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RISK OF ANTHROPOGENIC ENDOCRINE DISRUPTORS, ASSESSMENT OF ITS AWARENESS AND PRODUCT LABELS AMONG ZAMBIAN CONSUMERS.

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Abstract

Endocrine disruptors these are chemicals, that are man-made or occurring naturally in the environment, food, and consumer products that mimic the hormonal system and there disrupt the internal physiological balance of organisms. Alkylphenol ethoxylate (NPE) and Bisphenol A (BPA) are used in a wide variety of industrial applications and consumer products, and are gaining worldwide attention as disruptors of the endocrine system in humans and wildlife. NPE are used as surfactants in the making of domestic laundry agents while BPA can be found in baby and water bottles, the inside lining as an epoxy resin of food and beverage canned containers. Most baby milk formula is packaged in tins. This study was a baseline survey to investigate and determine whether the Zambian human and wildlife populations are at risk from anthropogenic endocrine disruptors sources and how these risks can be mitigated. Data regarding the Zambian context is scarce hence; here we describe the findings from the survey of potential sources of NPE and BPA in Zambia. Results from 150 questionnaires administered to rural populations in Ndola and Lumwana villages and urban population in Kitwe town show the that 86 % were not aware of either BPA nor NPE late alone endocrine disruptors. Data collected from a survey of a local leading chain store to indicate potential sources of the two, showed that the products had no product labels or did not have sufficient information to adequately inform the consumers .90 % of the consumers did not read product labels.

It is therefore recommended that deliberate efforts should be taken to enhance product labelling, provide education to consumers to raise their awareness and use of product labelling information as well as develop a consumer guide on product labels.

Keywords: *Bisphenol A, Nonylphenol Ethoxylates, Endocrine Disruptors, Product labels, Awareness levels.*

Introduction

The different forms of pollution have made the potential of pollutants to be countless. Over 30,000 chemicals are being used both at industrial and domestic levels and from this number; any one of them is being released in the environment. From this number less than 1% is been investigated intensively such as its associated human health risks known and its toxicity ascertained. (Allsopp, et al., 1997)

Endocrine disruptors these are chemicals, that are man-made or occurring naturally in the environment, food, and consumer products that mimic the hormonal system and there disrupt the internal physiological balance of organisms (EPA, 2007). Hormones are the chemical messengers that enable different parts of the body to communicate to each other. In order for the message to be decoded these hormones bind to receptors thereby, eliciting a particular biological effect. Endocrine disrupting chemicals (EDCs) disturb the balance of hormones by either mimicking them or by affecting the hormonal control by the brain (Allsopp, et al., 1997, Danzo, 1997).

A variety of substances have been identified as endocrine disruptors. These include substances of synthetic origin used as industrial solvents/lubricants and their byproducts. These are polychlorinated biphenyls (PCBs) (Kato *et al.*,1998; Hansen, 1998), dioxins, plastics bisphenol A (BPA), (Hunt *et al.*, 2003; Susiarjo M *et al.*,2003), plasticizers (phthalates) (ATSDR, 2002), pesticides such as dichloro-diphenyl-trichloroethane (DDT) (Langer 2008), fungicides (Juhler ,1999), and pharmaceutical agents such as diethylstilbestrol (DES) (Kolpin ,2002)]. These disruptors may also be found in products that are used in our day to day lives (Culliney et al.,1992). These include plastic bottles, metal food cans, detergents, flame retardants, food, toys, cosmetics, and pesticides.

Source of Concern

Even low environmental levels of many endocrine-disrupting chemicals can lead to high levels in the body tissues of animals and humans. This is because many endocrine disrupters, most notably

more persistent chemicals, become stored in fatty tissues. They build up to higher levels in fat as more of the chemical is taken in.

In humans, EDCs have been linked to cause aberrant egg development in females and these changes are directly transferred to the offspring via the placenta or breast milk (Ikezuki, 2002). Therefore, EDCs have been implicated as a cause of miscarriages and deformities of the unborn offspring. Thyroid and steroid hormones are targeted by EDCs. Sex hormones such as testosterone and estrogen are examples of steroid hormones. In males, EDCs have been implicated as a cause of prostate cancer, low sperm counts and testicular cancer (Ho, 2006). In females EDCs have been implicated in endometriosis, infertility and breast cancer (Davis et *al.*, 1993; Davis *et al.*, 1995)

EDCs also affect wildlife and this has been recorded over a period of 50 years. The effects seen in wildlife have been feminization of male fish and reduced population numbers of the fish (Jobling *et al.*, 1993). Embryo death and deformities have been observed in birds, whereas reproductive problems have been observed in reptiles, birds, and mammals (Guillette *et al.*, 1995).

Methodology

A chain store was surveyed using a methodology adopted from (Dodson etal, 2010). Using 150 questionnaires which were had both closed and open ended questions, the level awareness of NPE, BPA and endocrine disruption was ascertained. The likely routes that would pose as potential sources were identified. Results from questionnaires administered to rural populations in Ndola and Lumwana villages and urban population in Kitwe town show the levels of awareness. The data obtained was analyzed using a statistical data package (SPSSV16.0).

Results

From the questionnaire findings from both rural and urban population revealed that most subjects surveyed do their laundry by hand and most are not aware of Nonyl phenol ethoxylate (NPE) use as a surfactant in making detergents. Figures 5 show laundry products in a store and results of the choice of laundry preparation. Both population do laundry by hand (34%) in rural and (39%) in the urban areas. Most of the laundry products sampled had little or no product labels.

Figure 1: Graph indicating the distribution of doing laundry by hand or machine in rural and urban populations.

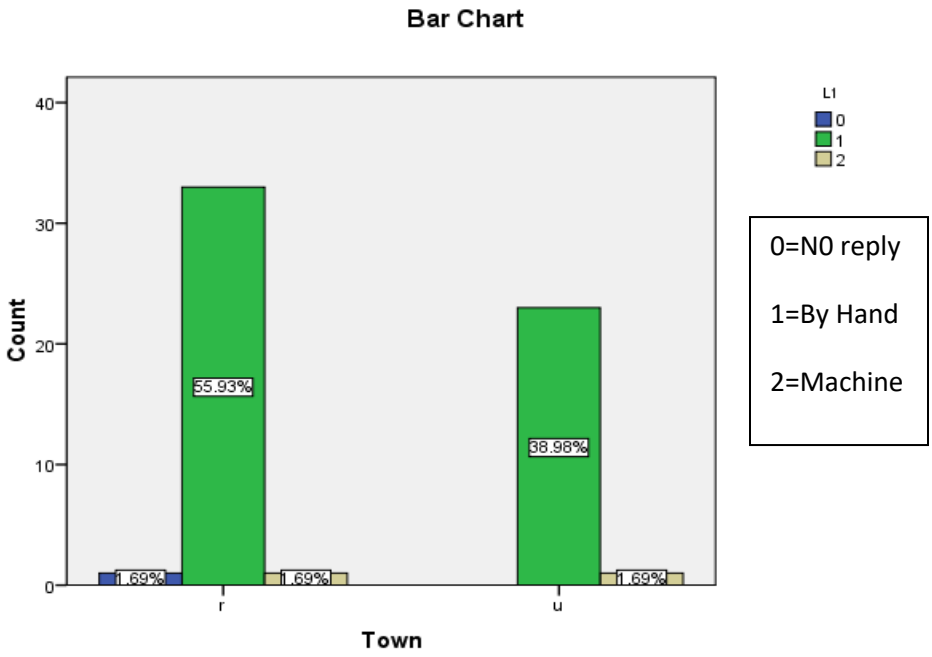


Figure 2: Surfactant based laundry products in a chain store

Picture taken by author in the chain store surveyed

From a survey of a leading chain store it was found that most laundry products had little or no product label to indicate what chemicals are in the various laundry agents.

BPA free product labelled products

Figure 3: baby products labelled BPA free

Picture taken by author in the chain store surveyed

Frequency of Baby Milk Formula Purchase

Figure 4: showing frequency of baby milk formula purchase in both rural and urban populations

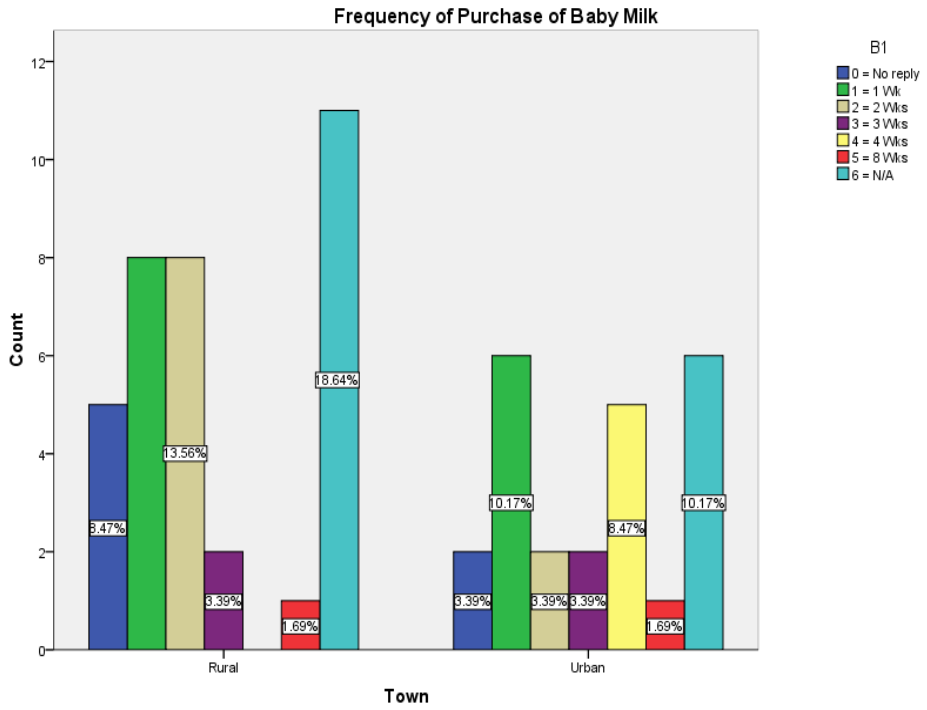
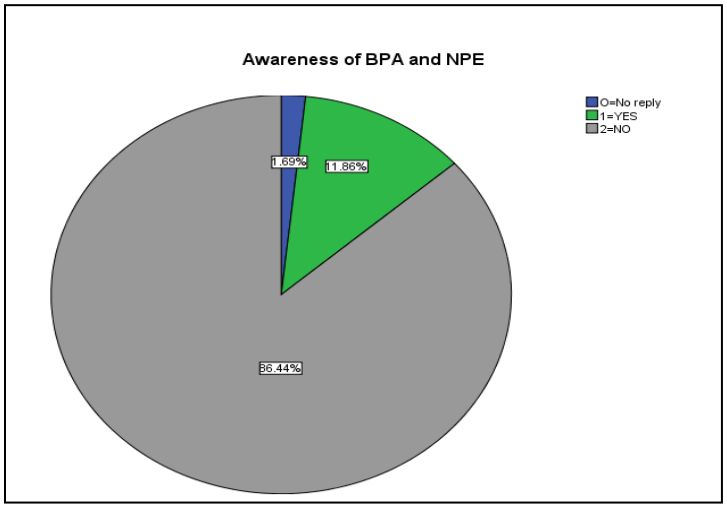


Figure 4 shows that both urban and rural populations purchase baby milk with the highest purchase being done in one week, 14% in rural and 10% in urban towns.

The milk was mostly packaged in tins not labeled whether BPA free or not. Other baby products sampled were labeled BPA free as seen from figure 3.

Level of Awareness

Figure 5: Pie chart showing level of awareness in both rural and urban populations



aware of endocrine disruptors,

Discussion

From the questionnaire findings from both rural and urban population revealed that most subjects surveyed do their laundry by hand , (34%) in rural and (39%) in the urban areas and eighty six percent (86 %) in both population sampled were not aware of Nonyl phenol ethoxylate (NPE) use as a surfactant in making detergents this was shown in Figures 5.A similar study by Sunelle 2010, conducted in South Africa revealed that although the consumers were able to read the product labels, their did not fully benefit from the packaging labels as he speculated that the level of education had a bearing in trying to deduce the information, such that even precautions needed to be taken could not be initiated in case of any harmful ingredients in the products. From this study, the laundry products sampled had little or no product labels as seen in figure 2. This as a significant bearing on the consumer in making an informed decision as noted by Katarzyna etal ,2010 that product labels played a dual role in both informing a consumer hence, enabling a consumer in making informed decisions and also the labels are used as a ploy in marketing by the manufactures. The products with no label products could potentially put the consumer at risk to a

potential endocrine disruptor like nonylphenol ethoxylate or Bisphenol A. Prathiraja,2003 found out that product label reading is also influenced by the sex, age and health status education, they found that health conscious individuals tend to read the product labels due to the fact that they had a health condition or were more knowledgeable about their health in general. The lack of reading product labels could also be attributed to the fact that once consumers see a product on the shelf they assume it's safe as the associate the quality assurance of products to be the responsibilities of the government and public service institutions such as the Zambia Bureau of Standards (ZABS) whose mandate is to carry out such certification. A similar conclusion was also researched by Philip and etal,2010 in the United Kingdom were it was noted that product label reading can also be affected by the format of the label such as the primary fonts used, style of language in which they were written.

Product labels help the consumer make an informed decision, but (Wansink and Park, 2002) found that even though the products had labels or warning signs the consumers still need made the product purchase disregarding the warning information. This was observed in this study that consumers purchasing baby products did not regard the BPA free products when making a purchase. This finding could be attributed also to factors also obtained in the Lesotho study conducted by Mahgoub and Gobotswang, (2007) where the level of education can influence the consumer in making an informed decision also the economic standing of the consumer such that the pricing of the product comes into play.

Gender has also been implicated in having a role in influencing purchasing labelled products. Wansink and Park, (2002) investigations revealed that consumers believed that the health claims by the manufacturers of the products are misleading and exaggerated such that they speculated that even though alcohol and cigarettes packaging has health hazards warnings, consumers still went ahead and purchased the products. The front and back label has also been investigated widely by researchers who found that the consumers usually considered the front labels and most just skim over the information. Such that if the front line is not comprehensible or incomplete most consumers would not turn to the back information on the product. However, the trend in the health-conscious individuals was found to be different in a study by Roe et al, (1999) who found

that these types of consumers often even read the back-label information if the front label was not sufficient.

Conclusion

The objectives of these study were meet in that the potential sources of pollutants to the Zambian public and wildlife were ascertained and it was found that 86% of the Zambian consumers surveyed did not read product labels and the products that have been implicated to have the break down compounds of NPE did not contain enough or sufficient information on the product label in order to adequately inform the consumer. Hence, it's imperative to further carry out chemical analysis to determine if there contain the endocrine disrupting chemicals (EDC) and at what levels. It will be also important to investigate if there is any policy on product labels as most locally manufactured laundry agents did not contain product labels and also investigate if there is a precautionary principle pertaining potential endocrine disruptors. There is also need to determine what type of lining is used in the manufacture of the tins because these were not labeled whether BPA free or not, this could pose as a potential source of BPA to the baby milk. The plastic baby feeding bottles were not a threat as most were labeled BPA free. There is need to educate the population about EDCs and their effects. This was shown when the majority in both populations indicated that that there were not aware of the two chemicals, BPA and NPE. This awareness will help reduce the exposure to these chemicals and also there will be in a position to make informed decisions when purchasing products that could be potentials sources of EDCs. This baseline survey has shown that there is further need to do more questionnaires in more areas so as to increase the sample size to give a representative sample of the whole Zambia.

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APPENDIX

Appendix 1: Informed Consent

Copperbelt University, school of mathematics and natural sciences, department of biological sciences

Introduction:

Greetings! My name is …….. I'm working on this research project with the objective of determining awareness of product labelling and use of the information in purchasing the products among consumers in Kitwe and Lumwana rural and urban towns, Zambia.

Purpose of the study

The purpose of the questionnaire is to collect information from Zambian consumers on their level of awareness on the basic product labelling information and use of the information in decision making during purchasing of products among consumers in Kitwe and Lumwana rural and urban towns. You are being asked to participate in this study because we believe that you have particular experiences that may be important to the study.

What participation Involves

If you agree to participate in this study the following will occur:

1. You will be required to sit with interviewer and answer questions about your awareness and use of pre-packaged product labelling information. The interviewer will record your responses in the questionnaire.

2. No identifying information will be collected from you during this interview, except your age, level of education and your monthly earning.

3. You will be interviewed only once for approximately 10 -15 minutes in a private setting.

Confidentiality and consent:

I assure you that all the information collected from you will be kept confidential. Only people working in this research study will have access to the information. Your name will not be written on this form, and will never be used in connection with any of the information you tell me. You do not have to answer any questions that you do not want to answer, and you may end this interview at any time you want to.

However, your honest answers to these questions will help us to understand the level awareness on food labelling and use of the information in purchasing pre-packaged products among consumers.

Benefits

The information you provide will help us and other stakeholders in the pre-packaged products industry and regulatory authorities in the country on issues related to product labelling information including raising awareness on products labelling information among consumers as well as improvement of products labelling information by products manufacturers and regulators.

In case of injury

We do not anticipate any harm to occur to you or your family as a result of participating in this study.

Whom to contact

If you ever have questions about this study, you should contact Principal Investigator, Gezile Mbewe Chalwe, Copperbelt University, School of Mathematics and Natural Sciences, P.O. Box 21692, Kitwe. (Cell. No. +260-973-730328)

If you have questions about your right as a participant, you may call Dr. Kasali G, Postgraduate Coordinator, School of Mathematics and Natural Sciences, P.O. Box 21692, Kitwe. and Dr. Mutondo M, who is the supervisor of this study.

Appendix 2: Questionnaire

A QUESTIONNAIRE FOR AWARENESS OF BPA AND NPA (ENDOCRINE DISRUPTORS) AND PRODUCT LABELLING AND USE OF THE INFORMATION IN PURCHASING PRE-PACKAGED PRODUCTS AMONG CONSUMERS IN KITWE AND LUWAMWANA RURAL AND URBAN COMMUNITIES, ZAMBIA.

Questionnaire

Age group: 15-25 yrs ⬭ 26-35yrs ⬭ 36-45yrs ⬭ above 45 yrs ⬭

Sex: ☐ Female ☐ Male

City/town: …….

BABY CARE AND PRODUCTS (Diapers, Toys and Feeding bottles)

1. How often do you buy baby milk/formula?

Once a week ⬭ Twice a week ⬭ After 3 weeks ⬭ After 1 month ⬭ After 2 months &above ⬭

2. What type of feeding bottles do you use?

Plastic ⬭ Glass ⬭

3. How do you clean/sterilize the baby bottles?

Cleaning tablet ⬭ Boiling water ⬭ Ordinary cleaning detergent ⬭ Bicarbonate of soda ⬭

Other (specify) ……..

4. After how long do you dispose of the bottle?

   3 - 4 weeks ⬭ 5 - 8 weeks ⬭ Above 8 weeks ⬭

5. What type of toys do you purchase for your children?

   Plastic ⬭ Metal ⬭ Fabric ⬭ Combo ⬭

6. If combination, state what combination.

   ……..

7. Are you aware that the baby products that you use could contain potential hazardous chemicals?

   Yes ⬭ No ⬭

LAUNDRY

1. How do you do your laundry?

   By hand ⬭ By machine ⬭

2. What laundry agent do you use?

   Bar ⬭ Liquid ⬭ Powder ⬭ Paste ⬭ Combo ⬭

3. If combination(s), please state ……

4. Do you check/read the label of your preferred cleaning agent?

   Yes No

5. Are you aware that some laundry cleaning agents may contain potential hazardous chemicals?

Yes No

HOUSEHOLD PRODUCTS

1. What is your preferred household agent/product?

……

2. Do you check/read the label of your preferred product?

Yes No

3. Are you aware that some household cleaning products contain potential hazardous chemicals?

Yes No

4. Do you adhere to the warning which is on the product?

Yes No

PERSONAL CARE PRODUCTS

- COSMETICS

1. What type of Beauty product(s) do you use?

Lotion Lipstick/lipbum Eye shadow/blush Face powder Shaving products

2. Perfumes

Deodorant Roll-on Spray Other

If other, specify ……..

3. What type of hair products do you use?

Pomade	Relaxers	Taint/dye	Spray
⬭	⬭	⬭	⬭

4. With the preferred product(s), are you aware that they could contain hazardous elements to both you and to others?

Yes	No
⬭	⬭

Do you understand the role of hormones in your body?

Yes	No
⬭	⬭

Do you know that there are artificial sources of hormones?

Yes	No
⬭	⬭

Have you ever heard of Bisphenol and Phenol Ethoxylate chemical?

Yes	No
⬭	⬭