DETERMINATION OF ALUMINUM IN INFANT MILK POWDER SERVING IN PEDIATRICS ASSIUT UNIVERSITY HOSPITAL

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ABSTRACT

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A total of 30 random samples of infant milk powder serving in pediatrics Assiut university hospital were collected at the time form January to March 2014 for estimate aluminum concentration in them. All examined samples were found to be contaminated with aluminum and its concentration / ppm was ranged from 0.0619 to 0.9601 with an average 0.4027 ppm. The highest frequency distribution was 18 (60%) lied within the range of 0.2 and 0.4 ppm. The resultes in our study was agree with the Egyptian organization for standardization and quality control (2012) that lied within the range of legal limit (0 - 4 ppm). The healthy importance of Aluminum and methods of controls are discussed.

Key words: Aluminum, *infant milk powder, pediatrics, Assiut university* hospital.

INTRODUCTION

Infant milk powder formulae are the most important food for babies from (0 - 6) months because it may be the only food at that age specially when replaced mother milk for any reason as unhealthy babies so it is important to sure that this formula must be free from any harmful agents specially trace elements as aluminum.

Aluminum considered one of the very important element which may present normally in food or may contaminate it from many sources during manufacturing, packing and distribution.

Infant milk powder contain negligible amount of aluminum ions come from raw milk itself while manufacturing machines, cooking pots, pans tools and utensils act as additional sources of aluminum (Uluozluet *et al.,* 2009) or from drinking water at time of reconstitution (Adam., 2013).

Low level aluminum intake is not harmful but high concentration of metal can be extremely toxic (Yokel and Allen., 2004) which must be within the rang of legal limit 0 - 4 ppm (Egyptian organization for standardization and quality control 2012) 3000 - 4000 mg / kg can be fatal specially in infant or when dietary calcium or phosphorus is low (NRC 2005).

Normal ingestion of it (3-5 mg/day -15 mg) will absorbed through the wall of gastrointestinal tract and excreted through the kidney however if the intake is greater than 1000 mg /day retention occure (Barreto and Araujo, 2011).

Aluminum accumulate in tissues such as brain, bone, liver, kidney, lung and milk (Lemire and Appanne 2011) and may cause organ dysfunction and serious health problem as renal damage, neurological disturbance (memory loss, tremor, jerking movement), permanent damage of the brain and end by Alzheimer's disease (Percy *et al.,* 2011).

It may be accumulated in the brain and bone and may persistent more than any metabolic poisons and cause neurotoxin lesion (Garttner *at al.,* 2009) causing damage of central nervous system, neurotoxicity, loss of memory restlessness and sever trembling (Flaten, 1990).

Due to the healthy importance of aluminum in human being from the time of birth till old ages this work is planned to estimate it in infant milk powder formulae serving in pediatrics Assiut university hospital.

MATERIALS and METHODS

Collection of samples:
A total of 30 random samples of infant milk powder serving in pediatrics Assiut university hospital were collected at the time form January to March 2014 in clean, dry and sterile containers from food department of pediatrics Assiut university hospital. Samples were dispatched to the laboratory with a minimum of delay where they were examined.

Determination of Aluminum concentration in milk samples:

Preparation and digestion of samples:

Milk samples were digested according to Slavin *et al.* (1975) with some modification as the follow:

From each milk sample, 25 ml was drawn with clean sterile 25 ml glass pipette and placed in clean dried 250 ml Erlenmeyer flask.

Erlenmeyer flasks that contained milk samples were put in hot air oven at 100C for half an hour and then were left at 50C for 24 hours till evaporation of water from the sample.

25 ml digestion mixter (Equal volumes of concentrated nitric acid and 72% perchloric acid) was added to each flask, shacked and the acid was allowed to react at room temperature for 24 hours to facilitate the processes of digestion.

After this the flasks were put on hot plate at approximately 100C, shacked and several milliliters of concentrated nitric acid were added each flask during the process of heating. Heating continued till the sample become colorless (complete digestion of the sample and disappearance of the brown gas (Nitric oxide, NO_3) after its evaporation from the flask).

Samples were allowed to cool, filtered with filter paper, flasks then washed out several times with ion free water till the final volume of the digested sample reach 25 ml. These samples stored at refrigerator tell their analysis and estimation of Aluminum.

Determination of aluminum in milk samples: Aluminum in ppm was estimated in the digested milk samples by means of, atomic absorption spectrophotometer at the central laboratory in the faculty of veterinary medicin -Assiut university (Szkoda and Zmudzki, 2005) Shimadzu Atomic absorption / flam spectrophotometer ModelAA630-02P / N204-27600-02AA630-02), Kyoto-Japan.

RESULTS

Table 1: Statistical analytical results of aluminum concentrations (ppm) in the examined infant milk powder samples:

Metal	N. of exam. samples	+ve samples	Min.	Max.	Average
Aluminum	30	30	0.0619	0.9601	0.4027

Table 2: Frequancy distribuithion of the examined infant milk powder samples based on thier aluminum concentration (ppm):

	N. of samples /30	% of +ve samples
0.0 -	7	23.3
0.2 -	9	30
0.4 -	9	30
0.6 -	3	10
0.8 -	2	6.7

DISCUSSION

Human milk is considered to be the best source of nutrition for the infants (Picciano, 2001). But infant milk powder is generally recommended in developed and developing countries when it is difficult to bring up an infant on mother's milk so we must sure that milk is of good keeping quality and free from any harmful agent as trace elements specially aluminum due to its harmful effect in neonatal age as it may accumulate in tissue such as brain, bone, liver, kidney and lung causing organ dysfunction and serious health problems as renal damage, neurological disturbance (memory loss, tremor, jerking movement), permanent damage of the brain and end by Alzheimer s disease (Percy *et al.*, 2011).

AL contamination occurs during the manufacturing or storage processes in tin pack lining with Al foil, although this can be avoided using the adequate

control packing procedures (Narin *et al.*, 2004).

The results summarized results in Table 1 showed that 30 (100 %) samples contaminated with aluminum and its concentration (ppm) in the examined infant milk powder samples ranged from 0.0619 to 0.9601 with an average 0.4027 ppm.

The results in table 2 showed that the highest frequency distribution was 18 (60%) lied within the range of 0.2 and 0.4 ppm.

Higher results were obtained by Sibel *et al.* (2007) who indicted that the original raw milk contain high % of trace elements may be come from animals food or dairy environment and dairy utensils and equipment. On the other hand it may be contaminated during manufacturing by using metal machines or tin containers of foil lining packing or from contaminated drinking water which used to reconstitute infant milk powder at time of use.

Nearly similar results were obtained by Vinfas *et al.* (1997), Tasneem *et al.* (2004), *Deeb* and *Gomaa*, (2011), Salah *et al.* (2013).

According to Egyptian organization for standardization and quality control (2012) that lied within the range of legal limit (0 - 4 ppm) which indicate that products come from dairy farm produce raw milk contain permissible limit of trace element specially aluminum and not contaminated during manufacturing by any sources of it.

CONCLUSION

Aluminum content in infant milk powder samples suggests that contamination occurs during the manufacturing or storage processes in containers although this can be avoided using the adequate control packing procedures.

So infant milk powder must be come from a manufacture source or dairy processing plant which not only characterized by HACCP system but also has a great attention towards contamination by trace elements.

Periodical examination of infant milk powder locally manufactured or imported one must take place to insure that agreeing with Egyptian organization for Standardization and Quality Control and excluded any kind of it not agree.

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قياس نسبة الألمونيوم فى البان الأطفال المجففة المستخدمة فى مستشفى الأطفال بجامعة اسيوط

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تم جمع ٣٠ عينة عشوائية من الالبان المجففة المستخدمة فى تغذية الأطفال المرضى فى مستشفى الأطفال بجامعة اسيوط فى الفترة من يناير حتى مارس٢٠١٤ وتم فحصهم لتقديرمدى تركيزعنصر الألمونيوم بهم. وأظهرت النتائج أن جميع العينات وعددها ٣٠ عينة بنسبة ١٠٠% كانت ايجابية بالنسبة لوجود عنصر الألمونيوم بها بتركيز يتراوح من ٠,٠٦١٩ الى ٠,٩٦٠١ ومتوسط ٠,٤٠٢٧ جزء فى المليون. وكان اعلى معدل انتشار لتلك النتائج ١٨ عينة بنسبة ٦٠% يقع ٠,٢ الى ٠,٤ جزء فى المليون. وكانت هذه النسب فى الحدود المسموح بها طبقا للمواصفات القياسية المصرية لسنة (٢٠١٢) للألبان المجففة. وقد تم ماقشة الاهمية الصحية لعنصر الالمونيوم ومخاطر تلوث اغذية الأطفال به وطرق الحد من ذلك.