LEAD AND ZINC IN FINGER NAILS AND SCALP HAIR OF ADULT MALES IN KENYA

[(1)*]James Ndiritu, [(2)] Ruth Wanjau, [(3)] Jane Murungi

Department of Chemistry, School of Pure and Applied Sciences, Kenyatta University,

P.O. BOX 43844 – 00100, Nairobi, Kenya.

[(1)]jamesndiritunyambura@yahoo.com [(2)] ruthwanjaug@gmail.com [(3)] jane_murungi@yahoo.com

Abstract

Lead and zinc concentrations were determined in scalp hair and finger nails of exposed and unexposed males by atomic absorption spectrometry (AAS). The mean levels of Pb in the finger nails ranged from 50-480 µg/g, and 50-240 µg/g for exposed and unexposed males respectively. The mean levels of Pb in the scalp hair ranged from 30-410 µg/g, and 30-200 µg/g for exposed and unexposed males respectively. The mean levels of Zn in the finger nails ranged from 40-400 µg/g and 80-450 µg/g for exposed and unexposed males respectively, while in the scalp hair the mean levels of Zn ranged from 30-490 µg/g and 50-440 µg/g for exposed and unexposed males respectively. The study established that there was a negative correlation between Pb and essential element Zn in both scalp hair and finger nail samples of unexposed male respondents. However, Pb was found to have a positive correlation with Zn in the finger nails and scalp hair samples for the exposed males. There was no significant difference (P>0.05) indicated when Pb and Zn mean levels were compared in the combined samples of finger nails and scalp hair. Comparing the mean lead concentration in scalp hair with finger nails a significant difference was indicated in the two tissues (P<0.05). Human hair and finger nails are therefore recording filaments that can reflect metabolic changes over long period of time and hence furnish a print out of post nutritional event of dietary levels of some of the essential elements.

Key words: Lead, Zinc, Human males, Scalp hair, Finger nails, Determination.

Introduction

Lead has raised concern among heavy metals, due to its relatively high toxicity and elevated quantity in the environment as a result of its widespread use (Cambra *et al.*, 1999). It is a heavy metal used extensively in the manufacture of storage batteries, various alloys including solder and ammunition, some plastics and protective coatings. Further, Pb does not have any known biological and even small amounts of lead and lead compounds can be toxic when ingested or inhaled. (Mielke *et al.*, 1999; Gaw *et al.*, 2006). It is well documented that one may be exposed to lead through contamination of food, water, house, leaded dust, soil and through industrial activities (where adult males predominate) such as metal recycling, battery industry and flaking paints (Park and Palk, 2002; Nabulo *et al.*, 2006; Ndiritu *et al.*, 2012b). Nabulo *et al*. (2006) found that when Pb is released into the air, it stays there for ten days and most of it in the soil comes from particles falling from the air. Use of glazed ceramics, smoking of tobacco, source of water for drinking, consumption of exposed and highly refined foods with high fat content have also been reported to lead to increased levels of nail and hair Pb (Owago, 1999; Oyaro, 2000; Were *et al*., 2008; Mogwasi, 2009;Ndiritu *et al.*, 2012c).

NHMRC (2009) reported that human beings may be exposed to lead through the following: restoration of homes, boats, cars and furniture coated with lead-based paints (probably the most

important source of lead exposure in communities which are not industrially exposed), pottery (glazing and firing) soldering (radiators, stained glass, electronics), lead casting (to make ammunition, fishing, Burning of lead-stabilized plastics or materials coated with lead-based paints Recycling of objects containing, or coated with, lead products, e.g. motor vehicle bodies,
batteries, electronic equipment among others. It is worth noting that human males predominate in most of these activities and hence will be more exposed to lead exposure than any other category of the population (Ndiritu *et al.,* 2012c). There is evidence that lead adversely affects sperm motility, size, numbers and quality in occupationally exposed males (NHMRC, 2009). Zinc is widely distributed in the body (Singh, 2004) biochemically, it is a component of at least 100 enzymes including carbonic anhydrase, which is essential for the carriage of CO_2 in the blood and in the secretion of hydrogen ions by the kidneys (Cousins *et al.,* 2004; Nath, 2000). It is required for the synthesis of DNA and RNA (Singh, 2004; Nath, 2000). More than a hundred years ago, zinc was shown to be essential for microorganisms, plants and animals (Allen, 2001). Foods rich in zinc include milk, fish, nuts and legumes (Nath, 2000). It is conceivable that a person on a vegetable diet may not receive adequate zinc because of phytic acid as there appears to be a correlation between zinc deficiency and phytate content of bread. Various studies have reported the levels of Zn in scalp hair and finger nails (Imran *et al.,* 2003; De Romana *et al.,* 2005; Mehra and Juneja, 2005; Ayodele and Bayero, 2007; Ndiritu *et al.,* 2012c). Studies have shown that low levels of essential elements in the body exacerbates the uptake of lead in the body, for example Zinc has been known as a potent antagonist to Pb and its administration has shown a decrease in Pb accumulation in body organs (Nowak and Chmielnicka, 2000).

Various biopsy materials such as blood, hair, nail, teeth and other body fluids may be used as bio-indicators for this purpose (Mehra and Juneja, 2005). Unlike blood that gives transient concentrations, nails and hair can provide a continuous record of trace element concentrations in the body (Wilhelm and Hafner, 1993; Sukumar and Subramanian, 2003; Mehra and Juneja, 2005; Wilhelm *et al.,* 2007). They can be easily sampled and analysed for accumulated toxic and essential metals in the tissue. Studies on nails as bioindicators have been reported by Nowak and Chmielnicka (2000), Mandal *et al.* (2003), Sukumar and Subramanian (2003), Samatha *et al.* (2004) and Mehra and Juneja (2005). However, studies on correlation of nail-metal levels with different parameters as well as with various health disorders are scarce. In recent years studies have shown that there are increased human health disorders due to negligible concentration of essential elements in the body (Drapper, 1996; Penny, 2004). Men who are heads of families and bread winners are particularly poor eaters of foods which are considered essential to health (Fapohunda and Rutenberg, 1999; Oakes and Slotterback, 2005). Studies on Pb and essential element levels have been reported by Were *et al.* (2008) among school age children using finger nails and in women Owago (1999) using blood. However, no study has reported Pb and essential element levels in the male population. The purpose of this study therefore was to determine the levels of Zn and Pb in human males from Nairobi and Mathira rural. Finger nails and scalp hair tissues are rich in keratin, which are metabolically dead materials in the epidermis but their roots are highly influenced by the health status of the cell and can provide a good record of essential element status and environmental exposure to lead. This paper reports the determination of Pb and Zn in human male scalp hair and finger nails using Atomic Absorption Spectroscopy (AAS). Deficiencies of Zn exacerbates Pb uptake in the body (Nowak and Chmielnicka, 2000). It is important to note that human males are not exempted from diseases and ailments that are brought about by Zn deficiencies, it is therefore imperative that human males are advised accordingly on proper eating habits. This will go a long way in reducing the effects of Pb pollution besides reducing its absorption in the body.

Area description

Nairobi, cover an area of 697 km^2 with a population of over 3.1 million (CBS, 2010). Nationally it is established to have the greatest concentrations of industrial and vehicular air pollution sources (UNEP, 2006). It is reputed to be the fastest growing city of the world and lacks air quality management system (Mulaku and Kariuki, 2001). Indeed among the developing countries cities that were sampled for the study on air quality management capabilities, Nairobi was rated the worst (UNEP/WHO, 1996). The city is now regarded as a "hot zone" with highest concentration of pollutants which has been influenced by increasing industries, population, construction, heavy traffic density and deforestation of city fringes (Mulaku and Kariuki, 2001). The CBS (2010) reported that Mathira is situated in central Kenya with a population of 152,000 and covers an area of 434 Km^2. It is a rural setting with few vehicles and industries. The study sites included schools and homes situated in this agricultural region, in which coffee, tea and horticultural crops are predominant. These crops requires substantial amount of fertilizers and pesticides for their production. These chemicals have heavy metals in-put. Therefore it was the aim of this study to determine levels of lead and Zn in the fingernails and scalp hair samples of males over the age of 18 years in different environmental settings to find out whether they accumulate metals differently.

Experimental

Participation of all the subjects in this study was voluntary and relevant permits were obtained prior to the study. Confidentiality of the data collected and subsequent findings were assured by using only code numbers for each participant. Participants were free to terminate participation at their convenience. Any subject who would later like to know the levels of Pb and Zn in his finger nails and scalp hair samples would do so. Field visits and sampling began in June 2010 and ended in September 2010. Samples were obtained from Nairobi and Mathira.

Equipment and reagents

Atomic Absorption Spectrophotometer (AAS-Spectr AA-10, Varian- Techron, Austria) was used. Water used throughout the analytical procedures was deionised and distilled. Weighing balance used was Mettler Toledo AG-240. Digester block was 2080/DA, No 935, Volt 220-w Germany,-LIEBISCH BIELEFELD 14. Reagents used in the analysis were of high quality analytical grade. Liquid soap-an Izal product, nitric acid AR, acetone, 4-methyl pentan-2-one and perchloric acid were supplied by Hopkin and Williams, England. The plastic bottles were cleaned with non-ionic liquid soap rinsed with distilled water. They were then soaked overnight in 1:1 nitric acid and rinsed thoroughly with deionised and distilled water. All the glasswares used in this study were decontaminated by soaking them overnight in 5 % HNO_3 and rinsed thoroughly in deionised and distilled water. They were oven dried at 105 ^oC and stored safely. The metal standards from the stock solution (1000 µg/ml) were freshly prepared daily by serial dilution and checked for constancy of the results before taking the readings.

Sampling

Two hundred (n=200) males over the age of 18 years were randomly recruited. Consent was sought from parents/guardians in case the subject was still under their care. The informed and consented subjects (n=200) filled a self-administered questionnaire. This took into account the previous findings and the WHO (1996) recommendations. The questionnaire elicited information on demographic characteristics, health conditions, socio-economic background, environmental risk exposure factors and diet habits of the subjects. The diet habits considered factors such as consuming processed food, canned with high fat content and marginal proteins. The environmental risk factors included; working in industries, petrol stations, drivers and conductors, those people who spend most of their time traveling, living near the road, living in a house pain
ted with leaded paint or use of glazed ceramics utensils frequently, consuming exposed food from open air market or streets and taking water from leaded piping or borehole water frequently. Purposive sampling strategy was used to select males in both urban and rural settings. The major criterion for selection of males in urban areas was influenced by the intensity of pollution, one hundred and twenty (n=120) subjects were recruited under this category. In Mathira rural, the criterion for selection was that it is in the interior far from urban influence. Therefore, eighty (n=80) subjects were recruited under this category. Each recruited subject gave his paired sample of finger nails and scalp hair. In view of high prevalence of bacterial and fungi infections, each subject was given a labelled stainless steel nail clippers and a towel. All the fingernails and scalp hair samples of the subjects were cleaned using surgical spirit followed by non-ionic detergent. They were rinsed with water then dried with a clean towel. In order to minimize secondary contamination with metallic elements the stainless steel nail clippers were washed with analytical reagent grade HCl, diluted at 1:10 then rinsed with distilled water. Twenty eight (n=28) subjects were excluded from this study as either they dropped from the study or were unable to get sufficient samples for analysis. Fingernails and scalp hair were clipped from the same subject once in two weeks for a period of three months. The samples (n=344) were kept in labeled plastic bottles under lock and key until they were analysed.

Laboratory procedure and quality assurance

Analysis of nail and hair samples was carried out using standard methods as reported by Mehra and Juneja (2005) and Sukumar and Subramanian (2003).

Sample pre-treatment

Great care was taken to avoid external contamination of samples during analytical procedure. The fingernail and scalp hair samples were separately soaked in non-ionic liquid soap in a glass beaker for two hours and washed free from metallic debris following a standardized washing procedure (Mehra and Juneja, 2005; Sukumar and Subramanian, 2003). They were subsequently soaked in acetone for one hour and rinsed five times in deionised and distilled water. The samples were kept in vial tubes, and oven dried at 60 ^{o}C to a constant weight. The polished finger nail and scalp hair samples were separately placed into beakers to which 10 ml of 4-methyl pentan-2-one was added and left for 45 min. They were then rinsed three times using deionised and distilled water before oven drying. The samples were weighed in triplicates and kept in the desiccators.

Acid digestion and aas analysis

The dry 1.0000 g samples were quantitatively transferred into digesting tubes. A 6 ml aliquot of concentrated nitric acid was added and heating done until brown fumes were observed, the solution was cooled to room temperature after which 1 ml of concentrated perchloric acid was added. The digesting tubes were then covered with aluminum foil and placed on digester block in a fume chamber and subsequently heated at 180 °C (Mehra and Juneja, 2005); use of open digestion is discouraged due to air borne particles, and loss of volatile elements and production of hazardous vapour (Samatha *et al*., 2004). The samples were then allowed to digest slowly for about one hour until all the samples (nails or hair) dissolved to form a clear solution. The digested sample solution was diluted with 1 ml aliquot of 0.1 N HNO_3 and then quantitatively transferred into a 100 ml volumetric flask, and volume adjusted to the mark with distilled water. They were then put in plastic bottles, labeled and stored under lock and key awaiting AAS analysis. Analysis of nail and hair samples was carried out using standard methods as reported by Mehra and Juneja (2005) and Sukumar and Subramanian (2003). Concentration of Pb was assayed by use of AAS in triplicates with acetylene flame (the accuracy of the AAS was checked by triplication of the samples). A series of standards were prepared by serial dilution of the stock solutions containing 1000 µg/l of the metal and were used for instrumental calibration. For quality control, standards and blank samples were analyzed for every ten samples analyzed. The main instrumental parameter for example band width, lamp current, height of the flame and wavelength for AAS were optimized for Pb. Experimental detection limits of the instrument used for the analysis were 0.011 and 0.00221 for Pb and Zn respectively. Adequate quality control was ensured by inter-laboratory comparisons of representative samples carried out at Kenyatta University Research Laboratory and Mines and Geology Analytical Research Department, Nairobi. The validity of method was further ascertained by linearity of calibration curves and regression equations.

Data analysis

Statistical calculations were done using statistical SPSS program (Statistical Package for Social Sciences Version 17).

Results and discussion

The concentration of elements in scalp hair and finger nails vary widely among individuals, thus large number of samples from a population was analyzed and the results treated statistically for meaningful correlation. Pb and Zn concentration in scalp hair and finger nails were determined using atomic absorption spectroscopy (AAS). Information on demographic characteristics, health conditions, socio-economic background, environmental risk exposure factors and diet habits of the subjects were noted from the questionnaire. The age distribution pattern for the age of donors (years) is as shown in Figure 1

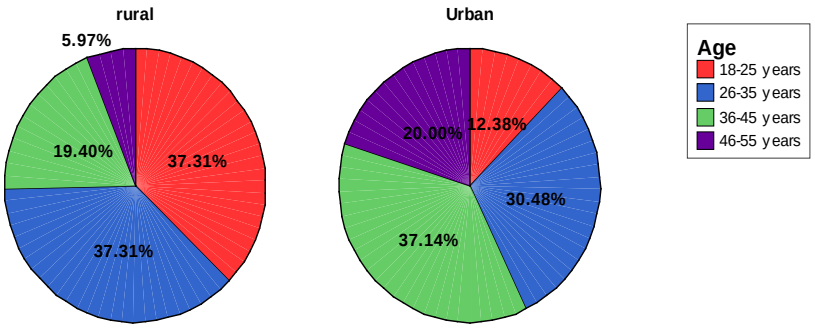

Figure 1: Age distribution of the respondents from rural and urban areas

It was established that 63.37 % of the respondents from both urban and rural were middle aged, the age category of 26-45 years. These people are energetic and hence active in their respective occupations. These findings agree with those of other researchers (Owago, 1999; Mogwasi, 2009). It is also evident that after people go to urban areas while young, they are reluctant to go back to their rural homes since in the rural areas there were fewer people aged 36-55 years. The mean Pb and Zn levels in the finger nails and scalp hair of males from rural and urban areas are summarized in Table 1.

Table 1: Mean Pb and Zn levels (µg/g) in scalp hair and finger nails of urban and rural subjects

	Finger nail samples		Scalp hair samples		
Element	rural	urban	rural	urban	P-value
Pb	126.25±4.05[b]	275.92±11.13[d]	79.36±3.85[a]	176.39±8.11[c]	0.001
Zn	242.31±9.49[b]	214.44±7.74[a]	203.70±11.07[a]	206.60±8.80[a]	0.028

Mean levels capped with different small letters within the same row are significantly different $p<0.05$(One-way Anova)

From Table 1, the mean levels of Pb was highest in the nails from urban subjects (275.92±11.13 µg/g) and lowest in the hair of the rural samples (79.36±3.85 µg/g) the mean levels of Pb in the finger nails and scalp hair samples from rural and urban areas all were significantly different. The mean levels of Pb were higher in the urban respondents than in the rural respondents in both finger nails and scalp hair samples the means were significantly different. This could be as a result of the increased environmental pollution due to mushrooming of many industries dealing with heavy metals which could be released to the environment and find their way into the bodies of human beings, vehicular density also could be a contributory factor to this high level of lead since most vehicles could still be using leaded gasoline which when emitted into the atmosphere can then be inhaled into the body. Oyaro (2000) noted that the concentration of Pb in large cities where there was heavy traffic using leaded gasoline and near highways was so high to cause toxic reactions in some individuals. There could also have Pb aerosol deposition on vegetables, fruits among other food substances which could have been grown along the roads or are sold in open places where there is heavy traffic. Besides this there is occupational exposure among other risk factors. Although the subjects in the rural area had lower levels of Pb than their urban counter parts, the levels were dangerous for human health. The elevated levels of Pb in the rural areas could be as a result of the fertilizers and a wide range of pesticides used in this highly agricultural area since most of the subjects were farmers and students. The mean Pb levels were generally higher than those reported by Wilhelm and Hafner (1993); Rodushkin and Alexelsson (2000) Mehra and Juneja, 2005; Were *et al.*, 2008; and others in finger nails and scalp hair. The levels were higher than those reported in blood (Owago, 1999; Mogwasi, 2009). However, the mean levels were generally lower than those reported by Ayodele and Bayero (2009) 0.384±0.34 mg/g and 0.464±0.364 mg/g in hair and finger nails respectively for exposed subjects to environmental pollution.

Mean Zn levels (µg/g) in scalp hair and finger nails of urban and rural subjects

From Table 1, it can be seen that the mean levels of Zn were highest in nail samples from the rural areas (242.31±9.49 µg/g) and lowest in the hair samples from the rural areas (203.70±11.07 µg/g). The mean levels of Zn in the nail samples from the rural areas was significantly higher than the mean levels of Zn in hair samples from rural and urban areas as well as in the nail samples from the urban area (P=0.028). The mean levels of Zn in the scalp hair samples from both rural and urban settings were lower than in the finger nails from the same

settings. The higher levels of Pb and Zn in the finger nail samples as opposed to the scalp hair samples could be attributed to the different treatments adopted by the respondents for washing their hair, thus affecting the metal profile in scalp hair as compared to finger nail samples. This is so because few metals are easily washed out of scalp hair during treatment, which may lead to low levels in scalp hair. Comparing hair and nails as points of excretion the latter appear superior to the former. The mean levels of Zn obtained in this study were higher than the levels reported by other studies in finger nails and scalp hair (Ryabukin, 1978; Krejpcio *et al.*, 1999; Sukumar and Subramanian, 2003; Chojnacka *et al.,* 2005; Wilhelm *et al*., 2007). However, the levels were lower than those reported by Imran *et al.* (2003), Mehra and Juneja (2004), Nnorom *et al.* (2005) and Ayodele and Bayero (2007).

Table 2: Mean levels (µg/g) of Pb and Zn in the combined samples of finger nails and scalp hair for urban and rural sites

Parameter	Site	Mean µg/g ±SE	P-value
Pb	rural	102.81±3.45	0.000
	Urban	226.16±7.68	
Zn	rural	223.01±7.46*	0.187
	Urban	210.52±5.85*	

N for urban=105 **N for rural=67**

*mean ±SE were not significantly different at α=0.05

From Table 2, it can be seen that the mean levels of Pb were highest in the combined samples of urban subjects than in the rural subjects, the mean levels of Pb were significantly different at α=0.05. The mean levels of Zn in urban and rural subjects were not significantly different at α=0.05. The higher levels of Zn in the rural subjects can be attributed to the type of diet among the rural subjects on the other hand the high levels of Pb in the urban subjects affected the levels of Zn in the urban subjects (Nowak and Chmielnicka, 2000; Were *et al.,* 2008). The males in rural area mostly feed on natural foods rich in essential elements for example Zn as opposed to highly refined foods consumed in the urban areas (Ndiritu *et al.,* 2012b). These results are in agreement with other studies where Pb was seen to affect the levels of essential elements for example Ca, Fe and Zn (Wilhelm and Hafner, 1993; Palminger *et al.,* 1995; Oostdam *et al.,* 1999; Nowak and Chmielnicka, 2000; Satarug *et al.,* 2000; Barbosa *et al.,* 2005; Were *et al.,* 2008). In addition these studies reported significantly higher levels of Zn in subjects who were not exposed to environmental pollution than those who were exposed.

Influence of age on mean Pb and Zn levels (µg/g) in finger nails and scalp hair

The results of quantative analysis of Pb and Zn in the scalp hair and finger nail samples for subjects of different ages from the rural and urban settings are presented in Tables 3 and 4 respectively.

Table 3: Relationship between age and mean Pb and Zn levels in the rural area

		18-25	26-35	36-45	46-55
		Mean±SE	Mean±SE	Mean±SE	Mean±SE
Pb	Nails	100.14±6.35^{a}	136.98±3.49^{b}	142.23±4.13^{b}	170.50±24.64^{c}
	Hair	57.44±3.94^{a}	81.32±4.01^{b}	103.31±6.80^{c}	126.25±30.10^{d}
Zn	Nails	288.40±14.82^{c}	237.80±13.76^{bc}	191.54±13.31^{ab}	147.50±13.77^{a}
	Hair	236.08±18.48	202.80±15.82	152.38±19.83	173.75±71.72

Mean levels capped with different small letters within the same row are significantly different P<0.05(One-way Anova)

Table 4: Relationship between age and mean Pb and Zn levels in the urban setting

		18-25	26-35	36-45	46-55
		Mean±SE	Mean±SE	Mean±SE	Mean±SE
Pb	Nails	154.46±24.37^{a}	233.94±19.37^{b}	318.28±15.03^{c}	336.43±19.37^{c}
	Hair	115.38±20.84^{a}	157.16±13.31^{ab}	193.03±13.02^{b}	212.57±17.19^{b}
Zn	Nails	239.62±25.26	198.48±15.45	217.44±10.93	217.62±17.14
	Hair	258.46±28.48	196.34±17.67	204.62±12.72	193.81±17.46

Mean levels capped with different small letters within the same row are significantly different P<0.05(One-way Anova)

The study established that the mean Pb levels in both the finger nails and scalp hair increased with increase in the age of the subjects (Tables 3 and 4). In the rural setting, the mean levels of Pb in the scalp hair samples of subjects in all the age categories studied were significantly different. However, the mean Pb levels in the finger nails of subjects in the age categories 26-35 years and 36-45 years were not significantly different. Younger subjects had significantly higher Zn levels than older subjects consequently, their Pb levels were also low an indication that higher levels of Zn led to low accumulation of nail or hair Pb this is especially so in the rural respondents. Mean levels of Zn decreased with increase in age though the decrease in scalp hair samples was not uniform in all the age categories studied. There were significant differences in the mean levels of Zn in the finger nail samples from rural area however, mean Zn levels in the scalp hair samples had no significant differences. For exposed subjects in urban areas, the mean Pb levels increased with increase in the age of the subjects, the means across all the age categories studied were significantly different. The study established that the levels of Zn decreased with increase in the levels of nail and hair Pb. There were no significant differences between the mean Zn in the sclp hair and finger nail samples across all the age categories studied. The study established that Mean Zn levels decreased with increase in age and as the mean Pb levels increased. This confirms that a higher Zn level discourages absorption of Pb (Ndiritu *et al.*, 2012c) therefore correlation of Pb and Zn was done and the results are presented in Table 5.

Table 5: Correlation of lead with essential element Zn

		Pb	**Zn**
Rural	Hair	1	-0.181
	Nails	1	-0.549**
Urban	Hair	1	+0.075
	Nails	1	+0.080

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

There was a negative correlation between Pb and Zn in both the hair and nail samples from rural areas implying that as the Zn levels increased, the levels of Pb decreased (Table 5). The correlation between Pb and Zn was significant at 0.05 level (R=-0.549) in the finger nails. However, the study established a positive correlation between Pb and Zn in both the hair and nail samples from urban samples this means that as the levels of Pb increased the levels of Zn also increased. Therefore, there are other factors (nutritional and environmental) in urban area that influence the relationship between Pb and Zn in the scalp hair and finger nails (Ndiritu *et al.*, 2013). The positive correlation observed between Pb and Zn can be attributed to the high level of pollution in the urban environment for Pb as well as the essential trace metals for example Zn besides nutritional factors. The negative correlation observed between Pb and Zn can be attributed to the low levels of pollution in the rural environment coupled with the fact that subjects in the rural area depend on natural foods which supply high levels of essential elements in their bodies (Owago, 1999; Mogwasi, 2009; Ndiritu *et al.*, 2013). The results of this study agrees with other studies done elsewhere which reported that low dietary levels of Ca enhances the absorption of Pb and exacerbates the symptoms of Pb poisoning (Wilhelm and Hafner, 1993; Oostdam *et al.*, 1999; Nowak and Chmielnicka, 2000; Satarug *et al.*, 2000; Barbosa *et al.*, 2005; Were *et al.*, 2008). It is therefore possible that those with high Pb levels consumed less Zn. Correlation of Pb and Zn in combined samples of finger nails and scalp hair was done and results presented in Figures 2 and 3.

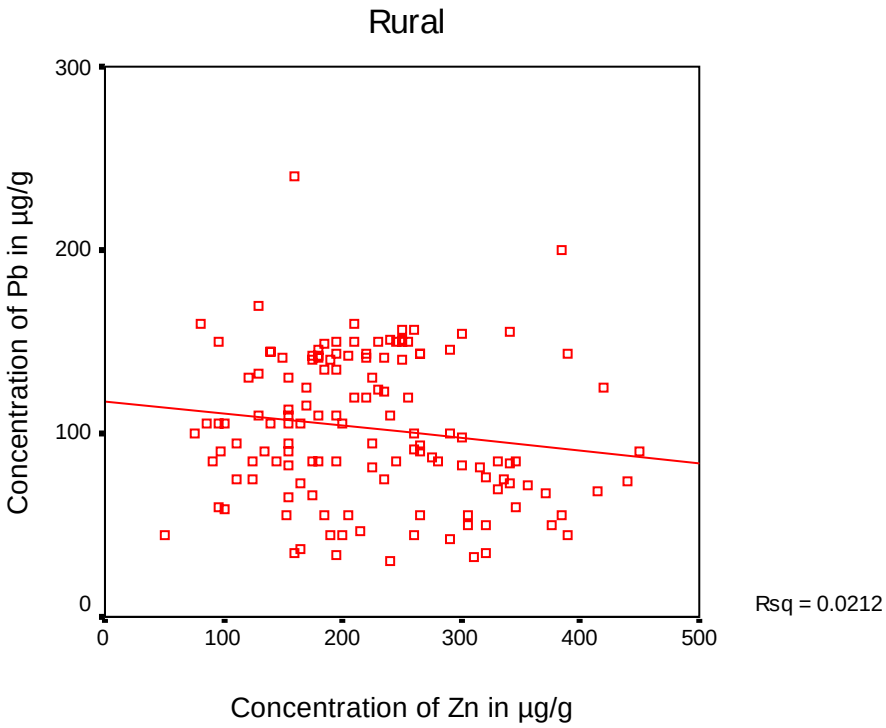

Figure 2: Correlation of Pb with Zn in combined sample of finger nails and scalp hair in rural setting

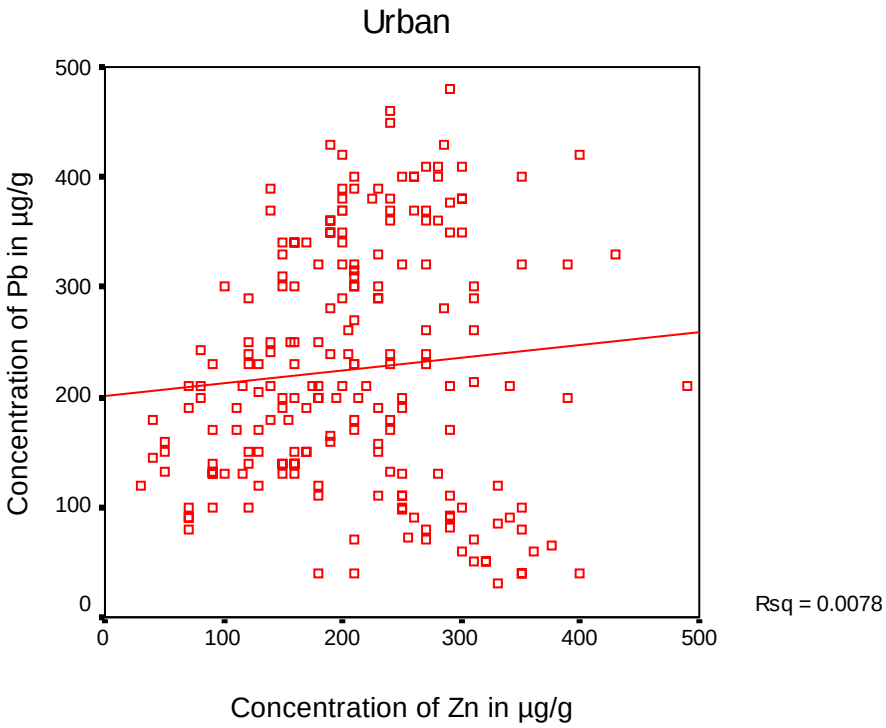

Figure 3: Correlation of Pb with Zn in combined sample of finger nails and scalp hair in urban setting

Conclusions

The levels of Pb were high in the two tissues irrespective of whether the subject was from rural or urban area and considering that the finger nails and scalp hair are points of excretion it therefore means that the levels are equally high in the body. The mean levels of Pb were significantly lower in subjects who had higher Zn levels and vice versa. Therefore scalp hair or finger nails are recording filaments that can reflect the extent of environmental pollution. The study established negative correlation between Pb levels and Zn in nails and hair from rural setting. Human males and general public should be advised accordingly on proper eating habits to ensure that they have higher levels of Zn as well as other essential elements. This will go a long way in reducing the chances of Pb absorption.

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