The Pharmaceutical and Chemical Journal, 2016, 3(2):364-366

Available online www.tpcj.org

Research Article

ISSN: 2349-7092
CODEN(USA): PCJHBA

The Effect of Age and Sex Distribution on BPA & Environmental Oestrogen Levels in an African Population

Maduka Ignatius C[1], Ifejimalu Uche E[2], Ogueche Nnamdi P[3]

[1,3]Department of Human Biochemistry,
[2] Department of Medical Laboratory Science, Nnamdi
[3]Azikiwe University, Nnewi campus, Anambra state, Nigeria

Abstract Endocrine disruptors such as BPA and environmental oestrogen have been associated with portable water sources in an African population. The study investigated the effect of age and sex on the oestrogen-like substances. One hundred and thirty six (136) subjects aged 40 years and above were recruited for the study which comprised of fifty eight (58) males and seventy eight (78) females who were grouped into three (3) different age groups (40-49, 50-59 and ≥60) years. All subjects were assayed for BPA and environmental oestrogen using ELISA Kit by Wkea Med Supplies Corp, China. The results obtained were expressed as mean±S.D and mean difference statistically determined. The results obtained showed that BPA levels was not statistically different among the age groups studied which may be due to uniform pattern of exposure as was deduced from the questionnaires administered but environmental oestrogen was found to be significantly higher in younger age group when compared to the older group which may be attributed to life style and urbanization. From the study also, BPA was found to be significantly higher in males than in females. This could be attributed to the gender difference in clearance probably due to reduced UGT activities in males. Male subjects may be more prone to BPA bioaccumulation which may be attributed to occupational exposure and reduced clearance rate.

Keywords Age, Sex, BPA, Environmental oestrogen, Africa, and Population

Introduction

Bisphenol A (BPA) is a widely used high volume production chemical used in the manufacture of polycarbonate plastics (which are used extensively in drinks containers and food packing), and epoxy resins (used in the lining of canned foods). In developed and developing countries, exposure to BPA is significant and continuous. It is found in plastics such as baby and water bottles, sports equipment, medical tubings, CDs and DVDs, household electronics, eyeglass lenses, foundry castings, and the lining of water pipes, metal can linings, dental sealants, toys and other products and can leach out of these products especially when exposed to heat or acidity [1]. Hence, widespread and continuous human exposure to BPA is believed to be mainly through dietary intake, with additional exposure through drinking water, dental sealants, dermal exposure and inhalation of household dusts [2]. Significant amount of BPA has been found in rainwater stored in plastic containers [3]. Worldwide, over 6 billion pounds of BPA are produced each year, and over 100tons are released into the air annually [2].

Bisphenol A (BPA) is a contaminant which, increasing exposure to, exerts both toxic and estrogenic effects on mammalian cells. Exposure to endocrine disrupting chemicals (EDCs) such as BPA is of concern because they interfere with many metabolic processes and cause widespread damage to body tissues and cardiovascular disease [4]. BPA is believed to act as an endocrine disruptor i.e a compound capable of causing dysfunction to hormonally regulated body systems [2].

Oestrogens are a group of compounds named for their importance in both menstrual and oestrous cycles. They are often referred to as the female sex hormones because women have higher levels of them than men. Oestrogen

(steroidal oestrogens are synthesized in the body by different organs but majorly the ovaries while non-steroidal oestrogens (Xenoestrogens also known as environmental oestrogens) are obtained from other sources other than production from the body [5]. Environmental oestrogens (Xenoestrogens) are a type of xenohormone that imitates oestrogen. They can be either synthetic or natural chemical compounds. Natural xenoestrogens include phytoestrogens which are plant-derived xenoestrogens. However, xenoestrogen can be obtained from the following: exhaust fumes, pesticides & herbicides on all inorganically grown foods, cling wrap, polystyrene, plastics, synthetic clothes, vaseline and aqueous hand and body creams, shampoos and other personal care products, household detergents, insect repellants, insecticides used in the home, wax floor polish, P.C.B.'s and other industrial chemicals, paint,solvents,glues, pharmaceutical drugs and hormones (e.g pills, fertility drugs, hormone replacement therapy (H.R.T.), hormones fed to beef and chickens to fatten them, hormones given to cows to prolong lactation [6].

Environmental oestrogens (xenoestrogens) mimic oestrogen and can alter the functions of the endocrine system and cause various health defects by interfering with synthesis, metabolism, binding or cellular responses of natural estrogens. Hence, the overall mechanism of action is binding of the exogenous compounds that mimic oestrogen to the oestrogen binding receptors and cause the determined action in the target organs while blocking the action of natural hormones [7].

Materials and Methods

Design: Subjects from different parts of the state who gave their informed consent were randomly selected for the study. A total of one hundred and thirty six (136) subjects including male and female aged 40 years and above were recruited. They were in all fifty eight (58) males and seventy eight (78) females who were also grouped into three (3) age brackets (40-49, 50-59, and ≥ 60) years of age. A questionnaire was administered each subject to check their pattern of exposure to the studied parameters.

Sample collection: 2ml of venous fasting blood sample was aseptically collected from each subject into clean glass tube, allowed to clot and retract at room temperature, and then centrifuged for 5minutes at 5,000r.p.m for prompt separation. All serum samples were separated immediately after centrifugation into clean, sterile and dry glass tubes. The samples were taken to the laboratory where they were stored frozen at -20ºC and analyzed within 1month.

Sample analysis: BPA and Environmental oestrogen were analysed by ELISA method [8] using Human BPA and Human environmental oestrogen ELISA Kits by Wkea Med Supplies Corp, China respectively. Samples and standards were analysed in duplicates and the average used for the calculation. Internal quality control serum was used for each batch of the assay.

Result analysis: Results were expressed as mean±SD. Statistical differences between means were determined by students't-test and comparisms done with ANOVA using Statistical Package for Social Sciences (SPSS).

Results

Table 1: Mean and sd of bpa and environmental oestrogen within the age groups

Parameter	40 - 49 n = 45	50 - 59 n = 47	≥60 n = 44	P-value
BPA(ng/L)	63.03±22.14	60.00±21.34	60.23±18.62	0.742
Environmental oestrogen (pmol/L)	3.57±2.05[a]	3.14±1.64	2.43±2.38[b]	0.031[*]

* - Significant at P<0.05, a and b significant at P<0.05

Table 2: Mean and sd of bpa and environmental oestrogen between male and female subjects

Parameter	Male n = 58	Female n = 78	P-value
BPA (ng/L)	67.83±18.45	56.06±20.90	0.001[*]
Environmental oestrogen (pmol/L)	2.78±2.04	3.26±2.09	0.184

Table 1 shows the mean and SD of BPA and environmental oestrogen within the studied age groups (40-49, 50-59, and ≥60 years) to be (63.03±22.14, 60.00±21.34 and 60.23±18.62)ng/L and (3.57±2.05, 3.14±1.64 and 2.43±2.38) pmol/L respectively.

Table 2 shows the mean and SD of BPA and environmental oestrogen of male and female subjects to be (67.83±18.45 and 56.06±20.90)ng/L and (2.78±2.04 and 3.26±2.09)pmol/L respectively.

Discussions

As seen in table 1, there was no statistical significant difference in BPA among the different age categories studied owing to the uniform pattern of exposure to BPA. This is because of the widespread distribution BPA in almost all

consumer products. On the other hand, there were also no statistical significant difference in environmental oestrogen between the age groups 50-59 and ≥60 as well as 50-59 and 40-49 but oestrogen was found to be statistically reduced in group ≥60 than in 40-49. This can probably be attributed to additional exposure due to life style pattern and urbanization which expose the younger age groups more than older groups as was seen also from the questionnaires. Again, in table 2 BPA levels in male subjects were found to be significantly higher than in female subjects. This could be attributed to two factors. Firstly, the ratio of BPA glucoronidation in the micro some reaction has been found to be significantly higher in female than in males due to reduced UGT (Uridyl Glucoronyl Transferase) activity in male [9]. Hence, the gender difference in serum BPA concentrations may be explained by the difference in clearance based on the UGT activities. Secondly, workers from BPA-exposed factories are said to be exposed to very high BPA levels in their work place (occupational exposure) [10]. However, no statistical significant difference was found in environmental oestrogen between the male and female subjects which may be probably due to similar pattern of exposure.

Conclusion

This study found no relationship between BPA and the age groups studied but environmental oestrogen was found to be significantly higher in younger age group when compared to the older group. Also from the study, BPA was found to be significantly higher in males than in females while environmental oestrogen showed no significant difference between the male and female subjects.

References

1. Welshons W.V., Nagel S.C., Vom Saal F.S. (2006). Endocrine mechanisms mediating effects of bisphenol A at levels of human exposure. *Endocrinology* 147: 56-69.
2. Vandenberg L.N., Maffini M.V., Sonnenschein C., Rubin B.S., Soto A.M. (2009). Bisphenol A and the great divide: a review of controversies in the field of endocrine disruption. *Endocrine Reviews* 30: 75-95.
3. Maduka C.I., Ezeonu C.F., Neboh E.E., Shu N.E. (2010). Prepondence of Bisphenol A in harvested rain water in Enugu municipality, South East Nigeria. *Research Journal of Environmental and Earth Sciences* 2(1): 36-38.
4. Humblet O., Birnbaum L., Rimm E., Mittleman M. A., Hauser R. (2008). Dioxins and cardiovascular disease mortality. *Environmental Health Perspectives* 116(11): 1443-1448.
5. Goldin B.R., Adlercreutz H., Gorbach S.L., Warram J.H., Dwyer J.I. (2000). Oestrogen patterns and plasma levels in vegetarian and omnivorous women. *New England Journal of Medicine* 307: 1542-1547.
6. Mueller S.O. (2004). Xenoestrogens: mechanisms of action and detection methods. *Analytical and Bioanalytical Chemistry* 378 (3): 582-587.
7. Caserta D., Maranghi L., Mantovani A., Marci R., Maranghi F., Moscarini M. (2008). Impact of endocrinne disruptor chemicals in gynaecology. *Human Reproduction* 14(1): 59-72.
8. Cheesbrough M. (2002). Clinical Chemistry Tests. In: District Laboratory Practice in Tropical Countries. M. Cheesbrough, (Ed.). Part 1. Low Price Edn., United Kingdom, Cambridge University Press, pp:437-452.
9. Takeuchi T., Tsutsumi O., Nakamura N.,Ikezuki Y., Yano T., Taketani Y. (2004). Gender difference in serum bisphenol A levels may be caused by liver UDP-glucoronosyl transferase activity in rats. *Biochemical and Biophysical Research Communications* 325(2): 549-554.
10. Li D., Zhou Z., Qing D., He Y., Wu T., Miao M., Wang J., Weng X., Ferber J.R., Herrinton L.J., Zhu Q., Gao E., Checkoway H., Yuan W. (2010). Occupational exposure to bisphenol-A (BPA) and the risk of self-reported male sexual dysfunction. *Human Reproduction* 25(2): 519-527.