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INVESTIGATORY SURVEY OF THE EXTENT OF CONTAMINATION OF FOOD BY ALUMINUM

El-Sayed, Samiha M. and Samia E. Farag
Food Science and Technology Dept., Faculty of Home Economics Tanta, Al-Azhar Univ.,Egypt

ABSTRACT

Aluminum is not an essential element to human and is considered to be a toxic metal ion. The concentrations of aluminum in some Egyptian foods (Meat, poultry products, fish, grain, beverages, vegetables, fruits, dessert, sugar, milk, dairy, products, spices, and others) collected from local markets in Alexandria and EL-Gharbia governorates were determined. The results indicated that aluminum concentration varied according to the type of foods, processing treatments, food additives and location of collected. The highest mean concentrations of aluminum were found in tomatoes(1631.33mg/kg), ketchup(12725.2mg/kg) , green onion fresh(1094.53 mg/kg), tea leaves (1034.80mg/kg), rocket fresh (897.6mg/kg), cream cheese (793.0 mg/kg), vegetar spiced coating (703.80mg/kg) and traceale (526.4 mg/kg)(dry weight basis). The mean values of aluminum concentration in bread samples ranged from 57.2 to 1748.4 mg/kg (dry weight). The results of this study indicate the presence of high levels of aluminum in some food groups sold in the local markets of Egypt representing public health hazards of the consumers.
Keywords: Aluminum, Egyptian food group, contamination.

INTRODUCTION

Aluminum is the most abundant metallic element and constitutes 8.13% of the earth's crust. It does not appear to have any role in animal and human biology (Soni *et.al*, 2001). Under very acidic conditions however aluminum can be released from rocks and soils in a soluble from which can be absorbed by plants and animals (Zatta & Alfrey, 1998).

Although aluminum is not a heavy metal (Martin & Holdich, 1986), it is unquestionably neurotoxin encephalopathy develops in some patients on long term renal dialysis with aluminum rich dialysate (Birchall& Chappell, 1988). Aluminum has a biologic effect on calcium phosphate precipitation and crystation by formation various aluminum complexs (Meyer&Thomas, 1986). The high amounts of ingested aluminum (more than 1g/day) interfered with phosphorus and calcium metabolism (Spencer *et.al*., 1982), wich hamer phosphorus absorption (Greger&Baier, 1983). As a result, aluminum inhibits both matrix synthesis and bone mineralization (Cournot *et.al*., 1986; Campbell *et.al*., 2004; Zaida *et.al*., 2007). Aluminum may be responses to anemia (Ishiwata *et.al*., 1988). Other neural enzymes are inhibited by the presence of aluminum and other heavy metals, resulting in an overall decrease in brain cell energy, fatigue and progressive loss of reasoning ability (King.1977, Zaida *et.al*, 2007). AL-Zaheimer`s disease and senile dementia has been associated with accumulation of aluminum in certain area of the brain (Crapper *et.al*.; 1976; Narin *et.al*., 2004).

The Joint FAO/WHO Expert Committee (FAO/WHO, 1989) have found that levels of aluminum intake up to 110 mg/kg body weight/day do not induce any toxicological effects. Recently, WHO/IPCS (1997) summarized the total intake of aluminum from food and beverages (excluding drinking water) from several countries. The estimates of aluminum intake from different countries studied are less than 15 mg/day (range 0.03-11.5).

The use of aluminum (in the form of aluminum sulphate) as flocculants in the treatment of drinking water may contribute to the large aluminum concentration in drinking water (ATSDR, 1992). Water containing 1 ppm fluoride (the usual level of fluoride in public water supplies) boiled for ten minutes in an aluminum pot, will increase the concentration of aluminum to 200 ppm, prolonged boiling can increase the concentration to 600ppm (LERG,1996).

Several of the intentional aluminum containing food additives aluminum ammonium sulphate, aluminum potassium sulphate, aluminum sodium sulphate and sodium aluminum phosphate) are used as buffers and neutralizing agents. Others are used as dough strengtheners, leavening agents (acidic sodium aluminum phosphate),acid reacting ingredients in self rising flour or cornmeal, emulsifying agents (basic sodium aluminum phosphate) for processed cheese, firming agents, processing aids, stabilizers, thickeners, curing agents and components in bleaching agents, texturizers, anticaking agents (aluminum silicate) and aluminum color additives (lakes) from various food dyes. Unintentional aluminum containing additives may migrate from paper or paperboard food containers, animal glue,adhesives, cellophane, rubber or resinous and polymeric coatings (Pennington.1987; Soni *et.al*, 2001)

The aluminum content of foods may include that which is present naturally, that which comes from aluminum containing in food additives and food containers (cookware, utensils, pressure cookers, roasting pan spots, foil, coffee pots, saucepans, frozen dinner trays and food wrappings)(Pennington & Jones, 1988).Boiling water in aluminum containers especially water containing acidic substances, causes aluminum to leach into the water and food (LERG.1996).

The present investigation aimed to evalute the contamination level of some Egyptian foods collected from retail markets in Alexandria and EL-Gharbia governorates.

MATERIALS AND METHODS

Collection of Samples

A total of 320 different food samples (Meat, fish, grain, beverages, vegetables, fruits, dessert and sugar, milk and dairy products, spices, and others) were collected(3Kg for each)at random from local markets of Alexandria and EL-Gharbia governorates during the year2005-2006.Every type of food samples which collected from different area in two governorates mixed with then to obtained the representative samples and the samples were taken and placed in clean polyethylene and kept at -20 ^{0}C until analysis was carried out.

Aluminum Determination

Analysis for aluminum was performed using atomic absorption spectrophotometer (PERKIN –EL-MER 2380) following by dry ashing method according to AOAC (2000). Aluminum content of food groups was calculated as mg/ Kg dry weight.

RESULTS AND DISCUSSION

Aluminum content of studied foods Meat, poultry products and fish

Table (1) showed that the levels of aluminum in meat and poultry products ranged from 60.8± 0.01 mg/Kg to 526.4 ± 0.04. The highest mean concentration of aluminum was found in the spleen (526.4± 0.04mg/kg). Among poultry products, the processed chicken (hot chicken stick, chicken fillets (pre-fried), chicken grilled and chicken sausages) showed high aluminum levels. The differences in mean aluminum concentrations in poultry products may be due contamination of chicken diets with aluminum, type of product, processing method, aluminum contamination from utensils, additives (e.g. salt, spices and herbs), packaging material and location of collected .These results agree with Ranau *et.al*.,(2001),who reported that presumably two factors were responsible for higher temperature of preparation when grilling fillets and second the high aluminum content of mixed spices(63.5mg aluminum/kg),which may be taken up in part by the grilled fillets. or caused by a packaging material which used in fast foods. Also, Lòpez *et,al*., (2002) showed that the most elevated aluminum concentrations were found in some samples of chicken soup with vegetables and chicken with mushroom, also they reported that mean aluminum concentration in chicken sandwiches, chicken with aromatic herbs and chicken with mushroom was 6.20,15,70 and 16,75µg/g,respectively.

Park (1976) reported that sodium aluminum phosphate is used in food processing as a meat agent .The higher level in the present results disagree with those of Pennington & Jones (1988) who indicated that the mean concentration of aluminum phosphate in fried and roasted chicken meat was 0.127, 0.022 mg/100g, respectively.

Pennington (1987) reported that the factors affecting the increase in the aluminum content of these foods include: the type of aluminum utensil (e.g. wrought or cast aluminum), previous use of utensil, pH of the foods and/or cooking water, length of time of contact, cooking and presence of salt or sugar.

Oke (1967) found that the mean concentration of aluminum was 2.39 and 3.83 mg/100g in crayfish and dried fish, respectively. One unusually high value was that for total diet study (TDS) fish sticks (5.14mg/100g), this high level may indicate an aluminum additive in the breading (Pennington, 1987). Reported value for aluminum in fish was 347.6 mg/Kg. These results are in agreement with Ysart *et.al*.,(2000) who reported that the highest mean concentrations of aluminum were found in the bread (6.6 mg/Kg. fresh weight) and fish (6.1 mg/Kg. fresh weight) groups.The same authors indicated that the mean concentration of fresh weight of aluminum in meat products and poultry were 1.9 and 0.3 mg/Kg, respectively.Zaida *et.al*.,(2007)reported that the mean aluminum concentrations in bovine meat, chicken, sardine fish and sole fish were 12.5,51.0,94.5 and 41,3 mg/kg, respectively.

Grain products

The present study revealed that the mean concentration levels of aluminum in rice, breadcrumbs, biscuits, macaroni and cookies were in descending order as follows: 845.23, 783.4, 514.2, 276.8, 214.2 and 152.2 mg/Kg, respectively. The higher aluminum levels in the present study or were in agreement with those reported by Pennington (1987) who reported that grain products with higher aluminum levels (biscuits, cornbread, muffins, pancakes and tortillas) were probably made with aluminum containing additives. Also, Zaida *et.al*.,(2007) reported that the mean aluminum concentration in semolina of barley, semolina of wheat, rice, and biscuit samples were 14.1,47.5,59.5and 33.0 mg/kg, respectively

Sodium aluminum phosphates are the most commonly used aluminum containing additives (FASEB, 1979). The acidic form of this compound reacts with sodium bicarbonate to cause a leavening action .Acidic sodium aluminum phosphate is used in biscuit, pancake, waffle, cake, doughnut and muffin mixes, frozen rolls and yeast dough's, canned biscuits and self rising flours (Park, 1976; Lione.1983) .Such baking powders will contain about 70 mg of aluminum containing baking powder may contain 5-15 mg of aluminum. Most commercial baking powders and some that are sold for household use contain mono calcium phosphate rather than aluminum salts (Lione, 1983).

The total diet study cakes had very high levels of aluminum (806 and 16.9 mg/100g). Which probably reflect an aluminum additive in the baking powder the higher levels in other baked desserts such as other cakes, cookies, Danish pastry and dough nuts may also reflect aluminum additives in baking powder (Pennington, 1987). The mean aluminum concentration in miscellaneous cereals group (5.2 mg/Kg). The relatively high concentration found in miscellaneous cereals group the studies were likely to have been caused by the presence of containing additives as these are permitted for use in some of the bakery products included in the Miscellaneous cereals group (U K Government,1995) .

The most commonly used foods that may contain substantial amounts of aluminum containing food additives are processed cheeses, baking powder, cake mixes, frozen dough, pancake mixes, self rising flours, food starch modifiers,anti-caking and pickled vegetables (Lione, 1983,LERG,1996).

Varo *et.al*., (1980c) reported that the mean concentrations of aluminum were 1.2, 2.8, 25.0 and 2.6 mg/100g in popcorn, rice brown, rice feed meal and wheat bran, respectively, while Furr *et.al*.,(1981) indicated that the level of aluminum was 7.51 in millet .The main contributors to aluminum intake are grain and cereals(Moll &Moll,2000).

Beverages

The analysis of the obtained data in Table (1) showed the mean values of aluminum concentration in beverages group were between 87.2±0.17 to 1034.8± 0.10 mg/Kg. The highest mean concentration of aluminum was found in tea powder(1034.80mg/kg). The same results obtained by Lewis

(1990) who reported that tea plant is able to grow in very acidic soils, where aluminum is readily available for uptake by the roots. The tea leaves serve as a sink accumulating over 10^4 u g $^{-1}$ aluminum in some cases. Nowadays, chests lined with aluminum foil are used for storage and transportation of tea instead of lead foil which could be counted as a source of tea contamination with aluminum (Michie &Dixon, 1977). Meanwhile, Atta (1995) showed that the average of aluminum content in tea imported from Sir lank was 4842 µg/g, while Indian tea contained 3674 µg/g. Our results in agreement with Zaida *et.al*., (2007)who showed that the highest concentration of aluminum was found in beverages like tea (481mg/kg).Also,Wu *et.al*.,(1997) showed that tea is one of the few plants that accumulate aluminum. Pennington (1987) reported that the concentrations of aluminum were quite high in tea leaves and tea powder (67.0 to 140.0 mg/100g), however the concentration in brewed tea was only 0.02 to 0.446 mg/100g. Also, the author indicated that the values of aluminum for prepared coffee ranged from 0.004 to o.oo6 mg/100g.

Lione *et.al*., (1984) found that the aluminum content of coffee brewed in used hardly used and new aluminum posts increased four, five and seven fold ,respectively. They noticed that the use of aluminum post to brew and reheat acidic beverages such as coffee may be a significant source of aluminum. As a matter of fact, tea and herbs are the richest natural food sources in aluminum (Greger, 1985).

Among Beverages, the *sahlab* powder and orange beverage powder showed high aluminum levels, while the mean values of aluminum concentration in cocoa and coffee powder were 89.0± 0.34 and 87.2± 0.17 mg/Kg, respectively. The extent of the increase of aluminum is strongly dependent on factors such as temperature, pH value, duration of contact or heating, presence of sugar, organic acids, salt and other ions (Ranau *et.al*, 2001).

Khattab *et.al*., (1984) reported that the aluminum content of two fruit juices (processed by two Egyptian companies) was increased by contact with their aluminum foil containers. They also reported that the acidity of the products enhanced the increase in aluminum during storage. The aluminum content as determined by differential pulse polarography of mango and pineapple juices in aluminum foil containers was 3.530 and 4.903 mg/100g, respectively. After incubation for 6 weeks at 4˚C, the aluminum content increased six and four fold, respectively. Ysart *et.al*., (2000) reported that the mean concentration of aluminum was 1.3 mg/Kg (fresh weight) in beverages.

Vegetables

Table (1) listed the aluminum content of various vegetables which collected from local market in Alexandria and EL-Gharbia governorates. The obtained data showed that the mean concentrations of aluminum were between 61.6±0.30 mg/Kg in fresh potatoes and 1631.33[c] ± 0.31mg/Kg in fresh tomatoes. Within the selected vegetables, the highest concentrations of aluminum were noticed in followed by fresh tomatoe ,green onion, rocket, green fenugreek,green pepper, fresh coriander and carrot.Verissimo *et.al*.,(2006)showed that several products as potatoes, spinach and tea are known to have high aluminum content.

The high contamination found in some fruits and vegetables might be closely related to the pollutants in irrigation water, farm soil or due to pollution from the highways traffic (Qiu *et.al*., 2000).Also,Zaida *et.al*.,(2007) reported that the mean aluminum concentration in carrots and potato was 41.3and 73,6mg/kg,respectively.Also,Neelam & Kaladhar (2000) analyzed the aluminum content of certain cooked foods to assess its daily burden in the Indian populations and concluded that significant levels were detected in most of the samples, green leafy vegetables, pulse preparation and the storage of food in aluminum vessels contribute greatly to total daily aluminum intakes

Hazelton (1984) indicated that the foods had higher aluminum retention were tomatoes, cabbage, apple sauce which were cooked in aluminum saucepans and chocolate which was wrapped in aluminum foil for 1 week or longer.

Koning (1981) noticed a higher aluminum retention in acidic (rhubarb) and basic (Oat meal) foods than in a neutral food (carrots) cooked in aluminum utensils. The major contributor to aluminum was the grain and cereal products group (67.5%). Also, the contribution of the vegetables (potato, leafy, root, legume and other) was 18.5%, while dairy products supplied 11.0% and meat. Fish and poultry supplied 3.0% (Taner &Friedma, 1977).

Varo *et.al*.,(1980c)showed that the mean concentration of aluminum in green vegetables, potatoes and other vegetables was given as 3.1, 0.9 and 2.7 mg/ Kg fresh weight by Ysart *et.al*.,(2000).The highest aluminum concentrations in foods are found in bread, cereals, fish and vegetables(Vinás *et.al*.,2001).

Dessert and sugar

The data shown in Table (1) indicated that mean aluminum concentrations in traceal, *Halwa tehenia*, sugar, honey and apricot jelly were 526.4, 256.0, 19.80, 184.2 and 110.66 mg/ Kg, respectively .Also, the data of present study showed that the highest mean concentration of aluminum were found in traceale (526.4± 0.40 mg/ Kg) .These increasing may be due to processing treatments such as milling processes (extraction), clarification (liming) or concentration process which occur during manufacture of traceale.

The aluminum content of fruit butters, sauces, jam, jelly and marmalade ranged from 0.030 to 0.528 mg/ 100g, Also average aluminum values for honey were in the range of 0.074 to 0.855 (except one value which was 5.77 mg/ 100g), molasses and sugar cane juice appeared to be high in aluminum, while average values for sugar ranged from 0.005 to 0.52 mg/ 100g (Pennington, 1987), while recorded as 2.7 mg/ Kg for sugars and preserves by Ysart *et.al*., (2000).

Milk and dairy products

The data given in Table (1) reveal higher aluminum concentrations in cream cheese (793.0± 0.82 mg/ Kg) and milk (150.7± 0.06mg/ Kg), while, the same samples of dry milk recorded as 0.380 and 38.8 mg/ 100g by Pennington (1987). Also,Biego *et.al*.,(1988) indicated that the principal sources of aluminum are milk and dairy products(36%). Zaida et.al., (2007) showed that the mean aluminum concentration in cow`s milk was 29.2µg/l.

Our results agree with Pediatrics (1986) who reported that pasteurization process(aluminum vats and piping)contributes to the amount of aluminum in milk, or it involves the feed the animal is eating, is unknown.

The basic form of sodium aluminum phosphate is used in processed cheeses and cheese foods as an emulsifying agent to give softnes of the texture of cheese products and allow easy melting (Park,1976& Lione,1983) .It is commonly used in individually wrapped sliced processed cheeses and may result in about 50 mg of aluminum per slice (Lione,1983). Reported values for aluminum in cheese were less than 2 mg/ 100g except for two levels (69.5 and 41.1mg/ 100g) for American cheese (Pennington, 1987). Mean while, Gormican (1970) indicated that the American cheese that she analyzed contained the emulsifier sodium aluminum phosphate. The American cheese in the total diet studies (Pennington & Joes, 1988) probably also contained an aluminum additives.

Grebennikov *et.al*., (1964) reported that the aluminum content was greater in the milk of rapidly growing animal,of the five milk species that they analyzed (human, mare, cow, goat and sheep), the aluminum concentration decreased as the number of day taken to double birth weight increased. The mean aluminum content of fluid cow milk and cultured milk ranged from less than 0.001 to 0.2 mg/ 100g except for condensed milk, which contained 0.90 mg/ 100g, values for dry milk ranged from o.380 to 38.8 mg/100g (Pennington, 1987).

The analysis of the obtained data in Table (1) showed the mean value of aluminum concentration in ghee samples was 92.0±0.45 mg/kg. Excluding the value for cream substitute, the aluminum content of fats and oils ranged from 0.001 mg/ 100g for corn oil to 0.80 mg/ 100g for cream. The aluminum concentration of the Total diet study powdered cream substitute was 13.9 mg/ 100; it most likely contained an aluminum additive (Pennington, 1987).Lopez *et.al*., (2000)showed that the aluminum level in olive oil was ranged between 19.6-70.1µg/kg.Ysart *et.al.,* (2000)reported that the mean concentration of aluminum was 1.1 mg/ Kg in oils and fats.

Spices and herbs

The results of the survey of spices and herbs present in Alexandria and EL-Gharbia governorates for aluminum levels are presented in table (1). Vegetar spiced coating mix was found to contain the highest mean concentration of aluminum (703.8± 0.10 mg/ Kg) followed by laurel leaf 323.6± 0.20 mg/ Kg, while the mean aluminum in hot pepper and cinnamon were 201.1± 0.05 and 196.0± 0.26 mg/ Kg, respectively. These results are in agreement with those of Lopez *et.al*., (2002) who reported that the more elevated aluminum concentrations were detected in foods with a greater content of spices and aromatic herbs, pasta, certain vegetables and additives and foods packaged in aluminum vessels. Lopez *et.al*.,(2000a)analyzed the aluminum levels in a total of 72 samples of 17 different spices and aromatic herbs, aluminum concentrations ranged from3.7 to 56.5 µg/g(dry wt.).

Others

From data in Table (1), it is noticed that the highest mean concentration was found in the Ketchup samples (12725.20 ^{c} ± 0.30mg/ Kg) .So our result agrees with those reported by Pennington (1987) who indicated that foods with the highest aluminum retentions (tomato sauce, cabbage, tomatoes, rhubarb, apricots, cranberry sauce and sauerkraut)were primarily acidic foods. Also, Lopez *et.al*., (2002),reported that the mean concentrations aluminum was 3.72 and 2.73µg/g in ketchup and tomato, respectively.

Considerable quantities of aluminum may move from aluminum vessels into foods when fruit or vegetable juice are simmered for 30 min, when foods are cooked from 2 to 6h or when tomatoes are held overnight, more common procedures used during food preparation should not cause such high levels of aluminum migration. Lione *et al*., (1984) determined the difference in aluminum after cooking tomatoes in porcelain and aluminum pans and after holding the cooked tomatoes overnight in this utensil there was a 23 fold increase in aluminum after cooking for 2h and a 48 fold increase after holding overnight in the aluminum utensils.

Reports mean values for aluminum in nuts, peanut butter and seeds ranged from less than 0.02 to 1.4 mg/ 100g (Pennington, 1987). The obtained results in Table (1) indicate that mean concentration level of aluminum in potato chipsy and salt were 256.00 ± 0.38 and 43.47 ± 0**.**58 mg/ Kg, respectively. The aluminum silicates (sodium aluminum silicate, aluminum calcium silicate and hydrated sodium calcium aluminum silicate) are found in anticaking agents in salt, non dairy creamers and other dry, powdered products (Lione, 1983).

The main contributor to the aluminum content of the total diet study (TDS) diet as estimated by Greger (1985) was also grain products (69.4%) followed by milk products (12.1%) , mixed dishes (7.2%) and beverages (4.5%) , salt, herbs and pepper contributed 4.2%. Also,the same author indicated that the major source of aluminum in the grain products was baking powder, the major aluminum source in the dairy products and combination main dishes was processed cheese containing aluminum additives, the major source of aluminum in beverages was tea and the major source of aluminum in salt was an aluminum additive.

Aluminum content in Egyptian bread samples:

The analysis of the obtained data in Table (2) showed the mean value of aluminum concentration in bread samples ranged from 57.2 ± 0.17 to 1748.4± 0.17 mg/ Kg**.** The highest mean concentration of aluminum was found in the brown bread (which collected from area near vegetables market in two governorates) (1748.4± 0.17mg/ Kg) and another brown bread sample (which collected from local market nearly the crowded streets with auto vehicles).The bread samples packed in polyethylene bags had the lowest concentration of aluminum. The differences in aluminum concentration in bread samples may be due to sampling area, bread source and contamination exposure and bread type.

The major contributors to aluminum intake of the adult male in the 1984 total diet studies "TDS" (Pennington & Jones, 1988) were grains and grain products (36.5%), milk, yoghurt and cheese (27.0%), desserts (16.6%), beverages (6.1%) and mixed dishes (5.1%). (Pennington &Jones, 1988).Ysart *et.al*., (2000) showed that the highest mean concentrations of aluminum were found in the bread (6.6mg/ Kg) and fish (6.1mg/ Kg) groups.

The concentration of aluminum in grains and grain fractions tended to be lower in refined products (barley, corn grits, rolled oats, white rice) than in the whole grains (Pennington, 1987).The use of aluminum containing food additives is so wide that these additives are the main source of aluminum in the diet (Saiyed & Yokel,2005).

Table 1: Aluminum content (mg/kg dry weight basis)of various Egyptian foods and food products(Mean±SD)

Food groups	Al	Food groups	Al
Meat, meat products and fish	**233.07 ± 152.91**		
Chicken fillets	$389.20^{c} \pm 0.01$	Chicken nuggets	$83.80^{b} \pm 0.01$
Banch Chicken breast meat	$307.00^{e} \pm 0.56$	Chicken burger	$85.40^{d} \pm 0.03$
Chicken luncheon (2)*	$326.00^{l} \pm 0.11$	Chicken finger	$169.20^{a} \pm 0.20$
Chicken luncheon(1) *	$60.80^{g} \pm 0.01$	Chicken sausages	$229.20^{a} \pm 0.03$
Hot Chicken stick	$490.60^{i} \pm 0.05$	Chicken shawerma	$205.60^{j} \pm 0.20$
Chicken kofta	$88.00^{k} \pm 0.54$	Beef meat	$62.80^{n} \pm 0.01$
Grilled chicken	$239.00^{m} \pm 0.10$	Spleen(fresh)	$526.40^{a} \pm 0.04$
		Fish (Bolti)	$347.60^{o} \pm 0.20$
Fish (Bolti)	**347.60 ± 0.20**		
Grain products	**315.13 ± 280.01**		
Popcorn	$175.98^{a} \pm 0.14$	Wheat flour(72% extraction)	$86.33^{b} \pm 0.52$
Breadcrumbs	$783.40^{c} \pm 0.10$	Pie – cookies	$111.80^{d} \pm 0.10$
Rice (raw)	$845.23^{e} \pm 0.07$	Cookies	$152.20^{f} \pm 0.07$
Biscuits	$276.80^{g} \pm 0.11$	Macaroni(raw)	$214.20^{h} \pm 0.20$
Beverages	**366.33 ± 384.82**		
Cocoa(powder)	$89.00^{a} \pm 0.34$	Orange beverage (powder)	$106.47^{b} \pm 0.12$
*Sahl*ab(powder)	$514.20^{c} \pm 0.52$	Coffee powder (nautral)	$87.20^{d} \pm 0.17$
Tea leaves(dried)	$1034.80^{e} \pm 0.10$		
Vegetables	**495.81 ± 419.78**		
Green coriander	$298.30^{a} \pm 0.30$	Cowpea (black eyed peas)	$143.00^{b} \pm 0.46$
Tomatoes (fresh)	$1631.33^{c} \pm 0.31$	Green fenugreek (fresh)	$503.40^{d} \pm 0.10$
Green onion	$1094.53^{e} \pm 0.12$	Rocket (fresh)	$897.60^{f} \pm 0.10$
Carrot (fresh)	$256.20^{g} \pm 0.20$	Green pepper (fresh)	$300.00^{h} \pm 0.02$
Potato (fresh)	$61.60^{i} \pm 0.30$	Garlic (fresh bulb)	$131.22^{j} \pm 0.11$
Dessert and sugar	**219.48 ± 178.40**		
Sugar	$19.80^{a} \pm 0.10$	Apricot Jelly(Artificial)	$110.66^{b} \pm 0.25$
Halwa Tehenia	$256.33^{c} \pm 0.58$	Traceale	$526.40^{d} \pm 0.40$
Honey	$184.20^{e} \pm 0.07$		
Milk and dairy products	**220.41 ± 267.55**		
Milk cream	$52.60^{a} \pm 0.22$	Milk butter	$80.40^{ac} \pm 0.18$
Cream Cheese	$793^{b} \pm 0.82$	Milk (fresh)	$150.7^{c} \pm 0.06$
Ghee	$92.00^{ac} \pm 0.45$		
Spices	**1084.23 ± 1315.33**		
Vegetar spiced coating	$703.80^{a} \pm 0.10$	Laurel leaf	$323.6^{b} \pm 0.20$
Hot pepper (chili)	$201.10^{c} \pm 0.05$	Cinnamon	$196.00^{d} \pm 0.26$
Others	**468.56 ± 615.80**		
Guava	$42.60^{a} \pm 0.26$	Peanuts	$368.80^{b} \pm 0.04$
Ketchup	$12725.20^{c} \pm 0.30$	Potato chips	$256.00^{d} \pm 0.38$
Salt	$43.47^{e} \pm 0.58$		

Significant at $p < 0.01$ Different superscripts are significant (1)*& (2)* Processed by two Egyptian companies

Table (2): **Aluminum content (mg/kg dry weight basis) in Egyptian bread samples(Mean±SD)**

Bread samples	Al	Food groups	Al
Brown	**728.46 ± 466.18**		
*1	457.40^{a} ± 0.04	*2	1748.4 ^{b}± 0.17
*3	379.57^{c} ± 0.05		
Shamy	**650.07 ± 571.68**		
*1	1403.20^{a} ± 0.07	*2	٣٧٥.20 ^{c} ± 0.01
*3	171.80^{b} ± 0.10		
White	**122.60 ± 63.03**		
*1	201.00^{a} ± 0.30	*2	109.60^{c} ± 0.30
*3	57.20^{b} ± 0.17		

Significant at $p < 0.01$ Different superscripts are significant
***1, *2 &*3: the different area which was collected the bread**
***1: Samples collected from local market near by the crowded streets**
2: Samples collected from area near high population vegetable market.
***3: Bread packed in polyethylene (from supermarket).**

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المسح التحقيقي لمدى تلوّثِ الغذاءِ بالألمنيومِ

سميحه محمد السيد و ساميه الصافى فرج
قسم علوم وتكنولوجيا الاغذيه- كليه الاقتصاد المنزلى- طنطا- جامعه الازهر

يعتبر الألومنيوم من العناصرغيرالضرورية بالنسبة للأنسان وهوأيضاً من الايونات المعدنية السامة. وينتج مرض الزهايمر من تراكم معدن الألومنيوم فى مراكزهامة فى المخ ، لذا أهتمت هذه الدراسة بتقديرتركيزمعدن الألومنيوم فى بعض الأغذية المصرية والتى تم تجميعها من السوق المحلى بمحافظتى الأسكندرية والغربية.

وقد أوضحت النتائج أن تركيزمعدن الألومنيوم يعتمدعلى العديد من العوامل منها:-

نوع الغذاء- المعاملات التصنيعية المختلفة التى يتعرض لها الغذاء – المضافات الغذائية المستخدمة وأيضاً المنطقة التى تم تجميع العينات منها.

وقد أظهرت النتائج أن أعلى متوسط تركيز للألومنيوم وجد فى الأغذية التالية:-

الطماطم (١٦٣١٫٣٣ مجم/كجم) ، الكاتشب (١٢٧٢٥٫٢مجم/كجم) ، البصل الأخضرالطازج(١٠٩٤٫٥٣مجم/كجم) ،أوراق الشاى (١٠٣٤٫٨٠مجم/كجم) ، الجرجير الطازج (٨٩٧٫٦مجم/كجم) ، الجبن الأبيض دوبل كريم (٧٩٣٫٠مجم/كجم) ، الفيجيتار (٧٠٣٫٨٠مجم/كجم) والعسل الاسود (٥٢٦٫٤مجم/كجم) على أساس الوزن الجاف وكان اقل تركيز للالمونيوم فى عينات الخبز المعبأة فى البولى أثيلين. وقد بينت النتائج أيضاً أن متوسط تركيزالألومنيوم فى عينات الخبز والتى تم تجميعها من مناطق مختلفة قد تراوحت من٥٧٫٢مجم/كجم الى١٧٤٨٫٤مجم/كجم على أساس الوزن الجاف. ومن النتائج السابقة يتضح أن تركيز معدن الألومنيوم فى الأغذية محل الدراسة كان عاليا مما يمثل خطورة على الصحة العامة للمستهلك .