

Level of contamination with lead and aluminum in liver sandwiches served by street vendors and some restaurants with different hygienic practice

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A total of fifty liver sandwiches served by street vendors and restaurants with different hygienic practices (25 of each), were collected from Giza Governorate. The levels of lead and aluminium residues were determined by using atomic absorption spectrophotometer. The mean values of lead residues in cooked liver sandwiches served by each of street vendors and restaurants were 1.68 ± 0.51 and 0.73 ± 0.2 mg/kg; respectively; as well as, it was constituted 6.2 ± 2.1 and 4.3 ± 1.1 mg/kg for aluminum residues, respectively. The levels of lead and aluminum residues in liver sandwiches served by street vendors were high as compared to that detected in restaurants. The sources of contamination with such elements (lead and aluminium) as well as the public health importance were discussed. The suggestive measures to avoid the contamination with such elements in cooked food were recommended.

The widespread of cooked liver in sandwiches as fast food meals with street vendors and in some restaurants may cause public health hazards. The livers are contaminated during processing from deposition of contamination of air through dusts and equipment (Benneth, 1981 and Oyaro *et al.*, 2007). It is therefore, important to keep monitoring the various pollutants in livers since most of butchers sell their livers in strategic places like roadsides and near bus stop. The heavy metal residues in animal tissues including livers were detected by many investigators (Sharma and shupe, 1977; Holm, 1981; kreuger *et al.*, 1991; Doganic, 1996; Oyaro *et al.*, 2007; Abdel-Wahab, 2010). Lead is the most frequent cause of acute heavy metal poisoning. Aluminum is detected in liver of cattle (Jorhem *et al.*, 1989) as well as the contamination from cookware and from food additives are possible (Saied and Yokel, 2005).

Aluminum is widespread throughout the natural environment and is present in air, water, plants and consequently, throughout the food chain (Erdemoglu, 2000).

There is unavailable data concerning values for heavy metals (lead and aluminum) in cooked livers of sandwiches which sold as takeaway meals by either of street vendors or restaurants.

Therefore, the aim of this work was planned out to determine the levels of lead and aluminum residues in liver sandwiches served by street

vendors and some restaurants with different hygienic practices in Giza Governorate.

Materials and methods

Collection of samples. Fifty liver sandwiches served by street vendors and some restaurants with different hygienic practices (25 of each) were collected from Giza Governorate to determine their lead and aluminum levels. The samples were separately collected in polyethylene bags and then identified. The collected samples were rapidly transported to the laboratory and preserved in package at 4°C until analysis.

Preparation of samples. The samples were digested according to the technique applied by Khan *et al.*, (1995). The resulting solutions (digest) were kept until analysis.

Lead residues. The atomic absorption spectrophotometer (AAS) was used for digest analysis at wavelength 217 nm with detection limit 0.001 ppm. The lead concentration was directly recorded from digest scale of AAS and calculated.

Aluminum residues. The graphite furnace AAS was used at wavelength 309.3 nm for aluminum concentration (Sullivan *et al.*, 1987; Soylack *et al.*, 2006).

Results and discussion

From the results recorded in Tables (1, 2) and Fig. (1, 2) it is obvious that the lead residual level in the examined cooked liver sandwiches served through street vendors ranged from 0.38 to 2.16 with a mean value of 1.68 ± 0.51 mg/kg while, it ranged from 0.26 to 1.22 with a mean value of 0.73 ± 0.20 mg / kg in cooked liver

sandwiches served in restaurants.

Forty percent and 16% of the examined cooked liver sandwiches served in street vendors and restaurants (Tables 3, 4), were exceeded the

lead residual limit stated by Egyptian Organization for Standardization (EOS, 1993) which stated that the permissible limit of lead should not exceed 0.5 mg/kg (ppm) in beef liver.

Table (1): Lead and aluminum residues (mg/kg) in liver sandwiches served in street vendors (25 samples).

Heavy metal	Minimum	Maximum	Mean	±SE
Lead	0.38	2.16	1.68	±0.51
Aluminum	3.00	9.40	2.60	±2.1

Table (2): Lead and aluminum residues (mg/kg) in liver sandwiches served in some restaurants (25 samples).

Heavy metal	Minimum	Maximum	Mean	±SE
Lead	0.26	1.22	0.73	±0.2
Aluminum	2.4	6.8	4.3	±1.1

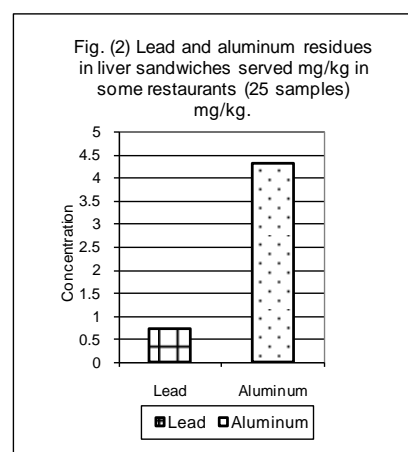
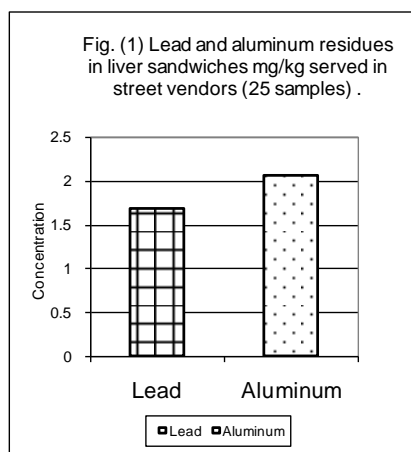


Table (3): Frequency distribution of liver sandwiches (mg/kg) based on lead residual levels (25 samples).

Frequency distribution	Street vendors		Restaurants	
	No.	%	No.	%
> 0.1	25	100	25	100
> 0.5	10	40	4	16
> 1.0	8	32	2	8
> 1.5	5	20	0	0
> 2.0	1	4	0	0
> 2.5	0	0	0	0

Table (4): Frequency distribution of liver sandwiches (mg/kg) based on aluminum residual levels (25 samples).

Frequency distribution	Street vendors		Restaurants	
	No.	%	No.	%
> 1	25	100	25	100
> 3	22	88	15	60
> 5	15	60	5	20
> 7	6	24	0	0
> 9	3	12	0	0
> 11	0	0	0	0

The source of lead contamination may be attributed to that lead is a widespread environmental contaminant from largely air borne sources, such as industrial emissions, road traffic with leaded petrol, cigarette smoking, dust emissions of coal gas-fired power stations. The fallout from these sources is of particular problems to grazing animals as well as external contaminant for offal including livers during preparation and cooking. This held the view reported by WHO (1977); Humphreys (1991); Oyaro *et al.*, (2007).

Liver sandwiches are usually prepared, in most of the street vendors, in open air as well as roasted near the roadsides and are sold to walkers and passengers as fast food.

The lead residual levels in liver sandwiches sold by restaurant was low as compared to that of street vendors and this may be attributed to that, the handling, roasting and serving in restaurants were operated in closed, and protected area as compared to street vendors who strategically situated near the roadside in very crowded areas as well as in bus station where the lead is high in surrounding environment. This is in agreement of opinions of Oyaro *et al.*, (2007).

Provisional tolerate weekly intake of lead was 25 mg/kg body weight by the joint UNPE/FAI/WHO food contamination monitoring programme to collect information on dietary intake of various contaminants. However, FAO/WHO, (1976) stated that the standard for lead as maximum permissible dose in 3 mg/week for adult.

From the present data in Table (2) and Fig. (2), it is illustrated that the range of aluminum levels in the examined cooked liver sandwiches served in street vendors were 3.0 to 9.4 with a mean value of 6.2 ± 2.1 mg/kg, while it was 2.4 to 6.8 with a mean value of 4.3 ± 1.1 mg/kg in cooked liver sandwiches served in restaurants.

Twenty four percent of the examined cooked liver sandwiches served by street vendors were exceeded 7 mg/kg as well as none of examined samples collected from restaurants exceeded such frequency (Table, 4).

The main sources of aluminum in the body are from consumed food and water. Aluminum in food naturally occurs and also through its addition from food additive and by contact with aluminum utensils, containers and other cookware. This agrees with that stated by WHO, (2007) which stated that the aluminum containing food additives have been used in food

processing for over a century, as firming agents, colouring matter, raising agents, stabilizers and anti-caking agents.

High level of aluminum residues in cooked liver sandwiches served by street vendors as compared to that of restaurants may be attributed to bad quality of utensils and equipment as well as leaching of aluminum during cooking from cookware into food.

Apparently an amount of one to two mg of aluminum is contributed to cooked foods in aluminum cooking pots and pans; especially in acidic foods, which are most likely to absorb aluminum. This held the hypothesis reported by Saied and Yokel (2005). In this respect WHO, (2007) stated that cooking of food in aluminum containers increase the aluminum content in food by less than one mg/kg of food. However, the potential dietary exposure of population to aluminum is 0.6 mg/kg body weight/week.

The intake of low levels of heavy metals over a prolonged period of time may have a harmful effect on human health. These elements, (lead and aluminum) are generally regarded as accidental contaminants. However, their interaction and cumulative nature make them highly dangerous even if they are consumed in low concentrations for relatively longer periods (Doyle and Spaulding, 1978) causing various health problems.

However, excess lead can cause serious damage to brain, kidney, nervous system and blood cells (Anon., 2002).

Moreover Alzheimer's disease represents the main consumer concern of aluminum cookware, but also has little scientific base (WHO, 2003).

From the present data, it could be concluded that the preparation of cooked liver sandwiches by street vendors in open air considered as a source of lead contamination of these sandwiches and the cause of high lead residues as compared to that served in restaurants. The use of aluminum either in container or cookware may be contributed in increasing of aluminum residues in cooked food.

Therefore, it is recommended that the cooking and preparation of sandwiches must be done in closed areas with good hygienic measures with application of Good Hygienic Practices (GHPs) and Good Manufacturing Practices (GMPs) as well as use of anodizing aluminum cookware and discard or recycling of pitted aluminum pot or cookware to avoid health problems.

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مستوى تلوث ساندوتشات الكبد المقدمة بواسطة الباعة الجائلين و بعض المطاعم بالرصاص والالومنيوم

تم تجميع عدد خمسين ساندوتش كبد مجهزة بواسطة الباعة الجائلين و بعض المطاعم ذات المستوى الصحي المختلف من محافظة الجيزة. وتم ارسال العينات منفصلة الى المعمل لتجهيزها وضمها. وتم قياس عنصرى الرصاص والالومنيوم بواسطة جهاز الامتصاص الذرى الضوئى وكانت النتائج كالتالى: متوسط قيمة بقايا الرصاص فى ساندوتشات الكبد المجهزة بواسطة الباعة الجائلين والمطاعم كانت 0.51 ± 1.68 و 0.23 ± 0.73 ملجم/كجم على التوالي. متوسط قيمة بقايا الالومنيوم فى ساندوتشات الكبد المجهزة بواسطة الباعة الجائلين والمطاعم كانت 2.1 ± 6.2 و 3.1 ± 4.1 ملجم/كجم على التوالي. اوضحت النتائج ان مستوى تواجد بقايا عنصرى الرصاص والالومنيوم فى ساندوتشات الكبد المجهزة بواسطة الباعة الجائلين كانت اعلى من مستواها فى ساندوتشات الكبد المجهزة بالمطاعم. هذا وقد تم مناقشة مصادر التلوث بعنصرى الرصاص والالومنيوم وكذلك الأهمية الصحية وتم وضع التوصيات اللازمة لتجنب التلوث بمثل هذه العناصر.