماء الجوفي وماء الشرب في عملية تنميش القمح علي محتوي الدقيق الناتج من الرماد وبعض العناصر الثقيلة

أحمد السيد البرديني* ، عبد التواب سعد بركات وعبد المنعم صالح إبراهيم****

*** شركة مطاحن شمال القاهرة, القاهرة مصر**

**** معهد بحوث تكنولوجيا الأغذية, مركز البحوث الزراعية, الجيزة, مصر**

تتم عملية تنميش القمح بضبط معدل الرطوبة وتوزيعها خلال كل حبة قمح وذلك بإضافة كمية الماء المطلوبة حتى تصل نسبة رطوبة الحبوب إلي ١٥,٥% في الأقماح الضعيفة و ١٧,٥%, في الأقماح الصلبة بغرض اعداد الحبوب لعملية الطحن.

تستخدم بعض المطاحن الماء الجوفي مباشرة في تنميش القمح لتقليل التكلفة دون اعتبار لمحتوى من المعادن الثقيلة.

اجري هذا البحث في بعض مطاحن محافظة القاهرة التي تستخدم الماء الجوفي او ماء الشرب في عملية التنميش بغرض تقدير محتوي دقيق القمح الكامل ودقيق إستخراج ٨٢%و ٧٢%,من الرماد, المنجنيز, الحديد, الزنك,النحاس والرصاص, ومقارنتها بالعينة الكنترول وكذلك بالمواصفات القياسية المصرية المتاحة في هذا الشأن.

ولقد اظهرت النتائج أن:

محتوي رماد دقيق القمح إستخراج ٨٢% و٧٢% الناتج من قمح تم تنميشه بماء جوفي كان ١,١٤% و ٠,٦٦%,علي الترتيب, في حين تشترط المواصفات القياسية المصرية ألا تزيد هذه النسبة عن ١,١% و ٠,٥٦%,علي الترتيب.

وجد زيادة في المنجنيز, الحديد والنحاس في الدقيق إستخراج ٨٢%الناتج من قمح تم تنميشه بماء جوفي, ووصلت نسبة الزيادة عن محتوي الكنترول من هذه العناصر إلي ١١٤, ٢٠٧و ١٤٧%, علي الترتيب.

وصلت نسبة الزيادة عن الكنترول في محتوي دقيق القمح إستخراج ٧٢% الناتج من القمح المنمش بالماء الجوفي إلي ١٤٠% للمنجنيز, ١٦٩% للحديد, ١٤٥% للزنك, ٣٠٠% للنحاس والرصاص.

يؤدي تناول الخبز البلدي الناتج من دقيق استخراج ٨٢% من قمح منمش بهذه المياه إلي زيادة المتناول اليومي من هذه العناصر عن التوصيات الغذائية المسموحة.

بعض هذه المعادن سام مثل الرصاص, وبعضها مهم للجسم ولكن بتركيزات منخفضة ولكنها تصبح سامه عند التركيزات العالية مثل المنجنيز, الحديد, الزنك والنحاس. لم تشترط المواصفات القياسية حدود قصوي لهذه المعادن في الدقيق.